



**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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Zhongzhou 16.5 MW Hydropower Project

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Gelöscht: 3

Gelöscht: 05

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 DNA's comments and submitted to DOE for public comments
03	16/04/2007	Revised based on validation protocol
04	23/05/2007	Update contact info of buyer to keep consistent with MOC
<u>05</u>	<u>29/12/2007</u>	<u>Corrections as per request for review</u>

A.2. Description of the project activity:

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The Zhongzhou 16.5 MW Hydropower Project (hereafter referred to as the Project) is sited on the mid-and-down stream of Nanshui River within Zhongzhou Village, Sangesi Town, Longhui County, Shaoyang City, Hunan Province, P.R.China. It is a 16.5 MW hydropower plant with power density of 105.7 W/m².

Water diversion utilizing gate dam plus overflow dam in conjunction with diversion channel is adopted by the Project, in which water is diverted to the power house to generate electricity. The total installed capacity of the Project is 16.5 MW with a guaranteed output of 4.358 MW. It is estimated that the feed-in electricity to the Central China Grid is approximately 55.4 GWh per year which may achieve emission reductions of 360,448 tCO₂e over the first crediting period. All the electricity generated will be delivered to the Central China Grid via a 35 kV outlet circuit.

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;
- ◆ stimulating economy development of least developed area in China and promoting environmental protection through provide clean energy;
- ◆ 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. After that, CDM development and relevant revenues was considered by the Project owner. The construction of the Project was started on Sep., 15th, 2005. It is under construction at present and the 1st turbine is proposed to be put into operation by the end of Aug., 2007 while the 2nd and the 3rd turbine are proposed to be put into operation by the end of Dec., 2007. The Project is invested by Hunan Zhongzhou Hydropower Development Co., Ltd. and constructed by Sino Hydro Engineering Bureau 8.

**A.3. Project participants:**

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Project 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 Zhongzhou Hydropower Development Co., Ltd. (project owner)	No
Sweden	Carbon Asset Management Sweden AB (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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Zhongzhou Village, Sangesi Town, Longhui 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 Nanshui River within Zhongzhou Village, Sangesi Town, Longhui County, Shaoyang City, Hunan Province, P.R.China. The Project has geographical coordinates with east longitude of 110°22'14" and north latitude of 27°9'23". The project site is 19 km to the downtown of Longhui County and 70 km to the downtown of Shaoyang City. Figure 1 shows the location of the Longhui County. Figure 2 shows the location of the Project.

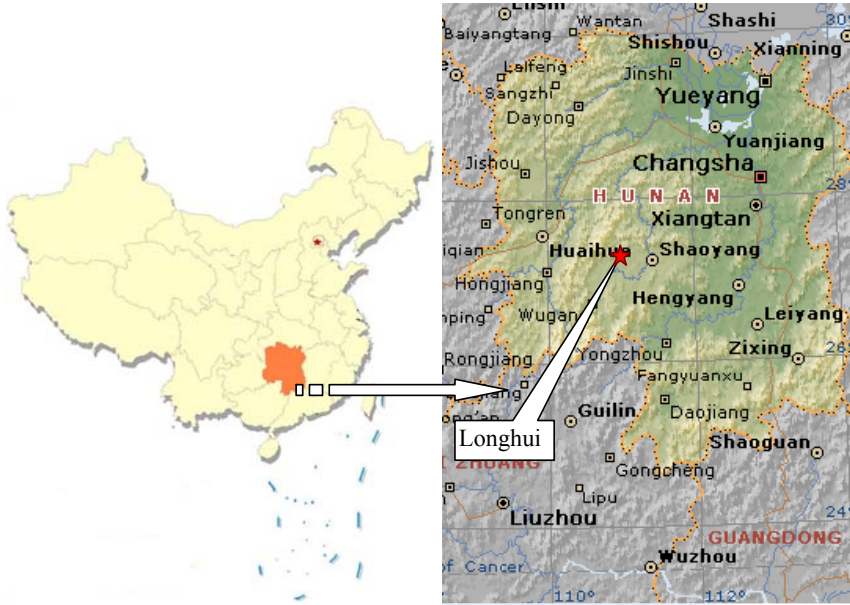


Figure 1. Location of Longhui County



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 diversion type run-of-river hydropower plant with the maximum dam height of 14.5 m. The Project is designed to deliver discharge flow of 225 m³/s with 8.5 m of water head through a 525 m long diversion channel. Three sets of 5.5 MW Fancies turbine and associated generators which are made in China will be installed in the Project. The total installed capacity of the Project is 16.5 MW. With 156,078 m² of reservoir area¹, the power density of the Project is 105.7 W/m². It is estimated that the feed-in electricity to the Central China Grid is approximately 55.4 GWh per year. The electricity generated by the Project will be delivered to the Central China Grid via a 35 kV outlet circuit through Chashan substation.

The Project involves no technology transfer from abroad. Hydro turbines and generators used in the Project are produced by Chongqing Hydro Turbine Factory Co., Ltd., which is environmental safe. 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	Sets	Type	Key Index
Hydro Turbine-1	1	ZZ480-LH-360	Rated head 8.5 m
			Rated power 5.789 MW
			Declared working condition efficiency 93%
Hydro Turbine-2	2	ZD480-LH-360	Rated head 8.5 m
			Rated power 5.789 MW
			Declared working condition efficiency 92.8%
Generator-1	3	SF5500-52/5500	Rated voltage 6.3 kV
			Power factor (lagged) 0.8
No.1 Main Transformer on site	1	SFZ9-8000kVA/35 38.5 ± 3 × 2.5/6.3kV	A Two Winding Transformer connected with No.1 generator whose short current impedance is 7.5%.
No.2 Main Transformer on site	1	SFZ9-16000KVA/35kV 38.5 ± 3 × 2.5/6.3kV	A Two Winding Transformer connected with No.2 and No.3 generator whose short current impedance is 7.5%.

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The project owner hires ten graduates from Hunan Engineering and Technical College of Water Resources and Hydroelectric Power to operate the Project. They are junior college students and technical school students whose major are hydropower plant, electric equipment and automatic control system of electricity system. Training schedule for these employees will be drafted before the Project is put into operation.

¹ Area of 234 Mu on P2 of Preliminary Design Report. Conversion rate from Mu to m² is 1 Mu=667 m².



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

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Renewable crediting period (7yrs×3) is adopted by the Project. It is expected that the Project activities will generate emission reductions for about 360,448 tCO₂e over the first 7-year crediting period from Nov., 2007 to Oct., 2014.

Years	Annual estimation of emission reductions in tonnes of CO ₂ e
Nov., to Dec., 2007	2,907 ²
2008	52,323
2009	52,323
2010	52,323
2011	52,323
2012	52,323
2013	52,323
Jan., to Oct., 2014	43,603
Total estimated reductions (tonnes of CO₂e)	360,448
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO₂e)	51,493

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.

² Emission reductions generated by the first set of hydro turbine and accompanied generator are estimated from Nov., 2007. Emission reductions generated by the other two sets of hydro turbines and accompanied generators are estimated from Jan., 2008.

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**SECTION B. Application of a baseline methodology****B.1. Title and reference of the approved baseline methodology applied to the project activity:**

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

The *Tool for the Demonstration and Assessment of Additionality* ver 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 run-of-river hydropower plant.
- 2) The power density of the Project is 105.7 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 available³.

B.3. Description of how 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.

³ Detailed information of the grid in China can be obtained from the *China Electric Power Yearbook* (published annually), the *China Energy Statistical Yearbook* (published annually after 2003) 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=1235>) on December 15th, 2006.



	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 run-of-river hydropower plant 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.

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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* approved by CDM EB.

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 1.2~1.6 m/s that has no economically exploitable wind resource⁴. Furthermore, the project site can not provide biomass resource for power generation with a commensurate scale to the Project⁵. Moreover, other renewable energy, such as solar PV, is suffered with high cost and 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 16.5 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 grids⁶. For these reasons, the possible alternative baseline scenario of building a fuel-fired power plant with an installed capacity lower than 16.5 MW conflicts with China's current regulations. Therefore, Alternative I is not feasible.

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

For 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 satisfies China's regulations, which is also economically feasible.

Therefore, Alternative II and Alternative IV are analysed in Step 2 as potential baseline alternatives.

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 *Tools for the Demonstration and Assessment of Additionality* suggests three analysis methods which 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)

4 Page 3 of the preliminary design report of the Project.

5 <http://www.89110.net/news/Show.asp?ArticleID=56733>, <http://www.jlcoop.gov.cn/info.asp?id=4023>.

6 *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.



According to the *Economic Evaluation Code for Small Hydropower Projects* issued by the Ministry of Water Resources in 1995 (Document No. SL16-95), the financial benchmark rate of return (after tax) adopted by the Project is 10% for the IRR of total investment (FIRR). On the basis of 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

According to the Preliminary Design Report and document No. XiangJiaZhong[2005]183, basic parameters for calculation of financial indicators of the Project are summarized in Table 2:

Table 2. Financial parameters for calculation of IRR of total investment (FIRR) of the Project

Series	Item	Value	Remark	Data source
	general description			
1	installed capacity	16.5	MW	PDR 268
2	feed-in electricity	55.40	GWh	Document No. XiangJiaZhong[2005]183
3	construction period	2	year	PDR 268
4	operation period	30	year	PDR 268
5	bus-bar tariff (including VAT)	0.316	RMB/kWh	Document No. XiangJiaZhong[2005]183
	investment plan			
	total investment	12614	10000RMB	Sum of value of fixed assets and fluid capital
1	value of fixed assets	12599	10000RMB	PDR 267
2	fluid capital	15	10000RMB	PDR 267
	tax			
1	VAT	6.00%		PDR 269
2	income tax	33%		PDR 269
3	urban maintenance and construction tax	1%		PDR 269
4	surtax for education	3%		PDR 269
	cost			
1	rate for maintenance	1.0%		PDR 268
2	staff	24	person	PDR 268
3	salary	1	10000RMB/year	PDR 268
4	rate of employee welfare	40%		PDR 268
5	water fee	0.001	RMB/kWh	PDR 268
8	other fees	12	RMB/kW	PDR 268
9	integrated depreciation rate	3.31%		PDR 268
	other			
1	surplus reserves and community chest	15%		PDR 269

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(2) Comparison of the financial benchmark of IRR of total investment (FIRR) for the Project

In accordance with the benchmark analysis (Option III), if the financial indicators (such as FIRR) 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 IRR of total investment (FIRR) of the Project is 8.51%, which is lower than the benchmark (10%). 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 (not including VAT)

The results of sensitive analysis of three indicators of the Project are shown in Table 3 and Figure 3.

Table 3. IRR of total investment (FIRR) sensitivity to different financial parameters of the Project (without CERs sales revenues)

Parameter \ Range	-10%	0	+10%
Total investment (%)	9.50	8.51	7.67
Annual O&M cost (%)	8.62	8.51	8.40
Bus-bar tariff (not including VAT) (%)	7.48	8.51	9.50

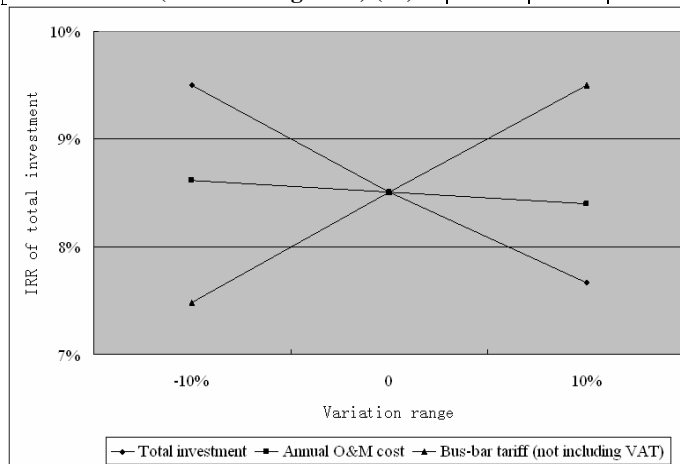


Figure 3. IRR of total investment (FIRR) sensitivity to different financial parameters of the Project (without CERs sales revenues)

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

Based on the Investment Analysis above, the Project is not financially attractive without consideration of CERs 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 8/tCO₂e, 7 yrs×3 crediting period), the IRR of total investment (FIRR) of the Project will be significantly improved to reach benchmark, as shown in Table 4.



Table 4. Comparison of IRR of total investment (FIRR) of the Project with and without CERs sales revenues

	the Project	Benchmark
Without CERs sales revenues	8.51%	10%
With CERs sales revenues	12.11%	10%

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It is shown in Table 4 that CERs sales revenues can alleviate the identified barriers, therefore the Project is additional.

Step 3 Barrier analysis

Barrier analysis is not adopted for the Project which satisfies the requirement of the *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 newly built 16.5 MW hydropower plant located in Hunan Province, therefore, activities similar to the Project should located in Hunan Province with an installed capacity between 15~50 MW. Here 15 MW is limit for small scale CDM project and 50 MW is the limit for small hydropower project⁷.

Furthermore, hydropower plants being completed before 2002 were all developed by the state owned enterprises, most of the plants were constructed with the national or the local governmental funds, or the government provide the loan guarantee for the companies, the developers didn't have any financing difficulties. Meanwhile, the government provides favourable policies for electricity tariff of the plants at that time, namely the electricity tariff of each power plant was determined according to the principle of full-cost recovery⁸, so developer didn't have any investment risk. But the favourable policies for electricity tariff were cancelled in 2001⁹. Therefore project activities similar to the Project should be constructed since 2002.

Similar activities identified with such criteria are listed in Table 5¹⁰.

7 *Economic Evaluation Code for Small Hydropower Projects* issued by the Ministry of Water Resources in 1995 (Document No. SL16-95)

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

9 State Planning Committee, Notice on Standardizing Electricity Tariff Management (No. 701 Jijiage[2001])

10 China Water Resources Yearbook (2006); Hunan Hydro & Power Design Institute, Investigation Report on Hydropower Plants with Installed Capacity of over 15 MW Constructed since 2002 in Hunan Province, 31/10/2006.



Table 5. Activities similar to the Project

No.	Project name	Installed capacity (MW)
1	Yangmingshan II	22
2	Mulongtan	15
3	Yongxing II	20
4	Chengjiangkou	25
5	Ruoshui	15
6	Leizhong	40.5

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

About 60% of hydropower plants in Hunan Province are run-of-river power plants. Due to the high development rate of hydropower resources in Hunan Province, hydropower resources remaining are characterized by poor conditions, small scales, low value for development and relatively high cost involved¹¹, into which category the Project falls. Hydropower plants in Table 5 were developed earlier than the Project with better natural conditions, so these plants had better financial performances as summarized in Table 6.

Table 6. IRR comparison between the Project and activities similar to the Project¹²

IRR of the Project	IRR of activities similar to the Project	Benchmark IRR
8.51%	12.4% for Yangmingshan II Hydropower Project 11.1% for Mulongtan Hydropower Project 10.8% for Yongxing II Hydropower Project 10.2% for Chengjiangkou Hydropower Project 10.35% for Ruoshui Hydropower Project 10.9% for Leizhong Hydropower Project	10%

It is clearly shown in Table 6 that IRR of activities similar to the Project are all higher than benchmark thus financially feasible, i.e. do not face investment barrier. Since the IRR of the Project is lower than benchmark thus it faces investment barrier, the Project is different from activities similar to the Project from the view of investment and fulfils the requirement of additionality.

To sum up, the proposed project activity faces severe investment barrier and has strong additionality. The proposed project activity would not be implemented without the incentive provided by the CDM.

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;

11 [Http://news.sina.com.cn/c/2006-03-08/07358387620s.shtml](http://news.sina.com.cn/c/2006-03-08/07358387620s.shtml).

12 Hunan Hydro & Power Design Institute, Investigation Report on Hydropower Plants with Installed Capacity of over 15 MW Constructed since 2002 in Hunan Province, 31/10/2006.



·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.

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 38.00% in 2000, 36.76% in 2001, 35.95% in 2002, 32.86% in 2003 and 32.36% in 2004, 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 38.00% in 2000, 36.76% in 2001, 35.95% in 2002, 32.86% in 2003 and 32.36% in 2004, 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 1998 to 2005 (published annually). 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 2000 to 2005 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from Table 1-2 and Table 1-4 of the *Revised 1996*



IPCC Guidelines for National Greenhouse Gas Inventories: Workbook.

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 1.2526 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 (tCe) consumed by relevant power source m in year(s) y,

$COEF_{i,m,y}$ is the CO₂ emission coefficient of fuel i (tCO₂/tCe), 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 methodology¹³:

- 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.

¹³ [Http://cdm.unfccc.int/Projects/Deviations](http://cdm.unfccc.int/Projects/Deviations).



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

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

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

where:

$F_{i,j,y}$ 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 CO₂ emission coefficient of fuel i (tCO₂/tCe), 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 2000 to 2005 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from Table 1-2 and Table 1-4 of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook*.

With reference to the *Notification on Determining Baseline Emission Factor of China's Grid*, the weighted average fuel consumption for power generation of 11 sets of 600 MW sub-critical coal-fired power generators built in 2004 (336.66 gCe/kWh) and the 200 MW oil/gas based combined cycle power generators (268.13 gCe/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 0.6363 tCO₂e/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

$$EF_y = 0.5 \times 1.2526 + 0.5 \times 0.6363 = 0.94445 \text{ (tCO}_2\text{e/MWh)}$$

Baseline emissions

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

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

II. Calculate the project GHG emissions

The Project is a run-of-river hydropower plant that the project emissions should not be considered as per ACM0002, i.e. $PE_y = 0$ tCO₂e.

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, $L_y = 0$ tCO₂e.

IV. Calculate the emission reductions

The project activity will generate GHG emission reductions by avoiding CO₂ emissions from electricity generation by fossil fuel power plants. The emission reduction (ER_y) during a given year y is calculated as follows:

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

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

Data / Parameter:	$CAP_{j,y}$
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:	P365 of <i>China Energy Statistical Yearbook</i> 2005 Edition.
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>IPCC Guideline for National Greenhouse Gas Inventories</i>
Value applied:	0.995 for gas fuel, 0.99 for liquid fuel and 0.98 for solid fuel
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from <i>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:	<i>IPCC Guideline for National Greenhouse Gas Inventories</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 <i>IPCC Guideline for National Greenhouse Gas Inventories</i> is reliable.
Any comment:	-

Data / Parameter:	$FC_{adv,coal}$
Data unit:	gCe/kWh
Description:	weighted average fuel consumption for power generation of 11 sets of 600 MW sub-critical coal-fired power generators built in 2004 (taken as efficiency level of the best technology commercially available in China)
Source of data used:	<i>Notification on Determining Baseline Emission Factor of China's Grid.</i>
Value applied:	336.66
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.
Any comment:	-

Data / Parameter:	$FC_{adv,oil/gas}$
Data unit:	gCe/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:	<i>IPCC Guideline for National Greenhouse Gas Inventories</i>
Value applied:	268.13
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data obtained from <i>IPCC Guideline for National Greenhouse Gas Inventories</i> is reliable.
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:	1.2526
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.
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:	0.6363
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.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

>>

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

According to the preliminary design report of the Project, the annual power generation is estimated to be 55.4 GWh. According to the *Notification on Determining Baseline Emission Factor of China's Grid*, the baseline emission factor for the Project is 0.94445 tCO₂e/MWh and the annual baseline emission of the Project is 52,323 tCO₂e as calculated below.

$$BE_y = EG_y \times EF_y = 55.4 \times 1000 \times 0.94445 = 52,323 \text{ tCO}_2\text{e.}$$

II. Estimated project activity emissions:

The Project is a run-of-river hydropower plant that the project emissions should not be considered as per ACM0002, i.e. $PE_y = 0$ tCO₂e.

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 (11), the annual emission reductions of the Project are 52,323 tCO₂e as calculated below.

$$ER_y = BE_y - PE_y - L_y = 52,323 - 0 - 0 = 52,323 \text{ tCO}_2\text{e}$$

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

>>

Renewable crediting period (7yrs×3) is adopted by the Project. It is expected that the Project activities will generate emission reductions for about 360,448 tCO₂e over the first 7-year crediting period from Nov., 2007 to Oct., 2014.

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)
Nov., to Dec., 2007	0	2,907	0	2,907 ¹⁴
2008	0	52,323	0	52,323
2009	0	52,323	0	52,323
2010	0	52,323	0	52,323
2011	0	52,323	0	52,323
2012	0	52,323	0	52,323
2013	0	52,323	0	52,323
Jan., to Oct., 2014	0	43,603	0	43,603
Total (tCO₂e)	0	360,448	0	360,448

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

14 Emission reductions generated by the first set of hydro turbine and accompanied generator are estimated from Nov., 2007. Emission reductions generated by the other two sets of hydro turbines and accompanied generators are estimated from Jan., 2008.

Gelöscht: Sep

Gelöscht: or the first date of registration

Eingefügt: or the first date of registration

Gelöscht: or the first date of registration

Eingefügt: or the first date of registration



B.7.1 Data and parameters monitored:	
<i>(Copy this table for each data and parameter)</i>	
Data / Parameter:	EG_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 Document No. XiangJiaZhong[2005]183. Actual data will be read from ammeters.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	55,400
Description of measurement methods and procedures to be applied:	Continuously monitored through metering equipments installed at the Chashan 110 kV substation (interconnection facility connecting the Project to the grid) and monthly recorded by the project owner. Back up metering equipments will be installed at the Chashan 110 kV substation 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}
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 6.3 kV Auxiliary Electricity Substation. Recorded per month by appointed staff as backup.
QA/QC procedures to be applied:	Double-checked with readings on 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 0.5 s, 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.
- Electronical 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. Management Structure

Details regarding the management structure of the monitoring plan please refer to Figure 4.

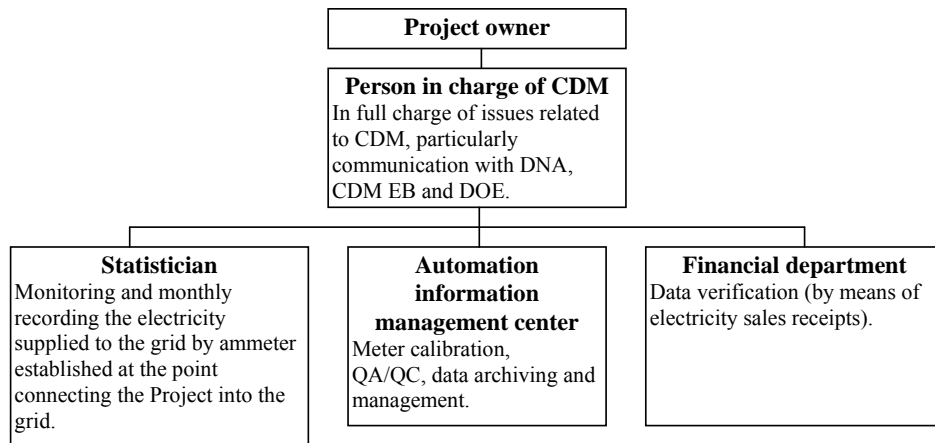


Figure 4. Management Structure of Monitoring Plan

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 the application of the baseline study and monitoring methodology of the Project was completed on 23/05/2007 by Dr. Zheng Zhaoning and Ms. Pan Tao.

Tuttle International Co., Ltd.
Address: Room 109, Building 2, Jiada Jiayuan, Haidian District, Beijng, P.R.China
Tel: (86) 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:**

>>

15/09/2005

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:**

>>

12/11/2007 or registration date, adopt the later one.

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:**

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The EIA report of the Project was completed by the Environmental Protection Institute of Shaoyang City, and approved by the Hunan Environmental Protection Agency in August 2005 (Document No. Xiang Huan Ping [2005]77). The EIA report is drafted in accordance with following laws and regulations:

- Environmental Protection Law of the People's Republic of China,*
- Environmental Impact Assessment Law of the People's Republic of China,*
- Water Law, Law of Water and Soil Conservation and of the People's Republic of China*
- Law of the People's Republic of China on the Prevention and control of Water Pollution*
- Law of the People's Republic of China on the Prevention and control of Solid Waste Pollution*
- Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution*
- Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise*
- Law of the People's Republic of China on the Protection of Wildlife*
- Law of the People's Republic of China on the Protection of Wild Plant*
- Integrated Emission Standard of Air Pollutants (GB16297-1996)*
- Noise Limits for Construction Site (GB12523-90)*
- Sewage Drainage Comprehensive Standard (GB8978-1996)*

According to the EIA report of the Project, environmental impacts possibly caused by the Project and corresponding measures adopted by the project owner are analyzed as follows:

Land use

The Project will permanently take up 141.8 Mu of land. After the completion of the Project, 156 Mu of arable land, 10.5 Mu of vegetable plot, 65.1 Mu of dry land, 59.07 Mu of forestland and 2.4 Mu of pond will be inundated. Houses of 1250 m² will be inundated by the Project, entailing migration of 18 families (totally 80 people). The project owner will make compensations according to the *Regulation on Compensation of Land Requisition and Immigrant Settlement for Construction of Large and Medium-sized Hydraulic and Hydropower Project*, the *Land Administration Law of the People's Republic of China* and relevant regulations. The living conditions of the migrants must be ensured to be at least no worse than before, and settlement of these migrants should be accomplished in the area closest to the land occupied.

Air pollution and noise

Exhaust 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 exhaust 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 outfitting the construction machines with vibration dampening and sound insulation equipment, installing noise screen and avoiding generating sudden noises during rest time. The project owner will provide compensations for those residents directly affected by the Project.

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 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 of Longhui County.

Ecological impact

The Project is located in the area that has no native vegetation, rare aquatic and terrestrial animals. Terrestrial wildlife in the area affected by the Project is ordinary small wildlife with strong adaptability, whose survival will not be affected by the project construction. After completion of the construction, stream will be slowed and quantity of plankton increased, which is conducive to the growth of fish; in the meanwhile, owing to the development of fishery, quantity of cultivated fish in front of the dam will be significantly increased.

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:

>>

Staff of Hunan Zhongzhou Hydropower Development Co., Ltd. made a survey in Jul. of 2006 on the villagers living near the project site. 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?

Comments from these villagers are summarized as follows. The government of Longhui County and relevant agencies, after conducting a comprehensive investigation, provided the support letter for the project which is available for DOE's verification.

E.2. Summary of the comments received:

>>

The survey was conducted through distributing and collecting responses to a questionnaire. Totally 34 questionnaires returned out of 34 with 100% response rate. The basic constitutes of the respondents are shown in Table 7.

Table 7. Statistics on the basic conditions of people surveyed

Structure of educational level			Structure of age		
Educational level	Number	Percentage (%)	Age	Number	Percentage (%)
Junior college and above	4	11.76	20~30	6	17.65
Senior high school and technical secondary school	7	20.59	31~40	4	11.76
Junior high school	13	38.24	41~50	7	20.59
Below junior high school	7	20.59	51~60	10	29.41
N.A.	3	8.82	61	7	20.59

Attitudes of the local residents towards the Project are summarized as follows:

- All people surveyed (100%) support the construction of the Project.
- Possible positive impacts considered by the people surveyed to be caused by the construction of the Project include reduction of electricity price (85.29%), increases in electricity supply (52.94%), creation of employment opportunities (35.29%), improvement of living conditions (32.35%), increases in income (32.35%) and improvement of shipping conditions (17.65%).
- Possible negative impacts as a result of the construction of the Project concerned by the people surveyed include land occupation (85.29%), noises generated (23.53%), decreases in the output of arable land (17.65%), destruction of local ecological environment (8.82%), reduction of fish products (8.82%) and decreases in water supply (2.94%).
- Among the 20 people surveyed who were affected by the land occupation or water usage of the Project, 18 people have obtained the compensations with which 16 of them are satisfied (2 people provided no information in this regard), while one person wish the occupied land can be compensated as business land.



In addition, 26 people surveyed hope that the Project can help reduce the local electricity price, 25 people hope that local water resource conditions can be improved via the Project, 22 people hope that transportation on the dam can be realized, 14 people hope that employment opportunities can be created by the Project, and 3 people hope that local ecological environment can be improved by the Project.

As shown by the responses reflected in the questionnaire, the Project has gained support from the local residents, for people surveyed generally believe that the Project can bring various positive impacts on their living conditions, and people affected have basically obtained the satisfactory compensations.

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

>>

Analysis on the desires expected by the people surveyed to be resolved by the Project is as follows:

·Reduction of electricity price--though adjustment of electricity price is out of the reach of the project owner, completion of the Project will alleviate the electricity shortage of the area, helping reduce electricity price;

·Improvement of water resource conditions--completion of the Project will improve the local water resource conditions, especially irrigation conditions in agriculture, fishery development conditions and navigation capacity of the river course;

·Creation of employment opportunities--completion of the Project will facilitate the development of local tertiary industry and fishery, helping creating employment opportunities;

·Transportation on the dam--the top of the dam has a width of 2.5 m, from the perspective of both the transportation safety and the dam safety, non load-carrying vehicles can be allowed on the dam;

·Sufficient communication on compensation of the occupied land has been carried out by the project owner. All the people who are influenced by the occupied land have signed occupation agreement with the project owner, including the one who previously wished his occupied land can be compensated as business land.

To sum up, construction of the Project satisfies the interests and requirement of stakeholders and has gained the necessary support. Based on the comments received from stakeholders, there has been no need to modify the design, construction and operation pattern of the Project.

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

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Middle Name:	-
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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 2002

	Electricity generation (MWh)	Auxiliary electricity consumption (%)	Electricity delivered to the grid (MWh)
Jiangxi	18648000	7.67	17217698
Henan	84734000	8.03	77929860
Hubei	34301000	7.73	31649533
Hunan	20058000	7.73	18507517
Chongqing	14727000	10.21	13223373
Sichuan	27879000	9.59	25205404
Total			183733385

Data source: *China Electric Power Yearbook 2003*.

Table A2. 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 A3. 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 A4. Calculation of simple OM emission factor of the Central China Grid in 2002

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 ¹⁵ (tCO ₂ e) K
Coal	10 ⁴ t	1062.63	4679.02	1710	1113.78	398.57	1964.32	10928.32	25.8	98	20908	211827873.7*
Cleaned coal	10 ⁴ t	2.72	0	0	0	0	0	2.72	25.8	98	26344	66430.54781*
Other washed coal	10 ⁴ t	3.66	26.49	0	0	249.99	0	280.14	25.8	98	8363	2171973.055
Coke	10 ⁴ t	0	1.15	0	0	0	0	1.15	29.5	98	28435	34663.35501*
Coke oven gas	10 ⁸ m ³	0	0	1.11	0	0	0	1.11	13	99.5	16726	88054.77967*
Other gas	10 ⁸ m ³	0	2.16	0	0	0	0	2.16	13	99.5	5227	53548.10604*
Crude oil	10 ⁴ t	0	0.67	1.17	0	0	0.81	2.65	20	99	41816	80449.8024*
Diesel	10 ⁴ t	1	1.34	1.08	2.19	0.51	0.51	6.63	20.2	99	42652	207353.2866*
Fuel oil	10 ⁴ t	0.33	0.16	0.34	0.69	0	1.51	3.03	21.1	99	41816	97045.23051*
LPG	10 ⁴ t	0	0.02	0	0	0	0	0.02	17.2	99.5	50179	629.7598311*
Refinery gas	10 ⁴ t	0.49	0	0	1.9	0	0	2.39	18.2	99.5	46055	73087.0759*
Nature gas	10 ⁸ m ³	0	0	0	0	0	1.75	1.75	15.3	99.5	38931	380294.067*
Other energy	10 ⁴ tCe	0	3.38	0	0	0	0	3.38	0	0	0	0*
Total emission of the Central China Grid (tCO₂e)								215081402.8				
Fossil power supply of the Central China Grid (MWh)								183733384.7				
OM emission factor of the Central China Grid (tCO₂e/MWh)								1.170616887				

Data sources: China Energy Statistical Yearbook (2000-2002).

15 If the unit of the fuel is 10⁴t, then $K=G \times H \times I \times J \times 44 / 12 / 10^4$; if the unit of the fuel is 10⁸m³, 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.

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Table A5. 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 (tCO ₂ e) K
Coal	10 ⁴ t	1427.41	5504.94	2072.44	1646.47	769.47	2430.93	13851.66	25.8	98	20908	268492109.1*
Other washed coal	10 ⁴ t	2.03	39.63	0	0	106.12	0	147.78	25.8	98	8363	1145763.469*
Coke	10 ⁴ t	0	0	0	1.22	0	0	1.22	29.5	98	28435	36773.29836*
Coke oven gas	10 ⁸ m ³	0	0	0.93	0	0	0	0.93	13	99.5	16726	73775.62621*
Crude oil	10 ⁴ t	0	0.5	0.24	0	0	1.2	1.94	20	99	41816	58895.32704*
Diesel	10 ⁴ t	0.52	2.54	0.69	1.21	0.77	0	5.73	20.2	99	42652	179205.7816*
Fuel oil	10 ⁴ t	0.42	0.25	2.17	0.54	0.28	1.2	4.86	21.1	99	41816	155656.7064*
Refinery gas	10 ⁴ t	1.76	6.53	0	0.66	0	0	8.95	18.2	99.5	46055	273694.28*
Nature gas	10 ⁸ m ³	0	0	0	0	0.04	2.2	2.24	15.3	99.5	38931	486776.4058*
Other energy	10 ⁴ tCe	0	11.04	0	0	16.2	0	27.24	0	0	0	0
Total emission of the Central China Grid (tCO₂e)								270902650				
Fossil power supply of the Central China Grid (MWh)								225987719.2				
OM emission factor of the Central China Grid (tCO₂e/MWh)								1.198749432				

Data sources: China Energy Statistical Yearbook 2004.

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Table A6. 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	98	20908	332310753.2
Cleaned coal	10 ⁴ t	0	2.34	0	0	0	0	2.34	25.8	98	26344	57149.80952
Other washed coal	10 ⁴ t	48.93	104.22	0	0	89.72	0	242.87	25.8	98	8363	1883012.408
Coke	10 ⁴ t	0	109.61	0	0	0	0	109.61	29.5	98	28435	3303869.863
Coke oven gas	10 ⁸ m ³	0	0	1.68	0	0.34	0	2.02	13	99.5	16726	160243.8333
Other gas	10 ⁸ m ³	0	0	0	0	2.61	0	2.61	13	99.5	5227	64703.96147
Crude oil	10 ⁴ t	0	0.86	0.22	0	0	0	1.08	20	99	41816	32787.08928
Gasoline	10 ⁴ t	0	0.06	0	0	0.01	0	0.07	18.9	99	43070	2068.432443
Diesel	10 ⁴ t	0.02	3.86	1.7	1.72	1.14	0	8.44	20.2	99	42652	263961.0466
Fuel oil	10 ⁴ t	1.09	0.19	9.55	1.38	0.48	1.68	14.37	21.1	99	41816	460244.212
Refinery gas	10 ⁴ t	3.52	2.27	0	0	0	0	5.79	18.2	99.5	46055	177060.3219
Nature gas	10 ⁸ m ³	0	0	0	0	0	2.27	2.27	15.3	99.5	38931	493295.7327
Other energy	10 ⁴ tCe	0	16.92	0	15.2	20.95	0	53.07	0	0	0	0
Total emission of the Central China Grid (tCO₂e)								339209149.9				
Fossil power supply of the Central China Grid (MWh)								249074186.3				
OM emission factor of the Central China Grid (tCO₂e/MWh)								1.361879988				

Data sources: China Energy Statistical Yearbook 2005.

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Table A9. Installed capacity of the Central China Grid in 2004

	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power (MW)	5496	21788.5	9509.3	6779.5	3271.1	6900.3	53744.7
Hydro power (MW)	2549.9	2438	7415.1	7448.2	1407.9	13382.9	34642
Nuclear power (MW)	0	0	0	0	0	0	0
Wind power and Other (MW)	0	0	0	0	0	0	0
Total (MW)	8045.9	24226.5	16924.4	14227.8	4679	20283.2	88386.8

Data source: China Electric Power Yearbook 2005, of which the Three Gorge is not involved in the data of Hubei.

Table A10. Installed capacity of the Central China Grid in 2001

	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power (MW)	4869.8	15349	8077.3	4997.8	2898.3	6377	42569.2
Hydro power (MW)	2067.8	2438	7125.6	5966.1	1268	11531.5	30397
Nuclear power (MW)	0	0	0	0	0	0	0
Wind power and Other (MW)	0	0	0	0	0	0	0
Total (MW)	6937.6	17787	15202.9	10963.8	4166.3	17908.5	72966.1

Data source: China Electric Power Yearbook 2002.

Table A11. Installed capacity of the Central China Grid in 2000

	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power (MW)	4474.3	13789	8038.8	4477.4	2995	6090.1	39864.6
Hydro power (MW)	1846	1528	7070.5	5858	1327	11008.3	28637.8
Nuclear power (MW)	0	0	0	0	0	0	0
Wind power and Other (MW)	0	0	0	0	0	0	0
Total (MW)	6320.3	15317	15109.3	10335.4	4322	17098.4	68502.4

Data source: China Electric Power Yearbook 2001.



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

	Installed capacity in 2000 (MW) A	Installed capacity in 2001 (MW) B	Installed capacity in 2004 (MW) C	Capacity additions from 2000 to 2004 (MW) D=C-A	Share in total capacity additions
Thermal power	39864.6	42569.2	53744.7	13880.1	69.80%
Hydro power	28637.8	30397	34642	6004.2	30.20%
Nuclear power	0	0	0	0	0.00%
Wind power and other	0	0	0	0	0.00%
Total	68502.4	72966.2	88386.7	19884.3	100.00%
Share in total installed capacity of 2004	77.5%	82.55%	100%		

$$EF_{BM,y} = 0.9116 \times 69.80\% = 0.6363 \text{ tCO}_2\text{e/MWh.}$$



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.

Below is the diagram of the location of the power meters:

