

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

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Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	<ul style="list-style-type: none">● The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document.● As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at http://cdm.unfccc.int/Reference/Documents.
03	22 December 2006	<ul style="list-style-type: none">● The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

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SECTION A. General description of small-scale project activity
A.1 Title of the small-scale project activity:

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Title: Lixian Yikeyin Small Hydropower Project**Version:** 04**Date of Submission:** 17/04/2009
A.2. Description of the small-scale project activity:

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Lixian Yikeyin Small Hydropower Project (hereafter: the Project), a run-of-river small hydropower project, is located at Putou Village of Li County, Sichuan Province, People's Republic of China. The Project includes two small power plants: Stage 1 and Stage 2. Both of them are located on the Rijiaogou River, which is a branch of Zagunao River. The main parameters for Stage1 and Stage 2 are as followings:

Stage 1: The installed capacity of Stage 1 is 4MW (2MW * 2), with a rated water head of 167m, rated flux of 1.5 m³/s, and operation for 4842h per year, Stage 1 is expected to generate electricity by 19360 MWh per year, and the net power delivered to the grid will be 18300 MWh. The estimated of emission reduction is 17843 tCO₂e.

Stage 2: The installed capacity of Stage 2 is 9.6MW (3.2MW *3), with a rated water head of 366m, rated flux of 1.15 m³/s, and operation for 4502h, Stage 2 is expected to generate electricity by 43220 MWh a year, and the net power exported to the grid will be 40850 MWh. The estimated of emission reduction is 39831 tCO₂e.

In general, the Project has a total installed capacity of 13.6 MW, the annual electricity generation from the Project is expected to be 62580 MWh, and the net power exported to the grid is 59150 MWh. The electricity will deliver to the Central China Power Grid (CCPG). Then, the estimated annual emission reduction is expected to be 57674 tCO₂e.

Implementation of the project activity is expected to result in several positive impacts and contributes to sustainable development of the region as following:

- (a) The project activity generates additional employments during the construction period. Majority of the additional employment opportunities are for unskilled labor.
- (b) The project activity results in flow of financial resources as investment for the project. Significant part of this investment will go into the rural economy towards construction activities in the project site as wages for unskilled labor, construction material, local construction equipment etc.
- (c) The proposed project will reduce greenhouse gas emission by replacing part of the electricity generated in CCPG; hence, the project activity contributes to the environmental well being.

In view of the above, the project activity contributes to the sustainable development of the host country.

A.3. Project participants:

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Name of Party involved(*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants(*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant(Yes/No)
People's Republic of China (host)	Li County Jiujiayi Hydropower Development Co. Ltd.	No
Sweden	Carbon Asset Management Sweden AB	No

A.4. Technical description of the small-scale project activity:
A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

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People's Republic of China

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

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Sichuan Province

A.4.1.3. City/Town/Community etc.:

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Li County, Putou Village, Wuwangan Group

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

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Lixian Yikeyin Small Hydropower Project includes 2 small power plants: Stage 1 and Stage 2, both of them use water potential in Rijiaogou River to generate electricity. Stage 1 locates on the upriver of Stage 2. The distance is 5 km far from the powerhouse of Stage 2 to Li Township, Sichuan Province, P.R. China.

The geographical coordinate of Stage 1 is:

Longitude: 102°32'46" ~ 102°50'30" E

Latitude: 31°07'54" ~ 31°16'40" N

And the geographical coordinate of the powerhouse of Stage 2 is:

Longitude: 102°52'32" ~ 103°02'12" E

Latitude: 31°16'42" ~ 31°26'10" N

Figure 1 shows the location.

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Figure 1 The location of Lixian Yikeyin Small Hydropower Project

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

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The proposed project is about generating electricity from renewable energy of hydro and supplying to the nearby grid, and the total installed capacity is 13.6 MW, thus, the methodology of AMS-I.D (Version 13) is applicable for the proposed project. The type and category of the proposed project is as following:

Type I: Renewable Energy Project

Category 1.D: Grid connected renewable electricity generation.

Technology of project activity

The Project is a run-of-river hydropower project, including 2 plants: Stage 1 and Stage 2. The tailing water of Stage 1 will be conducted to Stage 2 to generate electricity. Both plants use water potential in Rijiaogou River. The constructions include barrage, tunnel, pressure regulation house, steel penstock, and power house.

According to the Feasibility Study Report of the proposed project, the barrage of each plant is 3.5 m in height, and 3.0 m of it is under ground. It means that only 0.5 m of the barrage is above the ground. The water from the river will drop through a lattice to a well, and then conducted through a tunnel to the powerhouse. Thus, there is not submerged area in the proposed project. The main design features and characteristics of the proposed project were listed in Table 1.

Table 1 Major technological parameters of the project¹

	Stage 1	Stage 2
Turbine		
Type	CJA475-W-120/2*13.5	CJA237-W-130/1×14
Quantity	2	3
Rated water head (m)	167	365
Rated flowing (m ³ /s)	1.46	1.1
Generator		
Type	SFW2000-14/1730	SFW3200-10/1730
Quantity	2	3
Rated installed capacity (MW)	2.0	3.2
Rated voltage (kV)	6.3	6.3
Others		
The length of the tunnel (m)	3092.37	1357.79
The height of the barrage (m)	3.53	3.5
Operation hours (h)	4842	4502

Environmental Safe Technology:

The technology, which has used worldwide, used is safe on environment. Characteristics of the Project and its construction methodology will not permit a negative damage to the ecosystem by using tunnel technology to divert water from the river to the powerhouse.

Technology transfer:

The main equipments used in the Project, such as the turbines and electricity generators, are produced domestically. No technology transferred from other countries is involved in this project activity.

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

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The renewable crediting period of 7*3 years is chosen for the proposed project. The estimated annual total emission reductions from the proposed project in the first crediting period are 57674 tCO₂e (17843 tCO₂e from Stage 1 and 39831 tCO₂e from Stage 2). Then, over the first crediting period, the estimated total amount of emission reductions from the proposed project will be 403718 tCO₂e. The estimated emission reductions from Stage 1 and Stage 2 are calculated separately as following:

Table 2 The estimated emission reduction amount over the first crediting period from Stage 1

Year	Annual estimation of emission reductions (tCO ₂ e)
Jan.2010 -Dec. 2010	17843
Jan.2011 -Dec. 2011	17843

¹ Data source: the Purchase Agreement for the turbine and generator signed between the project owner and Hunan Linli Hengyuan Electricity Generation Facilities Co. Ltd. on Jul. 30, 2007.

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Jan.2012 -Dec. 2012	17843
Jan.2013 -Dec. 2013	17843
Jan.2014 -Dec. 2014	17843
Jan.2015 -Dec. 2015	17843
Jan.2016 -Dec. 2016	17843
Total estimated reductions (tCO ₂ e)	124901
Total number of crediting years (y)	7
Annual average over the crediting period of estimated reductions (tCO ₂ e)	17843

Table 3 The estimated emission reduction amount over the first crediting period from Stage 2

Year	Annual estimation of emission reductions (tCO ₂ e)
Jan.2010 -Dec. 2010	39831
Jan.2011 -Dec. 2011	39831
Jan.2012 -Dec. 2012	39831
Jan.2013 -Dec. 2013	39831
Jan.2014 -Dec. 2014	39831
Jan.2015 -Dec. 2015	39831
Jan.2016 -Dec. 2016	39831
Total estimated reductions (tCO ₂ e)	278817
Total number of crediting years (y)	7
Annual average over the crediting period of estimated reductions (tCO ₂ e)	39831

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

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No public funding from Annex I countries are provided for the proposed project.

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

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The project participants confirm that the proposed project is not a debundled component of a larger project activity. There is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity within 1 km of the project boundary of the proposed small-scale activity at the closest point.

SECTION B. Application of a baseline and monitoring methodology
B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

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The title of the approved baseline and monitoring methodology applied to the Project is “AMS.I.D. Grid connected renewable electricity generation” (version13).

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For more information regarding the methodology, please refer to the link:
<http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>

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

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The category of the proposed project activity is Category 1.D: Grid connected renewable electricity generation. The proposed project is a 13.6MW hydropower project delivering electricity to the Central China Power Grid (CCPG), which is predominantly coal-fired (see Annex 3 for detail). Therefore, all applicability conditions for the use of simplified baseline methodology category I.D have been satisfied.

The size of the proposed project is 13.6 MW in total, which is within the limit of 15 MW stipulated by the chosen (small-scale) methodology. And the power density is higher than 10 W/m². As described in A.4.2. above, the proposed project is a run-of-river type hydropower plant with a barrage of 3.5 m in height, and only 0.5 m of the barrage is above ground based on the Feasibility Study Report. Thus, there is not submerged area in the proposed project.

Thus, Category 1.D and the methodology AMS-I.D. is applicable to the proposed project.

B.3. Description of the project boundary:

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Based on the methodology AMS.I.D. (version 13), the Project boundary encompasses the physical, geographical site of the renewable generation source. The electricity displaced by the Project should be the electricity generated by CCPG. Therefore, the boundary could be identified as CCPG. The spatial scope of the Project boundary covers the Project site and all power plants connected physically into CCPG.

Electricity generated from the proposed project will be connected to Aba Zang & Qiang Autonom Prefecture Power Grid, which is a part of Sichuan Provincial Power Grid, and then the electricity will be connected to the Central China Power Grid (CCPG). According to the Chinese DNA guidance, CCPG is composed of Jiangxi Provincial Power Grid, Henan Provincial Power Grid, Hubei Provincial Power Grid, Hunan Provincial Power Grid and Chongqing City Power Grid. CCPG is then defined as the proposed project boundary. The other reasons for the boundary chosen are:

- There is a guidance available from China DNA on project boundary identifying the applicable grid as the Project boundary²;

Thus, the Project boundary will include the physical and geographical site of the proposed project, and all the facilities and power plants in CCPG which related to the electricity to be replaced by the proposed project activity.

B.4. Description of baseline and its development:

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The baseline scenario of the proposed project is the continued operation of the existing power plants in the system and the addition of new generation sources to meet increased electricity demand. The Project activity involves a construction of a zero-emission power source. Thus, the emission reductions are equal to the baseline emissions.

In accordance with the small scale methodology AMS-I.D (version 13), baseline emissions are equal to power generated by the Project activity and delivered to the grid, multiplied by the baseline emission

² Data source: *Baseline Emission Factors for Regional Power Grids in China* issued by China's DNA on August 9, 2007 on, <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf>.

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factor of CCPG. The calculation of grid emission factors is provided in B6.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

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Additionality of the Project is demonstrated based on the requirement of Attachment A to Appendix B to the *Simplified Modalities and Procedures for Small-scale CDM Project Activities*.

As a small hydropower project locates in poor mountainous area, the Project faces many problems, which make the Project far from financial attractive. The investment barrier is the most prohibitive factor in implementing the proposed project. Detailed analysis is shown as follows:

The Incentive of CDM

The project owner was in an early stage aware about CDM from various medium, and they have contacted some CDM experts already. A letter of intent on CDM development cooperation was signed between the project owner and the consultant on Feb. 18, 2006³.

The Feasibility Study Reports (FSRs) of the proposed project was written by Sichuan Province Dazhou City Hydropower Survey & Design Institute in Aug. 2006. Then a detailed financial analysis was conducted for the proposed project by the CDM experts. The results showed that the IRR values would increase from 7.14% to 11.18% for Stage 1 and from 7.54% to 11.75% for Stage 2 with CERs unit price of 9.0US\$. It means that the financial indicators of the proposed project would be improved to be acceptable level with CDM revenue. The shareholders showed confidence to CDM and agreed to apply CDM project, and then a decision on CDM development was achieved in the board meeting on Sep. 16, 2006⁴. The agreement on CDM project development cooperation was signed between the project owner and the consultant on Oct. 16, 2006⁵. The Emission Reduction Purchase was signed between the project owner and the buyer on Aug. 30, 2007. And the PDD was submitted for validation and published on the UNFCCC on Jan. 4, 2008. In Jan. 2010, the proposed project was expected to start operation and then the emission reduction would be achieved.

The “start date of a project activity” is as defined in paragraph 67 of EB41 report. In this context, it has always been the Board’s view that the start date of a CDM project activity is the earliest of the dates at which the implementation or construction or real action of the project activity begins.

For the proposed project activity, the FSRs of Stage 1 and Stage 2 were approved by the Development & Reform Committee of Aba Zang & Qiang Autonomus Prefecture on October 23, 2006 (Document number: A Zhou Fa Gai [2006]490 for Stage 1, and A Zhou Fa Gai [2006]491 for Stage 2), and the construction permission was issued on May 26, 2007⁶. Then tunnel construction started on Jul. 18, 2007⁷, and the Purchase Agreement for the turbine and generator signed between the project owner and

³ Data source: the Letter of Intent on CDM development cooperation signed between Li County Jiujiayi Hydropower Development Co. Ltd. and Foshan Perfect Carbon Co. Ltd. on Feb. 18, 2006.

⁴ Data source: the minutes of the shareholders’ meetings about CDM development held on Sep. 16, 2006.

⁵ Data source: the Agreement about CDM development cooperation signed between Li County Jiujiayi Hydropower Development Co. Ltd. and Foshan Perfect Carbon Co. Ltd. on Oct. 16, 2006.

⁶ Data source: the construction permission issued by the Development & Reform Committee of Aba Zang & Qiang Autonomus Prefecture dated May 26, 2007 (Document No: A Zhou Fa Gai [2007]298).

⁷ Data source: the Agreement on the tunnel construction signed between the project owner and the constructor on Jul. 18, 2007.

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Hunan Linli Hengyuan Electricity Generation Facilities Co. Ltd. on Jul. 30, 2007. Thus, May 26, 2007 was considered as the start date of the proposed project activity.

It may therefore be clear that the project owner has fully considered the revenues from CDM when making the decision to implement the project activity. This is also illustrated with the following schedule of key events relating to the project:

Date	Key events
Feb. 18, 2006	The letter of intent about CDM development cooperation was signed between the project owner and the consultant.
Aug. 2006	The Feasibility Study Report was written by Sichuan Province Dazhou City Hydropower Survey & Design Institute.
Oct. 16, 2006	The Agreement about CDM development was signed between the project owner and the consultant company
Oct. 23, 2006	the Feasibility Study Report were approved by the Development & Reform Committee of Aba Zang & Qiang Autonomous Prefecture
Apr. 2007	The draft project design document (PDD) was developed, and negotiation with the CER buyer started.
May 26, 2007	The construction permit was issued.
Jul. 18, 2007	The tunnel construction started.
Jul. 30, 2007	The purchase agreements on the generator and turbine were signed between the project owner and Hunan Linglin Electricity Generation Instruments Co. Ltd.
Aug. 30, 2007	The Emission Reduction Purchase Agreement (ERPA) was signed between the project owner and Carbon Asset Management Sweden AB
Jan. 4, 2008	The PDD was submitted for validation and published on UNFCCC
Jan. 2010	The proposed project will start operation and emission reduction will be achieved.

Investment Analysis

According to “*Tool for the demonstration and assessment of additionality* (version 05.2 dated Aug. 26, 2008)”, three options can be applied to conduct the investment analysis. They are: the simple cost analysis (Option I), the investment comparison analysis (Option II) and the benchmark analysis (Option III).

Since this project will generate financial/economic benefits other than CDM-related income, through the sale of generated electricity, Option I (Simple Cost Analysis) is not applicable.

The investment comparison analysis (Option II) is also not applicable for the proposed project because investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. The Central China Power Grid is not a new investment project; therefore Option II is not appropriate.

Thus, the benchmark analysis (Option III) was chosen for the proposed project.

The benchmark for the proposed project was quoted from the *Economic Evaluation Code for Small Hydropower Projects* (Document No. SL16-95) issued in 1995 by Ministry of Water Resources of P.R.China, in which it mentions “This evaluation code is applied for small hydropower projects with installed capacity no more than 25MW (all newly-built, capacity expansion, modification or retrofit projects). The proposed project is a newly-built hydropower project with a total installed capacity of 13.6 MW which is less than 25MW. Thus, the SL16-95 is applicable to the proposed project.

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In 2002, the Ministry of Water Resources issued a Bulletin on Effective Technical Standard in Hydro & Water Industry. The *Economic Evaluation Code for Small Hydropower Projects* (Document No. SL16-95) issued in 1995 is still valid as indicated in this list⁸. The ongoing validity of this code was further confirmed again by the Ministry of Water Resources of the People's Republic of China on Sep. 9, 2006⁹.

According to the Document No.SL16-95, the benchmark IRR of total investment is 10% (after income tax). Thus, 10% was chosen as the benchmark IRR for the proposed project.

A. Calculation and comparison of financial indicators for Stage 1

Basic parameters for calculation of financial indicators are listed in Table 4 below.

Table 4 Main parameters for calculation of financial indicators (Stage 1)

No	Parameters	Unit	Value	Data Source
1	Installed capacity	MW	4.0	FSR-1 ¹⁰
2	Total investment in the fixed assets	million CNY	25.01	FSR-1, page 177
3	Operational cost ¹¹	million CNY	0.4705	FSR-1, page 178
4	Electricity generation	MWh/y	19360	FSR-1, page 177
5	Net electricity export to CCPG ¹²	MWh/y	18300	FSR-1, page 177
6	Electricity tariff (including VAT)	CNY/kWh	0.173	FSR-1, page 178 ¹³
7	Income tax (0 in the first 2 years, 16.5% in the following 3 years, and 33% later)	%	33	FSR-1, page 177
8	Value added tax (VAT)	%	6	FSR-1, page 177
9	Additional tax for city development	%	5	FSR-1, page 177
10	Additional tax for education	%	3	FSR-1, page 177
11	Depreciation ratio	%	5	FSR-1, annex Table 12-4
12	Estimated CERs	tCO ₂ e/y	17843	
13	Estimated CERs price	US\$/CERs	9.0	
14	Project operation life time	y	30	FSR-1, page 178

⁸ Data source: <http://www.cws.net.cn/guifan/bzdt/bzgg.asp>

⁹ Data source: http://www.chinawater.net.cn/jishujiandu/CWSNews_View.asp?CWSNewsID=24696

¹⁰ Data source: FSR-1 refers to the Feasibility Study Report of Lixian Yikeyin Small Hydropower Project- Stage 1.

¹¹ See the attached Excel file of IRR calculation for Stage 1 for details.

¹² See the attached Excel file of IRR calculation for Stage 1 for details.

¹³ Data source: the electricity tariff was cited from the FSR of Stage 1 which was based on the electricity tariff document (Document No: A Zhou Jia Tiao [2004]33), and the electricity tariff was the same in the Power Purchase Agreement signed between Li County Power Co. Ltd. and the project owner on Nov. 16, 2006.

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Table 5 IRR with or without income from CERs (Stage 1)

Item	IRR	Benchmark
Without income from CERs	7.14%	10%
With income from CERs	11.18%	10%

Table 5 shows the financial analysis result for Stage 1 with and without CERs revenue. As shown, IRR of Stage 1 (IRR without income from CERs: 7.14%) is lower than the benchmark rate of return applicable, which is 10% for power project investment in the China. This therefore indicates that Stage 1 would not be a financially viable investment option.

Sensitivity analysis

A detailed sensitivity analysis of the project activity was done to test the project feasibility with varying project parameters. The project activity feasibility is mainly dependent on the following parameters.

- Total investment
- Annual electricity output amount
- Electricity tariff
- Operational cost

The results of sensitivity analysis were listed in Table 6 below.

Table 6 Sensitive analysis results (Stage 1)

	-90.00%	-24.85%	-10.00%	0.00%	+10.00%	+27.76%
Total investment	-	10.00%	8.26%	7.14%	5.48%	-
Annual electricity output	-	-	5.40%	7.14%	8.28%	10.00%
Electricity tariff	-	-	5.40%	7.14%	8.28%	10.00%
Operational cost	8.64%	-	7.26%	7.14%	6.38%	-

From the results shown in Table 6, we can find that the IRRs have the same trends when it variation with annual electricity output or with electricity tariff. However, without revenue from CDM, the IRRs of Stage 1 are always lower than the benchmark of 10% even the four indicators various from -10% to +10%.

But if the total investment in fixed assets decreases by 24.85%, the IRRs value of the proposed project will rise up to the benchmark of 10%. However, this hypothesis will not come true with the price of construction materials and wage standard rising in China¹⁴. According to the FSRs, the total investment of Stage 1 and 2 should be 74.9784 million CNY (the electricity export system included). But the actual investment for Stage 1 and 2 was 90 million CNY based on the contract¹⁵, which increased by 20%.

¹⁴ Data source: The price of raw materials, fuel and electricity grew by 4.4% in 2007, and the producer price of industrial products grew by 3.1% in 2007 in China, stated by the State Statistical Bureau in Jan. 2008. Also see <http://finance.sina.com.cn/g/20080124/10024447240.shtml> for details.

¹⁵ Data source: the proclamation on the share purchase from Li County Jiujiayi Hydropower Development Co. Ltd. for Lixian Yikeyin Small Hydropower Project construction issued by Sichuan Minjiang Electricity Co. Ltd. on Jul. 31, 2007. Also see: <http://stock.baidu.com/cn/read.php?code=600131&id=239552&t=2>

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What was worse, the earthquake took place in China on May 12, 2008 resulted in a great loss by 19 million CNY¹⁶. Thus, it's impossible for the total investment in fixed assets decreased by 24.85%.

If the annual electricity output increase by 27.76 %, the IRR value of Stage 1 will rise up to the benchmark of 10%. However, the annual electricity output was calculated based on long-term hydrological parameters (e.g. the installed capacity, annual operational hours, water energy utilization efficiency, water head and water flowing) which were from 1958 to 2002. The annual electricity output was the average value of 45 years and changed very lightly. And if the annual electricity output increased by 27.76%, it will be higher than that of water abundant year. Thus, it's unlikely to increase by 27.76% for the annual electricity output.

And if the electricity tariff increases by 27.76%, the IRR value of Stage 1 will up to the benchmark of 10%. The electricity tariff is mainly regulated by the market. And the proposed project owner, which is a small private company and with a small hydropower project, has very limited capacity to negotiate with the power grid company for the electricity tariff. Thus, it's also unlikely for the electricity tariff increased by 27.76%.

As for the operational cost, the influence on the IRR value is quite weak. The IRR value will not reach the benchmark of 10% even when the operational cost decreases by 90%.

In conclusion, Stage 1 is not financial acceptable without CDM revenue.

B. Calculation and comparison of financial indicators for Stage 2

The basic parameters for calculation of financial indicators of Stage 2 are shown in Table 7.

Table 7 Main parameters for calculation of financial indicators (Stage 2)

No	Parameters	Unit	Value	Data Source
1	Installed capacity	MW	9.6	FSR-2 ¹⁷
2	Total investment in fixed assets excluding electricity export system	million CNY	41.776	FSR-2, page 199
3	The cost for the electricity export facilities construction	million CNY	8.194	The Electricity Export System Design Report ¹⁸
4	Electricity generation	MWh/y	43220	FSR-2, page 199
5	Net electricity export to CCPG ¹⁹	MWh/y	40850	FSR-2, page 199
6	Electricity tariff (including VAT)	CNY/kWh	0.173	FSR-2, page 200 ²⁰

¹⁶ Data source: the losses in the earthquake. Also see: <http://www.zf119.com/Article/niugu/qfii/200808/74034.htm>

¹⁷ Data source: FSR-2 refers to the Feasibility Study Report of Lixian Yikeyin Small Hydropower Project- Stage 2.

¹⁸ The electricity export system design report written by Sichuan Province Xichang Electricity Technology Co. Ltd. in Nov. 2006.

¹⁹ See the attached Excel file of IRR calculation for Stage 2 for details.

²⁰ Data source: the electricity tariff was cited from the FSR of Stage 2 which was based on the electricity tariff document (Document No: A Zhou Jia Tiao [2004]33), and the electricity tariff was the same in the Power Purchase Agreement signed between Li County Power Co. Ltd. and the project owner on Nov. 16, 2006

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7	Operational cost ²¹	million CNY	1.160	FSR-2, page 200
8	Income tax (0 in the first 2 years, 16.5% in the following 3 years, and 33% later)	%	33	FSR-2, page 201
9	Value added tax (VAT)	%	6	FSR-2, page 200
10	Additional tax for city development	%	5	FSR-2, page 201
11	Additional tax for education	%	3	FSR-2, page 201
12	Depreciation ratio	%	5	FSR-2, annex Table 12-4
13	Estimated CERs amount	tCO ₂ e	39831	
14	Estimated CERs price	US\$/CERs	9.0	
15	Project operation life time	y	30	FSR-2, page 200

Table 8 shows the financial analysis for Stage 2 with and without CER finance. As shown, IRR of Stage 2 (IRR without income from CERs: 7.54%) is lower than the benchmark rate of return applicable, which is 10% for power project investment in the China. This therefore indicates that in comparison to other investments, Stage 2 would not be a more financially viable investment option for securing the best returns.

Table 8 IRR with or without income from CERs (Stage 2)

Item	IRR	Benchmark
Without income from CERs	7.54%	10%
With income from CERs	11.75%	10%

Sensitivity analysis

A detailed sensitivity analysis of the project activity was done to test the project feasibility with varying project parameters. The project activity feasibility is mainly dependent on the following parameters.

- Total investment
- Annual electricity output amount
- Electricity tariff
- Operational cost

The results of sensitivity analysis were listed in Table 9 below.

Table 9 Sensitive analysis results (Stage 2)

	-90%	-18.73%	-10%	0%	+10%	+21.22%
Total investment	-	10.00%	8.72%	7.54%	6.72%	-
Annual electricity output	-	-	6.62%	7.54%	8.82%	10.00%
Electricity tariff	-	-	6.62%	7.54%	8.82%	10.00%
Operational cost	9.43%	-	7.90%	7.54%	7.54%	-

From the results shown in Table 9, we can find that the IRRs have the same trends when variation with

²¹ See the attached Excel file of IRR calculation for Stage 2 for details.

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annual electricity output or with electricity tariff. However, without revenue from CDM, the IRRs of Stage 2 are always lower than the benchmark of 10% even the four indicators various from -10% to +10%.

But if the total investment in fixed assets decreases by 18.73%, the IRRs value of the proposed project will rise up to the benchmark of 10%. However, this hypothesis will not come true. As described in Stage 1 above, the price of construction materials and wage standard rising in China. According to the FSRs, the total investment of Stage 1 and 2 should be 74.9784 million CNY (the electricity export system included). But the actual investment for Stage 1 and 2 would be 90 million CNY based on the contract, which increased by 20%. What was worse, the earthquake took place in China on May 12, 2008 resulted in a great loss by 19 million CNY. Thus, it's impossible for the total investment in fixed assets decreased by 18.73%.

If the annual electricity output increase by 21.22 %, the IRR value of Stage 2 will rise up to the benchmark of 10%. However, the annual electricity output was calculated based on long-term hydrological parameters (e.g. the installed capacity, annual operational hours, water energy utilization efficiency, water head and water flowing) which were from 1958 to 2002. The annual electricity output was the average value of 45 years and changed very lightly. And if the annual electricity output increased by 21.22%, it will be higher than that of water abundant year. Thus, it's unlikely to increase by 21.22% for the annual electricity output.

And if the electricity tariff increases by 21.22%, the IRR value of the proposed project will up to the benchmark of 10%. The electricity tariff is mainly regulated by the market. And the proposed project owner, which is a small private company and with a small hydropower project, has very limited capacity to negotiate with the power grid company for the electricity tariff. Thus, it's also unlikely for the electricity tariff increased by 21.22% in recent years.

As for the operational cost, the influence on the IRR value is quite weak. The IRR value will not reach the benchmark of 10% even when the operational cost decreases by 90%. It doesn't work obviously.

Thus, Stage 2 is not financial acceptable without CDM revenue.

It can be concluded that the proposed project is not financial acceptable without CDM revenue. It's just under the incentive of CDM, the proposed project start construction. Thus, Lixian Yikeyin Small Hydropower Project is additional.

B.6. Emission reductions:

<h3>B.6.1. Explanation of methodological choices:</h3>

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According to the methodology of AMS-I.D. (version 13) and analysis in B.3 above, the CCPG is selected as the project boundary.

The CO₂ emission factor ($EF_{grid,CM,y}$) for the displacement of electricity generated by power plants in an electricity system, by calculating the “operating margin” (OM) and “build margin” (BM) as well as the “combined margin” (CM).

$EF_{grid,CM,y}$ refers to Combined margin CO₂ emission factor for grid connected power generation in year y;

$EF_{grid,BM,y}$ refers to Build margin CO₂ emission factor for grid connected power generation in year y;

$EF_{grid,OM,y}$ refers to Operating margin CO₂ emission factor for grid connected power generation in year y.

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The emission factors are determined according to the procedures prescribed in the “Tool to calculate the emission factor for an electricity system” (version 01.1) as following six steps:

- STEP 1. Identify the relevant electric power system.
- STEP 2. Select an operating margin (OM) method.
- STEP 3. Calculate the operating margin emission factor according to the selected method.
- STEP 4. Identify the cohort of power units to be included in the build margin (BM).
- STEP 5. Calculate the build margin emission factor.
- STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1. Identify the relevant electric power system

As described in B.3 above, electricity generated from the proposed project will be connected to Aba Zang & Qiang Autonomous Prefecture Power Grid, which is a part of Sichuan Provincial Power Grid, and then the electricity will be connected to the Central China Power Grid (CCPG). Thus, the electricity displaced by the proposed project should be the electricity generated by CCPG. Therefore, CCPG is identified as the relevant electric power system. And the Chinese DNA has also published a delineation of the project electricity system and the connected electricity system.

According to the Chinese DNA guidance, CCPG is composed of Jiangxi Provincial Power Grid, Henan Provincial Power Grid, Hubei Provincial Power Grid, Hunan Provincial Power Grid and Chongqing City Power Grid. CCPG is then defined as the proposed project boundary.

Step 2. Select an operating margin (OM) method

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods according to the instruction of *Tool to calculate the emission factor for an electricity system* (version 01):

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

According to the *Tool to calculate the emission factor for an electricity system* (version 01.1), any of the four methods can be used. However, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

The low-cost must run resources constitute less than 50% of total grid generation in Central China Power Grid, the percentage of the low-cost must run resources in the recent 5 years are: 37% in 2001, 35.95% in 2002, 34.43% in 2003, 38.44% in 2004 and 38.18% in 2005²², which accords with the defined condition of method (a), but not method (d). Consequently, Simple OM method is selected to calculate the Operating Margin emission factor of the proposed project.

Step 3. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

²² Data source: China Electric Power Yearbook -2006.

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- Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option C)

Option A should be preferred and must be used if fuel consumption data is available for each power plant / unit. In other cases, option B or option C can be used. For the purpose of calculating the simple OM, Option C should only be used if the necessary data for option A and option B is not available and can only be used if only nuclear and renewable power generation are considered as low-cost / must-run power sources and if the quantity of electricity supplied to the grid by these sources is known.

The necessary data for Option A and Option B are not available in China, thus, Option C is chosen to calculate the simple OM.

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_m EG_{m,y}} \quad (1)$$

Where:

$EF_{grid,OMsimple,y}$: Simple operating margin CO₂ emission factor in year y (tCO₂/MWh)

$FC_{i,m,y}$: Amount of fossil fuel type i consumed by power plant / unit m in year y (mass or volume unit)

$NCV_{i,y}$: Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)

$EF_{CO2,i,y}$: CO₂ emission factor of fossil fuel type i in year y (tCO₂/GJ)

$EG_{m,y}$: Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/ must-run power plants/unit, in year y (MWh)

i : All fossil fuel types combusted in power sources in the project electricity system in year y ,

y : Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option).

$$EF_{grid,OMsimple,y} = 1.29086 \text{ tCO}_2\text{e/MWh.}$$

For the detailed information, please see the Annex 3.

Step 4. Identify the cohort of power units to be included in the build margin (BM)

The sample group of power unit m used to calculate the build margin consists of either:

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

Project participants should use the set of power units that comprises the larger annual generation.

However, the data of the set of power unit are not public available in China, the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently (Option 2) is used for the proposed project.

Calculation of the new capacity additions

The generation capacity addition used to calculate the BM has to be above 20% of the current electricity generation capacity in year y . “ n ” is therefore the number of years ($y-1, y-2, \dots, y-n$) which

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have to be considered to achieve the 20% capacity addition to the current electricity generation capacity.

The result for “n” should mean that:

$$\frac{\sum_m CAP_{m,y-n}}{\sum_m CAP_{m,y}} \geq 20\% \quad (2)$$

From 2004 to 2006 (the most recent year for which data is available), the amount of capacity additions is over 20% of the total capacity in 2005 in the CCPG. Therefore “n” =3 (See Annex 3).

Step 5. Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (3)$$

Where:

$EF_{grid,BM,y}$: Build margin CO₂ emission factor in year *y* (CO₂/MWh)

$EG_{m,y}$: Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)

$EF_{EL,m,y}$: CO₂ emission factor of power unit *m* in year *y* (tCO₂/MWh)

m: Power unit include in the build margin

y: Most recent historical year for which power generation data is available

The sample *m*, according to the methodology, should be over the latest 5 power plants added to the grid, or over the last added power plants accounting for at least 20% of power generation. We apply an indirect approach based on the EB decision as mentioned in step 4.

First we calculate the newly-added installed capacity and the share of each power generation technology in the total capacity. Second, we calculate the weights of each power generation technology in the newly-added installed capacity. Third, emission factors for each fuel group are calculated on the basis of an advanced efficiency level for each power generation technology and a weighted average carbon emission factor on the basis of IPCC default carbon emission factors of individual fuels.

Since the exact data are aggregated, the calculation will apply the following method: We calculate the share of the CO₂ emissions of solid fuel, liquid fuel and gas fuel in total emissions respectively by using the latest energy balance data available; the calculated shares are the weights.

Using the emission factor for advanced efficient technology we calculate the emission factor for thermal power; the BM emission factor of the power grid will be calculated by multiplying the emission factor of the thermal power with the share of the thermal power in the most recently added 20% of total installed capacity.

Detailed steps and formulas are as below:

Calculation of weights of CO₂ emissions of solid, liquid and gas fuel in total emissions for power generation

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The weights of CO₂ emissions from solid, liquid and gas fuels in the total emissions in CCPG are calculated by the formulae as follows:

$$\lambda_{Coal} = \frac{\sum_{i,m} F_{i,m,y} \times EF_{EL,m,y}}{\sum_{i,m} F_{i,m,y} \times EF_{EL,m,y}} \quad (4)$$

$$\lambda_{Oil} = \frac{\sum_{i,m} F_{i,m,y} \times EF_{EL,m,y}}{\sum_{i,m} F_{i,m,y} \times EF_{EL,m,y}} \quad (5)$$

$$\lambda_{Gas} = \frac{\sum_{i,m} F_{i,m,y} \times EF_{EL,m,y}}{\sum_{i,m} F_{i,m,y} \times EF_{EL,m,y}} \quad (6)$$

Where:

λ_{Coal} , λ_{Oil} and λ_{Gas} respectively refers to weights of CO₂ emissions of solid, liquid and gas fuel in total emissions; *Coal*, *Oil* and *Gas* respectively refers to the group of solid, liquid, and gas fuels; $F_{i,j,y}$ is the amount of fuel *i* consumed in province *m* in year *y*; $COEF_{i,j,y}$ is the CO₂ emission coefficient of fuel *i*, taking into account the carbon content of the fuels *i* used in province *m* and the percent oxidation of the fuel in years *y*.

$$\lambda_{Coal} = 99.48\%, \lambda_{Oil} = 0.17\%, \text{ and } \lambda_{Gas} = 0.35\%$$

For the detailed information, please see the Annex 3.

Calculation of Emission Factor of Relevant Thermal Power

The emission factor of thermal is then calculated by using a formula as follows:

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

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ respectively refers to the emission factor representing best technology commercially available for fuel of coal, oil or gas fired power plants. λ_{Coal} , λ_{Oil} and λ_{Gas} respectively refers to the weighing of capacity additions for fuel of coal, oil or gas fired power plants.

According to analysis in Sub-step 2, CO₂ emissions from the coal, oil and gas in CCPG accounted for 99.48%, 0.17% and 0.35% in total emissions of the grid in 2005, respectively, (see annex 3 for details). Thus, most of the GHG emission is comes from coal consumption.

The most advanced and commercially available coal power technology in China in 2005 is 600MW sub-critical unit with power supply coal consumption of 343.33 gce/kWh, which is equivalent to a power supply efficiency of 35.82%²³. Thus, $EF_{Coal,Adv}$ is calculated to be 0.9508 tCO₂/MWh (see Table 14 in annex 3 for details).

²³ Data source: <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf>

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According to above analysis and Equation (7), the conservatively estimated emission coefficient of new thermal power plants ($EF_{Thermal,adv}$) is:

$$EF_{thermal,adv} = 99.48\% * 0.9508 + 0.17\% * 0.5843 + 0.35\% * 0.4237 = 0.94829 \text{ tCO}_2\text{e/MWh}$$

Calculation of BM of the Grid

The calculation of the Grid BM is based on the results above and the weighing of thermal power of recent 20% capacity additions.

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

Where:

CAP_{Total} is the total of new capacity additions;

$CAP_{Thermal}$ is the new capacity addition of thermal power.

The share of thermal power of recent 20% capacity addition is 69.52% (See Annex 3 for details), thus, the Build Margin emission factor ($EF_{grid,BM,y}$) of the CCPG is calculated as:

$$EF_{grid,BM,y} = 69.52\% * EF_{Thermal,adv} = 69.52\% * 0.94829 = 0.65923 \text{ tCO}_2\text{/MWh}$$

Step 6. Calculate the combined margin (CM) emissions factor

To calculate $EF_{grid,CM,y}$ with the combined margin (CM), the following equation is used:

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y} \quad (9)$$

Where:

$EF_{grid,BM,y}$: Build margin CO₂ emission factor in year y (tCO₂/MWh)

$EF_{grid,OM,y}$: Operating margin CO₂ emission factor in year y (tCO₂/MWh)

w_{OM} : Weighting of operating margin emissions factor (%)

w_{BM} : Weighting of build margin emission factor (%)

Thus,

$$\begin{aligned} EF_{grid,CM,y} &= EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM} \\ &= 1.29086 * 0.5 + 0.65923 * 0.5 = 0.97505 \text{ tCO}_2\text{/MWh} \end{aligned}$$

Calculation of the baseline emission

Baseline emissions (BE_y) are obtained as:

$$BE_y = EG_y * EF_{grid,CM,y} \quad (10)$$

Where:

BE_y : the baseline emission of CCPG in year y;

EG_y : the net electricity generated by the Project and supplied to the grid;

$EF_{grid,CM,y}$: the ex-ante emission factor in year y, which is 0.97505 tCO₂/MWh.

Emissions from project activity

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According to the Feasibility Study Report of the proposed project, the barrage of each plant is 3.5 m in height, and 3.0 m of it is under ground. The water from the river will drop through a lattice to a well, and then conducted through a tunnel to the powerhouse. Thus, there is not submerged area in the proposed project. Hence, the Project emission is zero.

Leakage

As newly built hydropower plants, there is no energy generating equipment be transferred from another activity and no existing equipment be transferred to another activity involved in the Project activities. No leakage needs to be considered in the Project.

Emission Reductions

The annual emission reductions ER_y for the Project activity are calculated as the baseline emissions minus the Project emissions. The final GHG emission reductions are calculated as follows:

$$ER_y (tCO_2e/y) = BE_y - PE_y = EG_y * EF_{grid,CM,y} - 0 \quad (11)$$

Where:

PE_y : Project emissions in year y in tCO_2e ;

EG_y : Net electricity supplied to the grid by the Project each year in MWh/y;

$EF_{grid,CM,y}$: GHG emission factor of the CCPG (ex-ante) in tCO_2e/MWh .

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

(Copy this table for each data and parameter)

Data / Parameter:	<i>Installed Capacity of the project activity (Stage 1)</i>
Data unit:	MW
Description:	The installed capacity of the Stage 1
Source of data used:	Feasibility Study Report of Stage 1
Value applied:	4.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Feasibility Study Report of Stage 1 has been approved by local government.
Any comment:	<i>Official approved data</i>

Data / Parameter:	<i>Installed Capacity of the project activity (Stage 2)</i>
Data unit:	MW
Description:	The installed capacity of the Stage 2
Source of data used:	Feasibility Study Report of Stage 2
Value applied:	9.6
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Feasibility Study Report of Stage 2 has been approved by local government.
Any comment:	<i>Official approved data</i>

Data / Parameter:	<i>FC_{i,m,y}</i>
Data unit:	tons, or m ³
Description:	Amount of fossil fuel type i consumed by power plant/unit m in year y

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Source of data used:	China Energy Statistics Yearbook (2004-2006)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source.
Any comment:	<i>Official data</i>

Data / Parameter:	<i>Electricity generation in CCPG</i>
Data unit:	MWh
Description:	The electricity generation by source j in year y of each province connected to CCPG
Source of data used:	China Electric Power Yearbook (2004-2006)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	<i>Official data</i>

Data / Parameter:	<i>Electricity self-consumption ratio</i>
Data unit:	%
Description:	The internal use rate of power source j in each province connected to CCPG
Source of data used:	China Electric Power Yearbook 2004-2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	<i>Official data</i>

Data / Parameter:	NCV_i
Data unit:	$K,J/t,m^3$
Description:	The net calorific value (energy content) per mass or volume unit of fuel i .
Source of data used:	China Energy Statistic Yearbook 2006
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	<i>Official data</i>

Data / Parameter:	$EF_{CO_2,i,y}/EF_{EL,m,y}$
Data unit:	tCO_2/GJ
Description:	CO ₂ emission factor
Source of data used:	“2006 IPCC Guidelines for National Greenhouse Gas Inventories” Volume 2 Energy
Value applied:	See Annex 3

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Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	<i>IPCC data</i>

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	The oxidation factor of the fuel
Source of data used:	“2006 IPCC Guidelines for National Greenhouse Gas Inventories” Volume 2 Energy
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value
Any comment:	<i>IPCC data</i>

Data / Parameter:	$SCC_{Coal,adv}$
Data unit:	gce/kWh
Description:	Standard coal consumption in a 600MW sub-critical unit with coal consumption in a thermal power plant
Source of data used:	http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File
Value applied:	343.33
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	<i>Official data</i>

Data / Parameter:	$CAP_{m,y,j}$
Data unit:	MW
Description:	The installed capacity of power source j of province m in years y .
Source of data used:	China Electric Power Yearbook
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistic; publicly accessible and reliable data source
Any comment:	<i>Official data</i>

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO ₂ e/MWh
Description:	Operating Margin emission factor of CCPG
Source of data used:	The result is calculated from official statistical data
Value applied:	1.29086
Justification of the choice of data or description of measurement methods and procedures actually applied:	Official released statistic; publicly accessible and reliable data source

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Any comment:	<i>Official data</i>
Data / Parameter:	$EF_{grid, BM, y}$
Data unit:	tCO ₂ e/MWh
Description:	Build Margin emission factor of CCPG
Source of data used:	The result is calculated from official statistical data
Value applied:	0.65923
Justification of the choice of data or description of measurement methods and procedures actually applied:	Official released statistic; publicly accessible and reliable data source
Any comment:	<i>Official data</i>

Data / Parameter:	$EF_{grid, CM, y}$
Data unit:	tCO ₂ /MWh
Description:	Combined margin grid emission factor in year y;
Source of data used:	Calculated ex-ante (see Annex 3)
Value applied:	0.97505
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated ex-ante (see Annex 3)
Any comment:	<i>Official data</i>

B.6.3 Ex-ante calculation of emission reductions:

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As described in B.6, the emission reductions of the proposed project are calculated as follows:

Baseline emissions

According to the Feasibility Study Report of the proposed project, the annual electricity delivered to the grid (EG) is approximately 18300 MWh from Stage 1 and 40850 MWh from Stage 2.

Based on the calculation results in B.6.1. above, the emission factors is as follows:

$$EF_{grid, OM, y} = 1.29086 \text{ tCO}_2\text{e/MWh}$$

$$EF_{grid, BM, y} = 0.65923 \text{ tCO}_2\text{e/MWh}$$

Thus, the combined ex-ante baseline emission factor of the Project is 0.97505 tCO₂e/MWh. The calculation equation is as follows:

$$EF_{grid, CM, y} = 1.29086 * 0.5 + 0.65923 * 0.5 = 0.97505 \text{ tCO}_2\text{e/MWh}$$

Thus, the annual baseline emissions are 17843 tCO₂e from Stage 1 and 39831 tCO₂e from Stage 2. The calculation equation is as follows:

$$BE_{1, y} = 18300 * 0.97505 = 17843 \text{ (tCO}_2\text{e)}$$

$$BE_{2, y} = 40850 * 0.97505 = 39831 \text{ (tCO}_2\text{e)}$$

Project emissions

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According to AMS.I.D., there are no expected project emissions related to the generation of electricity, as generation is based on a renewable resource.

Also, the proposed project is a run-of-river type hydropower plant with a barrage of 3.5 m in height, and only 0.5 m of the barrage is above ground. Thus, there is not submerged area in the proposed project, and the power density is higher than 10 W/m².

Therefore, $PE_y = 0$

Leakage

As described in section B.6.1, the leakage of the Project (L_y) will be 0 tCO₂e.

Therefore, $L_y = 0$

Emission reductions calculation

Based on formula (11) in section B.6.1, the ex-ante annual emission reductions are estimated as 17843 tCO₂e from Stage 1 and 39831 tCO₂e from Stage 2. The proposed project activity is expected to achieve total 403718 tCO₂e of net emission reductions during the first 7-year crediting period.

$$ER_{1,y} = EG_y * EF_{grid,CM} - 0 = 18300 * 0.97505 = 17843 \text{ (tCO}_2\text{e)}$$

$$ER_{2,y} = EG_y * EF_{grid,CM,y} - 0 = 40850 * 0.97505 = 39831 \text{ (tCO}_2\text{e)}$$

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

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Stage 1

Year	Estimation of project activity emissions (tCO ₂ e)	Estimation of baseline emissions (tCO ₂ e)	Estimation of leakage (tCO ₂ e)	Estimation of overall emission reductions (tCO ₂ e)
Jan.2010 -Dec. 2010	0	17843	0	17843
Jan.2011 -Dec. 2011	0	17843	0	17843
Jan.2012 -Dec. 2012	0	17843	0	17843
Jan.2013 -Dec. 2013	0	17843	0	17843
Jan.2014 -Dec. 2014	0	17843	0	17843
Jan.2015 -Dec. 2015	0	17843	0	17843
Jan.2016 -Dec. 2016	0	17843	0	17843
Total (tCO₂e)	0	124901	0	124901

Stage 2

Year	Estimation of project activity emissions (tCO ₂ e)	Estimation of baseline emissions (tCO ₂ e)	Estimation of leakage (tCO ₂ e)	Estimation of overall emission reductions (tCO ₂ e)
Jan.2010 -Dec. 2010	0	39831	0	39831
Jan.2011 -Dec. 2011	0	39831	0	39831
Jan.2012 -Dec. 2012	0	39831	0	39831

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Jan.2013 -Dec. 2013	0	39831	0	39831
Jan.2014 -Dec. 2014	0	39831	0	39831
Jan.2015 -Dec. 2015	0	39831	0	39831
Jan.2016 -Dec. 2016	0	39831	0	39831
Total (tCO₂e)	0	278817	0	278817

B.7 Application of a monitoring methodology and description of the monitoring plan:**B.7.1 Data and parameters monitored:**

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(Copy this table for each data and parameter)

Data / Parameter:	$EG_{export,y}$
Data unit:	MWh
Description:	Electricity supplied to the grid in year y
Source of data to be used:	Measured directly by the main meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	according to the meter readings
Description of measurement methods and procedures to be applied:	The electricity will be hourly measured and monthly recorded by the main meter which is a bi-direction meter type.
QA/QC procedures to be applied:	The data will be cross checked with the electricity sales invoices. A backup meter will be installed besides the main meter. In case the main meter is wrong, the readings in the backup meter will be adopted with transmission loss deducted based on historic records. Both the main meter and the backup meter will be calibrated at least once a year by a qualified third party. The accuracy of both meters is no less than 0.5s. All the electronic and paper monitoring documents will be archived during the crediting period and two years after.
Any comment:	The data is measured by the high accuracy ammeter, and cross-checked by the electricity sales invoice. Uncertainty level is low.

Data / Parameter:	$EG_{import,y}$
Data unit:	MWh
Description:	Electricity imported from the grid to the proposed project
Source of data to be used:	Measured directly by the main meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	according to the meter reading
Description of measurement methods and procedures to be applied:	The electricity will be hourly measured and monthly recorded by the main meter which is a bi-direction meter type.
QA/QC procedures to be applied:	The data will be cross checked with the electricity sales invoices. A backup meter will be installed besides the main meter. In case the main meter is wrong, the readings in the backup meter will be adopted

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	with transmission loss deducted based on historic records. Both the main meter and the backup meter will be calibrated at least once a year by a qualified third party. The accuracy of both meters is no less than 0.5s. All the electronic and paper monitoring documents will be archived during the crediting period and two years after.
Any comment:	The data is measured by the high accuracy ammeter, and cross-checked by the electricity sales invoice. Uncertainty level is low.

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net electricity supplied to the grid from the proposed project during year y
Source of data to be used:	Calculated by the readings from the main meter.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The expected total amount of electricity to be exported to the grid by the proposed project (Stage 1 and stage 2) is 59150 MWh per year.
Description of measurement methods and procedures to be applied:	Calculated by the formula as following: $EG_y = EG_{\text{export},y} - EG_{\text{import},y}$
QA/QC procedures to be applied:	The data will be cross checked with the electricity sales invoices.
Any comment:	Uncertainty level is low.

B.7.2 Description of the monitoring plan:
--

>>

The Monitoring Plan for this project has been developed to ensure that from the start, the project is well organized in terms of the collection and archiving of complete and reliable data.

1. Monitoring subject

Given the emission factor is ex-calculated and according to the Methodology AMS.I.D., the only data to be monitored is electricity supplied to the grid by the project (detailed in B.7.1).

2. Monitoring organization

Prior to the start of the crediting period, the organization of the monitoring team will be established. Clear roles and responsibilities will be assigned to all staff involved in the CDM project and a single CDM Manager will be nominated. The CDM Manager will have the overall responsibility for the monitoring system on this project.

All other CDM monitoring staff will have clearly defined roles and responsibilities. The CDM Manager will manage the process of training new staff, ensuring trained staff performs the monitoring duties and that where trained monitoring staff is absent; the integrity of the monitoring system is maintained by other trained staff.

A handbook of monitoring will be established prior to the start of the project. These procedures will detail the organization, control and steps required for certain key monitoring system features, including:

- CDM staff training

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- CDM data and record keeping arrangements
- Data collection
- CDM data quality control and quality assurance
- Equipment maintenance
- Equipment calibration
- Equipment failure

See Annex 4 for a description and the scope of these procedures.

The CDM Manager will be responsible for ensuring that the procedures are followed on site and for continuously improving the procedures to ensure a reliable monitoring system is established. All staff involved in the CDM project will receive some relevant training from CDM consultants. Records of trained CDM staff will be retained by the Project owner. The CDM Manager will ensure that only trained staff is involved in the operation of the monitoring system.

3. Monitoring equipment and installation

The proposed project includes two small sub-plants: Stage 1 and Stage 2. The electricity generated by Stage 1 will be connected to Stage 2, and then deliver to the grid together with that generated by stage 2. The meters' location was shown in Fig.2.

The electricity delivered to the grid by the proposed project activity (Stage 1 and Stage 2) and the power imported from the grid will be automatically monitored by electricity meters. The main meter (M4) will be installed at the connecting point of the proposed project and the power grid. To ensure maximum availability of CDM data and to introduce quality controls of the CDM data, a backup meter (M3) will be installed in addition to the main meter. This back-up meter will be located at the central control room of Stage 2.

Besides M3 and M4, meter M1 will be installed at the central room of Stage 1 by the project owner to monitor Stage 1, and meter M2 will be installed at the central room of Stage 2 to monitor Stage 2. The data recorded by M1 M2 will be used for cross check purpose.

All these electricity meters meet the relevant local standards at the time of installation. Before the installation of the meters, they were factory calibrated by the manufacturer. The meters are installed by either the project owner or the grid company according to the national Chinese standard.

In general, the data measured by the main meter will be used for CER calculation. In case any wrong takes place on the main meter, the data recorded by the backup meter will be adapted with transmission losses deducted. The function of M1 and M2 is for the project owner to monitor Stage 1 or Stage 2, respectively. The date measured and recorded by M1 and M2 will not used for CER calculation.

4. Data monitoring

The readings of the main meter will be used for calculating the emission reductions when the meter is in normal operation state. The monitoring steps are as follows:

- (1) The electricity imported and exported will be hourly measured and monthly recorded by the main meter. The difference of exported and imported electricity is the net electricity generation.
- (2) The Power Grid Company provides the project owner with the net electricity generation data;
- (3) The project owner provides the Power Grid Company with sales receipts and preserves the copies of the sales receipts.
- (4) The project owner provides DOE with readings record of meters and copies of sales receipts.

The principle of the processes is to guarantee the DOE could obtain the actual and precise data of net generated electricity.

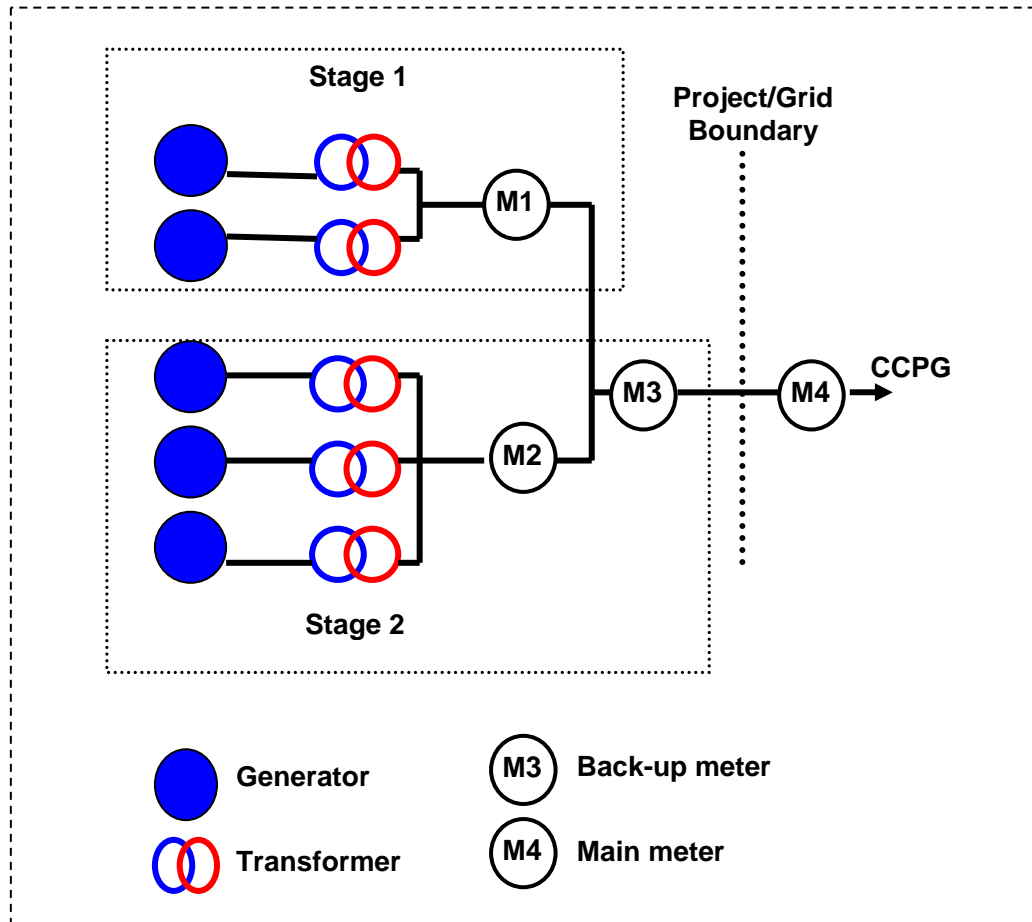


Fig. 2 the sketch map of the meters' location

5. QA/QC

Both the main meter and the back-up meter are bi-directional meter type, which can record both the electricity amount exported to the grid from the Project and the electricity amount imported from the grid to the Project. The readings of the electricity meter will be continually measured and monthly recorded. The recording data will be cross-checked by the electricity sale invoices.

According to national standards, both main meter and backup meter will be calibrated once a year. All calibration and maintenance standards and procedures will follow Chinese industrial codes and regulations. The accuracy of both meters is no less than 0.5s. In case of a reading of the main meter is evidenced to be wrong (or a calibration is not ok), readings from the backup meter will be adopted with transmission loss deducted.

6. Data management

At the end of each month the monitoring data will be filed electronically. The electronic files will have back-up or print-out. The project owner will keep electricity sale and purchase invoices.

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All written documentation such as maps, drawings, the EIA and the Feasibility Study Reports will be archived and available to the verifier so that the reliability of the information may be checked. In order to make it easy for the verifier to retrieve the documentation and information in relation to the project emission reduction verification, the project owner will provide a document register. The document management system will be developed to ensure adequate document control for CDM purposes.

The dedicated CDM Manager of the project owner is responsible for checking the data and the CDM Manager will be responsible for managing the collection, storage and archive of all data and records. All the data will be kept until two years after the end of the last credit period.

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

>>

Date of completing the final draft of this baseline section (DD/MM/YYYY)

16/05/2008

Name of person of determining baseline:
--

Jiesi LIU

Unit: College of Environmental Science and Engineering, Hunan University;
Foshan Perfect Carbon Co. Ltd.

Dr. Hongyu LIU

Unit: College of Environmental Science and Engineering, Hunan University;
Foshan Perfect Carbon Co. Ltd.

Contact by: hylu@hnu.cn

The persons of determining baseline are not project participant.

SECTION C. Duration of the <u>project activity</u> / <u>crediting period</u>

C.1 Duration of the <u>project activity</u>:

C.1.1. <u>Starting date of the project activity</u>:

>>

26/05/2007 (the construction permission issuance date)

C.1.2. <u>Expected operational lifetime of the project activity</u>:

>>

30 years 0 month for Stage 1

30 years 0 month for Stage 2

C.2 Choice of the <u>crediting period</u> and related information:

C.2.1. <u>Renewable crediting period</u>

>>

7 years *3 = 21 years

C.2.1.1. Starting date of the first <u>crediting period</u>:

>>

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01/01/2010

C.2.1.2. Length of the first <u>crediting period</u>:
--

>>

7 years 0 month

C.2.2. <u>Fixed crediting period</u>:
--

C.2.2.1. Starting date:

>>

Not applicable

C.2.2.2. Length:

>>

Not applicable

SECTION D. Environmental impacts

>>

D.1. If required by the <u>host Party</u>, documentation on the analysis of the environmental impacts of the project activity:

>>

The complete Environmental Impact Assessment (EIA) for Stage 1 and Stage 2 of Lixian Yikeyin Small Hydropower Project have been respectively approved by Li Town Environmental Protection Bureau on April 28, 2006 (document No: A Zhou Huan Jian Han [2006]153 for Stage 1, A Zhou Huan Jian Han [2006]154 for Stage 2). Conclusions of the EIA report are summarized as follows:

1. Noise impact assessment

Noise pollution will result from the explosion, machinery running and materials transportation during construction of the project. But no significant negative impacts are considered to the local inhabitants because they live far from the project site.

2. Atmospheric/air impact assessment

Some air pollutants will be let out from the explosion and machinery running. No significant negative impacts are considered because most of these pollutants are let in the tunnel and no inhabitants live near the project site. During the construction of the tunnel, the workers will wear gas mask, and ventilation condition will be enhanced.

3. Water quality impact assessment

Waste water will be generated during the construction and operation periods of the proposed project. All of this waste water will be treated before drained into Rijiaogou River. Therefore, the project does not have negative effect on quality of water in nearby area.

4. Ecological Impact assessment

Terrestrial Plants: Detailed analysis shows that adverse impacts on terrestrial plants are quite limited because there are no any rare and endangered species in the construction area.

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Terrestrial Animals: According to investigation, no any rare and endangered species near the project site. Therefore, the construction of the project would have little adverse impacts on it.

Aquatic creatures: No rare and endangered aquatic species were found in the river near the project site. Thus, no adverse impacts on aquatic creatures are expected due to the project activities.

The diversion system will reroutes water away from the natural river course, reducing the volume between the diversion and the point where the water is returned to the river. According to the investigation, no big fish and other aquatic creatures were found in the river. According to the EIA, the project owner will ensure that minimum ecological water flows will be maintained, therefore the negative impacts are not considered to be significant.

5. Erosion impact assessment

In China, the Law of Water and Soil Conservation requires that a soil conservation plan should be prepared and implemented for all kind of hydropower projects. Such a plan was prepared and approved by Aba Zang & Qiang Autonomus Prefecture Water Resources Bureau on April 10, 2006 (Document No: A Zhou Shui Fa [2006]201 for Stage 1, and A Zhou Shui Fa [2006]202 for stage 2). In the plan, total amount of soil erosion was predicted, detailed protection measures were identified. And total cost of 0.9737 million CNY would be paid for the water and soil conservation.

It is concluded that with implementation of the plan the soil erosion will be under effective control and the soil erosion due to construction of the GHP would be with an acceptable level.

6. Social impact assessment

The EIA states that the project will contribute to the development of the local economy and society. The project will also enhance the investment environment for the local economy. Both the EIA and the Feasibility Study Reports note that the project activities will increase local inhabitants' living standards, improve infrastructure and therefore make it a more attractive environment for investment.

7. Conclusion

It can be concluded that the proposed project activity does not have obvious negative effects to the environment on the whole, and the project will results in more positive environmental benefits by reducing both GHG emissions and local environmental pollutants caused by coal combustion, increasing in local inhabitants' living standards, improvement in infrastructure level etc. Therefore the project will have positive impact on socioeconomic 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:

>>

Strict environmental monitoring and mitigation measures will be carried out during the construction and operation stage of the project. Through these measures, the negative environmental impacts arising from the project activities will be reduced to minimum. Therefore, environmental impacts of the project are considered to be insignificant. Taking into account the contribution to sustainable development for the local and national area, the project will have an overall positive impact on the local and global environment. The EIA report for the proposed project indicated that the project would have significant positive impacts on local environment.

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SECTION E. Stakeholders' comments

>>

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

>>

Comments from the local stakeholders about Lixian Yikeyin Small Hydropower Project were consulted by visiting, symposium, and questionnaire distribution methods during the environmental impact assessment in 2006. In April, 2007, the project entity took questionnaires to better understand stakeholders' comments again.

Investigated stakeholders included representatives from several villages influenced by the project activity and local officers. The main consulted people were the direct relative employees, specialists and the inhabitants around the proposed project site. Total 50 questionnaires were distributed, all of the distributed questionnaires had been returned. All of the opinions from the local stakeholders had been collected and considered.

Consulted stakeholders involved in the proposed project were listed in table below:

	Item	number	Percentage
Gender	Male	39	78.0%
	Female	11	22.0%
Metier	Officer	6	12.0%
	Peasant	32	64.0%
	Expert	4	8.0%
	Others	8	16.0%

E.2. Summary of the comments received:

>>

Total 50 questionnaires were distributed, all of the distributed questionnaires had been returned. All of the opinions from the local stakeholders had been collected and considered. Comments from these questionnaires for local people are summarized in the table below:

Question	Answer	Number	%	Comments
Will construction and operation of the Project use or affect natural resources or ecosystems which are non-renewable or in short supply?	Yes	0	0	
	No	50	100	
Will the Project involve use or release of substances or materials (including solid waste) wch could be harmful to theenvironment?	Yes	0	0	
	No	50	100	
Will the Project release pollutants or any hazardous, toxic or noxious substances to air?	Yes	0	0	
	No	50	100	
Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?	Yes	6	12	The project will cause some noise, but the effect is not significant because no many inhabitants near the project site.
	No	44	88	

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Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater?	Yes	0	0	
	No	50	100	
Are there any areas on or around the location which are protected under international or national or local legislation for their ecological value, which could be affected by the project?	Yes	0	0	No protection area around the project site.
	No	50	100	
Are there any other areas on or around the location, which are important or sensitive for reasons of their ecology, which could be affected by the project?	Yes	0	0	No protection area around the project site
	No	50	100	
Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, over wintering, migration, which could be affected by the project?	Yes	0	0	No rare and endangered fauna or flora was found in construction area.
	No	50	100	
Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, over wintering, migration, which could be affected by the project?	Yes	0	0	No rare and endangered fauna or flora was found near the construction area.
	No	50	100	
Will there be any risk of accidents during construction or operation of the Project which could affect human health?	Yes	0	0	
	No	50	100	
Will the Project result in social changes, for example, in demography, traditional lifestyles, employment?	Yes	35	70	The project construction will provide some employment position for local inhabitants.
	No	15	30	
Is the project in a location where it is likely to be highly visible to many people?	Yes	0	0	The project site locates in the valley, where is far from the residential area.
	No	50	100	

The survey received 100% participation (50 questionnaires returned out of 50). The survey shows that stakeholders believe that the project will have positive impacts on the local ecological, environmental, employment, and social life. The survey forms are available from the company.

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

>>

In conclusion, the local government and inhabitants support the project activities. The proposed project will benefit the local economic development. No negative comments were received.

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

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State/Region:	Aba state
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E-Mail:	/
URL:	/
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URL:	www.tricornona.se
Represented by:	
Title:	President & CEO
Salutation:	Mr.
Last Name:	von Zweigbergk
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

**ANNEX 3
BASELINE INFORMATION**

The low calorific value, CO₂ emission factor and oxidation factor of fuels are listed in Table A1 below.

Table A1 Low calorific values, CO₂ emission factors and oxidation factors of fuels

Fuel	Low Calorific Value	Emission Factor (tC/TJ)	Oxidation Factor (%)
Raw Coal	20908 kJ/kg	25.8	100
Cleaned Coal	26344 kJ/kg	25.8	100
Other Washed Coal	8363 kJ/kg	25.8	100
Coke	28435 kJ/kg	29.2	100
Crude Oil	41816 kJ/kg	20.0	100
Gasoline	43070 kJ/kg	18.9	100
Diesel Oil	42652 kJ/kg	20.2	100
Fuel Oil	41816 kJ/kg	21.1	100
Natural Gas	38931 kJ/m ³	15.3	100
Coke Oven Gas	16726 kJ/m ³	12.1	100
Other Gas	5227 kJ/m ³	12.1	100
LPG	50179 kJ/kg	17.2	100
Refinery Dry Gas	46055 kJ/kg	15.7	100

Data source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy
China Energy Statistical Yearbook 2006
<http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1875.xls>

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Table A2 Operation Margin Emission Factor of Central China Power Grid in 2003

Fuel type	Unit	Province in the regional grid						Sub total	NCV (MJ/t, m ³ ,tce)	Emission Factor (tC/TJ)	OXID	CO ₂ emission (tCO ₂ e)
		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan					
Raw	10 ⁴ t	1427.41	5504.94	2072.44	1646.47	769.47	2430.93	13851.66	20908	25.8	1	273971539.89
Clean Coal	10 ⁴ t							0	26344	25.8	1	0.00
Other washed coal	10 ⁴ t	2.03	39.63			106.12		147.78	8363	25.8	1	1169146.40
Coke	10 ⁴ t				1.22			1.22	28435	29.2	1	37142.18
Coke oven gas	10 ⁸ m ³			0.93				0.93	16726	12.1	1	69013.15
Other coal gas	10 ⁸ m ³							0	5227	12.1	1	0.00
Crude oil	10 ⁴ t		0.5	0.24			1.2	1.94	41816	20.0	1	59490.23
Gasoline	10 ⁴ t							0	43070	18.9	1	0
Diesel	10 ⁴ t	0.52	2.54	0.69	1.21	0.77		5.73	42652	20.2	1	181015.94
Fuel oil	10 ⁴ t	0.42	0.25	2.17	0.54	0.28	1.2	4.86	41816	21.1	1	157229.00
LPG	10 ⁸ m ³							0	50179	17.2	1	0.00
Refinery gas	10 ⁸ m ³	1.76	6.53		0.66			8.95	46055	15.7	1	237285.34
Natural gas	10 ⁸ m ³					0.04	2.2	2.24	38931	15.3	1	489222.52
Other oil products	10 ⁴ t							0	38369	20.0	1	0.00
Other coke products	10 ⁴ t							0	28435	25.8	1	0.00
Other energy	10 ⁴ t							0	0	0	1	0.00
Total CO ₂ emission	tCO ₂											276371084.63
Total electricity generation	GWh	27165	95518	39532	29501	16341	32782					
Self consumption	%	6.43	7.68	3.81	4.58	8.97	4.41					
Electricity delivered to grid	GWh	25418	88182	38026	28150	14875	31336	225988				
<i>EF_{OM, Simple, 2004}</i>	tCO ₂ e/MWh											1.22294736

Data Source: China Energy Statistical Yearbook 2004

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Table A3 Operation Margin Emission Factor of Central China Power Grid in 2004

Fuel type	Unit	Province in the regional grid						Sub total	NCV (MJ/t, m ³ ,tce)	Emission Factor (tC/TJ)	OXID	CO ₂ emission (tCO ₂ e)
		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan					
Raw	10 ⁴ t	18.638	69.285	25.105	21.979	8.755	27.479	171.441	20908	25.8	1	339092605.3
Clean Coal	10 ⁴ t	0	0.0234	0	0	0	0	0.0234	26344	25.8	1	58316.13
Other washed coal	10 ⁴ t	0.4893	1.0422	0	0	0.8972	0	2.4287	8363	25.8	1	1921441.23
Coke	10 ⁴ t	0	1.0961	0	0	0	0	1.0961	28435	29.2	1	2948455.29
Coke oven gas	10 ⁸ m ³	0	0	168	0	34	0	202	16726	12.1	1	149899.53
Other coal gas	10 ⁸ m ³	0	0	0	0	261	0	261	5227	12.1	1	60527.09
Crude oil	10 ⁴ t	0	0.0086	0.0022	0	0	0	0.0108	41816	20.0	1	33118.27
Gasoline	10 ⁴ t	0	0.0006	0	0	0.0001	0	0.0007	43070	18.9	1	2089.33
Diesel	10 ⁴ t	0.0002	0.0386	0.0107	0.0172	0.0114	0	0.0781	42652	20.2	1	266627.32
Fuel oil	10 ⁴ t	0.0109	0.0019	0.0955	0.0138	0.0048	0.0168	0.1437	41816	21.1	1	464893.14
LPG	10 ⁸ m ³							0	50179	17.2	1	0.00
Refinery gas	10 ⁸ m ³	0.0352	0.0227	0	0	0	0	0.0579	46055	15.7	1	153506.38
Natural gas	10 ⁸ m ³	0	0	0	0	0	227	227	38931	15.3	1	495774.61
Other oil products	10 ⁴ t							0	38369	20.0	1	0.00
Other coke products	10 ⁴ t							0	28435	25.8	1	0.00
Other energy	10 ⁴ t	0	0.1692	0	0.152	0.2095	0	0.5307	0	0	1	0.00
Total CO ₂ emission	tCO ₂											346035809.73
Total electricity generation	GWh	30127	109352	43034	37186	16520	34627	270846				
Self consumption	%	7.04	8.19	6.58	7.47	11.06	9.41					
Electricity delivered to grid	GWh	28006	100396	40202	34408	14693	31369	249074				
<i>EF_{OM, Simple, 2004}</i>	tCO ₂ e/MWh											

Data Source: China Energy Statistical Yearbook 2005

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Table A4 Operation Margin Emission Factor of Central China Power Grid in 2005

Fuel type	Unit	Province in the regional grid						Sub total	NCV (MJ/t, m ³ ,tce)	Emission Factor (tC/TJ)	OXID	CO ₂ emission (tCO ₂ e)
		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan					
Raw	10 ⁴ t	18.6929	76.3887	27.3215	17.1227	8.754	29.9977	178.2775	20908	25.8	1	352614496.8
Clean Coal	10 ⁴ t	0.0002						0.0002	26344	25.8	1	498.43
Other washed coal	10 ⁴ t		1.3812			0.8999		2.2811	8363	25.8	1	1804669.00
Coke	10 ⁴ t		0.2595		1.05			1.3095	28435	29.2	1	3986695
Coke oven gas	10 ⁸ m ³			0.0115		0.0036		0.0151	16726	12.1	1	112053.61
Other coal gas	10 ⁸ m ³		0.102			0.0312		0.1332	5227	12.1	1	308896.88
Crude oil	10 ⁸ m ³		0.0082	0.0036				0.0118	41816	20.0	1	36184.78
Gasoline	10 ⁴ t		0.0002			0.0002		0.0004	43070	18.9	1	1193.90
Diesel	10 ⁴ t	0.013	0.0303	0.0239	0.0139	0.0138		0.0949	42652	20.2	1	299797.78
Fuel oil	10 ⁴ t	0.0064	0.0029	0.0315	0.0168	0.0089	0.0222	0.0887	41816	21.1	1	286959.09
LPG	10 ⁸ m ³							0	50179	17.2	1	0.00
Refinery gas	10 ⁴ t	0.0071	0.0341	0.0176	0.0078			0.0666	46055	15.7	1	176572
Natural gas	10 ⁸ m ³						3	0.03	38931	15.3	1	655208.73
Other oil products	10 ⁴ t							0	38369	20.0	1	0.00
Other coke products	10 ⁴ t				0.015			0.015	28435	25.8	1	40349.27
Other energy	10 ⁴ t		0.0288		0.0174	0.328		0.3742	0	0	1	0.00
Total CO ₂ emission	tCO ₂											360283226
Total electricity generation	GWh	30000	131590	47700	39900	17584	37202					
Self consumption	%	6.48	7.32	2.51	5.00	8.05	4.27					
Electricity delivered to grid	GWh	28.056	121957.6	46502.7	37905	16118.5	35613.5					286203.305
<i>EF_{OM, Simple, 2005}</i>	tCO ₂ e/MWh											

Data Source: China Energy Statistical Yearbook 2006

Table A5 Operation Margin Emission Factor of Central China Power Grid (Weighted Average)

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Item	Unit	2003	2004	2005	Total
Total CO ₂ emission	tCO ₂ e	276371085	346035810	360283226	982690120
Electricity delivered to the grid	MWh	225987719	249074186	286203305	761265210
EF of each year	tCO ₂ e/MWh	1.222947	1.389288	1.258837	
EF _{grid,OM,y}					1.290864

Table A6 Percentages of CO₂ emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO₂ emissions

		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	Average Low Calorific Value	Emission Factor (tC/TJ)	Oxidation	CO ₂ Emission (tCO ₂ e)
Fuel	Unit	A	B	C	D	E	F	G=A+...+F	H	I	J	K=G*H*I*J*44/12/100
Raw Coal	10 ⁴ t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	17827.8	20908 kJ/kg	25.8	100%	352614496.76
Cleaned Coal	10 ⁴ t	0.02	0					0.02	26344 kJ/kg	25.8	100%	498.43
Other Washed Coal	10 ⁴ t		138.12			89.99		228.11	8363 kJ/kg	25.8	100%	1804669.00
Coke	10 ⁴ t		25.95		105			130.95	28435 kJ/kg	29.2	100%	3986695.05
Subtotal												358406359.24
Crude Oil	10 ⁴ t		0.82	0.36				1.18	41816 kJ/kg	20	100%	36184.78
Gasoline	10 ⁴ t		0.02			0.02		0.04	43070 kJ/kg	18.9	100%	1193.90
Diesel Oil	10 ⁴ t	1.3	3.03	2.39	1.39	1.38		9.49	42652 kJ/kg	20.2	100%	299797.78
Fuel Oil	10 ⁴ t	0.64	0.29	3.15	1.68	0.89	2.22	8.87	41816 kJ/kg	21.1	100%	286959.09
Subtotal												624135.55
Natural Gas	10 ⁷ m ³						30	30	38931 kJ/m ³	15.3	100%	655208.73
Coke Oven Gas	10 ⁷ m ³			11.5		3.6		15.1	16726 kJ/m ³	12.1	100%	112053.61
Other Gas	10 ⁷ m ³		102			31.2		133.2	5227 kJ/m ³	12.1	100%	308896.88
LPG	10 ⁴ t							0	50179 kJ/kg	17.2	100%	0.00
Refinery Dry Gas	10 ⁴ t	0.71	3.41	1.76	0.78			6.66	46055 kJ/kg	15.7	100%	176572.11
Subtotal												1252731.33
Total												360283226.12

The percentages of CO₂ emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired CO₂ emissions are calculated as:

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$$\lambda_{Coal} = 99.48\%, \lambda_{Oil} = 0.17\%, \lambda_{Gas} = 0.35\%$$

Data source: Chinese Energy statistics Yearbook 2006

China DNA: <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File>

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Table A7 Installed Capacity of CCPG in 2005

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal plant	MW	5906	26267.8	9526.3	7211.6	3759.5	7496	60167.2
Hydropower plant	MW	3019	2639.9	8088.9	7905.1	1892.7	14959.6	38405.2
Nuclear power plant	MW	0	0	0	0	0	0	0
Wind power plant and Others	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 A8 Installed Capacity of CCPG in 2003

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal plant	MW	5407.8	17635.5	8173.3	6446.7	3126.2	6104	46893.5
Hydropower plant	MW	2307.4	2438	7337.2	6603.1	1329.8	12341.5	32357
Nuclear power plant	MW	0	0	0	0	0	0	0
Wind power plant and Others	MW	0	0	0	0	0	0	0
Total	MW	7715.2	20073.5	15510.5	13049.8	4456.0	18445.5	79250.5

Data Source: China Electric Power Yearbook 2004

Table A9 Installed Capacity of CCPG in 2002

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal plant	MW	5128.8	15904.5	8147.8	4975.6	3004.5	6142	43303.2
Hydropower plant	MW	2197.4	2438	7213.9	6135.3	1195.5	11854.6	31034.7
Nuclear power plant	MW	0	0	0	0	0	0	0
Wind power plant and Others	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

CDM – Executive Board

Table A10 Building Emission Calculation of CCPG

Item	Installed Capacity (MW)			2002-2005 newly installed capacity (MW)	Percentage to the newly installed capacity
	2002	2003	2005		
	A	B	C	D=C-A	
Thermal plant	43303.2	46893.5	60167.2	16864	69.52%
Hydropower plant	31034.7	32357	38405.2	7370.5	30.38%
Nuclear power plant	0	0	0	0	0.00%
Wind power plant and Others	0	0	24.0	24.0	0.00%
Total	74337.9	79250.5	98596.4	24258.5	
Percentage to that in 2005	75.40%	80.38%	100.00%		

Table A11 Calculation parameter of BM

	Variation	Power supply efficiency	Emission factor (tc/TJ)	OXID	CO ₂ emission (TCO ₂ /MWh)
		A	B	C	D=3.6/A/1000*B*C*44/12
Coal plant	$EF_{Coal,adv}$	35.82%	25.8	100%	0.9508
Oil plant	$EF_{Oil,adv}$	47.67%	21.1	100%	0.5843
Gas plant	$EF_{Gas,adv}$	47.67%	15.3	100%	0.4237

According to equation (7) in B.6.1, $EF_{Thermal,adv} = \lambda_{Coal} * EF_{Coal, Adv} + \lambda_{Oil} * EF_{Oil,Adv} + \lambda_{Gas} * EF_{Gas, Adv}$

Thus, $EF_{thermal} = 99.48\% * 0.9508 + 0.17\% * 0.5843 + 0.35\% * 0.4237 = 0.94829$ tCO₂e/MWh

Thus, $EF_{grid,BM,y}$ will be calculated based on equation (8) as:

$$EF_{BM,y} = 69.52\% * EF_{Thermal,adv} = 69.52\% * 0.94829 = 0.65923 \text{ tCO}_2\text{e/MWh.}$$

Data source: <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1875.pdf>

Table 12 Baseline emission factor of Central China Power Grid (CCPG, tCO₂/MWh)

Operation Margin Emission Factor	A	1.29086
Build Margin Emission Factor	B	0.65923
Combined Emission Factor	$C = 0.5 * A + 0.5 * B$	0.97505



Annex 4

MONITORING INFORMATION

Please refer to the section B.7 of the PDD.
