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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

>>
Title: Ganluo Camp Hydropower Project
Version: 03
Date: 05/06/2011

Revision History:

Version	Date	Comments
Version 01	30th Aug. 2010	PDD for NDRC
Version 02	28th Dec. 2010	PDD for GSP
Version 03	05th Jun. 2011	Revised PDD

A.2. Description of the project activity:

>>
Ganluo Camp Hydropower Project (hereafter: the proposed project), a run-of-river hydropower project, is located in Aga Town, Ganluo County, Sichuan Province, P. R. China. The proposed project will use available hydropower energy resources of Ganluo River, a branch of Dadu River, to generate electricity.

The proposed project has an installed capacity of 24.8MW (12.4MW*2). The annual electricity generation from the proposed project is estimated to be 121870MWh, and the net electricity supply from the proposed project is estimated to be 118238MWh per year[1]. With a total submerge area of 10294m^2, the power density is calculated to be 2409.17W/m^2 (24800000W / 10294 m^2 =2409.17 W/m^2)[2], which is higher than 10 W/m^2. And no inhabitants need to be resettled due to the proposed project activities[3].

The electricity generated from the proposed project will be connected to Sichuan Provincial Power Grid, which is a part of Central China Power Grid (CCPG). The proposed project will displace equal amount electricity generated by other power plants of CCPG, thus, greenhouse gases (GHG) emission reduction can be achieved. The average estimated GHG emission reductions will be 91126 tCO_2e per year. Prior to the start of the implementation of the proposed project, electricity was delivered to the grid by the operation of other power plants belonging to the CCPG. The baseline scenario as identified in section B.4 is the same as this scenario.

The project activity contributions to sustainable development are mainly:

- Reducing GHG emission by replacing fossil fuel-fired generated electricity with renewable water resource;
- Promoting the local water resource rational development;
- Improving the local energy generation infrastructure, bridging the gap between power supply and demand and reducing the deficiency of the local grid;
- Contributing to local economic development and improving inhabitant life quality through increasing employment opportunity.

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[1] Data source: the Preliminary Design Report (PDR). According to the PDR, the electricity output of the project is 121870MWh, excluding the consume rate of 1% and the transmission system loss rate of 2%, therefore the net electricity supply to the grid is 118238MWh which is calculated as: 121870*(1-1%)*(1-2%).

[2] Data sourse: the Environmental Impact Assessment (EIA), Volume 2, Page 11.

[3] Source: The Preliminary Design Report, Volume 1, Page 20.

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 (the host)	Ganluo County Camp Hydropower Development Co., Ltd	No
Sweden	Carbon Asset Management Sweden Pte Ltd	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:
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A.4.1.1. Host Party(ies):
>>
People's Republic of China

A.4.1.2. Region/State/Province etc.:
>>
Liangshan Autonomous Prefecture /Sichuan Province

A.4.1.3. City/Town/Community etc:
>>
Ganluo County

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):
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The barrage of the proposed project is located on upper reaches of Ganluo River, Aga Town, where is 60km far away from Ganluo County Town, Sichuan Province, P.R.China. The geographical coordinate of the propose project activity is:

Longitude: $102^{o}46' 54''$ E
Latitude: $28^{o}43' 31''$ N

Physical location of the proposed project is marked in the maps below.

Figure 1 Sketch map of the proposed project site

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

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Category: **"Energy Industries (Renewable sources)"**

Sector Scope Number: 1

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

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Electricity generated by the proposed project with water resource will be delivered to the China Centre Power Grid (CCPG) which is mainly dominated by fossil fuel-fired power plants.

The proposed project is a newly built run-of-river hydropower project, which will utilize water resource from Ganluo River to generate electricity. Water from Ganluo River will be diverted through the tunnel, fore bay, a steel penstock, and then run through the turbine and generator to generate power, and the tail water will return to Ganluo River. Total installed capacity of the project is 24.8MW, which involve two units of HLD381B-LJ-155 turbine and two units of SF12.4-10/3000 generator. The technology of the turbines and generators used in the proposed project is well known in the host country. The electricity generated of 118238MWh from the proposed project is delivered to CCPG. The main technical parameters of the proposed project are shown in Table 1.

Table 1 Technical specification of the machinery[4]

Turbines	
Turbine Type	HLD381B-LJ-155
Quantity	2
Rated Water head	245 m
Rated Flow	5.74 m^3/s
Rated Rotation Speed	600 r/min
Lifetime	20 years
Generators	
Model	SF12.4-10/3000
Quantity	2
Rated Unit Capacity	12.4MW
Rated Voltage	10.5 kV
Rated Rotation Speed	600 r/min
Lifetime	20 years

The main monitoring equipment of the proposed project is the Revenue meter, which locates at the connected point of the project and the power grid company which belongs to the power grid company.

Technology transfer:
All the equipments of the project are provided by domestic manufacturers. There is no technology import through the project activity.

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

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The estimated annual emission reduction of the proposed project is 91126 tCO_2e. the renewable crediting period of 21 years is chosen. In the first 7-year crediting period, the total emission reductions are estimated to be 637882.

Years	Annual estimation of emission reductions in tons of CO_2 e

[4] Data source: the Preliminary Design Report has been jointly approved by the Development and Reform Commission of Liangshan State and Water Conservancy Bureau of Liangshan Autonomous Prefecture.

01/01/2012-31/12/2012	91126
01/01/2013-31/12/2013	91126
01/01/2014-31/12/2014	91126
01/01/2015-31/12/2015	91126
01/01/2016-31/12/2016	91126
01/01/2017-31/12/2017	91126
01/01/2018-31/12/2018	91126
Total estimated reductions (tCO_2e)	637882
Total number of crediting years (y)	7
Annual average over the crediting period of estimated reductions (tCO_2e)	91126

A.4.5. Public funding of the project activity:

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The project activity does not involve any public funding from Annex 1 countries.

SECTION B. Application of a baseline and monitoring methodology:

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Title of the approved baseline and monitoring methodology applied to the project activity is:

Baseline and monitoring methodology ACM0002: "Consolidated baseline and monitoring methodology for grid-connected electricity generation from renewable sources" (ACM0002, Version 12.1.0).

Tool for the demonstration and assessment of additionality. (Version 05.2).

Tool to calculate the emission factor for an electricity system. (Version 02).

For detailed information please refer to: http://cdm.unfccc.int/methodologies/ approved

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

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The Methodology of ACM0002 (Version 12.1.0) is chosen and applicable to the proposed project due to the following reasons:

(1) The proposed project is a newly built hydropower project. So the project is a grid-connected renewable power generation project activity that install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity;

(2) The project activity results in a new reservoir, and the power density of the proposed project is 2409.17 W/m^2, as per definitions given in the Project Emission section, which is greater than 4 W/m^2;

(3) The proposed project does not involve switching from fossil fuels to renewable energy at the project activity; the project is also not Biomass fired power plant; and as described above, the project activity results in a new reservoir, and the power density of the proposed project is 2409.17 W/m^2 which is greater than 4 W/m^2

On the basis of the reasons above, the applicability criteria of the Methodology stated in ACM0002 (Version 12.1.0) are met.

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

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According to the ACM0002 (version 12.1.0), the spatial extent of the project boundary includes the proposed project and all power plants connected physically to the electricity system that the proposed project is connected to.

The proposed project is a newly built run-of-river hydropower project, which will utilize water resource from Ganluo River to generate electricity. Water from Ganluo River will be diverted through the tunnel, fore bay, a steel penstock, and then run through 2 unit systems of turbine and generator to generate electricity, and the tail water will return to Ganluo River. The electricity generated by the proposed project will be delivered to Sichuan Power Grid, which is a part of the Centre China Power Grid. Based on the boundary definitions issued by the Chinese DNA, the geographical boundary of CCPG covers Hubei Provincial Power Grid, Hunan Provincial Power Grid, Jiangxi Provincial Power Grid, Henan Provincial Power Grid, Chongqing Power Grid and Sichuan Provincial Power Grid.

Therefore, it is justifiable to determine the CCPG as the right project boundary for this specific project, considering the substantial inter-grid power exchange among other power grids.

The flow diagram of the project boundary is illustrated as follow:

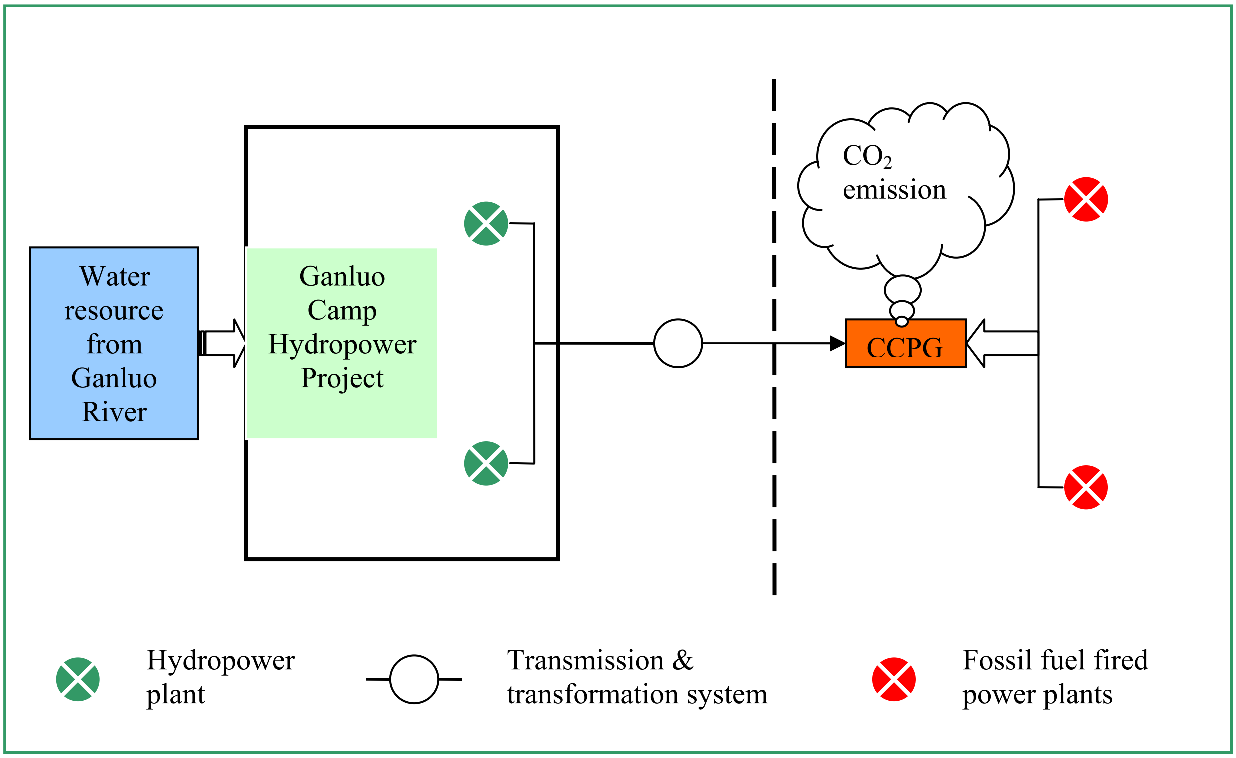

Fig.2 the flow diagram of the project boundary

The following gases and sources have been considered in the project activity.

	Source	Gas	Included?	Justification/Explanation

Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source.
Proposed project	For hydropower project, emissions of CH_4 from the reservoir.	CO_2	No	Minor emission source.
		CH_4	No	As the power density of the project activity is 2409.17 W/m^2, which is greater than 10 W/m^2, project emission don't need to be considered according to ACM0002.
		N_2O	No	Minor emission source.

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

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The project activity is the installation of a new grid-connected renewable power plant/unit, and the electricity generated will be transmitted to the Central China Power Grid via Sichuan Provincial Power Grid. According to ACM0002, the baseline scenario of the proposed project is:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources in the Central China Power Grid, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" (Version 02).

The proposed project is a new grid-connect renewable power plant, and is connected to the CCPG, so the baseline scenario of the proposed project is: Equivalent annual electricity supplied by CCPG.

The basic parameters used for calculating baseline emissions of the project are provided in table B.1:

Table B.1 Main data and parameter of calculating the baseline emission of the project activity

Parameter	Data value	Data sources
Operating margin emission factor $EF_{grid,OM,y}$(tCO_2e/MWh)	1.0871	China DNA: "*Notification on Determining Baseline Emission Factor of China's Grid*"—"*Calculation of Baseline Emission Factor of China's Grid*"
Build margin emission factor $EF_{grid,BM,y}$(tCO_2e/MWh)	0.4543	China DNA: "*Notification on Determining Baseline Emission Factor of China's Grid*"—"*Calculation of Baseline Emission Factor of China's Grid*"
Net annual electricity supply EG_y (MWh)	118238	Preliminary Design Report

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

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Prior consideration of CDM

The Preliminary Design Report (PDR) of the proposed project was written by Huaxi Engineering & Sichuan Xidian Power Design institution in October 2008, and the PDR has been jointly approved by the

Development and Reform Commission of Liangshan Yi Autonomous Prefecture and Water Conservancy Bureau of Liangshan Yi Autonomous Prefecture on 9th Jan. 2009 (Document number: Liang Shui Fa [2009]17). According to the PDR, without additional revenue, the project is financial unattractiveness as the low project IRR which was lower than the benchmark (10%). However, the additional revenues from CDM can obviously improve the project IRR and make it financially acceptable. After carefully consulting CDM specialists, the project owner organized a board meeting to discuss the CDM feasibility, and finally decided to apply CDM on 6th Mar 2009, and the CDM consulter was designated on 18th Jun. 2009. The CDM consulter collected all necessary documentations, after negotiation with CER Buyer, the Terms and Conditions for the forward Sale and Purchase of Certified Emission Reduction was signed on 15th Jul. 2009.

To secure CDM statues, there were continue efforts, the Prior Consideration of CDM Form was approved by China NDRC on 22nd Dec. 2009, the Form was also received by EB on 01st Feb. 2010. In Aug. 2010, the proposed project PDD was submitted to China NDRC, and then the LoA was issued by China NDRC on 31st Dec. 2010.

The project activities substantial started with the construction agreement signed on 01st Sep 2009, the construction permission issued by a supervision institute on 10th Sep. 2009, and then the equipments purchase agreement signed on 30th Sep. 2009. Thus, the earliest starting date of the proposed project is 01st Sep 2009.

It may therefore be clear that the project owner has fully considered the revenues from CDM when making the decision to implement the proposed project activity. The main timeline of the proposed project activity are shown in the table bellow:

No.	Date	Event	Reference
1	Oct. 2008	The PDR was finished	The PDR
2	9th Jan. 2009	The PDR was approved	The approve letter of the PDR
3	6th Mar. 2009	Considering CDM support	The board decision
4	18th Jun. 2009	CDM consulter was designed	The CDM Cooperation Agreement
5	15th Jul. 2009	The CER Buyer was confirmed	The Terms and Conditions for the forward Sale and Purchase of Certified Emission Reduction
6	1st Sep. 2009	The construction agreement was signed (Starting date of the project)	The Construction Agreement
7	10th Sep. 2009	The construction permission was issued	The Construction Permission Letter
8	30th Sep. 2009	The equipments was determine	The Equipments Purchase Agreement
9	22nd Dec. 2009	The Prior Consideration of CDM Form was approved by China DNA	The Prior Consideration of CDM Form
10	01st Feb. 2010	The Prior Consideration of the CDM Form was received by EB	http://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html
11	31st Dec. 2010	The proposed project was approved by China NDRC	The LoA
12	Jan. 2012	The project starting operation	

The analysis was carried out by using the "Tool for the demonstration and assessment of additionality" (Version 05.2), as specified by the approved methodology ACM0002 (version 12.1.0) as described below:

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

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

Four alternatives to the project scenario are considered:

Alternative 1: The proposed project activity without CDM incentive.
Alternative 2: Construction of a thermal power plant with the same installed capacity or the same annual power output;
Alternative 3: Construction of a power plant utilizing other renewable sources with equivalent annual power output;
Alternative 4: Central China Power Grid (CCPG) provides the same amount of electricity.

Alternative 3 is consistent with all current applicable laws and regulations. But it is still not a realistic and credible scenario for the following reasons: As for solar photovoltaic, its cost is eleven to eighteen times that of coal-fired electric energy, six to ten times that of wind electric energy, according to a quoted article from China Climate Change website[5], and is therefore higher than the cost of hydro electric energy. As a county level small private company,, the project owner won't invest in such project; wind power plant is not an option to substitute the proposed project since there is no wind resource in Sichuan Province for wind power development according to article from China Geography[6]; as for biomass power project, its operation is rather difficult due to "high cost but low electricity tariff". The biomass industry is calling on and looking forward to new preferential policy from the government to overcome financial barriers according to China New Energy website[7] and article from National Development and Reform Commission[8]; as for wave and tidal power plants, usually they are located in coastal cities. While the proposed project is located in mountainous area in Sichuan province, thus tidal and wave energy is unavailable; There is no solar energy, wind resources, biomass energy, tidal, wave energy and geothermal energy except abundant water resources at the project site. Therefore Alternative 3 is not feasible.

Sub-step 1b. Enforcement of applicable laws and regulations:

Since annual operational hours of fossil fuel power plant is far more than that of hydropower project, therefore, the installed capacity should be below 30MW when a fossil fuel power plant with the same amount of annual electricity generation as the proposed project is constructed. However, according to Chinese regulations, thermal power plants of less than 135MW are prohibited to construct[9].

And on Dec. 2, 2005, the "*Guidance on Industrial Structural Adjustment (Version 2005)*" was issued by National Development & Reform Commission; it proclaims that conventional fossil fuel power unit with single capacity below 135MW is prohibited[10]. Therefore, alternative (2) is not in line with the national regulation and can't be considered as the baseline scenario.

Thus, Alternative 1 and 4 are in compliance with current laws and regulations, and valid baseline scenario.

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[5] http://www.ccchina.gov.cn/cn/NewsInfo.asp?NewsId=5884

[6] http://www.cnwpem.com/web.php?wid=22&cid=3890;

http://www.showchina.org/zgdl/sylm/200701/t104908.htm.

[7] http://www.newenergy.org.cn/Html/0087/7220819239.html

[8] http://www.sdpc.gov.cn/zjgx/t20071123_174054.htm

[9] See the announcement about strictly forbid the construction of the thermal power station with the installed capacity lower than 135WM published by the state council office, Guo Ban Fa Ming Dian [2002] No.6.

[10] Data source: http://www.ndrc.gov.cn/zcfb/zcfbl/zcfbl2005/t20051222_54304.htm

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

The tool for additionality provides three options for investment analysis:
Option -I: Simple cost analysis;
Option-II: Investment comparison analysis;
Option-III: Benchmark analysis.

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.

Therefore the benchmark analysis (Option III) is chosen for assessing the financial attractiveness of the project activity.

Sub-step 2b – Option III Apply Benchmark analysis

The "Economic Evaluation Code for Small Hydropower Projects" issued by the Ministry of Water Resources in 1995 (Document No. SL16-95)[11], 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). Besides, project with a capacity of less than 50MW in rural areas can refer to this code too". The proposed project is a hydropower project with installed capacity of 24.8 MW located in Aga Town of Ganluo County, where is a countryside. Thus, the SL16-95 is applicable to the proposed project.

The validity of this code was further confirmed again by the Ministry of Water Resources of the People's Republic of China on 12. Jan, 2009[12]. The *Economic Evaluation Code for Small Hydropower Projects* (Document No: SL16-95) is widely adopted as benchmark reference for Chinese Hydropower projects.

According to the Document SL16-95, the benchmark of post tax project IRR is 10% (post tax).

Sub-step 2c – Calculation and Comparison of Financial Indicators

The detailed information about the investment return analysis was given below.

Table 2 Main parameters for calculation of financial indicators

No	Parameters	Unit	Value	Data Source
1	Installed capacity	MW	24.8	PDR
2	Total investment in fixed assets	Ten thousand CNY	22436.23	PDR

[11] Data source: http://www.cws.net.cn/guifan/bz/SL16-95

12 Data source: http://www.mwr.gov.cn/slzx/tzgg/tzgs/200903/t20090306_157857.html

3	Operational cost	Ten thousand CNY	377.45	PDR
4	Net annual electricity supply	MWh	118238	PDR
5	Power tariff	CNY/kWh	0.288	PDR
6	Value Added Tax (VAT)	%	17	PDR
7	Income tax	%	25	PDR
8	Additional tax for city development	%	1	PDR
9	Additional tax for education	%	3	PDR
10	Depreciation rate	%	4.75	PDR
11	Net residual rate	%	5	PDR
12	Project operational lifetime	y	20	PDR

Table 3 shows the financial analysis result for the proposed project with or without CER revenue. As shown, IRR of the proposed project (without revenue from CERs: 7.40%) is lower than the benchmark rate of return applicable, which is 10% (after tax) for the proposed project. This therefore indicates that in comparison to other investments, the proposed project would not be a more financially viable investment option for securing the best returns.

Table 3 Comparison of financial indicators with and without income from CERs

Item	Unit	Without CERs revenue	Benchmark	With CERs revenue
IRR on total investment	%	7.40	10	10.36

Sub-step 2d: 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 in fixed assets
- Net annual electricity supply
- Power tariff
- Operational cost

The results of sensitivity analysis were shown in Table 4 below.

Table 4 Calculation and comparison of financial indicators

	-90.00%	-22.80%	-10.00%	0.00%	10.00%	28.10%
Total investment in fixed assets	-	10.00%	8.41%	7.40%	6.45%	-
Net annual electricity supply	-	-	6.29%	7.40%	8.36%	10.00%
Power tariff	-	-	6.29%	7.40%	8.36%	10.00%
Operation cost	8.63%	-	7.65%	7.40%	7.11%	-

From the results shown in Table 4, we can find that without revenue from CDM, the project IRR of the proposed project is always lower than the benchmark of 10% even the four factors vary between -10% to +10%.

But if the Total investment in fixed assets decreases by22.80%, the project IRR value will rise up to the benchmark of 10%. However, according to the *GDP and Social Development Statistical Bulletin* published by National Bureau of Statistics of China from 2005 to 2009[13], the price of static investment, industrial products and raw materials keep continuous growth. Thus the hypothesis of total investment in fixed assets decrease by 22.80% will not come true.

Electricity revenue is affected mainly by electricity output amount and electricity tariff. If the annual electricity output or the electricity tariff increases by 28.10%, the IRR value of the proposed project will rise up to the benchmark of 10.0%. 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). The annual electricity output was the average value of 49 years (1959-2007) and changed very lightly[14]. Thus, it is unlikely that the annual electricity output increased by 28.10%.

And if the electricity tariff increases by 28.10%, the project IRRs will up to the benchmark of 10%. The power tariff of 0.288CNY/kWh for the proposed project was sourced from the PDR, which was based on a power tariff document (document No: Chuan Jia Fa [2006]145) issued by the Price Bureau of Sichuan Province on 29th Jun. 2006[15]. And now, the power tariff of 0.288 CNY/kWh is still as the policy tariff of Sichuan Province according to the latest power tariff document (document No: Chuan Jia Dian Fa [2009]59) issued by the Price Bureau of Sichuan Province on 19th Nov. 2009[16]. Thus, it is unlikely that the electricity tariff increases by 28.10%.

As for the operational cost, the influence on the IRR value is quite weak. Even when the operational cost decrease by 90% the IRR value is still not reach the benchmark of 10.0%.

After above sensitive analysis, we can conclude that when financial indicators change within reasonable range, the proposed project is not financially feasible without CDM support.

Step 4. Common Practice analysis

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

According to the requirements of common practice, the projects with similar conditions, such as investment conditions and natural conditions (including geographical conditions, climate conditions, development conditions and so on), are necessary to be analyzed. Projects located in different provinces of Center China Power Grid have not the similar investment conditions and natural conditions. Sichuan Province with an area of 48.5 ten thousand km^2[17], is comparatively and considerably larger than many countries. Therefore, the PDD selects geographical area, i.e. Sichuan Province, as a common practice region.

Power System Reform Blue Print, published by State Council, February 10, 2002. The power plants operating before were developed by the state under a power system environment that is substantially

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[13] The *GDP and Social Development Statistical Bulletin 2004-2008,* published by National Bureau of Statistics of China.

[14] Data source: the PDR of proposed project

[15] http://www.scpi.gov.cn/newzcfg/zcfg-content.asp?id=1972

[16] http://www.scpi.gov.cn/newzcfg/zcfg-content.asp?id=3574

[17] Data source: http://www.sc.gov.cn/scgk1/sq/dl/200905/t20090514_735228.shtml

different from the current power system environment, because, the first Power System Reform Blue Print has been published by State Council in February 2002, and the reform content mainly include: Power plants separating from the power grid, reforming enterprises for power plants and power grids; bidding to power grid, building a competitive and open power market initially; changing the current situation of all power purchased by the state owned grid enterprises. Therefore, the hydropower stations operated before 2002 can be excluded.

Thus, we selected the projects operated after 2002 with an installed capacity of between 15MW and 50MW in Sichuan Province as "similar scale" because Chinese government classifies hydropower stations less than 50MW in rural area as small hydropower projects[18]. Projects have been applied to CDM project were excluded, thus, the 10 stations have been listed in Table 5 below.

Table 5 Hydropower plants in Sichuan Province similar to the proposed project[19]

No.	Name of the hydro plant	Installed capacity (MW)	Remark
1	Sanjiang Hydropower Station	45	Meiya Electric Power Co., Ltd (Foreign Capital)[20]; 5556 CNY/kW for unit investment[21]
2	Niujiaowan III Hydropower Station	25	Sichuan Xichang Electric Power Co., Ltd (State-own), 6782 hours/year for annual operation hours[22] and 3650 CNY/kW for unit investment[23]
3	Fuliutan Hydropower Plant	39	Yuechi Fuliutan Power Co., Ltd. (State-owned) local government supported[24] 5734hours/year for annual operation hours[25] and 7564 CNY/kW for unit investment[26]
4	Tongkou Hydropower Plant	45	Sichuan Bashu Power Development Co., Ltd.(State-owned)[27] 5111hours/year for annual operation hours and 7777 CNY/kW for unit investment[28]
5	Shazui Hydropower Plant	38	6374hours/year for annual operation hours and 4289 CNY/kW for unit investment[29]

18 Data source: *Economic Evaluation Code for Small Hydropower Project* (Document No.SL16-95)

19 Data source: *China Water Resources Yearbook 2005-2008 and other obtainable documents*

20 Data source: http://news.sina.com.cn/s/2004-09-19/07443707044s.shtml

21 Data source: http://baike.baidu.com/view/4618910.htm

22 http://www.chinapower.com.cn/article/1004/art1004225.asp

23 http://biz.cn.yahoo.com/e/20040409/600505-01.html

24 Data source: http://www.chinarein.com/qkhc/detail.asp?id=781

25 Data source: *China Water Resources Yearbook 2006*

26 Data source: http://v.youku.com/v_show/id_cb00XMjEyMDkwNzY=.html

27 Data source: http://sichuan.scol.com.cn/bsxw/20030618/200361812815_sc.htm

28 Data source: http://www.sichuandaily.com.cn/2003/06/18/2003061820722423.51.htm

29 Data source: http://www.gzz.gov.cn/qy/58/index.html

6	Huangmeixi Hydropower station	18	Sichuan Ba River Hydropower Development Company (State owner)[30] 5482hours/year for annual operation hours and 7333 CNY/kW for unit investment
7	Bitan Hydropower Station	24	Sichuan Ba River Hydropower Development Co., Ltd. (State owner)[30] 5471hours/year for annual operation hours and 7917 CNY/kW for unit investment
8	Guaizituo Hydropower Project	25	Sichuan Huakang Electricity Power Co., Ltd.(The main stockholder have strong financing capability)[31] 5546hours/year for annual operation hours and 4800 CNY/kW for unit investment
9	Baishuihe Hydropower Project	24	6633hours/year for annual operation hours[32] and 4999 CNY/kW for unit investment[33]
10	Huilongqiao Hydropower Project	50	5078hours/year for annual operation hours[34] and 5360 CNY/kW for unit investment[35]

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

There are essential distinctions between the proposed project and the other already existing hydropower projects with installed capacity between 15 MW and 50MW in Sichuan Province.

Niujiaowan III project is invested by Xichang Electric Power Co. Ltd., which is the first Listed Companies of Liangshan Yi Autonomous Prefecture[36]. The largest shareholder of Xichang Electric Power Co. Ltd. is Sichuan Provincial Electric Power Co., Ltd[37], which is a state-owned enterprise and a wholly owned subsidiary company of the national power grid.[38] As for the state-owned companies (especially the companies whose shareholder was the electric power gird), first of all, they are easier to enjoy the convenient procedures for electricity connected to the grid and acquire the more attractive tariff. Secondly, they are easier to get the loan and financing from the bank because of their strong capacity to afford the loan and their excellent credit records. The project have larger capital reserves and operational capacity such that they are better able to gain access to project finance and manage operational risks.

Fuliutan Project is invested by Yuechi Fuliutan Power Co., Ltd., which is a State-owned company with large capital reserves and operational capacity which allow it better and easier access to project finance.

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[30] Data source: http://www.hudong.com/wiki/%E5%9B%9B%E5%B7%9D%E5%B7%B4%E6%B2%B3%E6%B0%B4%E7%94%B5%E5%BC%80%E5%8F%91%E6%9C%89%E9%99%90%E5%85%AC%E5%8F%B8

[31] Data source: http://www.ssdl.cn/huakang.asp

[32] Data source: *China Water Resources Yearbook 2006*

[33] Data source: http://www.ctguly.com/view.asp?id=95

[34] Data source: *Registered project No. 1943*

http://cdm.unfccc.int/Projects/DB/DNV-CUK1215604025.32/view

[35] Data source: http://baike.baidu.com/view/3325397.htm

[36] Data source: http://baike.baidu.com/view/4296429.htm

[37] Data source: http://wenku.baidu.com/view/c806cef3f90f76c661371ad6.html

[38] Data source: http://baike.baidu.com/view/867617.htm

Therefore, it can better manage the project risks and have stronger negotiating power with the grid companies. Furthernore, it is a pilot project of rual electrification and was developed due to national poverty alleviation policy. Thus, it was guaranteed with preferential policies from National and local governments which help yield attractive returns.[39]

Tongkou Project is developed by Sichuan Bashu Power Development Co., Ltd. which is a large state-owned company with a gross asset of RMB 11.3 billion[40]. It can be seen that the project can easily get access to investment and other financial incentives from national and local government, and have stronger ability against financial risk;

Huangmeixi project is invested by Ba River Hydropower Development Co., Ltd, of which the largest shareholder is Sichuan Road & Bridge Co., Ltd, a state-owned enterprise. Thus, the project has larger capital reserves and operational capacity to allow them better (more and easier) access to project finance.

The Bitan project is invested by Ba River Hydropower Development Co., Ltd, of which the largest shareholder is Sichuan Road & Bridge Co., Ltd, a state-owned enterprise. Thus, the project has larger capital reserves and operational capacity to allow them better (more and easier) access to project finance. Furthermore, it was developed by national investment from the Perspective of the 11th Five-Year Plan, making the project financially attractive.[41]

Guaizituo project was developed by Sichuan Huakang Electricity Power Co., Ltd, a subsidiary company of Sichuan Shushui Electric Power Group,[42] which is a state-owned enterprise with strong financial capability[43], making the project larger capital reserves and operational capacity to allow them easier access to project finance.

From the above analysis, Niujiaowan III, Fuliutan, Tongkou, Huangmeixi, Bitan and Guaizitou projects have the background and connection to the big companies or the state-owned companies. However, the proposed project owner of the proposed project was private investors, and the proposed project is substantially different from Niujiaowan III, Fuliutan, Tongkou, Huangmeixi, Bitan and Guaizitou projects.

The primary barrier to the development of small hydropower project in China is the diminishing returns on investment. A large initial investment, inefficient management, a lack of technology innovation and a lack of cohesion as a sector have meant that the electricity cost from small hydropower project makes it difficult for companies to compete on the power market.

Government development funds dedicated to small hydropower project have declined steadily since their inception in the 1950s to the late 1990s. Today, however, with the shift to a more market orientated economic system, potential small hydropower project developers face the reality of having to make profits to survive and the sector must generate acceptable rates of return to attract investors.

With the Renewable Energy Law yet to take effect and no other operating market mechanism (such as a market for tradable renewable energy certificates), the CDM is seen as the preferable support mechanism for these investments.

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[39]Data source: http://wenku.baidu.com/view/0c342dd376eeaeaad1f330cf.htmlv

[40] Data source: http://sichuan.scol.com.cn/bsxw/20030618/200361812815_sc.htm

[41] Data source:http://125.64.4.140/pub/zh_sc/zwgk/jjjs/zdxm/bzdq/200701/t20070115_169293.shtml

[42] Data source:http://www.ssdl.cn/about.asp

[43] Data source:http://www.hudong.com/wiki/%E8%9C%80%E6%B0%B4

The proposed project owner is a small county-level developer, and has very limited financial capacity and thus a weak negotiating power with the grid operating company and a weak ability to cope with associated project risk. Thus, the proposed project is obvious difference with those hydropower station mentioned above.

As for Sanjiang Hydropower project, it was developed by foreign capital. Its investment climate is different with the proposed project.

In additional, as for Sanjiang, the unit investment is 5556 CNY/kW, which is 38.59% less than the proposed project, and the annual operation hour of Sanjiang is 4735 hours[44], which is similar with the proposed project(just 3.64 % less than the proposed project), It means that Sanjiang is more financially attractive than the proposed project. As for Niujiaowan III, the unit investment is 3650 CNY/kW, which is 59.66% less than the proposed project, and the annual operation hour of Niujiaowan III is 6782 hours, which is 38.01 % higher than the proposed project. It means that Niujiaowan III is more financially attractive than the proposed project. As for Fuliutan, the unit investment is 7564CNY/kW, which is 16.39% less than the proposed project, and the annual operation hour is 5734 hours, which is 16.69% higher than the proposed project. It means that Fuliutan is more financially attractive than the proposed project. As for Tongkou, the unit investment is 7777CNY/kW, which is 14.04% less than the proposed project, and the annual operation hour is 5111 hours, which is 4.01% higher than the proposed project. It means that Tongkou is more financially attractive than the proposed project. As for Huangmeixi, the unit investment is 7333CNY/kW, which is 18.95% less than the proposed project, and the annual operation hour is 5482 hours, which is 11.56% higher than the proposed project. It means that Huangmeixi is more financially attractive than the proposed project. As for Bitan, the unit investment is 7917CNY/kW, which is 12.49% less than the proposed project, and the annual operation hour is 5471 hours, which is 11.33% higher than the proposed project. It means that Bitan is more financially attractive than the proposed project. As for Guaizituo, the unit investment is 4800 CNY/kW, which is 46.94% less than the proposed project, and the annual operation hour is 5546 hours, which is 12.86% higher than the proposed project. It means that Guaizituo is more financially attractive than the proposed project.

The remaining project, having 3 similar background with the proposed project involve Shazui project, Baishuihe project, and Huilongqiao project

As for Shazui Project, the annual operation hour is 6374 hours/year, which is 29.71 % higher than the proposed project, and unit investment is 4289CNY/KW, which is 52.59 % less than the proposed project. As for Baishuihe Project, the annual operation hour is 6633 hours/year, which is 34.98 % higher than the proposed project, and unit investment is 4999CNY/KW, which is 44.74% less than the proposed project. As for Huilongqiao Project, the annual operation hour is 5078 hours/year, which is 3.34% higher than the proposed project, and unit investment is 5360 CNY/KW, which is 40.75% less than the proposed project. The tariff of all these three projects is 0.288 CNY/KWh[45]. Higher operation hours and lower capital cost can bring about the higher return on the investment when the tariff rate is the same. Therefore, Shazui project, Baishuihe project and Huilongqiao project are financial attractive and face less risks than the proposed project.

The lower annual operation hour implies that the water resource of the proposed project is bad. It will affect power generation and the proposed project will get less income due to less electricity generation. The very high unit investment will make the proposed project financially less attractive. On the other hand, the proposed project owner is a small county-level developer, and has very limited financial

[44] http://baike.baidu.com/view/4618910.htm

[45] http://scjc.scpi.gov.cn/flfg-content.asp?id=507

capacity and thus a weak negotiating power with the grid operating company and a weak ability to cope with associated project risk. Thus, the proposed project is obvious difference with those hydropower station mentioned above.

According to the analysis above, we can conclude that the start of the proposed project activity was just under CDM incentive. Without CDM, the proposed project would not be carried out due to the investment barrier; consequently, no emission reduction will be achieved. Therefore, the proposed project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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According to the methodology of ACM0002 (Version 12.1.0) and analysis in B.3 above, the CCPG is selected as the project boundary.

The CO_2 emission factor ($EF_{grid,CM,y}$) for the displacement of electricity generated by power plants in an electricity system, by calculating the "combined margin" emission factor (CM) of the electricity system: the "operating margin" (OM) and the "build margin" (BM).

$EF_{grid,CM,y}$ refers to Combined margin CO_2 emission factor for the project system in year y;
$EF_{grid,BM,y}$ refers to Build margin CO_2 emission factor for the project system in year y;
$EF_{grid,OM,y}$ refers to Operating margin CO_2 emission factor for the project system in year y.

The emission factors are determined according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system" (version 02) as following seven steps:

STEP 1. Identify the relevant electric power system.
STEP 2. Choose whether to include off-grid power plants in the project electricity system
STEP 3. Select a method to determine the operating margin (OM).
STEP 4. Calculate the operating margin emission factor according to the selected method.
STEP 5. Identify the group of power units to be included in the build margin (BM).
STEP 6. Calculate the build margin emission factor.
STEP 7. Calculate the combined margin (CM) emissions factor.

Step 1. Identify the relevant electric power system

As described in B.3 above, electricity generated from the proposed project will be connected to 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 proposed 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. Choose whether to include off-grid power plants in the project electricity system

The methodological tool for calculating operating margin and build margin emission factors provides two option:
Option I: Only grid power plants are included in the calculation

Option II: Both grid power plants and off-grid power plants are included in the calculation.

For the proposed project, Option I is chose to calculate emission factor.

***Step 3.* Select a method to determine the operating margin (OM).**

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

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

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:, 38.54% in 2004, 38.60% in 2005, 35.12% in 2006, 35.45% in 2007, and 39.50% in 2008[46], 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.

On the other hand, among these methods, method (c), cannot be used, because dispatch data, let alone detailed dispatch data, are not available to the public or to the project participants. For the same reason, method (b) cannot be used. The average OM does not take into account the non- dispatchable nature of low-cost/must-run resources and as low-cost/must-run resources constitute less than 50% of total grid generation, we have selected the Simple OM method as the most appropriate method.

Step 4. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

The simple OM may be calculated:

- Option A: Based on the net electricity generation and a CO_2 emission factor, of each power unit; or
- Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B can only be used if:

(a) The necessary data for Option A is not available; and
(b) Only nuclear and renewable power generation are considered as low-cost/must-run power source and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation

The OM emission factor was calculated according to Option B of the Simple OM method, as data required for Option A is not available to the public or to the project participants. Only nuclear and renewable power generation are considered as low-cost/must-run power source and the quantity of

[46] Data source: China Electric Power Yearbook 2005-2009.

electricity supplied to the grid by these sources is known, and off-grid power plants are not included in the calculation, so Option B was chosen. Calculate as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \qquad \textbf{(1)}$$

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

The published OM emission factor calculates the emission factor directly from published aggregated data on fuel consumption, net calorific values, and power supply to the grid and IPCC default values for the CO_2 emission factor.

Calculation of the OM emission factor as a three-year full generation weighted average

On the basis of these data, the Operating Margin emission factors for 2006, 2007 and 2008 are calculated. The three-year average is calculated as a full-generation-weighted average of the emission factors. For details we refer to the publications cited above and the detailed explanations and demonstration of the calculation of the OM emission factor provided in Annex 3. The Operation Margin Emission Factor is calculated as $EF_{grid,OMsimple,y}$ = 1.0871 tCO_2e/MWh.

The calculation of the OM emission factor is done once (*ex ante*) and will *not* be updated during the first crediting period. This has the added advantage of simplifying monitoring and verification of emission reductions.

Step 5. Identify the cohort of power units to be included in the build margin (BM)

According to the 'Tool to calculate the emission factor for an electricity system', 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.

In terms of vintage of data, project participants choose the Option 1:

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

Step 6. Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{\text{grid},BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \quad \textbf{(2)}$$

Where:
$EF_{grid,BM,y}$: Build margin CO_2 emission factor in year *y* (CO_2/MWh)
$EG_{m,y}$: Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$: CO_2 emission factor of power unit m in year *y* (tCO_2/MWh)
m: Power 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 CO_2 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:

Calculate the share of CO_2 emissions of the solid, liquid and gaseous fuels in total emissions respectively.

$$\lambda_{\text{Coal}} = \frac{\sum_{i \in COAL,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \quad \textbf{(3)}$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \quad (4)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \quad (5)$$

Where:
λ_{Coal}, λ_{Oil} and λ_{Gas} respectively refers to weights of CO_2 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;
$FC_{i,m,y}$ is the amount of fuel *i* consumed in province *m* in year *y*;
$NCV_{i,y}$ is the net calorific value (energy content) of fossil fuel *i* in year *y*;
$EF_{CO2,i,y}$ is the CO_2 emission factor of fossil fuel *i* in year *y*.

λ_{Coal} = 98.34%, λ_{Oil} = 0.18%, and λ_{Gas} = 1.48%

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:

$$EF_{Thermal,adv} = \lambda_{Coal} * EF_{Coal.\,Adv} + \lambda_{Oil} * EF_{Oil.Adv} + \lambda_{Gas} * EF_{Gas.\,Adv} \quad (6)$$

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, CO_2 emissions from the coal, oil and gas in CCPG accounted for 98.34%, 0.18% and 1.48% in total emissions of the grid in 2008, 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 2008 is 600MW sub-critical unit with power supply coal consumption of 314.35 gce/kWh, which is equivalent to a power supply efficiency of 39.08%[47].

The most advanced and commercially available oil and gas power technology in China in 2008 is 200MW sub-critical unit with power supply coal consumption of 238.74 gce/kWh, which is equivalent to a power supply efficiency of 51.46%.

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

$EF_{thermal,adv}$ = 98.34% * 0.8042 + 0.18% * 0.5282+ 1.48% * 0.3799= 0.7974tCO_2e/MWh

[47] Data source: http://qhs.ndrc.gov.cn/qjfzjz/W020090703644239079814.doc

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.

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \qquad \textbf{(7)}$$

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 56.97% (See Annex 3 for details), thus, the Build Margin emission factor ($EF_{grid,BM,y}$) of the CCPG is calculated as:

$EF_{grid,BM,y}$ = 56.97% * $EF_{Thermal,adv}$ = 56.97%*0.7974 = 0.4543tCO_2/MWh

Step 7. Calculate the combined margin (CM) emissions factor

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

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y} \qquad \textbf{(8)}$$

Where:
- $EF_{grid,BM,y}$: Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
- $EF_{grid,OM,y}$: Operating margin CO_2 emission factor in year y (tCO_2/MWh)
- w_{OM}: Weighting of operating margin emissions factor (%)
- w_{BM}: Weighting of build margin emission factor (%)

The defaults weights value for hydropower projects during the first crediting period are used as specified in the "Tool to calculate the emission factor for an electricity system" (Version 02).

$$w_{OM} = 0.5\,;\, w_{BM} = 0.5$$

Using above mentioned values the Combined Baseline Emission Factor of the Central China Power Grid corresponds to **0.7707 tCO_2e/MWh.**

Calculation of the baseline emission

Baseline emissions (BE_y) are obtained as:

$$BE_y = EG_{PG,y} * EF_{grid,CM,y} \qquad \textbf{(9)}$$

Where:

BE_y : Baseline emission of Central China Power Grid in year *y*; (tCO_2)

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

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

The the net amount of power generated by the project and supplied to the grid (EGy) can be calculted by:

$$EG_{PJ,y} = EG_{facility,y} \quad \textbf{(10)}$$

Where:

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

$EG_{facility,y}$: Quantity of net electricity generation supplied by the proposed project to the grid in year *y* (MWh/*yr*);

Project emissions

As a hydropower project, the project emission of the proposed project can be calculated by:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} = PE_{HP,y} \quad \textbf{(11)}$$

Where:

PE_y : Project emissions in year *y* (tCO_2e/*yr*)

$PE_{FF,y}$: Project emissions from fossil fuel consumption in year *y* (tCO_2e/*yr*)

$PE_{GP,y}$: Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/*yr*)

$PE_{HP,y}$: Project emissions from waster reservoirs of hydro power plants in year *y* (tCO_2e/*yr*)

According to ACM0002, there are no expected project emissions related to the generation of electricity, as generation is based on a renewable resource.

The power density of the project activity (*PD*) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad \textbf{(12)}$$

Where:

PD: Power density of the project activity (W/m^2)

Cap_{PJ}: Installed capacity of the hydro power plant after the implementation of the project activity (W)

Cap_{BL}: Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

A_{PJ}: Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)

A_{BL}: Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

Leakage

According to the ACM0002, no leakage needs to be considered in the proposed project.

Emission Reductions

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

$$ER_y = BE_y - PE_y \quad \textbf{(13)}$$

Where:

ER_y : Emission reductions in year *y*; (t CO_2e/yr)

BE_y : Baseline Emissions in year *y*; (t CO_2e/yr)

PE_y : Project emissions in year *y*; (t CO_2e/yr)

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

(Copy this table for each data and parameter)

Data / Parameter:	$FC_{i,y}$, $FC_{i,m,y}$
Data unit:	10^4t/10^8m^3
Description:	The amount of fossil fuel *i* consumed by relevant power source *m* in years *y*.
Source of data used:	China Energy Statistics Yearbook (2007-2009)
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:	*Official data*

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/TJ
Description:	The CO_2 emission factor
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:	*IPCC data*

Data / Parameter:	$NCV_{i,y}$
Data unit:	MJ/tm^3
Description:	The net calorific value (energy content) per mass or volume unit of fuel *i* in year *y*.
Source of data used:	China Energy Statistic Yearbook (2007-2009)
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:	*Official data*

Data / Parameter:	***EG_y (Electricity generation in CCPG)***
Data unit:	MWh
Description:	The electricity generation in year *y* of each province connected to CCPG
Source of data used:	China Electric Power Yearbook (2007-2009)
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:	*Official data*

Data / Parameter:	***Electricity self-consumption ratio***
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 (2007-2009)
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:	*Official data*

Data / Parameter:	*Efficiency of advanced thermal power plant supply*
Data unit:	%
Description:	based on the technologies available in China
Source of data used:	http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf
Value applied:	Coal 39.08%; Oil 51.46%; Gas 51.46%
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:	*Official data*

Data / Parameter:	$CAP_{i,j,y}$
Data unit:	MW
Description:	The installed capacity of power source *i* of province *j* in years *y*.
Source of data used:	China Electric Power Yearbook (2007-2009)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and	Official released statistic; publicly accessible and reliable data source

procedures actually applied :	
Any comment:	*Official data*

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO_2e/MWh
Description:	Operating Margin emission factor of CCPG
Source of data used:	The result is calculated from official statistical data
Value applied:	1.0871
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:	*Official date*

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2e/MWh
Description:	Build Margin emission factor of CCPG
Source of data used:	The result is calculated from official statistical data
Value applied:	0.4543
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:	*Official data*

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied:	Determine the installed capacity based on recognized standards
Any comment:	/

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied:	Measured from topographical surveys, maps, satellite pictures, etc.
Any comment:	/

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

>>

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

Baseline emissions

According to the Preliminary Design Reports of the proposed project, the annual electricity delivered to the grid (EG_y) is approximately 118238MWh from the proposed project.

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

$EF_{grid,OM,y}$ =1.0871 tCO_2/MWh
$EF_{grid,BM,y}$ = 0.4543 tCO_2/MWh

The combined ex-ante baseline emission factor of CCPG is 0.7707 tCO_2/MWh. The calculation equation is as follows:

$$EF_{grid,CM,y} = 1.0871 * 0.5 + 0.4543 * 0.5 = 0.7707\ tCO_2/MWh$$

Annual baseline emissions are 91126 tCO_2e. The calculation equation is as follows:

$$BE_y = 118238 * 0.7707 = 91126\ tCO_2e$$

Project emissions

According to ACM0002, there are no expected project emissions related to the generation of electricity, as generation is based on a renewable resource. Also, with a submerged area of 10294 m^2, the power density is calculated to be $24.8*10^6$ / 10294 = 2409.17W/m^2, which is higher than 10 W/m^2. Therefore, the project emission (PE_y) = 0.

Leakage

As described in section B.6.1, the leakage of the proposed project (L_y) will be 0 tCO_2e.

Therefore, $LE_y = 0$

Emission reductions calculation

Based on formula (12) in section B.6.1, the ex-ante annual emission reductions are estimated as 91126 tCO_2e for the proposed project. The proposed project activity is expected to achieve 637882 tCO_2e of net emission reductions during the first crediting period.

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

>>

Year	Estimation of project activity emissions (tons of CO_2e)	Estimation of baseline emissions (tons of CO_2e)	Estimation of leakage (tons of CO_2e)	Estimation of overall emission reductions (tons of CO_2e)
01/01/2012-31/12/2012	0	91126	0	91126

01/01/2013-31/12/2013	0	91126	0	91126
01/01/2014-31/12/2014	0	91126	0	91126
01/01/2015-31/12/2015	0	91126	0	91126
01/01/2016-31/12/2016	0	91126	0	91126
01/01/2017-31/12/2017	0	91126	0	91126
01/01/2018-31/12/2018	0	91126	0	91126
Total (tCO_2e)	0	**637882**	**0**	**637882**

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

>>

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{export,y}$
Data unit:	MWh
Description:	Annual electricity supply from the proposed project to the Grid during year y.
Source of data to be used:	The Revenue Meter reading.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	According to the actual records
Description of measurement methods and procedures to be applied:	$EG_{export,y}$ will be continuously measured and monthly recorded by the Revenue Meter.
QA/QC procedures to be applied:	The Revenue Meter will be jointly read by the project owner and the grid company once a month. Data measured by the Revenue Meter will be cross checked by electricity sales receipts. The Revenue Meter will be calibrated once a year against the application industrial codes and regulations. The accuracy of Revenue meter is no less than 0.5. New staff involved in the CDM project will receive CDM training before the induction. And all staff will be trained by CDM consulters once a year. Trained staff is responsible for recording electricity data from the electric meters. Data will be archived for 2 years following the end of the last crediting period by means of the electronic and paper backup.
Any comment:	The data is measured by high accuracy energy meter, and cross checked by the electricity sales receipts. Uncertainty level is low.

Data / Parameter:	$EG_{import,y}$
Data unit:	MWh
Description:	Annual electricity input from the Grid to the proposed project during year y.
Source of data to be used:	The Revenue Meter reading.
Value of data applied for	According to the actual records

the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	$EG_{import,y}$ will be continuously measured and monthly recorded by the Revenue Meter.
QA/QC procedures to be applied:	The Revenue Meter will be jointly read by the project owner and the grid company once a month. Data measured by the Revenue Meter will be cross checked by electricity purchase receipts. The Revenue Meter will be calibrated once a year against the application industrial codes and regulations. The accuracy of Revenuemeter is no less than 0.5. New staff involved in the CDM project will receive CDM training before the induction. And all staff will be trained by CDM consulters once a year. Trained staff is responsible for recording electricity data from the electric meters. Data will be archived for 2 years following the end of the last crediting period by means of the electronic and paper backup.
Any comment:	The data is measured by high accuracy energy meter, and cross checked by the electricity purchase receipts. Uncertainty level is low.

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh
Description:	Net annual electricity supply from the proposed project to the Grid during year y.
Source of data to be used:	Calculation as $EG_{export,y}$ - $EG_{import,y}$
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The net annual electricity supplied to the grid is estimated to be 118,238MWh
Description of measurement methods and procedures to be applied:	The Revenue Meter is a bi-direction electricity meter which can measure $EG_{export,y}$ and $EG_{import,y}$ in the meantime. Both the export and import electricity will be continuously measured and monthly recorded by the Revenue Meter. $EG_{facility}$ is calculated by the formula as: $EG_{facility,y} = EG_{export,y} - EG_{import,y}$.
QA/QC procedures to be applied:	The Revenue Meter will be jointly read by the project owner and the grid company once a month. Data measured by the Revenue Meter will be cross checked by electricity purchase and sales receipts. The Revenue Meter will be calibrated once a year against the application industrial codes and regulations. The accuracy of Revenue meter is no less than 0.5.

	New staff involved in the CDM project will receive CDM training before the induction. And all staff will be trained by CDM consulters once a year. Trained staff is responsible for recording electricity data from the electric meters. Data will be archived for 2 years following the end of the last crediting period by means of the electronic and paper backup.
Any comment:	The data is measured by high accuracy energy meter, and cross checked by the electricity purchase and sales receipts. Uncertainty level is low.

Data / Parameter:	CAP_{pj}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	24.8
Description of measurement methods and procedures to be applied:	The installed capacity of the hydro power plant after the implementation will be determined by the nameplate of generators or turbines. Monitoring frequency: yearly
QA/QC procedures to be applied:	/
Any comment:	/

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	10294
Description of measurement methods and procedures to be applied:	Measured from topographical surveys, maps, satellite pictures, etc. Monitoring frequency: yearly
QA/QC procedures to be applied:	/
Any comment:	/

B.7.2 Description of the monitoring plan:

>>

This section details the steps taken to monitor on a regular basis the GHG emissions reductions from the proposed project. The Monitoring Plan for this project will be developed to ensure that from the start, the proposed project is well organized in terms of the collection and archiving of complete and reliable data.

1. 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 and the process of training new staff, ensuring trained staff to perform the monitoring duties, and when trained monitoring staff is absent, the integrity of the monitoring system is maintained by other trained staff.

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

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

The CDM Manager will be responsible for ensuring that the procedures are followed on site and for improving the procedures to ensure a reliable monitoring system is established. New staff involved in the CDM project will receive CDM training before the induction. And all staff involved in the CDM project will receive some relevant training from CDM consulters once a year. The CDM Manager will ensure that only trained staff is involved in the operation of the monitoring system.

2. Monitoring parameter

Electricity supplied to the grid ($EG_{export,y}$) and Electricity import from the grid ($EG_{import,y}$)

Given the emission factor is ex-ante calculated and according to the Methodology ACM0002 (Version 12.1.0), the key data to be monitored involves electricity supplied to the grid by the proposed project **($EG_{export,y}$)**and electricity import from the grid to the proposed project **($EG_{import,y}$)** (detailed in B.7.1).

The Revenue meter for measuring the $EG_{export,y}$ and $EG_{import,y}$ is a bi-direction electricity meter which can measure these two electricity data in the meantime (detailed in B.7.1). It will be installed at the connecting point of the proposed project and the power grid company. This electricity meter will be the Revenue meter that measures the quantity of electricity that the proposed project will be paid for. As this meter provides the main CDM measurement, it will be the key part of the verification process.

Installed capacity of the proposed project

The installed capacity of the proposed project was approved by local office, and the installed capacity will be check out using the nameplate of turbines or generators.

Surface area of the reservoir

The surface area of the reservoir will be calculated using the design schematics and area maps.

Photographs of the reservoir at several key locations will be taken when the proposed project becomes operational to check whether the actual reservoir does not deviate substantially for the design.

3. QA/QC

Meter reading procedure:
Both the export and import electricity will be continuously measured and monthly recorded by the Revenue meter. Once a month, the proposed project owner and the grid company will take a meter reading and record the figures. And these data will be used for CERs calculation, and they're also the base for calculating the electricity sale to the grid. And the electricity data will be cross-check with the electricity purchase and sales receipts.

The ***Revenue*** meter should meet the relevant local standards at the time of installation. The meter will be installed by either the proposed project owner or the grid company according to the national Chinese standard. Records of the meter will be retained in the quality control system.
In case the following circumstances occur on the Revenue meter:

- any abnormal circumstances identified
- meter failure

In this case, the proposed project owner and the grid company will ensure informing the counterparty immediately. In the mean time, the Revenue meter will be repaired or replaced immediately. Maintenance records and any calibration documents will be retained by the project developer.

Calibration
The Revenue meter will be calibrated by a qualified third party once a year against the application industrial codes and regulations. The accuracy of the Revenue meter is no less than 0.5

4. Data records management

The proposed project owner needs to keep electricity sale receipts. All written documentation should be stored and available to the verifier so that the reliability of the information may be checked.

The dedicated CDM Manager 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 shall be kept until two years after the end of the last credit period.

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

>>

Date of completion of baseline and monitoring study
02/11/2010

Name of persons/entities determining the baseline and monitoring methodology
Jing Li
Unit: College of Environmental Science and Engineering, Hunan University;

Dr. Hongyu LIU
Unit: College of Environmental Science and Engineering, Hunan University
E-mail: hyliu@hnu.cn

The person of determining baseline is not a project participant.

SECTION C. Duration of the project activity / Crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

01/09/2009 (Date of the construction agreement signed for the proposed project)

The project construction agreement signed on 1st Sep 2009, the construction permission issued on 10th Sep. 2009, and the Equipments purchase agreement signed on 30th Sep. 2009. Thus, the earliest starting date of the proposed project is 1st Sep 2009.

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

20 years

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

>>

C.2.1. Renewable crediting period

>>

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

>>

01/01/2012 (or the registration date, whichever is later)

C.2.1.2. Length of the first crediting period:

>>

7 years

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>>

Not applicable

C.2.2.2. Length:

>>

Not applicable

SECTION D. Environmental impacts

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

>>

An environmental impact assessment (EIA) had been implemented to ensure that the proposed project complied with national, regional and local environmental regulations. The EIA report has been has been finished and approved by Liangshan Autonomous Prefecture Environmental Protection Bureau on 15th Oct. 2008.

Conclusions of the EIA reports are summarized as follows:

(1) Waste water

The waste water of the proposed project consists of construction waste water and sewage. All of waste water will be treated to meet the relevant china national standards and then discharge. Therefore, the proposed project activity has less impact on regional water quality.

(2) Air waste

The main air pollutant is released from construction activities of the proposed project and transportation of vehicles. During the construction of the proposed project, some measures will be taken to treatment pollutant, such as spraying water at construction site, selecting closed construction equipment and vehicles, installing dust-cleaning equipment and requiring workers to wear gas mask.

(3) Solid waste

The solid waste during the construction periods will be collected and reused as much as possible. The rest will be carried to the waste residue site, in which will maintains by reforestation. Therefore, the proposed project will not bring negative impacts on local environment.

(4) Noise pollution

Noise will be made from the explosion, machinery running and materials transportation at the project site. But the project site is far from the local inhabited area, thus, the impact of noise pollution is quite slight.

(5) Impacts on the wild animals and vegetables

Detailed search shows that there is no any rare and endangered plant species in the ecosystem around the project site, and the project site is not the main habitat of animals, thus, the impacts on the wild plants and animals are quite slight.

For the aquatic creatures, no rare and endangered aquatic species were found in construction area. No fish will disappear due to the construction activity of the proposed project.

(6) Impact on Erosion

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 Water Resources Bureau of Liangshan Autonomous Prefecture. In the plan, total amount of soil erosion was predicted, detailed protection measures were identified.

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 proposed project would be with an acceptable level.

(7) Impact on the local social economy

The proposed project is a run-of-river hydropower plant, no field will be flooded and no inhabitants need to be resettled due to the project activities.

With the proposed project construction, the expected annual electricity generation from the proposed project will be 118238MWh, which will effectively ameliorate the electricity supply shortage in the proposed project site and also accelerate the local economy development. With the construction of the proposed project, other local industry such as architecture and material industry will be facilitated.

It can be concluded that the proposed project activity does not have obvious negative effect to the environment on the whole, and will reduce both GHG emissions and local environmental pollutants caused by coal combustion. And there are many beneficial effects such as increase in local residents' living standards, improvement in infrastructure level etc. Therefore the proposed 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:

>>

No significant environment impacts have been identified. With mitigation controls planned, and taking into consideration the contribution made by the proposed project to sustainable development for the local and national area, the proposed project will have an overall positive impact on the local and global environment.

SECTION E. Stakeholders' comments

>>

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

>>

In 2008, a certified third party of Sichuan Environmental Protection Science Institute was commissioned to carried out the environmental impact assessment (EIA) and wrote the EIA report. The local stakeholders' comments were consulted by distributed questionnaire method. All of the consulted stakeholders supported the project activity[48]. Then, an expert examination and appraisal meeting was held by the local government, finally, the EIA report was approved by Liangshan Autonomous Prefecture Environmental Protection Bureau on 15th Oct. 2008.

To better understand stakeholders' comments again, a public announcement on the proposed project activity was posted to invite local stakeholders' comments from 26th Sep. 2009. In the meantime, total 30 questionnaires were distributed to the local stakeholders. The investigated stakeholders included representatives from several villages influenced by the proposed project activity and local officers. The main consulted people were the direct relative employees, specialists and the inhabitants around the proposed project site. Total 30 questionnaires were distributed, all of the distributed questionnaires had been returned. All of the opinions from the local stakeholders had been collected and considered.

E.2. Summary of the comments received:

>>

Total 30 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:

Number	Item	Opinion	person	Percentage (%)
1	Do you know Ganluo Camp Hydropower Plant?	Yes	30	100
		No	0	0

[48] Data source: the Environmental Impact Assessment Report of the proposed project, page 9-1~page 9-5.

2	What's your opinion to the construction of the proposed project?	Agree	30	100
		Don't agree	0	0
		Don't care	0	0
3	What impact on the local economy due to the proposed project?	Positive impact	30	100
		Negative impact	0	0
		No impact	0	0
4	How about the environment situation in the project site?	Acceptable	30	100
		unacceptable	0	0
5	What are the main impacts on the local environment due to the proposed project activities? (If there is any)	Water and soil erosion	0	0
		Noise pollution	0	0
		Water pollution	0	0
		No impact	30	100
6	What kind of impact on the daily life of local inhabitants due to the proposed project construction?	Positive impact	26	86.7
		Negative impact	0	0
		No impact	4	13.3
7	If you have any other opinions, state here please.	Provide more employment opportunities	3	10.0
		No opinion	27	90.0

The survey received 100% participation (30 questionnaires retuned out 30). The survey shows that stakeholders believe that the proposed 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.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Ganluo County Camp Hydropower Development Co., Ltd.
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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, CO_2 emission factor and oxidation factor of fuels are listed in Table A1 below.

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

Fuel	Carbon Content (tc/TJ)	Low Calorific Value （MJ/t,km3）	Fuel Emission Factor(kgCO2/TJ)	Oxidation Factor
Raw Coal	25.8	20908	87,300	100%
Cleaned Coal	25.8	26344	87,300	100%
Other Washed Coal	25.8	8363	87,300	100%
Briquette	26.6	20908	87,300	100%
Coke	29.2	28435	95,700	100%
Coke Oven Gas	12.1	16726	37,300	100%
Other Coal Gas	12.1	5227	37,300	100%
Crude Oil	20	41816	71,100	100%
Gasoline	18.9	43070	67,500	100%
Desiel Oil	20.2	42652	72,600	100%
Fuel Oil	21.1	41816	75,500	100%
LPG	17.2	50179	61,600	100%
Refinery Gas	15.7	46055	48,200	100%
Natural Gas product	15.3	38931	54,300	100%
Other Oil	20	41816	72,200	100%
Other Coke product	25.8	28435	95,700	100%
Other Energy	0	0	0	100%

Data source: <China Energy Statistical Yearbook 2009>;
2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, chapter 1, page 1.21-1.24, table1.3 and table1.4

Table A2 Operation Margin Emission Factor of Central China Power Grid in 2006

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF (tC/TJ)	Oxidation (%)	Emission Factor (kgCO2/TJ)	Average Low Calorific Value (MJ/t,km3)	CO_2 Emission (tCO_2e)
		A	B	C	D	E	F	G=A+B+C +D+E+F	H	I	J	J	K=G*J*K/10000
Raw Coal	10^4 t	1926.02	8098.01	3179.79	2454.48	1184.3	3285.22	20127.82	25.8	100	87300	20908	367386738
Cleaned Coal	10^4 t					5.79		5.79	25.8	100	87300	26344	133160
Other Washed Coal	10^4 t	4.51	104.12		8.59	79.21		196.43	25.8	100	87300	8363	1434116
Briquette	10^4 t						0.01	0.01	26.6	100	87300	20908	183
Coke	10^4 t		17.23		0.32			17.55	29.2	100	95700	28435	477576
Coke Oven Gas	10^8 m^3		0.52	1.07	4.24	0.38	0.01	6.22	12.1	100	37300	16726	388053
Other Gas	10^8 m^3	12.69	3.95		1.7	4.36	0.01	22.71	12.1	100	37300	5227	442770
Crude Oil	10^4 t		0.49					0.49	20	100	71100	41816	14568
Gasoline	10^4 t		0.01					0.01	18.9	100	67500	43070	291
Diesel Oil	10^4 t	0.91	2.23	1.41	1.78	0.96		7.29	20.2	100	72600	42652	225737
Fuel Oil	10^4 t	0.51	1.26	1.31	0.8	0.57	3.49	7.94	21.1	100	75500	41816	250674
LPG	10^4 t							0	17.2	100	61600	50179	0
Refinery gas	10^4 t	0.86	8.1	1	0.97			10.93	15.7	100	48200	46055	242630
Natural gas	10^7 m^3			0.28		0.16	18.63	19.07	15.3	100	54300	38931	4031309
Other oil product	10^4 t							0	20	100	75500	41816	0
Other coke product	10^4 t						0.01	0.01	25.8	100	95700	28435	272
Other energy	10^4 t	17.45	37.36	31.55	18.29	29.35		134	0	100	0	0	0
Total													**375,028,077.28**
Net electricity import from NWPG (MWh)													3028950.00
EF_{2006} of NWPG													0.99148
Total CO_2 emissions of CCPG in 2006(tCO_2e)													**378,031,221**

Data Source: China Energy Statistical Yearbook 2007

Table A3 Fuel-fired Electricity Generation of CCPG for Year 2006

Province	Electricity Generation (10^8 kWh)	Electricity Generation (MWh)	Auxiliary Power Ratio (%)	Supplied Electricity (MWh)
Jiangxi	344.49	34449000	6.17	32323496.7
Henan	1512.35	151235000	7.06	140557809
Hubei	548.41	54841000	2.75	53332872.5
Hunan	464.08	46408000	4.95	44110804
Chongqing	234.87	23487000	8.45	21502348.5
Sichuan	441.93	44193000	4.51	42199895.7
Total				**334027226.4**
Net electricity import from NWPG(MWh)				3028950
Total supplied electricity to CCPG in 2006 (MWh)				**337,056,176**

Data Source: China Electric Power Yearbook 2007

Table A4 Operation Margin Emission Factor of Central China Power Grid in 2007

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF	Oxidation	Emission Factor	Average Low Calorific Value	CO_2 Emission
									(tC/TJ)	(%)	(kgCO2/TJ)	(MJ/t,km3)	(tCO_2e)
		A	B	C	D	E	F	G=A+B+C +D+E+F	H	I	J	J	K=G*J*K/10000
Raw Coal	10^4 t	2200.57	9357	3479.81	2683.8	1547.7	3239	22507.89	25.8	100	87300	20908	410829404
Cleaned Coal	10^4 t		3.07			3.8		6.87	25.8	100	87300	26344	157998
Other Washed Coal	10^4 t	0.04	87.16		2.06	96.42		185.68	25.8	100	87300	8363	1355631
Briquette	10^4 t						0.01	0.01	26.6	100	87300	20908	183
Coke	10^4 t							0	29.2	100	95700	28435	0
Coke Oven Gas	10^8 m^3	0.08	2.61	0.25	0.31	0.91		4.16	12.1	100	37300	16726	259534
Other Gas	10^8 m^3	29.17	25.79		24.69		23.98	103.63	12.1	100	37300	5227	2020444
Crude Oil	10^4 t		0.43					0.43	20	100	71100	41816	12784
Gasoline	10^4 t				0.04	0.01		0.05	18.9	100	67500	43070	1454
Diesel Oil	10^4 t	0.98	3.21	2.51	2.83	1.93		11.46	20.2	100	72600	42652	354863
Fuel Oil	10^4 t	0.42	1.25	1.33	0.63	0.64	1.74	6.01	21.1	100	75500	41816	189742
LPG	10^4 t							0	17.2	100	61600	50179	0
Refinery gas	10^4 t	1.43	10.01	0.97	0.7			13.11	15.7	100	48200	46055	291022
Natural gas	10^7 m^3		0.12	0.18		0.2	1.87	2.37	15.3	100	54300	38931	501007
Other oil product	10^4 t							0	20	100	75500	41816	0
Other coke product	10^4 t							0	25.8	100	95700	28435	0
Other energy	10^4 t	23.43	63.65	35.95	29.46	23.21		175.7	0	100	0	0	0
Total													**415,974,066.13**
Net electricity import from NWPG (MWh)													3005400.00
EF_{2007} of NWPG													1.01129
Total CO_2 emissions of CCPG in 2007(tCO_2e)													**419,013,397**

Data Source: China Energy Statistical Yearbook 2008

Table A5 Fuel-fired Electricity Generation of CCPG for Year 2007

Province	Electricity Generation (10^8 kWh)	Electricity Generation (MWh)	Auxiliary Power Ratio (%)	Supplied Electricity (MWh)
Jiangxi	421	42,100,000	7.72	38849880
Henan	1773	177,300,000	7.55	163913850
Hubei	609	60,900,000	6.69	56825790
Hunan	542	54,200,000	7.18	50308440
Chongqing	288	28,800,000	9.2	26150400
Sichuan	451	45,100,000	8.68	41185320
Total				**377,233,680**
Net electricity import from NWPG(MWh)				3005400
Total supplied electricity to CCPG in 2007 (MWh)				**380,239,080**

Data Source: China Electric Power Yearbook 2008

Table A6 Operation Margin Emission Factor of Central China Power Grid in 2008

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	EF (tC/TJ)	Oxidation (%)	Emission Factor (kgCO2/TJ)	Average Low Calorific Value (MJ/t,km3)	CO_2 Emission (tCO_2e)
		A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	J	K=G*J*K/10000
Raw Coal	10^4 t	2137.08	9480.74	2852.29	2620.44	1421.42	2727.61	21239.58	25.8	100	87300	20908	387679342
Cleaned Coal	10^4 t		1.68			3.27		4.95	25.8	100	87300	26344	113842
Other Washed Coal	10^4 t	0.04	80.54		2.06	101.75		184.39	25.8	100	87300	8363	1346213
Briquette	10^4 t				6.12		0.01	6.13	26.6	100	87300	20908	111889
Coke	10^4 t		0.78		0.92			1.7	29.2	100	95700	28435	46261
Coke Oven Gas	10^8 m^3	0.1	4.19	0.37	0.24	6.66	0.01	11.57	12.1	100	37300	16726	721829
Other Gas	10^8 m^3	23.67	41.36		3.31	0.37	0.01	68.72	12.1	100	37300	5227	1339814
Crude Oil	10^4 t		0.17					0.17	20	100	71100	41816	5054
Gasoline	10^4 t							0	18.9	100	67500	43070	0
Diesel Oil	10^4 t	0.88	7.02	2.82	3.41	1.59		15.72	20.2	100	72600	42652	486775
Fuel Oil	10^4 t	0.07	1.45		1.29		3.14	5.95	21.1	100	75500	41816	187848
LPG	10^4 t							0	17.2	100	61600	50179	0
Refinery gas	10^4 t	0.21	3.91	2.78	0.71		0.01	7.62	15.7	100	48200	46055	169153
Natural gas	10^7 m^3		4.02	0.16		0.05	12.92	17.15	15.3	100	54300	38931	3625430
Other oil product	10^4 t			0.59				0.59	20	100	72200	41816	17813
Other coke product	10^4 t						0.01	0.01	25.8	100	95700	28435	272
Other energy	10^4 t	18.16	68.11	62.35	11.42	64.87		224.91	0	100	0	0	0
												Total	**395,851,534.16**
Net electricity import from NWPG (MWh)													3144070
EF_{2008} of NWPG													0.9825417

Net electricity import from CNPG(MWh)	33200
EF_{2008} of CNPG	1.0049453
Total CO_2 emissions of CCPG in 2008(tCO_2e)	**398,974,078**

Data Source: China Energy Statistical Yearbook 2009

Table A7 Fuel-fired Electricity Generation of CCPG for Year 2008

Province	Electricity Generation (10^8 kWh)	Electricity Generation (MWh)	Auxiliary Power Ratio (%)	Supplied Electricity (MWh)
Jiangxi	405	40,500,000	6.5	37867500
Henan	1890	189,000,000	7.22	175354200
Hubei	553	55,300,000	6.62	51639140
Hunan	537	53,700,000	6.46	50230980
Chongqing	286	28,600,000		28600000
Sichuan	401	40,100,000	10.21	36005790
Total				**379,697,610**
Net electricity import from NWPG(MWh)				3144070
Net electricity import from CNPG(MWh)				33200
Total supplied electricity to CCPG in 2008(MWh)				**382,874,880**

Data Source: China Electric Power Yearbook 2008

Table A8 Operation Margin Emission Factor of Central China Power Grid (Weighted Average)

Year	2006	2007	2008	Total
Total CO_2 emissions (tCO_2e)	378031221	419013397	398974078	1196018696
Total supplied electricity (MWh)	337056176	380239080	382874880	1100170136
EF	1.121567	1.101974	1.042048	
$EF_{grid,OM,y}$				**1.0871**

Table A9 Percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in total fuel-fired CO_2 emissions

		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	Average Low Calorific Value	Emission Factor (tC/TJ)	Oxidation	CO_2 Emission (tCO_2e)
Fuel	**Unit**	**A**	**B**	**C**	**D**	**E**	**F**	**G=A+…+F**	**H**	**I**	**J**	**K=G*H*I*J/100000**
Raw Coal	10^4 t	2137.08	9480.74	2852.29	2620.44	1421.42	2727.61	21239.58	20908	87300	1	387679342.03
Cleaned Coal	10^4 t	0	1.68	0	0	3.27	0	4.95	26344	87300	1	113841.64
Other Washed Coal	10^4 t	0.04	80.54	0	2.06	101.75	0	184.39	8363	87300	1	1346212.77
Briquette	10^4 t	0	0	0	6.12	0	0.01	6.13	20908	87300	1	111888.95
Coke	10^4 t	0	0.78	0	0.92	0	0	1.7	28435	95700	1	46260.90
Other Coke product	10^4 t	0	0	0	0	0	0	0	28435	95700	1	0.00
Subtotal												**389297546.30**
Crude Oil	10^4 t	0	0.17	0	0	0	0	0.17	41816	71100	1	5054.30
Gasoline	10^4 t	0	0	0	0	0	0	0	43070	67500	1	0.00
Diesel Oil	10^4 t	0.88	7.02	2.82	3.41	1.59	0	15.72	42652	72600	1	486775.33
Fuel Oil	10^4 t	0.07	1.45	0	1.29	0	3.14	5.95	41816	75500	1	187847.93
Other oil product	10^4 t	0	0	0.59	0	0	0	0.59	41816	72200	1	17812.78
Subtotal												**697490.34**
Natural Gas	10^7 m^3	0	40.2	1.6	0	0.5	129.2	171.5	38931	54300	1	3625429.91
Coke Oven Gas	10^7 m^3	1	41.9	3.7	2.4	66.6	0.1	115.7	16726	37300	1	721828.93
Other Gas	10^7 m^3	236.7	413.6	0	33.1	3.7	0.1	687.2	5227	37300	1	1339813.91
LPG	10^4 t	0	0	0	0	0	0	0	50179	61600	1	0.00
Refinery Gas	10^4 t	0.21	3.91	2.78	0.71	0	0.01	7.62	46055	48200	1	169152.65
Subtotal												**5856225.40**
Total												**395851262.03**

The percentages of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired CO_2 emissions are calculated as:

λ_{Coal} = 98.34%， λ_{Oil} = 0.18%， λ_{Gas} = 1.48%

Data source: Chinese Energy statistics Yearbook 2009

China DNA: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf

Table A10 Installed Capacity of CCPG in 2008

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal plant	MW	9,340	42,680	14,210	14,430	6,660	12,770	100,090
Hydropower plant	MW	3,710	3,020	29,050	10,650	4,060	22,240	72,730
Nuclear plant	MW	0	0	0	0	0	0	0
Wind plant and other	MW	30	30	10	0	0	0	70
Total	MW	13,080	45,730	43,270	25,080	10,720	35,010	172,890

Data Source: China Electric Power Yearbook 2009

Table A11 Installed Capacity of CCPG in 2007

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

Data Source: China Electric Power Yearbook 2008

Table A12 Installed Capacity of CCPG in 2006

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

Data Source: China Electric Power Yearbook 2007

Table A13 Building Emission Calculation of CCPG

	2006	2007	2008	New Capacity Additions from Year 2006-2008	New Capacity Additions from Year 2007-2008	Percentage to the newly installed capacity
	A	B	C	D= C- A	E=C-B	
Thermal plant (MW)	76,658.00	92,580	100,090	30500	9,813	**56.97%**
Hydropower plant (MW)	52,518.00	61,650	72,730	23005	11227	42.97%
Nuclear plant (MW)	0.00	0	0	0	0	0.00%
Wind plant & Others (MW)	41.00	51	70	29.0	19.0	0.05%
Total（MW）	129217	154281	172890	53534	21,059	100.00%
Percentage of installed Capacity to 2008	74.74%	89.24%	100.00%	30.96%	12.18%	

Table A14 Calculation parameter of BM

	Parameter	Efficiency of Power Suppy	Emission Factor of Fuel (tc/TJ)	Oxidation Factor	Emission Factor (tCO_2e/MWh)
Coal-fired Power Plant	$EF_{Coal,Adv}$	39.08%	87300	1	0.8042
Oil-fired Power Plant	$EF_{Oil,Adv}$	51.46%	75500	1	0.5282
Gas-fired Power Plant	$EF_{Gas,Adv}$	51.46%	54300	1	0.3799

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, $EF_{thermal,adv}$ = 98.34% * 0.8042 + 0.18% * 0.5282+ 1.48% * 0.3799 = 0.7974 tCO_2e/MWh

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

$EF_{BM,\ y}$ = 56.97% * $EF_{Thermal,adv}$ =56.97% * 0.7974 = 0.4543 tCO_2e/MWh.

Data source: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2552.pdf

Table 15 Baseline emission factor of Central China Power Grid (CCPG, tCO_2/MWh)

Operation Margin Emission Factor	A	1.0871
Build Margin Emission Factor	B	0.4543
Combined Emission Factor	C = 0.5*A + 0.5 *B	**0.7707**

Annex 4

MONITORING PLAN

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

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