



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

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**SECTION A. General description of project activity****A.1 Title of the project activity:**

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Xiaoxi Hydropower Project

Version number of the document: 06

Date: 02/12/2008

The version history of the PDD is summarized as below.

Version number of PDD	Date	Main revision and purpose
01	17/01/2007	Prepared for LOA application
02	31/01/2007	Revised based on experts' comments and submitted to DNA for LOA
03	15/02/2007	Revised based on experts' comments and submitted to DOE for public comments
04	08/06/2007	Revised based on validation protocol
05	20/09/2007	Update grid emission factor as recommended by DOE
06	02/12/2008	Revised PDD following request for correction

A.2. Description of the project activity:

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The Xiaoxi Hydropower Project (hereafter referred to as the Project) is sited on the midstream of Zishui River within Xiaoxi Village, Pingshang Town, Xinshao County, Shaoyang City, Hunan Province, P.R.China.

The total installed capacity of the Project is 135 MW. With 10.1 km² of reservoir area¹, the power density of the Project is 13.37 W/m². The Project is designed to deliver discharge flow of 812.62 m³/s with 19 m of water head. It is estimated that the feed-in electricity to the Central China Grid is approximately 468.76 GWh per year which may achieve emission reductions as 457,064 tCO₂e per year. All the electricity generated will be delivered to the Central China Grid via two 110 kV outlet circuits.

The Project will not only supply renewable electricity to grid, but also contribute to sustainable development of the local community, the host country and the world by means of:

- ♦ reducing greenhouse gas emissions compared to a business-as-usual scenario;
- ♦ promoting local economic development and environmental protection by means of providing clean electricity.
- ♦ reducing the emission of other pollutants resulting from the power generation industry in China, compared to a business-as-usual scenario;
- ♦ creating local employment opportunities during the project construction and operation period.

The construction of the Project was approved by Hunan Provincial Development and Reform Commission and Hunan Provincial Environment Protection Bureau. The construction of the Project was started on 20/10/2004. It is under construction at present and the 1st turbine (40 MW) is proposed to be put into operation in 20/12/2007, the 2nd turbine (40 MW) is proposed to be put into operation in 20/03/2008, the 3rd turbine (40 MW) is proposed to be put into operation in 20/06/2008 and the 4th turbine (15 MW) is proposed to be put into operation in 20/09/2008. The Project is invested by Hunan Xinshao Xiaoxi Hydropower Development Co., Ltd. and constructed by Sino Hydro Engineering Bureau 3 and

¹ P18 of EIA.



Sino Hydro Engineering Bureau 7.

A.3. Project participants:

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Participants to the project activity are the following:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R.China (host)	Hunan Xinshao Xiaoxi Hydropower Development Co., Ltd. (project owner)	No
The Federal Republic of Germany	RWE Power Aktiengesellschaft (CERs buyer)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

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The Host Country is the 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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Xiaoxi Village, Pingshang Town, Xinshao County, Shaoyang 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 sited on the midstream of Zishui River within Xiaoxi Village, Pingshang Town, Xinshao County, Shaoyang City, Hunan Province, P.R.China. The dam of the Project has geographical coordinates with east longitude of 111°26'50" and north latitude of 27°34'30". And the power house site of the Project has geographical coordinates with east longitude of 111°26'59" and north latitude of 27°34'32". The project site is 44 km to the downtown of Xinshao County and 58 km to the downtown of Shaoyang City. Figure 1 shows the location of the Xinshao County. Figure 2 shows the location of the Project.



Figure 1. Location of Xinshao County



Figure 2. Location of the Project

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

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The Project uses hydropower to generate electricity so that it would fall within sectoral scope 1: energy industries (renewable energy).

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

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The Project is constructed with 47 m of maximum dam height and 19 m of rated head. The total installed capacity of the Project is 135 MW. With 10.1 km² of reservoir area², the power density of the Project is 13.37 W/m². It is estimated that the feed-in electricity to the Central China Grid is approximately 468.76 GWh per year. The electricity generated by the Project will be delivered to the Central China Grid via two 110 kV outlet circuit through Lengjiang transformer substation.

Based on thorough analysis in PDR, technology which is environmentally safe and can results in a significantly better performance is selected to be applied by the Project³. Three sets of 40 MW Kaplan turbines and one set of 15 MW Kaplan turbine and associated generators which are made in China will be installed in the Project. Hydro turbines and generators used in the Project are produced by the TOSHIBA Hydro Power (Hangzhou) Co., Ltd. Key technical indicators of the key equipments used in the Project are illustrated in Table 1.

Table 1. Key technical indicators of the key equipments of the Project

Equipment	Type	Key Index	
Hydro Turbine-1	ZZ(ZK51)-LH-560	Rated head	19.0 m
		Rated power	41.7 MW
		Declared working condition efficiency	93.1%
Hydro Turbine-2	ZZ(ZK51)-LH-340	Rated head	19.0 m
		Rated power	15.5 MW
		Declared working condition efficiency	92.9%
Generator-1	SF40-52/9250	Rated voltage	10.5 kV
		Efficiency	97.5%
		Power factor	0.85 (lagged)
Generator-2	SF15-32/5720	Rated voltage	10.5 kV
		Efficiency	97.5%
		Power factor	0.85 (lagged)

Many technological innovations have been realized in the dam base treatment of the Project, and anchor pile technology introduced from Italy is used for the first time in China to treat the dam base, the implementation of which is conducive to the introduction of advanced know-how technology.

The Project involves no technology transfer. The implementation of the Project will have positive impact on technology progress of hydropower engineering in China. The Project is proposed to be put into operation in 20/12/2007, training schedule for employees has been arranged and carried out since Jan., 2007 and detailed documents on training has been submitted to DOE.

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

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² P18 of EIA.

³ Page 6-2 to page 6-5 of PDR of the Project.



Renewable crediting period (7yrs×3) is adopted by the Project. It is estimated that the project activities will generate emission reductions for about 3,059,792 tCO₂e over the first 7-year crediting period from 26/05/2008 to 25/05/2015.

Years	Annual estimation of emission reductions in tonnes of CO₂e
26/05/2008 to 31/12/2008	133,313
2009	457,064
2010	457,064
2011	457,064
2012	457,064
2013	457,064
2014	457,064
01/01/2015 to 25/05/2015	184,095
Total estimated reductions (tonnes of CO₂e)	3,059,792
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO₂e)	437,113

A.4.5. Public funding of the project activity:

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

**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:**

ACM0002.ver 06 – “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” and “Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources”.

The *Tool for the Demonstration and Assessment of Additionality* version 03.

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

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Hydropower generation technology is a renewable electricity generation technology which displaces fossil fuel-fired power generation technology to supply electricity to the grid. Therefore the Project applies the consolidated baseline methodology ACM0002 approved by CDM EB to determine the project baseline and calculate GHG emission reductions achieved by hydropower generation.

The Project meets all applicability conditions of the consolidated baseline methodology ACM0002 as follows:

- 1) The Project involves the electricity capacity additions from hydropower plant.
- 2) Power density of the Project is 13.37 W/m² which is higher than 4 W/m².
- 3) The Project does not involve switching from fossil fuels to renewable energy at the site of the project activity.
- 4) The geographic and system boundaries for the Central China Grid can be clearly identified and information on the characteristics of the Central China Grid is available⁴.

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

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The project boundary covers water-retaining structure and auxiliary facilities, power house and auxiliary facilities and the reservoir area.

Electricity generated by the Project will be delivered to the Hunan Power Grid. According to the *Notification on Determining Baseline Emission Factor of China's Grid*, Hunan Power Grid is an integral part of the Central China Grid. The Central China Grid is defined as the electricity system boundary of the Project. It is composed of Henan Power Grid, Sichuan Power Grid, Chongqing Power Grid, Hubei Power Grid, Jiangxi Power Grid and Hunan Power Grid.

⁴ Detailed information of the grid in China can be obtained from the *China Electric Power Yearbook*, the *China Energy Statistical Yearbook* and the *Notification on Determining Baseline Emission Factor of China's Grid* made publicly available on the website of China's DNA (<http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=1889>) on 09/08/2007.



	Source	Gas	Included?	Justification/Explanation
Baseline	Electricity generation of those fossil fuel-fired power plants connected into the Central China Grid.	CO ₂	Yes	Main emission sources.
		CH ₄	No	Excluded for simplification. This is conservative.
		N ₂ O	No	Excluded for simplification. This is conservative.
Project activity	Project emission	CO ₂	No	The Project is a hydropower plant with a power density higher than 10 W/m ² so that the project emissions should not be considered as per ACM0002.
		CH ₄	No	Same as above.
		N ₂ O	No	Same as above.

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 grid-connected electricity generation project based on renewable sources. The practical and feasible baseline scenario for the Project is the provision of an equivalent amount of annual power output by the Central China Grid into which the Project is connected.

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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The additionality of the Project is demonstrated and assessed by using the *Tool for the Demonstration and Assessment of Additionality* ver 03 approved by CDM EB.

The investment barrier and technology barrier that the Project was faced with were significantly perceived by the project owner prior to starting construction. In February of 2004, being convinced of the environment benefits of the Project, the management team of the project owner decided to apply the international financial supports to overcome the investment barrier and technology barrier by participating in the international GHG emission reduction cooperation. After serious consideration, a management decision to get GEF grant and CER sales revenues to overcome the investment barrier and technology barrier was achieved by the board of the project owner. In June of 2004, CER sales revenues became a loan payback guaranty in the letter of application for bank loan for the Project to China Construction bank, Xinshao Branch. Relevant documents have been provided to DOE showing that CDM has been seriously considered in the decision to proceed with the Project and it is one of the most important decision-making factors for the investment of the Project. Considering that barriers faced by the Project would be alleviated with the expected CERs sales revenues, in October of 2004, the Project started construction.

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

The objective of the Step 1 is to define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps:

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

Plausible and credible alternatives available to the Project that provide outputs or services comparable to the proposed CDM project activity include:

Alternative I: Construction of a fuel-fired power plant with equivalent amount of annual electricity generation;

Alternative II: The project activity was undertaken without being registered as a CDM project activity;

Alternative III: Construction of a power plant using other sources of renewable energy with equivalent amount of annual electricity generation; and

Alternative IV: Provision of an equivalent amount of annual power output by the Central China Grid into which the Project is connected.

Since the perennial average wind speed of the project site is only 1.6 m/s where has no economically exploitable wind resource⁵. The farmland of Xinshao County⁶ is only 281.214 km² that can not provide enough biomass resource for power generation with a commensurate scale to the Project. Moreover, other renewable energy, such as solar PV, are suffered with high cost that not commercially viable in China at present. Therefore, Alternative III is not feasible.

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

For Alternative I, considering the same annual electricity generation, the alternative baseline scenario for the Project should be a fuel-fired power plant with installed capacity lower than 135 MW. Further, as the Project is a grid-connected hydropower generation project, the alternative baseline scenario must be a grid-connected fuel-fired power generation project. However, according to China's regulations, construction of fuel-fired power plants with the installed unit capacity equal to or lower than 135 MW is prohibited in the areas which can be covered by large grids such as provincial grids⁷. For these reasons, Alternative I is conflict with China's current laws and regulations thus not feasible.

Alternative II (the project activity was undertaken without being registered as a CDM project activity) comply with China's laws and regulations at present and does not belongs to project types to be implemented with mandatory requirements.

Alternative IV (the installed capacity of the Central China Grid for both the existing power plants and the power plants to be built in a foreseeable future) is common practice which satisfies China's regulations.

Therefore Alternative II and Alternative IV are analyzed in Step 2.

Step 2. Investment Analysis

The purpose of this step is to determine whether the project activity is economically or financially less attractive than Alternative IV without an additional revenue/funding, possibly from the sale of certified emission reductions (CERs). The investment analysis was conducted in the following steps:

Sub-step 2a. Determine appropriate analysis method

The *Tool for the Demonstration and Assessment of Additionality* suggests three analysis methods which

⁵ Page 1-2 of the preliminary design report of the Project.

⁶ <http://www.xinshao.gov.cn/xinshao/gaikuang/2165.shtml>

⁷ *Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with the Capacity of 135 MW or Below* issued by the General Office of the State Council, decree no. 2002-6.



are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since the Project will earn revenues not only from the CERs sales but also from electricity sales, the simple cost analysis method is not appropriate. Investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. The Alternative IV of the Project is the Central China Grid rather than new investment projects. Therefore Option II is not appropriate. The Project will use benchmark analysis method (Option III) based on the consideration that benchmark IRR of the power sector is available.

Sub-step 2b. Benchmark Analysis Method (Option III)

According to the *Interim Rules on Economic Assessment of Electric Power Engineering Retrofit Projects*, the financial benchmark rate of return adopted by the Project is 8% for the project IRR. On the basis of the above benchmark, calculation and comparison of financial indicators are carried out in sub-step 2c.

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

(1) Basic parameters for calculation of financial indicators

The PDR of the Project was drafted by an authoritative and independent third party viz. Hunan Hydro & Power Design Institute (hereafter referred to as HHPDI) in September 2004 (1 month prior to the construction of the Project), submitted to government authorities in October 2005 and approved by government authorities in November 2005. HHPDI, a design institute with the top level of qualification, was established in 1956, capable of a series of work such as investigation and design of large scale power generation project, consulting and engineering procurement and construction (EPC). HHPDI designed more than 1,400 hydraulic and hydropower projects. Besides domestic business, HHPDI obtained business of design and technology consulting from 15 countries in Asia, Africa and America. For detailed introduction of HHPDI please referred to <http://www.hhpdi.com/>. As per the guidance given by EB 38 paragraph 54, the PDR of the Project is a reliable data source for investment analysis of the Project. According to the Preliminary Design Report, the basic parameters for calculation of financial indicators of the Project are as follows:

Series	Item	Value	unit	Data source
1	installed capacity	135	MW	PDR 15-4
2	feed-in electricity			
	year 4	234.38	GWh	PDR 15-14
	year 5 ~ year 34	468.76	GWh	PDR 15-14
3	construction period	4	year	PDR 15-5
4	operation period	30	year	PDR 15-5
5	bus-bar tariff (not including VAT)	0.269	RMB	PDR 15-6
6	total project cost	11,1232	10000RMB	PDR 15-4
7	working capital	135	10000RMB	PDR 15-10
8	VAT	17%		PDR 15-6
9	income tax	33%		PDR 15-7
10	urban maintenance and construction tax	5%		PDR 15-6
11	surtax for education	3%		PDR 15-6
12	maintenance	1.0%		PDR 15-5
13	staff	48	person	PDR 15-5
14	salary	1.5	10000RMB/year	PDR 15-5



15	employee welfare, labor and protection fund, housing fund	40%		PDR 15-5
16	reservoir maintenance fee	0.001	RMB/kWh	PDR 15-6
17	water resource fee	0.001	RMB/kWh	PDR 15-6
18	materials cost	5	RMB/kW	PDR 15-5
19	other cost	24	RMB/kW	PDR 15-6
20	depreciation rate	3.3%		PDR 15-6

(2) Comparison of the financial benchmark of project IRR

In accordance with the benchmark analysis (Option III), if the financial indicators (such as the project IRR) of a project are lower than the benchmark, the project is not considered as financially attractive.

Based on the data above, without CERs sales revenues, the project IRR of the Project is 5.56%, which is lower than the benchmark (8%). The Project is not financially attractive.

Sub-step 2d. Sensitivity analysis

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

- ◆ Total investment
- ◆ Annual O&M cost
- ◆ Bus-bar tariff
- ◆ Annual electricity output

Since the impact of bus-bar tariff on sensitivity analysis is the same as that of annual electricity output, only the impacts of total project cost, O & M expenses and bus-bar tariff of the Project on project IRR were analyzed. The results of sensitive analysis of three indicators of the Project are shown in Table 2 and Figure 3.

Table 2. Sensitivity of the project IRR to different financial parameters of the Project (without CERs sales revenues)

Parameter	Range	-10%	0	+10%
Total project cost (%)		6.37	5.56	4.87
O & M expenses (%)		5.67	5.56	5.46
Bus-bar tariff (%)		4.77	5.56	6.32

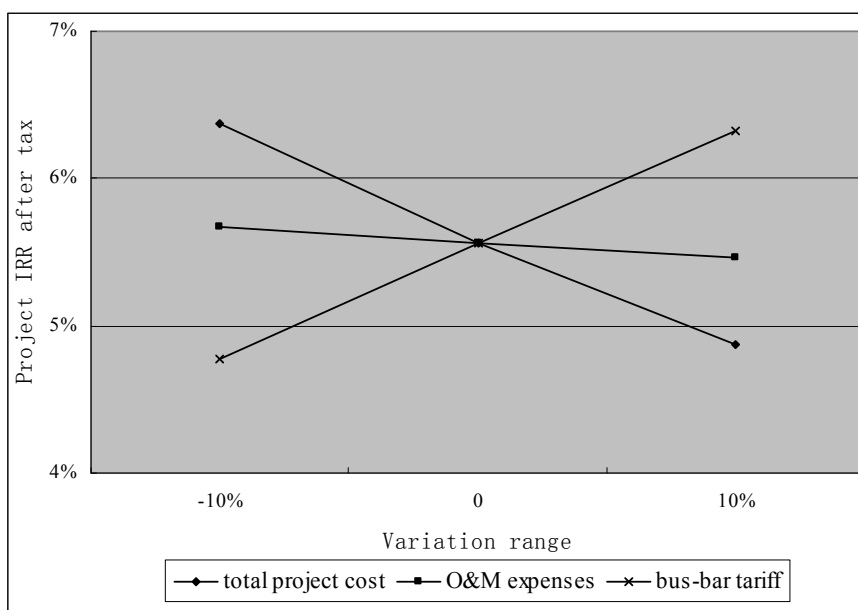


Figure 3. Sensitivity of the project IRR to different financial parameters of the Project (without CERs sales revenues)

As shown in the sensitivity analysis, even the variation range of the uncertain factors reaches 10%, the project IRR of the Project could not reach the benchmark and the additionality of the Project would not be influenced.

For further analyzing the robust of additionality of the Project and conservativeness of applied value in the IRR calculation, the actual values of the project were compared with those estimated values applied in the PDR of the Project, and the suitability of those estimated values applied in the PDR of the Project were analysed as follow::

I. For the comparison of the investment cost with the actual costs

The total project investment cost of the Xiaoxi Hydropower Project (hereafter referred to as the Project) is obtained from P15-4 of the Preliminary Design Report (hereafter referred to as the PDR) of the Project as 1,112,323,100 RMB. Although the Project is still under construction, the financial reports of the Project from 2004 to 2008 (till 30/09/2008) are provided for cross check.

The financial reports of the Project are audited every year and the audit reports from 2004-2007 have been provided to prove the reliability of data obtained from the financial reports. The business licenses and the accountant certifications of those four public accountants companies mentioned above are provided. The certification information of CPAs mentioned above can be found from the CPA management information system (<http://211.167.229.177/cicpa/public/queryAllPerson.jsp>) in the official website of Hunan CPA Association (<http://www.hnicpa.org/>).

According to these financial reports, actual cost of the Project that has occurred until September 30, 2008 is summarized in Table 3.

Table 3. Actual cost of the Project

Year	Cost	Source	Accountant	Person in charge
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	(accumulated) (RMB)			
2004	87,923,580.29	Audited financial report 2004	Hunan Jianye Certified Public Accountants Company Limited	Wen Zhongping (CPA certification no. 441000010008) Yang Zhuoping (CPA certification no. 430300060003)
2005	332,317,150.83	Audited financial report 2005	China Rightson Certified Public Accountants Hunan Tianxing Branch	Liu Yuanxin (CPA certification no. 430100160019) He Huanhua (CPA certification no. 430100140033)
2006	587,637,729.89	Audited financial report 2006	Hunan Hengji Certified Public Accountants Co., Ltd	Xiao Yuqin (CPA certification no. 430100170009) Yang Fuqiang (CPA certification no. 43010017001)
2007	885,326,979.67	Audited financial report 2007	Shengzhen Nanfang-Minhe Certified Public Accountants	Liang Xiaofang (CPA certification no. 430200010007) Chen Zhi (CPA certification no. 440300191038)
01/01/2008~30/09/2008	1,140,925,739.06	Audited financial report 2008	To be audited	To be audited

As detailed in Table 1, actual cost of the Project up to 30/09/2008 is 1,140,925,739.06 RMB, 2.57% higher than that estimated in the PDR (1,112,323,100 RMB, which was used in the PDD) when the Project is still under construction. The results of cross check confirm that the estimation of the total project investment cost of the Project in the PDR is conservative.

II. For the variation of bus-bar tariff and its impacts on economics of the Project

2.1 Actual bus-bar tariff received by the Project

As per Power Purchase Agreement (hereafter referred to as the PPA) of the Project, “The bus-bar tariff of the Project will be the bus-bar tariff determined by the local pricing bureau.” It is obvious that the bus-bar tariff of the Project is strictly controlled by the local government.

The Project includes installation of three sets of 40 MW hydropower generation units and 1 set of 15 MW hydropower generation unit. Of the four units, three sets of 40MW hydropower generation units have been put into operation. According to the transaction notes from 01/01/2008 to 30/09/2008, the average bus-bar tariff actually paid to the Project is 0.295 RMB/kWh. All of the transaction notes are provided as evidences. The expected bus-bar tariff in the PDR of the Project (which was adopted in the PDD) is 0.315 RMB/kWh. It can be seen that the average bus-bar tariff actually paid to the Project is close to but 6.66% lower than that expected in the PDR of the Project.

2.2 Bus-bar tariff policy of Hunan Province

In Hunan Province, the electricity generated by utilization of renewable resources got a higher bus-bar tariff in the past several years, but it was decreased because of the competition principle for the bus-bar tariff delivered to the grid. According to the document from Hunan Pricing Bureau, the bus-bar tariff has



decreased from 0.348 RMB/kWh⁸ in 2000 to 0.327 RMB/kWh⁹ in 2002, and further decreased to 0.315 RMB/kWh in 2004¹⁰. The bus-bar tariff adopted in the PDR of the Project drafted in 2004 is 0.315 RMB/kWh.

On June 28, 2006, Circular on Tariff Adjustment in Central China Grid(Document No.NDRC JG[2006]1233) issued by the National Development and Reform Commission stipulated the 0.301RMB/kWH as benchmark tariff for Hunan Province¹¹.

On July 11,2006, Circular on Relevant Issues of Adjustment of the Electricity Tariff in Hunan Power Grid (Document No.XJZ[2006]97) issued by the Bureau of Pricing of Hunan Province stipulated 0.301RMB/kWH as the benchmark tariff for hydropower plants **dispatched** by the provincial grid¹². According to the *table of tariff for power plants dispatched by the provincial grid*, those hydropower plant similar to the project was adjusted to 0.301RMB/kWH. It is noted that, the installed capacity for the smallest hydropower project dispatched by the provincial grid is 54.2MW.

On July 28, 2006, Circular on Relevant Issues of the Electricity Tariff of Power Plants **Not** dispatched by the provincial grid in Hunan Power Grid, (No.XJC(2006)111)¹³ issued by the Bureau of Pricing of Hunan Province stipulated that the highest tariff of those hydropower projects **Not dispatched** by the provincial grid is 0.316 RMB/kWh. It is noted that, the installed capacity for the largest hydropower project **Not dispatched** by the provincial grid is only 43.1MW.

Assume the bus-bar tariff of the Project to be increased to 0.348 RMB/kWh (the historical highest tariff during most recent ten years), the IRR of the Project will be increased by 6.36%, which is still lower than the financial benchmark of the Project (8%).

The increasing rate of the bus-bar tariff for those hydropower projects **Not dispatched** by the provincial grid from 2004 to 2006 is 0.32% $((0.316-0.315)/0.315=0.32\%)$. Assume the bus-bar tariff of the Project could be increased by 0.32% annually; the IRR of the Project will be increased to 5.85%, which is still lower than the financial benchmark of the Project (8%).

III. For the variation of the O&M cost of the Project

Since the Project is still under construction, only the actual quantity of employees and their salary can be obtained for cross check of the O&M cost. The comparison of data provided in the PDR and the actual data is summarized in Table 4.

⁸ Hunan Pricing Bureau , Circular on the Tariff of the Grid of Hunan Province, March 6, 2000 (No.XJC(2000)49), <http://www.xxpi.com/Article/ShowArticle.asp?ArticleID=952>.

⁹ Hunan Pricing Bureau, Circular on the Tariff of the Grid of Hunan Province, December 31, 2001 (No.XJC(2001)327), Hunan Pricing Bureau , Circular on the Tariff of the Grid of Hunan Province, August 4, 2004 (No.XJC(2004)114), <http://www.xxpi.com/Article/pi22/pi221/pi22102/pi22102002/200504/949.asp>.

¹⁰ Hunan Pricing Bureau, Circular on the Tariff of the Grid of Hunan Province, August 4, 2004 (No.XJC(2004)114), <http://www.xxpi.com/Article/pi22/pi221/pi22102/pi22102002/200504/949.asp>.

¹¹ http://www.chinaenergy.gov.cn/news_5963.html

¹²<http://www.yy12358.com/Article/ShowArticle.asp?ArticleID=572>

¹³ <http://www.yy12358.com/Article/ShowArticle.asp?ArticleID=634>



Table 4. employee quantity and their salary

	PDR data	Actual data	Variation range
Employee (person)	45	56	+24%
Annual salary (RMB)	15,000	21,600	+44%

It is shown in Table 4 that even in the employee salary O&M cost can we observe an increase of 534,600 RMB. The O&M cost provided in the PDR of the Project is 16,980,000 RMB. The total O&M cost increases 3.15% due to the employee salary even assuming other O&M costs keep constant. If the increase of the O&M would be taken into account when calculating the IRR, then the IRR would be further lower than the original one.

According to P85 in *Financial Assessment Methods and Parameters for Construction* which was issued by the National Development and Reform Commission and the Ministry of Construction, “it is hard either to predict the future price level in the preliminary study phase or to ensure the reliability of the predicted result due to the long-term operation period. So usually, the price level of the project input and project output in the first year of operation period should be predicted and this price level should be fixed in the investment analysis during the operation period”.

Moreover, other relevant parameters of the O&M costs of the PDR come from Interim Rules on Economic Assessment for Hydropower Projects (Document No.SGG[1994]0026) issued by Ministry of Electric Power and Ministry of Water Conservancy and other official documents issued by the central government and Hunan provincial government.

The benchmark adopted by the Project comes from Interim Rules on Economic Assessment of Electric Power Engineering for Retrofit Projects. As described on P34 of Interim Rules on Economic Assessment of Electric Power Engineering for Retrofit Projects, it is compiled in line with Economic Assessment Method and Parameters for Construction Project and Interim Rules on Economic Assessment for Hydropower Projects (Document No.SGG[1994]0026). Therefore, it is suitable to adopt Interim Rules on Economic Assessment for Hydropower Projects (Document No.SGG[1994]0026) as the data source and to keep the data fixed (constant) in the investment analysis during the operation period.

At last, the original sources of basic parameters and assumptions provided in the PDR/PDD are once again provided in detail.

In the IRR calculation spreadsheet, fixed values provided in the PDR of the Project that were determined from follow the guidance of

-*Interim Rules on Economic Assessment for Hydropower Projects* (Document No. SGG[1994]26);

-*Circular on Regulating the Standard of Water Resource Fee* (Document No.XJF[2003]128) issued by the Bureau of Pricing of Hunan Province and the Local Finance and Securities Office of Hunan Provincial People's Government
(<http://www.hnwr.gov.cn/news/html/2007/06/20070626155052-1.htm>);

-*Decision of the State Council on Setting Up Uniform Old-Age Insurance System for Employees of Enterprises* (Document No.GF[1997]26)
(http://www.tzcs.gov.cn/html/shbz/2005-11/27/15_30_27_124.html);

-*Decision of the State Council on Revision of Regulations on Management of Housing Provident Fund* (Decree No.350 of the State Council of the People's Republic of China)



(<http://www.shenyang.gov.cn/web/assembly/action/browsePage.do?channelID=1158644667336&contentID=345>).

The data adopted in the PDD, relevant data sources in the PDR and further evidences supporting the PDR are summarized in Table 5.

Table 5. Data, data sources in the PDR and further evidences supporting the PDR

item	value	unit	data source	original sources
operation period	30	year	PDR 15-5	Paragraph 1.0.4 of Section I and Paragraph 1.0.2 of Section II of <i>SGG[1994]26</i>
VAT	17%		PDR 15-6	Paragraph 2.3.1 of Section I of <i>SGG[1994]26</i>
income tax	33%		PDR 15-7	Paragraph 2.3.2 of Section I of <i>SGG[1994]26</i>
urban maintenance and construction tax	5%		PDR 15-6	Paragraph 2.3.1 of Section I of <i>SGG[1994]26</i>
surtax for education	3%		PDR 15-6	Paragraph 2.3.1 of Section I of <i>SGG[1994]26</i>
maintenance	1%		PDR 15-5	Paragraph 2.2.1 (2) of Section I of <i>SGG[1994]26</i>
employee welfare, labor and protection fund, housing fund	40%		PDR 15-5	Sum of employee welfare, labor and protection fund, housing fund
employee welfare	14%			Paragraph 2.2.1 (3) of Section I of <i>SGG[1994]26</i>
labor and protection fund	20%			Paragraph 3 of GF[1997]26
housing fund	6%			Paragraph 18 of Decree No.350
reservoir maintenance fee	0.001	RMB/kWh	PDR 15-6	Paragraph 2.2.1 (4) of Section I of <i>SGG[1994]26</i>
water resource fee	0.001	RMB/kWh	PDR 15-6	Annex of XJF[2003]128
materials cost	5	RMB/kWh	PDR 15-5	Paragraph 2.0.2 of Section II of <i>SGG[1994]26</i>
other cost	24	RMB/kWh	PDR 15-6	Paragraph 2.0.2 of Section II of <i>SGG[1994]26</i>

The following documents have been scanned, translated and provided to the DOE as evidences.

-*Interim Rules on Economic Assessment for Hydropower Projects* (Document No. SGG[1994]26);

-*Circular on Regulating the Standard of Water Resource Fee* (Document No.XJF[2003]128);

-*Decision of the State Council on Setting Up Uniform Old-Age Insurance System for Employees of Enterprises* (Document No.GF[1997]26);

-*Decision of the State Council on Revision of Regulations on Management of Housing Provident Fund* (Decree No.350 of the State Council of the People's Republic of China).



Based on the Investment Analysis above, the Project is not financially attractive without consideration of CDM sales revenues. Alternative II is not feasible.

If the Project can be successfully registered as a CDM project, the CERs sales revenues will guarantee the loan payback, supplement the high investment and low electricity output of the Project and significantly improve the financial indicators of the Project. Considering of the CERs sales revenues (calculated with EURO 10/tCO₂e, 7 yrs×3 crediting period)¹⁴, the project IRR of the Project will be significantly improved to reach benchmark, as shown in Table 6.

Table 6. Comparison of the project IRR of the Project with and without CERs sales revenues

	the Project	Benchmark
Without CERs sales revenues	5.56	8
With CERs sales revenues	9.06	8

It is shown in Table 3 that CERs sales revenues can alleviate the identified barriers, therefore the Project is additional.

Step 3. Barrier Analysis

Barrier analysis is not employed for the Project, which can satisfy the requirement of *Tool for the Demonstration and Assessment of Additionality*.

Step 4 Common practice analysis

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

The Project is a new built 135 MW hydropower plant located in Hunan Province, therefore, activities similar to the Project should located in Hunan Province, with a starting date of operation later than 01/01/2000 and with an installed capacity between 50~300 MW. These criteria to select other activities similar to the project activity were defined based on following considerations:

-The common practice analysis is limited to the provincial level as the investment environment and policies are similar within certain province but different among provinces in China. For example, the bus-bar tariff for different province is much different under the control of National Development and Reform Commission. The Project is located within Hunan Province, therefore the common practice analysis of the Project was limited to Hunan Province to ensure a comparable environment with respect to regulatory framework. With 211,875 km² of area and 98,596.4 MW of total installed capacity, Hunan Province is large enough to be considered as the boundary for the common practice analysis of the Project.

- 01/01/2000 is the date for the prompt start of CDM, so projects commissioned after 2000 were analyzed for common practice considering of taking place in a comparable environment with respect to access to financing. Then, reform of the power sector in China took place. As a result, the investment environment of hydropower plants in China before and after 2001 is very different. Before 2001, according to *Note on Implement methods of Various Electricity Tariff* (Document No.101SDCZ[1987]), “the electricity tariff of each power plant should be determined according to the principle of full-cost recovery and reasonable benefit”. With such favorable policies provided by the government, the developer of hydropower plants

¹⁴ Exchange rate: 1 EURO = 10 RMB.



didn't face any investment risk. In 2001, the favorable policies for electricity tariff were cancelled due to the issuance of Notice on Standardizing Electricity Tariff Management (Document No.701JJG[2001]) where the electricity tariff level was required to decrease and the mechanism of supplying electricity to the power grid through competing price was implemented. Since the starting date of the Project is later than 2001, project activities similar to the Project should be those which are put into operation later than 2001. To summarize, it is conservative to limit the common practice analysis of the Project to those projects commissioned after 2000.

- Limitation of installed capacity was applied in the common practice analysis to reflect similar technology and similar scale required by Tool for the Demonstration and Assessment of Additionality. In Standard for Classification and Flood Control of Water Resources and Hydropower Project (Document No.SL252-2000) issued by Ministry of Water Resources in 2000, hydro-power plants are divided into five categories according to the project scale and its importance to economy. The same categorization method is also adopted in Classification & Design Safety Standard of Hydropower Projects (Document No.DL5180-2003). The installed capacity of the Project is 135 MW and it belongs to Category III. Category III covers hydropower plants with an installed capacity between 50~300 MW, so the installed capacity of activities similar to the Project should be between 50~300 MW.

Similar activities identified based on the *Yearbook of China's Water Power* (1998~2004) with such criteria are listed in Table 7 below.

Table 7. Activities similar to the Project

Project Name	Installed Capacity (MW)
Hongjiang Hydropower Plant	225
Jinweizhou Hydropower Plant	63.18
Xiaoxiang Hydropower Plant	52
Jiangya Hydropower Plant	300
Wanmipo Hydropower Plant	240

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

Existing hydropower projects in Hunan Province with a commensurate scale to the Project are analysed as follows:

- The Hongjiang Hydropower Project obtained the support from JICA in the form of soft loans worth 17.663 billion yen¹⁵.
- The Jinweizhou Hydropower Project is invested by local government with loan provided by Austria government. The construction of this project is started in 1994, 10 year earlier than the Project which means very different investment circumstance¹⁶.
- The per kW cost of the Xiaoxiang Hydropower Project is about 6,000 RMB/kW¹⁷, 36% lower than that of the Project (9,313 RMB/kW). Meanwhile, the annual operation hours of the Xiaoxiang Hydropower Project are 4,135 h¹⁸, about 11% higher than that of the Project (3,730 h¹⁹). Both of the construction circumstances and hydro resources of the Xiaoxiang Hydropower Project is much better than that of the Project.
- The Jiangya Hydropower Project is supported by World Bank with loan of US\$ 97 million, accounts

15 <http://www.hongjiang.net/privents/d5/indexd501003.htm>.

16 <http://www.cet.com.cn/20070309/SPECIAL/200703090.htm>.

17 <http://finance.sina.com.cn/g/20041029/08341117772.shtml>.

18 <http://finance.sina.com.cn/g/20041029/08341117772.shtml>.

19 Page 15-4 of the Preliminary Design Report of the Project.



about 23% of the total project cost of the Project. As an annual regulation hydropower plant, it is much flexible in utilization of hydro resources compared to the Project²⁰.

- The Wannipo Hydropower Project is supported by Japan OECF loan of 6.833 billion yen, about 20% of the total project cost of the Project. As an incomplete seasonal regulation hydropower plant, it is much flexible in utilization of hydro resources compared to the Project²¹.

It can be seen from the above analysis that existing medium hydropower projects in Hunan Province with a commensurate scale to the Project possess incomparable advantages over the Project in respect of financing channels, construction circumstances, hydro resources and regulation feature. Since the Project does not have such advantages, it fulfils the requirement of additionality.

To summarize, if the Project fails to be registered as a CDM project, without CERs sales revenues, the high cost of the Project can not be compensated and the loan payback can not be guaranteed. Under such circumstances, it is difficult to implement and operate the Project. Being registered as a CDM project, CERs sales revenues can alleviate the identified barriers, be one of the sources to serve as the maintenance fund for the equipments therefore to guarantee the successful implementation of the Project, therefore the Project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The consolidated methodology ACM0002 is applied in the context of the Project in the following five steps:

- First, calculate the baseline GHG emissions;
- Second, calculate the project GHG emissions;
- Third, calculate the project leakage;
- Fourth, calculate the emission reductions.

I. Calculate the baseline GHG emissions

Baseline emission factors of operating margin ($EF_{OM,y}$) and build margin ($EF_{BM,y}$) were determined ex ante. The baseline emission factor (EF_y) is calculated as a combined margin (CM) of $EF_{OM,y}$ and $EF_{BM,y}$, according to the following three steps:

STEP 1. Calculate the Operating Margin Emission Factor(s) ($EF_{OM,y}$) based on one of the four following methods:

- (a) Simple OM, or
- (b) Simple adjusted OM, or
- (c) Dispatch data analysis OM, or
- (d) Average OM.

Each method is analyzed as below.

20 <http://www.wanfangdata.com.cn/qikan/periodical.Articles/rmcj/rmcj2000/0002/000221.htm>,
<http://www.hnwr.gov.cn/news/html/2004/11/20041117134859-1.htm>.

21 <http://dianli1000.com/Photo/ShowPhoto.asp?PhotoID=86>.



Method (a) Simple OM

The simple OM method only can be used when low-cost/must run resources constitute less than 50% of total amount of grid generating output 1) in the recent five years, or 2) by taking into account long-term normal for hydroelectricity generation. Among the total electricity generations of the Central China Grid which the Project is connected into, the amount of low-cost/must run resources accounts for about 36.76% in 2001, 35.95% in 2002, 32.86% in 2003, 32.36% in 2004 and 38.18% in 2005, all less than 50%. Thus, the method (a) Simple OM can be used to calculate the baseline emission factor of operating margin ($EF_{OM,y}$) for the Project.

Method (b) Simple adjusted OM

The application of simple adjusted OM method requires annual load duration curve of the grid. The power sector in China is in a transitional period of “separating the plant operation from the grid operation”, resulting in the detailed data of dispatch and fuel consumption are often taken as confidential business information by the grid company and the power plants. Therefore those data are not publicly available. In most cases, it is impossible for the CDM projects in China to adopt Method (b) for the calculation of the baseline emission factor of operating margin ($EF_{OM,y}$). Similarly, the Project can not adopt Method (b) for the calculation of the baseline emission factor of operating margin ($EF_{OM,y}$) due to unavailability of the dispatch data of the Central China Grid.

Method (c) Dispatch data analysis OM

Dispatch data analysis OM method should be the first choice if the dispatch data are available, because the method can truly reflect the substitutable relationship between the amount of electricity output from power plants of the baseline grid and that from the Project activity and the emission reductions generated. However, Method (c) cannot be adopted for the Project because of unavailability of the dispatch data of the Central China Grid, similar reason as method (b).

Method (d) Average OM

Method (d) can only be used when 1) low-cost/must run resources constitute more than 50% of total amount of grid electricity output and 2) detailed data required by applying method (b) and method (c) is unavailable. Among the total electricity generations of the Central China Grid which the Project is connected into, the amount of low-cost/must run resources accounts for about 36.76% in 2001, 35.95% in 2002, 32.86% in 2003, 32.36% in 2004 and 38.18% in 2005, all less than 50%, all less than 50%. Therefore method (d) cannot be applied to the Project.

In conclusion, Method (a) Simple OM is the only reasonable and feasible method among the four methods for the calculation of the operating margin emission factor(s) ($EF_{OM,y}$) of the Project. With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, Method (a) Simple OM is adopted for the calculation of the operating margin emission factor(s) ($EF_{OM,y}$) of the Project.

In accordance with the consolidated baseline methodology ACM0002, the Simple OM emission factor



($EF_{OM, simple, y}$) is calculated ex ante. The formula of $EF_{OM, simple, y}$ calculation is

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

where:

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

$COEF_{i,j,y}$ is the total amount the CO₂ emission coefficient of fuel i (tCO₂/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by power plant j and the oxidation rate of the fuel in year(s) y, and

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

The CO₂ emission coefficient $COEF_i$ is then obtained from equation (2) as

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

where:

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

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

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

Since there exists no net electricity imports ($COEF_{i,j, imports}$) in the Central China Grid, the emission factor(s) of other grid is not considered in the Project.

The data on electricity generation and auxiliary electricity consumption are obtained from the *China Electric Power Yearbook* from 2004 to 2006. The data on different fuel consumptions for power generation and the net calorific values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2004 to 2006. The emission factors and oxidation factors of the fuels adopted are obtained from Table 1.3 and Table 1.4 on P1.21-1.24 of Chapter 1, Volume 2 of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, the Simple OM emission factor ($EF_{OM,y}$) of the Central China Grid is 1.2909 tCO₂e/MWh (see Annex 3 for details).

STEP 2. Calculate the Build Margin Emission Factor ($EF_{BM,y}$) according to the consolidated baseline methodology ACM0002 using equation (3):

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

where:

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



$COEF_{i,m,y}$ is the CO₂ emission coefficient of fuel i (tCO₂/mass or volume unit), taking into account the carbon content of the fuels used by relevant power source m and the percent oxidation of the fuel in year(s) y , and

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

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

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

Consider of data availability, CDM EB accepts the following deviation in application of methodology²²:

- 1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity.
- 2) Use of weights estimated using installed capacity in place of annual electricity generation.

And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

Therefore for the Project: First, calculate the share of different power generation technology in recent capacity additions. Second, calculate the weight for capacity additions of each power generation technology. And finally calculate the emission factor use the efficiency level of the best technology commercially available in China.

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

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

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

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

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

where:

²² [Http://cdm.unfccc.int/Projects/Deviations](http://cdm.unfccc.int/Projects/Deviations).



$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by power plant j in year(s) y ,
 $COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i (t CO_2 /mass or volume unit), taking into account the carbon content of the fuels used by power plant j and the percent oxidation of the fuel in year(s) y , and
 COAL, OIL and GAS are footnote group for solid fuels, liquid fuels and gas fuels.

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

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

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

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

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

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

The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2004 to 2006. The emission factors and oxidation factors of the fuels adopted are obtained from Table 1.3 and Table 1.4 on P1.21-1.24 of Chapter 1, Volume 2 of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

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

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, the Build Margin emission factor ($EF_{BM,y}$) of the Central China Grid is 0.6592 t CO_2 e/MWh (see Annex 3 for details).

STEP3. Calculate the baseline emission factor (EF_y)

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

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

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



$$EF_y = 0.5 \times 1.2909 + 0.5 \times 0.6592 = 0.97505 \text{ (tCO}_2\text{e/MWh)}.$$

Baseline emissions

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

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

$$EG_y = EG_{Delivery,y} - EG_{Aux,y} \quad (11)$$

where:

BE_y are the baseline emissions for the project activity during the year y in tons of CO_2 ,

EG_y is the net electricity delivered to the grid by the project activity during the year y in MWh,

EF_y is the combined baseline emission factor for the project activity during the year y in tons of CO_2 per MWh,

$EG_{Delivery,y}$ is the electricity delivered by the project activity to the grid in year y in MWh,

$EG_{Aux,y}$ is the electricity imported by the project activity from the grid in year y in MWh.

II. Calculate the project GHG emissions

The Project is a hydropower plant with a power density of 13.37 W/m^2 , which is higher than 10 W/m^2 , so that the project emissions should not be considered as per ACM0002, i.e. $PE_y = 0 \text{ tCO}_2\text{e}$.

III. Calculate the project leakage GHG emissions

According to the consolidated baseline methodology ACM0002, the main indirect emissions potentially giving rise to leakage in the context of electric sector projects result from activities such as power plant construction, fuel handling (mining, processing, and transportation), and land inundation (for hydroelectric projects). The project developer does not need to consider such indirect emissions when applying the methodology. Therefore the Project can take no account of such leakages, $L_y = 0 \text{ tCO}_2\text{e}$.

IV. Calculate the emission reductions

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

$$ER_y = BE_y - PE_y - L_y \quad (12)$$

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

Data / Parameter:	$CAP_{j,y}$
Data unit:	MW
Description:	Total installed capacity of province j in year y .
Source of data used:	<i>China Electric Power Yearbook</i>



Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the <i>China Electric Power Yearbook</i> is reliable.
Any comment:	-

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh
Description:	Total power generation of province j in year y.
Source of data used:	<i>China Electric Power Yearbook</i>
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the <i>China Electric Power Yearbook</i> is reliable.
Any comment:	-

Data / Parameter:	$r_{j,y}$
Data unit:	%
Description:	Auxiliary electricity consumption rate of province j in year y.
Source of data used:	<i>China Electric Power Yearbook</i>
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the <i>China Electric Power Yearbook</i> is reliable.
Any comment:	-



Data / Parameter:	$F_{i,j,y}$
Data unit:	t or m ³
Description:	Consumption of fuel type i of province j in year y
Source of data used:	<i>China Energy Statistical Yearbook</i>
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the <i>China Energy Statistical Yearbook</i> is reliable.
Any comment:	-

Data / Parameter:	NCV_i
Data unit:	TJ per mass or volume unit of fuel i
Description:	Net caloric value of fuel i
Source of data used:	P287 of <i>China Energy Statistical Yearbook 2006 Edition</i> .
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the <i>China Energy Statistical Yearbook</i> is reliable.
Any comment:	-

Data / Parameter:	$OXID_i$
Data unit:	-
Description:	oxidation factor of the fuel i
Source of data used:	<i>2006 IPCC Guideline for National Greenhouse Gas Inventories</i>
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from <i>2006 IPCC Guideline for National Greenhouse Gas Inventories</i> is reliable.
Any comment:	-



Data / Parameter:	$EF_{CO_2,i}$
Data unit:	tC/TJ
Description:	CO ₂ emission factor per unit of energy of the fuel i
Source of data used:	2006 IPCC Guideline 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 :	The data obtained from 2006 IPCC Guideline for National Greenhouse Gas Inventories is reliable.
Any comment:	-

Data / Parameter:	$FC_{adv,coal}$
Data unit:	gram of standard coal equivalent/kWh
Description:	weighted average fuel consumption for power generation of 14 sets of 600 MW coal-fired power generators built in 2005 (taken as efficiency level of the best technology commercially available in China)
Source of data used:	Notification on Determining Baseline Emission Factor of China's Grid.
Value applied:	343.33
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the Notification on Determining Baseline Emission Factor of China's Grid made publicly available by China's DNA is reliable. (http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=1889)
Any comment:	-

Data / Parameter:	$FC_{adv,oil/gas}$
Data unit:	gram of standard coal equivalent/kWh
Description:	weighted average fuel consumption for power generation of 200 MW oil/gas based combined cycle power generators (taken as efficiency level of the best technology commercially available in China)
Source of data used:	Notification on Determining Baseline Emission Factor of China's Grid.
Value applied:	258
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the Notification on Determining Baseline Emission Factor of China's Grid is reliable. (http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=1889)
Any comment:	-



Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO ₂ e/MWh
Description:	The OM emission factor.
Source of data used:	<i>Notification on Determining Baseline Emission Factor of China's Grid.</i>
Value applied:	1.2909
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the <i>Notification on Determining Baseline Emission Factor of China's Grid</i> made publicly available by China's DNA is reliable. (http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=1889)
Any comment:	-

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO ₂ e/MWh
Description:	The BM emission factor.
Source of data used:	<i>Notification on Determining Baseline Emission Factor of China's Grid.</i>
Value applied:	0.6592
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from the <i>Notification on Determining Baseline Emission Factor of China's Grid</i> made publicly available by China's DNA is reliable. (http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=1889)
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

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I. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

According to the *Preliminary Design Report* of the Project, the annual electricity delivered by the Project to the grid ($EG_{Delivery,y}$) is estimated to be 468.76 GWh. Since the Project only imports electricity from the grid for emergency starting off and the amount of electricity imported from the grid is uncertain, $EG_{Aux,y}$ is assumed as 0 MWh in the PDD. And the annual net electricity delivered by the Project to the grid (EG_y) is estimated as 468.76 GWh. According to the *Notification on Determining Baseline Emission Factor of China's Grid*, the baseline emission factor for the Project is 0.97505 tCO₂e/MWh and the annual baseline emission of the Project is 457,064 tCO₂e as calculated below.

$$BE_y = EG_y \times EF_y = 468.76 \times 1000 \times 0.97505 = 457,064 \text{ tCO}_2\text{e.}$$

II. Estimated project activity emissions:

The Project is a hydropower plant with a power density of 13.37 W/m², which is higher than 10 W/m², so that the project emissions should not be considered as per ACM0002, i.e. $PE_y = 0 \text{ tCO}_2\text{e.}$

**III. Estimated project leakage emissions:**

As above ACM0002, the leakage of the Project is not considered, i.e. $L_y = 0$ tCO₂e.

IV. Estimated emission reductions

As per formula (12), the annual emission reductions of the Project are 457,064 tCO₂e as calculated below.

$$ER_y = BE_y - PE_y - L_y = 457,064 - 0 - 0 = 457,064 \text{ tCO}_2\text{e.}$$

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

>>

Renewable crediting period (7yrs×3) is adopted by the Project. It is estimated that the project activities will generate emission reductions for about 3,059,792 tCO₂e over the first 7-year crediting period from 26/05/2008 to 25/05/2015.

Year	Estimation of project activity emissions (tonnes of CO ₂ e)	Estimation of baseline emissions (tonnes of CO ₂ e)	Estimation of leakage (tonnes of CO ₂ e)	Estimation of overall emission reductions (tonnes of CO ₂ e)
26/05/2008 to 31/12/2008	0	133,313	0	133,313
2009	0	457,064	0	457,064
2010	0	457,064	0	457,064
2011	0	457,064	0	457,064
2012	0	457,064	0	457,064
2013	0	457,064	0	457,064
2014	0	457,064	0	457,064
01/01/2015 to 25/05/2015	0	184,095	0	184,095
Total (tCO₂e)	0	3,059,792	0	3,059,792

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



B.7.1 Data and parameters monitored:	
<i>(Copy this table for each data and parameter)</i>	
Data / Parameter:	$EG_{Delivery,y}$
Data unit:	MWh
Description:	Electricity delivered by the Project to the grid in year y.
Source of data to be used:	Data used in the PDD is obtained from the preliminary design report of the Project. Actual data will be read from ammeters.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	468,760
Description of measurement methods and procedures to be applied:	Continuously monitored through metering equipments installed at the Protection Room and monthly recorded by the project owner. Back up metering equipments will be installed at the Protection Room to ensure the availability of back-up data.
QA/QC procedures to be applied:	Sales receipts/records to the grid are used to ensure the consistency.
Any comment:	-

Data / Parameter:	$EG_{Aux,y}$
Data unit:	MWh
Description:	Electricity imported by the Project from the grid in year y.
Source of data to be used:	Data used in the PDD is assumed as zero. Actual data will be read from ammeters.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Continuously measured by ammeters installed at the Protection Room. Recorded per month by appointed staff as backup.
QA/QC procedures to be applied:	Double-checked with readings of the backup ammeter.
Any comment:	-

B.7.2 Description of the monitoring plan:

>>

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

1. Calibration of Meters & Metering



The electricity meters of the Project will be installed according to the Technical Norm of Electricity Measurement and Electrical Energy Measurement Devices Design (DL/T 5137-2001). The measurement precision of the ammeters employed by the Project is 0.2s, which should be calibrated at least once a year. Data of electricity measurement will be sent into computer monitoring system by AC sampling devices and electricity meter communication interface. And all the records should be documented and maintained by the project owner for DOE's verification.

2. Quality Assurance and Quality Control

The quality assurance and quality control procedures for recording, maintaining and archiving data shall be improved as part of this CDM project activity according to CDM EB rules and real practice in terms of the need for verification of the emission reductions on an annual basis according to this PDD.

3. Data Management System

- Specific staff will be appointed by the project owner to take the overall responsibility for monitoring greenhouse gas emission reductions and keeping all the data collected as part of monitoring archived electronically and kept at least for two years after the end of the last crediting period.
- Electronic data and documents, including readings from electric meters connected into the computer central control system, will be regularly copied and archived via optical discs and storage tapes, and kept at least for two years after the end of the last crediting period.
- Written data and documents, including receipts for cross-checking of data, will be copied and archived with an explanation of the department or company where the original copy is kept, and kept for at least two years after the end of the last crediting period.

4. Verification

It is expected that the verification of emission reductions generated from the Project will be done annually. Besides the data and documents required in Section B.7., other documents will be prepared by the project owner for verification including, but not limited to:

- PDD (registration version), including the electronic spreadsheets and supporting documentation (assumptions, estimations, measurement, etc);
- Report on qualifications of persons responsible for the monitoring and calculation;
- Report on Quality Control and Quality Assurance;
- Report on maintenance and calibration of meters;
- Report on Project Management Record (including data collection and management system).

5. Monitoring Structure

Please refer to Figure 4 for details regarding the management structure of the monitoring plan.

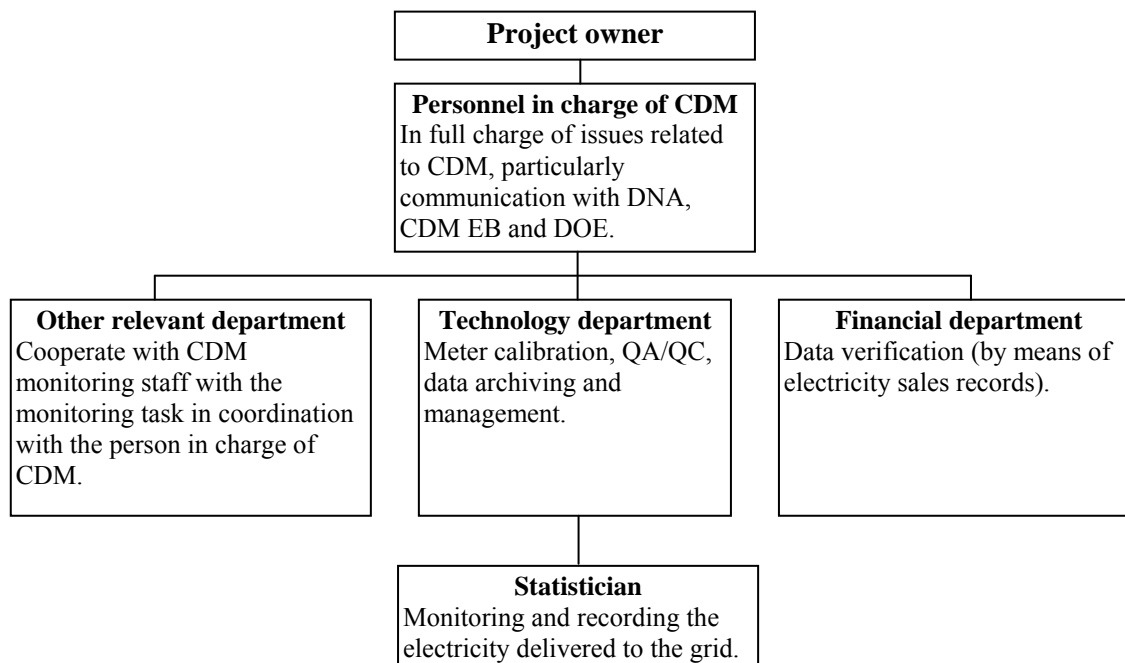


Figure 4. Management Structure of Monitoring Plan

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

>>

The application of the baseline study and monitoring methodology of the Project was completed on 02/12/2008 by Dr. Zheng Zhaoning and Ms. Pan Tao.

Tuttle International Co., Ltd.

Address: Room 109, Building 2, Jiaoda Jiayuan, Haidian District, Beijing, P.R.China

Tel: (8610) 13911049424

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



SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

20/10/2004 (starting date of construction)

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

>>

30y-0m

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

C.2.1. Renewable crediting period

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

>>

26/05/2008 or the date after registration, whichever is later.

C.2.1.2. Length of the first crediting period:

>>

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

Not applicable.

C.2.2.2. Length:

>>

Not applicable.

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

>>

The EIA report of the Project was completed by the project owner, and approved by the Hunan Environmental Protection Agency in April 2005 (Document No. Xiang Huan Ping [2005]37). According to the preliminary design report and the EIA report of the Project, environmental impacts possibly caused by the Project and the corresponding measures adopted by the project owner are analyzed as follows:

Land use

Land occupation and resettlement will be undertaken according to the *Planning Report on Inundation Treatment and Resettlement for the Preliminary Design Phase of Xiaoxi Hydropower Project* (Document Xiang Yi Han[2005]50) approved by the Hunan Resettlement & Development Bureau.

According to the *Package Agreement of Resettlement Task and Investment*, Xinshao County government will be in full charge of relevant resettlement task. To guarantee the openness, fairness and transparency of resettlement procedure as well as reasonable usage of resettlement fees, the project owner invited Xiangyi Construction Supervision Co., Ltd of Hunan Province to supervise the whole process of resettlement.

After the construction of the Project, 0.778 km² of arable land, 0.007 km² of garden plot, 0.322 km² of forest land, 0.004 km² of flood land, 0.979 km² of barren hill and grassland, as well as 0.014 km² of pond will be inundated. Houses of 252092.76 m² will be inundated by the Project, entailing resettlement of 7593 people. The Project will permanently take up 0.192 km² of land, among which are 0.114 km² of arable land, 0.054 km² of forest land, 0.001 km² of pond, 0.013 km² of construction land, and 0.010 km² of unexploited land; and will temporarily take up 0.258 km² of land, among which are 0.186 km² of arable land; land occupation requires pulling down 5893.87 m² of houses, and resettlement of 122 people.

Land occupation and resettlement will be undertaken according to the following national/local regulations:

- National level: the *Land Administration Law of the People's Republic of China*, the *Implementation Regulation on the Land Administration Law of the People's Republic of China*, the *Regulation on Compensation of Land Requisition and Resettlement for Construction of Large and Medium-sized Hydraulic and Hydropower Project* (the State Council decree No. 74) and the *Guidance on Improving Compensation Institution of Land Requisition and Resettlement* (Guo Tu Zi Fa [2004]238);
- Provincial level of Hunan Province: the *Implementation Measures of the Land Administration Law of the People's Republic of China in Hunan Province*, the *Suggestions on Deepening Reform and Enforcing Stricter Land Administration by Hunan Government* (Document Xiang Zheng Fa[2005]4) and the *Regulation on Resettlement for Construction of Large and Medium-sized Reservoir*;
- County level of Xinshao County: the *Implementation Measures on Compensation of Land Requisition and Resettlement for Construction of Xinshao County Xiaoxi Hydropower Project*, the *Notice on Truly Implementing Resettlement of Xiaoxi Hydropower Project*, the *Measures on Financial Regulation of Specific Capital for Resettlement of Xinshao County Xiaoxi Hydropower Reservoir*, the *Preferential Policies for Resettlement of Xinshao Xiaoxi Hydropower Project*, the *Implementation Measures on Resettlement and Land Adjustment of Xinshao County Xiaoxi Hydropower Project* and the *Methods on Identifying and Determining Persons Needed be Resettled Due to Xinshao County Xiaoxi Hydropower*



Project²³;

- the Project level: the *Planning Report on Inundation Treatment and Resettlement for the Preliminary Design Phase of Xiaoxi Hydropower Project* (Document Xiang Yi Han[2005]50) approved by the Hunan Resettlement & Development Bureau.

To ensure the successful implementation of Resettlement, the project owner signed the *Package Agreement of Resettlement Task and Investment* with Xinshao County government on June 23, 2005. According to the agreement, the project owner will pay Xinshao County government compensation fees for resettlement as per the *Planning Report on Inundation Treatment and Resettlement of Preliminary Design Phase of Xiaoxi Hydropower Project* (Document Xiang Yi Han[2005]50) approved by Hunan Resettlement & Development Bureau, and Xinshao County government will be in full charge of relevant resettlement task. Xinshao County government has particularly established the headquarters of Xiaoxi Hydropower Project's Resettlement Work to tackle the resettlement. To guarantee the openness, fairness and transparency of resettlement procedure as well as reasonable usage of resettlement fees, the project owner invited Xiangyi Construction Supervision Co., Ltd of Hunan Province to supervise the whole process of resettlement. Under the supervision of the company, the headquarters of Xiaoxi Hydropower Project's Resettlement work has signed the compensation agreement related to resettlement with each resettled family.

Air pollution and noise

Waste gas, dust and noise generated by the excavation and transportation during the construction of the Project will have certain impacts on the air environment and acoustical environment of the construction area. Measures to reduce waste gas and dust will be taken, including processing concrete in a closed workshop and transporting it in a type of closed vehicles, sprinkling water during construction, road-hardening and regularly sprinkling water on the road; and measures to reduce the impacts of noises as well, including constructing isolation booth, outfitting the construction machines with vibration dampening and sound insulation equipment, providing construction staff with protection devices and avoiding generating sudden noises during rest time.

Air pollution and noise generated by the construction of the Project satisfy the requirement of the *Integrated Emission Standard of Air Pollutants* (GB16297-1996) and the *Noise Limits for Construction Site* (GB12523-90).

Waste water

Production waste water and residential waste water will be generated during the construction and operation of the Project. Main pollutants of production waste water are suspended particles, which are innocuous, and waste water will be recycled after removing the suspended particles by means of sedimentation tank. Waste water containing oil will be recycled after separating the waste oil from water. Residential waste water will be discharged after being treated in septic tank and reaching the relevant standards. Waste water emissions of the Project satisfy the requirement of the first standard of the *Sewage Drainage Comprehensive Standard* (GB8978-1996).

Solid waste

Waste solid and discarded soil generated during the construction will be recycled, and those which can

23 [Http://www.xinshao.gov.cn/zhuanti/yimin/yxdz/](http://www.xinshao.gov.cn/zhuanti/yimin/yxdz/).



not be recycled will be sent to the spoil area for treatment. Residential garbage generated during the construction and operation will be collected and regularly sent to garbage disposal station by particular staff in charge.

Ecological impact


The Project is located the area where has no native vegetation, rare aquatic, terrestrial animals. Terrestrial wildlife in the area affected by the Project is ordinary small reptiles, small mammals and birds, whose survival will not be affected by the project construction. After completion of the construction, stream current will be slowed and quantity of plankton increased, which is conducive to the growth of fish; in the meanwhile, the project owner will throw 250 million fish fries into the affected river between April and June each year, for the purpose of promoting the development of fishery in the area affected by the Project.

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

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

>>

The Project use clean renewable energy to generate electricity whose environmental impact comply with relevant national laws and regulations. Environmental impacts are considered not significant.



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

>>

Major stakeholders identified for the Project are the migrants and the local government.

From Aug., to Oct., 2006, the project owner carried out the first round of survey focus on the migrants of the Project. Totally 250 questionnaires were distributed in a random manner to the migrants of the Project and copies of the questionnaires were allowed to be submitted. The questionnaires mainly focus on following issues:

- What's the attitude of the stakeholders on the construction and operation of the Project?
- What positive impacts will be introduced by the implementation of the Project from the view of stakeholders?
- What negative impacts will be introduced by the implementation of the Project from the view of stakeholders?
- What measures should be applied to reduce the negative impacts from the view of stakeholders?

Migrants involved in the Project and local residents take active part in the survey. As on 20/10/2006, totally 316 questionnaires collected, results of which are summarized in Section E.2.

Based on results of the first round of survey, the project owner took following measures to avoid potential negative impacts:

- Verify compensation fee of the Project, supervise and urge the issue of compensation fee;
- Use different ways to disseminate information on which regulation is followed to determine compensation standards.
- Hold special meeting with certain stakeholder on how to solve their problems;
- Use different ways to disseminate information on how the construction of the Project is following the requirement of EIA and relevant regulations.

In order to have clear understanding on the change of opinion of stakeholders, the project owner carried out the second round of survey use same questionnaire. Totally 250 questionnaires were distributed to stakeholders who has participate in the first round of survey and 212 questionnaires were collected. Results of which are summarized in Section E.2.

At the same time, based on comprehensive investigation, the government of Xinshao County issued a support letter for the Project.

E.2. Summary of the comments received:

>>

Result of the first round of survey:

According to the 316 questionnaires collected, the basic structure of the respondents is illustrated in Table 5.



Table 5. The basic structure of the respondents

Structure of gender			Structure of educational level			Structure of age		
Gender	Number	Percentage (%)	Educational level	Number	Percentage (%)	Age	Number	Percentage (%)
Male	240	76	Junior college and higher	14	4	20 and younger	10	3
Female	73	23	Senior high school and technical secondary school	61	19	20~30	37	12
Left blank	3	1	Junior high school	114	36	31~40	70	22
			Below junior high school	65	21	41~50	75	24
			Left blank	62	20	51~60	79	25
						60 and older	36	11
						Left blank	9	3

According to the 316 questionnaires collected, attitudes towards the Project by the local stakeholders are summarized as follows:

- 314 respondents (99.36%) support the construction of the Project, 1 respondent (0.32%) shows indifference towards the construction, and 1 respondent (0.32%) gives no response.
- Respondents consider that the positive impacts possibly brought about by the Project construction include increased income (61%), reduced electricity price (61%), increased employment opportunities (58%), improved living standards (58%), improved navigation conditions (54%), increased fishing output and cultivation (53%), and increased agricultural output (9%).
- Negative impacts concerned by the respondents which might be caused by the Project construction include land occupation (86%), destruction of ecological environment (29%), noise generation (13%) and decrease in water supply (10%).
- Among the respondents, 78% respondents have obtained the compensation, 61% respondents are satisfied with the compensation standards.
- 87 respondents (28%) are not satisfied with the compensation standards, some consider that property compensation for resettlement is lower than their expectation (7%), some consider that the compensation is not in line with the interests of migrants (3%), some hope that the compensation can be granted as soon as possible (17%), and some hope that compensation can be made as per the compensation standards newly released (9%).

Result of the second round of survey:

According to the 212 questionnaires collected, it can be drawn that 90% of the respondents have obtained the compensation and 97% of the respondents are satisfied with the compensation standards. Both of the indexes are significantly improved. The other 7 respondents left blank.

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

>>

Land occupation and resettlement compensation plan of the Project has been approved in 2005 by Hunan



Resettlement & Development Bureau²⁴, with a compensation standard higher than that for other hydropower projects under construction in Hunan Province²⁵. As described in Section D.1, the project owner has entrusted the task of resettlement fully to the government of Xinshao County, and invited Xiangyi Construction Supervision Co., Ltd of Hunan Province to supervise the whole process of the task. In June of 2005, the project owner signed the *Package Agreement of Resettlement Task and Investment* with the government of Xinshao County and paid resettlement compensation fees to the government of Xinshao County according to the process of resettlement. In July of 2006, the project owner signed the *Supplemental Package Agreement of Resettlement Task and Investment* with the government of Xinshao County and increased the previously agreed amount of compensation fees by 13.6%.

Moreover, special fund has been arranged by the Project for ecological environment protection. Grass cultivation and tree planting will be carried out to achieve recovery of plant. The Project owner is constructing isolation booth, outfitting the construction machines with vibration dampening and sound insulation equipment to reduce the impact of noise to satisfy the requirement of the *Standard of Environmental Noise of Urban Area* (GB 3096-93). The Project will satisfy downstream industrial and residential water demand by adjusting operation of the turbines.

During the first round of survey, issues of compensation to migrants were concerned by some respondents. With effective communication and dissemination of information on relevant issues, the result of the second round of survey shows that stakeholders are satisfied.

To protect benefit of migrants and guarantee the implementation of the Project, the project owner will enhance following practice:

- Make all of compensation standard, method of compensation measure and calculation and issue of the compensation fee public available in an open and transparent manner.
- Supervise the implementation of land occupation and resettlement compensation plan.
- Arrange more resources for resettlement to accelerate the resettlement process.

24 Approval by Hunan Province Government on the plan design report of implementing immigrant resttlement as a result of land occupation by the construction of Hunan Province Zishui Xiaoxi Hydropower Project under technical construction design phase(Document No. Xiangzhenghan [2006]9).

25 Comparison between compensation standards for inundation by reservoirs of some projects in Hunan Province.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

**Annex 3****BASELINE INFORMATION**

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

The following tables summarise the numerical results from the equations listed in the approved methodology ACM0002 (version 6). The information provided by the tables includes data, data sources and the underlying calculations.

Table A1. Electricity generation of the Central China Grid in 2003

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Jiangxi	27165000	6.43	25418291
Henan	95518000	7.68	88182218
Hubei	39532000	3.81	38025831
Hunan	29501000	4.58	28149854
Chongqing	16341000	8.97	14875212
Sichuan	32782000	4.41	31336314
Total			225987719

Data source: China Electric Power Yearbook 2004.

Table A2. Electricity generation of the Central China Grid in 2004

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Jiangxi	30127000	7.04	28006059
Henan	109352000	8.19	100396071
Hubei	43034000	6.58	40202363
Hunan	37186000	7.47	34408206
Chongqing	16520000	11.06	14692888
Sichuan	34627000	9.41	31368599
Total			249074186

Data source: China Electric Power Yearbook 2005.

Table A3. Electricity generation of the Central China Grid in 2005

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Jiangxi	30000000	6.48	28056000
Henan	131590000	7.32	121957612
Hubei	47700000	2.51	46502730
Hunan	39900000	5	37905000
Chongqing	17584000	8.05	16168488
Sichuan	37202000	4.27	35613475
Total			286203305



Data source: China Electric Power Yearbook 2006.



Table A4. Calculation of simple OM emission factor of the Central China Grid in 2003

Energy	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total Fuel G=A+B+...+ F	Emission factor (tC/TJ) H	Oxidation rate (%) I	NCV (MJ/t or 1000m ³) J	Emission ²⁶ (tCO ₂ e) K
Coal	10 ⁴ t	1427.41	5504.94	2072.44	1646.47	769.47	2430.93	13851.66	25.8	100	20908	273971539.89
Other washed coal	10 ⁴ t	2.03	39.63	0	0	106.12	0	147.78	25.8	100	8363	1169146.40
Coke	10 ⁴ t	0	0	0	1.22	0	0	1.22	29.2	100	28435	37142.18
Coke oven gas	10 ⁸ m ³	0	0	0.93	0	0	0	0.93	12.1	100	16726	69013.15
Crude oil	10 ⁴ t	0	0.5	0.24	0	0	1.2	1.94	20	100	41816	59490.23
Diesel	10 ⁴ t	0.52	2.54	0.69	1.21	0.77	0	5.73	20.2	100	42652	181015.94
Fuel oil	10 ⁴ t	0.42	0.25	2.17	0.54	0.28	1.2	4.86	21.1	100	41816	157229.00
Refinery gas	10 ⁴ t	1.76	6.53	0	0.66	0	0	8.95	15.7	100	46055	237285.34
Nature gas	10 ⁸ m ³	0	0	0	0	0.04	2.2	2.24	15.3	100	38931	489222.52
Other energy	10 ⁴ tCe	0	11.04	0	0	16.2	0	27.24	0	100	0	0
Total emission of the Central China Grid (tCO₂e)								276371085				

Data sources: China Energy Statistical Yearbook 2004.

26 If the unit of the fuel is 10⁴ t, then $K=G \times H \times I \times J \times 44 / 12 / 10^4$; if the unit of the fuel is 10⁸ m³, then $K=G \times H \times I \times J \times 44 / 12 / 10^3$. The same about the calculation of K in Table A5 and Table A6.



Table A5. Calculation of simple OM emission factor of the Central China Grid in 2004

Energy	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total Fuel G=A+B+...+ F	Emission factor (tC/TJ) H	Oxidation rate (%) I	NCV (MJ/t or 1000m ³) J	Emission (tCO ₂ e) K
Coal	10 ⁴ t	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	17144.1	25.8	100	20908	339092605.29
Cleaned coal	10 ⁴ t	0	2.34	0	0	0	0	2.34	25.8	100	26344	58316.13
Other washed coal	10 ⁴ t	48.93	104.22	0	0	89.72	0	242.87	25.8	100	8363	1921441.23
Coke	10 ⁴ t	0	109.61	0	0	0	0	109.61	29.2	100	28435	3337011.42
Coke oven gas	10 ⁸ m ³	0	0	1.68	0	0.34	0	2.02	12.1	100	16726	149899.53
Other gas	10 ⁸ m ³	0	0	0	0	2.61	0	2.61	12.1	100	5227	60527.09
Crude oil	10 ⁴ t	0	0.86	0.22	0	0	0	1.08	20	100	41816	33118.27
Gasoline	10 ⁴ t	0	0.06	0	0	0.01	0	0.07	18.9	100	43070	2089.33
Diesel	10 ⁴ t	0.02	3.86	1.7	1.72	1.14	0	8.44	20.2	100	42652	266627.32
Fuel oil	10 ⁴ t	1.09	0.19	9.55	1.38	0.48	1.68	14.37	21.1	100	41816	464893.14
Refinery gas	10 ⁴ t	3.52	2.27	0	0	0	0	5.79	15.7	100	46055	153506.38
Nature gas	10 ⁸ m ³	0	0	0	0	0	2.27	2.27	15.3	100	38931	495774.61
Other energy	10 ⁴ tCe	0	16.92	0	15.2	20.95	0	53.07	0	100	0	0
Total emission of the Central China Grid (tCO₂e)								346035810				

Data sources: China Energy Statistical Yearbook 2005.



Table A6. Calculation of simple OM emission factor of the Central China Grid in 2005

Energy	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total Fuel G=A+B+...+ F	Emission factor (tC/TJ) H	Oxidation rate (%) I	NCV (MJ/t or 1000m ³) J	Emission (tCO ₂ e) K
Coal	10 ⁴ t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	17827.75	25.8	100	20908	352614496.76
Cleaned coal	10 ⁴ t	0.02	0	0	0	0	0	0.02	25.8	100	26344	498.43
Other washed coal	10 ⁴ t	0	138.12	0	0	89.99	0	228.11	25.8	100	8363	1804669.00
Coke	10 ⁴ t	0	25.95	0	106.5	0	0	130.95	29.2	100	28435	3986695.05
Coke oven gas	10 ⁸ m ³	0	0	1.15	0	0.36	0	1.51	12.1	100	16726	112053.61
Other gas	10 ⁸ m ³	0	10.2	0	0	3.12	0	13.32	12.1	100	5227	308896.88
Crude oil	10 ⁴ t	0	0.82	0.36	0	0	0	1.18	20	100	41816	36184.78
Gasoline	10 ⁴ t	0	0.02	0	0	0.02	0	0.04	18.9	100	43070	1193.90
Diesel	10 ⁴ t	1.3	3.03	2.39	1.39	1.38	0	9.49	20.2	100	42652	299797.78
Fuel oil	10 ⁴ t	0.64	0.29	3.15	1.68	0.89	2.22	8.87	21.1	100	41816	286959.09
Refinery gas	10 ⁴ t	0.71	3.41	1.76	0.78	0	0	6.66	15.7	100	46055	176572.11
Nature gas	10 ⁸ m ³	0	0	0	0	0	3	3	15.3	100	38931	655208.73
Other coking products	10 ⁴ t	0	0	0	1.5	0	0	1.5	25.8	100	28435	40349.27
Other energy	10 ⁴ tCe	0	2.88	0	1.74	32.8	0	37.42	0	100	0	0.00
Total emission of the Central China Grid (tCO₂e)								360323575				

Data sources: China Energy Statistical Yearbook 2006.

Calculate with data provided in Table A1~A6, $EF_{OM,y} = (276371085+346035810+360323575) / (225987719+249074186+286203305) = 1.2909$ tCO₂e/MWh.



Table A7. Data and result of Step a.

Energy	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total Fuel G=A+B+...+F	NCV (MJ/t or 1000m ³) H	Emission factor (tC/TJ) I	Oxidation Rate J	Emission (tCO ₂ e) K
		A	B	C	D	E	F					
Raw coal	10 ⁴ t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	17827.75	25.8	100	20908	352,614,497
Cleaned coal	10 ⁴ t	0.02	0	0	0	0	0	0.02	25.8	100	26344	498
Other washed coal	10 ⁴ t	0	138.12	0	0	89.99	0	228.11	25.8	100	8363	1,804,669
Coke	10 ⁴ t	0	25.95	0	106.5	0	0	130.95	29.2	100	28435	3,986,695
Sub-total												358,406,359
Crude oil	10 ⁴ t	0	0.82	0.36	0	0	0	1.18	20	100	41816	36,185
Gasoline	10 ⁴ t	0	0.02	0	0	0.02	0	0.04	18.9	100	43070	1,194
Diesel	10 ⁴ t	1.3	3.03	2.39	1.39	1.38	0	9.49	20.2	100	42652	299,798
Fuel oil	10 ⁴ t	0.64	0.29	3.15	1.68	0.89	2.22	8.87	21.1	100	41816	286,959
Sub-total												624,136
Natural gas	10 ⁷ m ³	0	0	0	0	0	3	3	15.3	100	38931	655,209
Coke oven gas	10 ⁷ m ³	0	0	1.15	0	0.36	0	1.51	12.1	100	16726	112,054
Other gas	10 ⁷ m ³	0	10.2	0	0	3.12	0	13.32	12.1	100	5227	308,897
Refinery gas	10 ⁴ t	0.71	3.41	1.76	0.78	0	0	6.66	15.7	100	46055	176,572
Sub-total												1,252,732
Total												360,283,227

Data sources: China Energy Statistical Yearbook 2006.

Table A8. Emission factor of best technology

	Variable	Electricity supply efficiency	Emission factor of fuel (tC/TJ)	Oxidation rate	Emission factor (tCO ₂ /MWh)
		A	B	C	D=3.6/A/1000*B*C*44/12
Coal-based power plants	$EF_{Coal,Adv}$	35.82%	25.8	1	0.9508
Gas-based power plants	$EF_{Gas,Adv}$	47.67%	15.3	1	0.4237
Oil-based power plants	$EF_{Oil,Adv}$	47.67%	21.1	1	0.5843

Calculate with data provided in Table A7 and formula (4)~(6), the value for λ_{Coal} is 99.48%, the value for λ_{Oil} is 0.17% and the value for λ_{Gas} is 0.35%.

Therefore $EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9483 \text{ tCO}_2\text{e/MWh}$.



Table A9. Installed capacity of the Central China Grid in 2005

	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power (MW)	5906	26267.8	9526.3	7211.6	3759.5	7496	60167.2
Hydro power (MW)	3019	2539.9	8088.9	7905.1	1892.7	14959.6	38405.2
Nuclear power (MW)	0	0	0	0	0	0	0
Wind power and Other (MW)	0	0	0	0	24	0	24
Total (MW)	8925	28807.7	17615.2	15116.7	5676.2	22455.6	98596.4

Data source: China Electric Power Yearbook 2006.

Table A10. Installed capacity of the Central China Grid in 2003

	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power (MW)	5407.8	17635.5	8173.3	6446.7	3126.2	6104	46893.5
Hydro power (MW)	2307.4	2438	7337.2	6603.1	1329.8	12341.5	32357
Nuclear power (MW)	0	0	0	0	0	0	0
Wind power and Other (MW)	0	0	0	0	0	0	0
Total (MW)	7715.2	20073.5	15510.5	13049.8	4456	18445.5	79250.5

Data source: China Electric Power Yearbook 2004.

Table A11. Installed capacity of the Central China Grid in 2002

	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power (MW)	5128.8	15904.5	8147.8	4975.6	3004.5	6142	43303.2
Hydro power (MW)	2197.4	2438	7213.9	6135.3	1195.5	11854.6	31034.7
Nuclear power (MW)	0	0	0	0	0	0	0
Wind power and Other (MW)	0	0	0	0	0	0	0
Total (MW)	7326.2	18342.5	15361.7	11110.9	4200	17996.6	74337.9

Data source: China Electric Power Yearbook 2003.



Table A12. Calculation of generation capacity additions of the Central China Grid

	Installed capacity in 2002 (MW) A	Installed capacity in 2003 (MW) B	Installed capacity in 2005 (MW) C	Capacity additions from 2002 to 2005 (MW) D=C-A	Share in total capacity additions
Thermal power	43303.2	46893.5	60167.2	16864	69.52%
Hydro power	31034.7	32357	38405.2	7370.5	30.38%
Nuclear power	0	0	0	0	0.00%
Wind power and Other	0	0	24	24	0.10%
Total	74337.9	79250.5	98596.4	24258.5	100.00%
Share in total installed capacity of 2005	75.40%	80.38%	100%		

$$EF_{BM,y} = 0.9483 \times 69.52\% = 0.6592 \text{ tCO}_2\text{e/MWh.}$$



Annex 4

MONITORING INFORMATION

The calibration of meters & metering, the QA/QC procedure and others of the monitoring plan should be carried out with reference to the Power Purchase Agreement of the Project, the Parallel Operation Agreement of the Project and the checking and testing standard and the specification of the monitoring equipments. A CDM Manual for the monitoring of the Project has been drafted including following aspects:

- Operation and management structure, including the authority and responsibility for project management, registration, monitoring and reporting;
- Training of monitoring personnel;
- The installment, calibration and maintenance of the monitoring equipment, including equipment detailed information;
- Possible monitoring data adjustments & uncertainties;
- Emergency preparedness; and
- Internal audits of the implementation of monitoring plan.

Main Electrical Connection Diagram is provided to DOE. Below is a simple diagram of the location of the power meters:

