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

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SECTION A. General description of project activity

A.1 Title of the project activity:

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Sichuan Huadian Xixi River Hydro-electricity Development Co., Ltd. Diluo Hydroelectric Project

Version 5.1

19/05/2011

A.2. Description of the project activity:

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The Sichuan Huadian Xixi River Hydro-electricity Development Co., Ltd. Diluo Hydroelectric Project (hereafter referred to as the "Project") developed by Sichuan Huadian Xixi River Hydro-electricity Development Co., Ltd (hereafter referred to as the "Project Developer"), is a grid-connected hydropower plant with a run-of-river reservoir in Sichuan Province in People's Republic of China (hereafter referred to as the "Host Country").

The purpose of the Project is to utilise the hydrological resources of the Xixi River to generate renewable electricity for the Central China Power Grid (CCPG). Total installed capacity of the Project is 100 MW, consisting of two 50 MW turbines. The annual electricity can be generated by the project in theory is 445,570MWh and it is expected to supply 397,013MWh[1] to the grid. The surface area of the full reservoir is 292000m^2, and the power density of the Project is 342 W/m^2.

Electricity delivered by the project activity to the CCPG would have otherwise been generated in grid-connected fossil fuel based power plants resulting in Green House Gas (GHG) emissions in the absence of the project activity. The project activity therefore, by displacing relatively carbon intensive grid electricity (primary emission source with a Combined Margin Emission Factor of 0.85285 tCO_2/ MWh[2]) with renewable hydroelectricity, reduces GHG emission that would have occurred in the baseline.

The scenario existing prior to the start of the implementation of the project activity is same as the baseline scenario as described above.

The Project will contribute towards sustainable development of the Host Country. Specifically, the Project:

- Increases employment opportunities in the area where it is located, and Project construction secures jobs in the construction sector. The Project therefore contributes to poverty alleviation
- Enhances the local investment environment, and therefore improves the local economy
- Diversifies the sources of electricity generation. This is important for meeting growing energy demands, and transitioning away from diesel and coal-supplied electricity generation
- Makes use of renewable hydroelectric resources

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[1] Expected annual electricity supply to the Grid = Annual theoretical electricity generation * Effective Power Coefficient * (1 – internal electricity consumption rate)* (1 – Transmission loss rate) = 445,570MWh * 0.9 *(1 – 0.5%) – (1 – 0.5%) = 397,013MWh.

[2] Please refer annex 3 for details

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	Sichuan Huadian Xixi River Hydro-electricity Development Co., Ltd	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities International Limited	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.

Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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The Project is located near the village of Zhatai, near Diluo Town of Butuo County in Sichuan Province, People's Republic of China (‘P. R. China’)

A.4.1.1. Host Party(ies):

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People’s Republic of China (P. R. China)

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

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Sichuan Province

A.4.1.3. City/Town/Community etc:

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Zhatai Village, near Diluo Town of Butuo 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 exact location of the Project is defined using geographic coordinates obtained with a Global Positioning System (GPS) receiver:
Powerhouse: longitude 103°2′41″ E, latitude 27°34′52″ N;
Dam Site: longitude 103°2′50.43″ E, latitude 27°40′12.76″ N.

Figure 1. Map showing the location of the Project

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

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According to Annex A of the Kyoto Protocol, this project fits in Sectoral Category 1, Energy Industries (renewable/non-renewable).

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

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The purpose of the Project is to use well-established hydro power generation technology for electricity generation and transmission. This renewable electricity generated will be delivered to the CCPG, thereby

displacing CO_2 emissions from equivalent electricity generation in the fossil fuel based power plants connected to CCPG.

Prior to the start of implementation of the project activity the electricity was being generated by fossil fuel based power plants physically connected to CCPG, resulting in GHG emission. The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity

The Project is a hydropower plant with a run-of-river reservoir, and has a total installed capacity of 100 MW (consisting of two 50 MW turbines). The Project consists of an intake structure, a water conveyance system and a powerhouse. The water intake structure is located on the upstream portion of the Xixi River, and consists of a low diversion dam with one sluice gate, which directs part of the river flow into the water conveyance system. The diversion dam has no storage function and only creates a small holding pond. The power density of the Project, given as the total capacity (in W) divided by the surface area of the full reservoir (in m^2), is shown to be 342 W/m^2. The conveyance system comprises a tunnel, a penstock, a pressure adjustment well and high pressure pipelines. It forms a 286 m water head to take advantage of the natural height drop of the river, and carries the water to the powerhouse. The water enters, through high pressure pipelines, into the two 50 MW turbines installed in the powerhouse. After power generation, the water is discharged into the Xixi River through a tailrace.

The main technical parameters of the proposed Project are shown in Table A.4.1. below.

Table A.4.1. Main technical parameters of the proposed Project

	Value	**Source**
Installed capacity (MW)	100	Preliminary Design Report (PDR)* 1-4
Forecasted annual power generation (MWh)	445,570	PDR 15-2
Plant Load Factor	50.9%	Calculated: 50.9 = 445,570MWh / 100MW / 8760 Hours
Effective power coefficient	0.9	PDR 15-2
Internal electricity consumption rate	0.5%	PDR 15-2
Transmission loss rate[3]	0.5%	PDR 15-2
Transmission loss rate fixed in the metering agreement[2]	0.8%	Metering Agreement issued by the project developer and the Sichuan Electric Power Corporation on 2 August 2010
Forecast annual power supply to the grid (MWh)	397,013	PDR 15-2 397,013 = 445,570 * 0.9 * (1-0.5%) * (1-0.5%)
Forecast annual power supply to the grid for ER calculation (MWh)	395,816	395,816 = 445,570 * 0.9 * (1-0.5%) * (1-0.8%) The transmission loss rate fixed in the metering agreement of 0.8% was applied, for being conservative.

[3] The transmission loss rate was estimated as 0.5% at the project design stage. The actual transmission loss rate was agreed as 0.8% with the Grid Company at the operation stage. For being conservative, the smaller value of 0.5% was applied for financial analysis and the larger value of 0.8% was applied for emission reduction calculation.

Water head (m)	286	PDR 1-7
Design flow (m^3/s)	39.3	PDR 1-7
The surface area of the full reservoir (m^2)	292,000	PDR 9-1
Power density (w/m^2)	342	Calculated

* The Preliminary Design Report was completed by Sichuan Investigation Design & Research Institute of Water Conservancy & Electric Power in April 2006 and approved by Development and Reform commission of Sichuan Province on 8th June 2006.

Table A.4.2. Technical characteristics of the generating equipment

Turbine		Generator	
Turbine Type	HLD358B-LJ-180	Generator Type	SF50-10/4120
Rated Head	286 m	Designed Capacity	50 MW
Discharge	19.38 m^3/s	Rated Voltage	10.5 kV
Rated speed	600 rpm	Rated speed	600 rpm

The Project will use recognised state-of-the-art technology in electricity generation and transmission. Essential equipment used in the Project is domestically produced, and the Project Developer is experienced in handling and operating this kind of equipment.

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

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Years	Estimation of annual emission reductions in tonnes of CO_2e
01/07/2011 – 31/12/2011	168,786
2012	337,572
2013	337,572
2014	337,572
2015	337,572
2016	337,572
2017	337,572
01/01/2018 – 30/06/2018	168,786
Total estimated reductions (tonnes of CO_2e)	**2,363,004**
Total number of crediting years	**7**
Annual average of the estimated reductions over the crediting period (tonnes of CO_2e)	**337,572**

Refer to Section B.6.3 for further details on the quantification of GHG emission reductions associated with the Project.

A.4.5. Public funding of the project activity:

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The Project will not receive any public funding from Parties included in Annex I of the UNFCCC.

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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The project activity makes use of following methodology and associated tools:

1. The approved consolidated baseline and monitoring methodology ACM0002: "Consolidated methodology for grid-connected electricity generation from renewable sources", Version 12.1.0, in effect as of EB 58;
2. The approved "Tool for demonstration and assessment of additionality", Version 5.2, in effect as of EB 39 and
3. The approved "Tool to calculate the emission factor for an electricity system", Version 2, in effect as of EB 50.

Further information pertaining to the methodology can be obtained at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

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ACM0002 (Version 12.1.0) is applicable to the proposed project activity in the following manner:

- The project activity is a grid-connected renewable power generation project activity that installs a new run of the reservoir hydro power plant at a site where no renewable power plant was operated prior to the implementation of the project activity.
- The project activity is not a retrofit, replacement or capacity addition to an existing hydro power plant
- The project activity results in a new run of the river reservoir, and the power density of the power plant (342 W/m^2) is greater than 4 W/m^2 (see section B.6.3. for the calculation of power density).
- The project activity neither involve any switching from fossil fuels to renewable energy at the site of the project activity nor it is a biomass fired plant.

The project activity meets the applicability conditions of the 'Tool to calculate the emission factor for an electricity system', and the 'Tool for the demonstration and assessment of additionality',

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

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The spatial extent of the project boundary includes the Project power plant and all power plants physically connected to the CCPG to which the Project is connected.

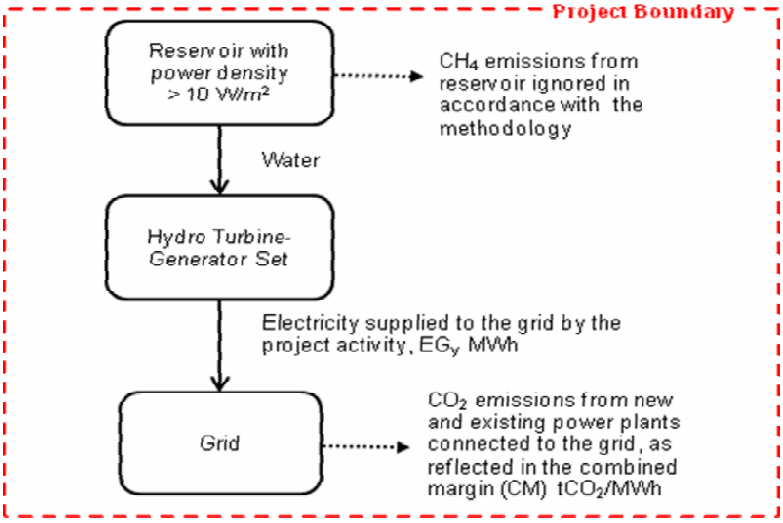

Figure B.1 Flow diagram of the project boundary

The GHG and emission sources included in, or excluded from the project boundary are listed in Table B.3 below.

Table B.3. Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants connected to the CCPG	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project Activity	Emissions of CH_4 from the reservoir.	CO_2	No	Minor emission source
		CH_4	No	Since the power density of the project is greater than 10 W/m^{2,} no GHG emissions from the project have 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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As the project activity is the installation of a new grid-connected renewable power plant, the baseline scenario as per ACM0002, version 12.1.0 is the following:

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, as reflected in the Combined Margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

Table B.4.1. Key Information and Data Used to Determine the Baseline Scenario

Variable	Value / Unit	Source
Operating Margin Emission Factor	1.1255 tCO_2/MWh	Calculated from the **China Energy Statistics Yearbooks 2006-2008** and the **China Electric Power Yearbooks 2006-2008**
Build Margin Emission Factor	0.5802 tCO_2/MWh	Calculated from the **China Energy Statistics Yearbook 2008** and the **China Electric Power Yearbooks 2005-2008**
Combined Margin Emission Factor	0.85285 tCO_2/MWh	Calculated from the **China Energy Statistics Yearbooks 2006-2008** and the **China Electric Power Yearbooks 2005-2008**
Power supplied to the grid by the project in year y	395,816MWh	Please refer to table A.4.1. above.

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

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The following steps are used to demonstrate the additionality of the Project according to the latest version of the "Tool for the demonstration and assessment of additionality" approved by the Executive Board.

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

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

Project activities that apply the tool in context of approved consolidated methodology ACM0002 only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity. The following two alternatives to the Project activity are considered here in detail:

Alternative 1: The proposed Project activity undertaken without being registered as a CDM project activity, i.e. the construction of a new hydroelectricity generation plant with an installed capacity of 100 MW, connected to the local grid, and implemented without considering CDM revenues.

Alternative 2: Continuation of the current situation, i.e. electricity will continue to be generated by the existing generation mix operating in the CCPG.

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

The Chinese power sector has undergone a transformation to a market-oriented system, Therefore investment in a power generation project is an individual power project developer's decision, based on the project return and risk profile[4]. There are no laws compelling the project developer to develop hydroelectric plants, thus *Alternatives 1* and *2* identified are in line with all applicable laws and regulations.

[4] Source: State Council's Decision on Reforming Investment Approval Process, 16/07/2004. http://en.ndrc.gov.cn/policyrelease/t20060207_58851.htm

The main sectoral policy relevant to this Project activity is the 'Renewable Energy Law of the People's Republic of China'[5], which came into effect 01/01/2006, and which aims to promote renewable energy in the Host Country. This Law demonstrates the Chinese Government's commitment to the development of renewable energy as part of the overall energy development strategy, and encourages grid-connected power generation from renewable sources. Nevertheless, there are no direct incentives, such as financial grants, higher tariffs, or subsidised loans available for these types of project.

In addition, although energy efficiency and renewable energy were included in the agenda for the Host Country's 11th Five-Year Plan (2006-2010), there is no legislative requirement to meet the projections under this Plan[6].

Step 2. Investment Analysis

Sub-step 2a. Determine appropriate analysis method

According to the latest version of the "Tool for the demonstration and assessment of additionality", three options can be applied to conduct the investment analysis. These are Simple Cost Analysis (Option I), Investment Comparison Analysis (Option II), and Benchmark Analysis (Option III).

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

According to the Additionality Tool, if the alternative to the CDM project activity does not include investments of comparable scale to the Project, then Option III must be used.

Given that the project developer does not have alternative and comparable investment choices, Benchmark Analysis (Option III) is more appropriate than Investment Comparison Analysis (Option II) for assessing the financial attractiveness of the project activity.

Sub-step 2b. Option III – Application of benchmark analysis

The likelihood of development of the Project, as opposed to the continuation of the generation of grid electricity from the existing generation mix (i.e. *Alternative 2* - the baseline), will be determined by comparing the Project IRR without CDM financing (*Alternative 1*) with benchmark rates applicable to a local investor, i.e. those provided by national authorities, local banks, or investment bonds in the Host Country.

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

According to codes and rules published by the Chinese government and the State Power Corporation, the Project IRR of large-scale hydro power projects in the Host Country should be higher than 8%[7]. An 8%

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[5] http://www.ccchina.gov.cn/en/NewsInfo.asp?NewsId=5371

[6] See: Point Carbon's CDM & JI Monitor: *Chinese official defends additionality of renewables in CDM,* 21/03/2007

[7] The three documents (below) mention a benchmark value relevant to the proposed Project. An 8% benchmark for the Project IRR is chosen in order to be conservative (see below for details on the value mentioned in each document).

benchmark is also used in the Preliminary Design Report of the proposed Project. Thus an 8% benchmark for the IRR of this Project is applicable and used to assess the Project. This benchmark is widely used for power project investments in the Host Country, and serves as the sectoral benchmark rate on total investment for hydro projects[8].

Table B.5.1 below shows the financial analysis for the Project activity with and without CDM financing. As shown, the Project IRR without CDM of 6.85 % was lower than the benchmark rate applicable to the Project. This therefore indicates that in comparison to alternative investments, the Project was not financially attractive in the absence of CDM financing.

Table B.5.1. Summary of project investment analysis without and with CDM financing

IRR without CDM	6.85 %[9]
IRR with CDM	10.44 %

Table B.5.2. Main parameters used in the investment analysis

Name	**Value**	**Source**
Installed capacity (MW)	100	Preliminary Design Report (PDR)* 1-4
Expected power supplied to the grid (MWh)	397,013	PDR 15-2, point 15.1.2.1
Total investment (RMB)	877,785,400	PDR 15-10
Total annual operating costs (RMB)	21,390,000	PDR 15-11
Income tax (%)	33	PDR 15-4, point 15.1.4.3
City Maintenance and Construction Tax (%)	5	PDR 15-4, point 15.1.4.2
Educational Surcharge Tax (%)	3	PDR 15-4, point 15.1.4.2
Electricity tariff, including VAT (RMB/MWh)	288	PDR 15-3, point 15.1.4.1
VAT (%)	17	PDR 15-4, point 15.1.4.2

Interim Rules on financial assessment of hydropower projects (1994) substitute of financial assessment part of No. 3, published by The Ministry of Power of P.R.China, and The Ministry of Water Resources of P.R.China - General Water Resources and Hydro Power Planning and Design Institute, indicates that the benchmark (Project IRR) for hydropower projects is 12%.

Economic evaluation Implementation code for hydropower projects, published by The Ministry of Water Resources of the P.R.China - General Water Resources and Hydro Power Planning and Design Institute, uses a 10% benchmark for the Project IRR.

Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects (Guodianfa[2002]623), published by the Operations Department of Power Generation and Power Transmission of the State Power Corporation of China, specifies in Section 1.11 that the benchmark (Project IRR) for the power industry (not only for retrofit projects) is 8%.

[8] Hydropower Design Institutes, such as the Sichuan Provincial Water Conservation and Hydro Electric Power Survey and Design Institute of the National Water Conservation Bureau or the Northwest China Survey and Design Institute of the National Grid Company, apply this benchmark when assessing large-scale hydropower projects.

[9] As the project started operation in 2009, the IRR of the project was also calculated using values available at the time of validation. Using the actual investment incurred, theoretical electricity generation (being conservative) and applicable tax rate the IRR was only 4.68%.

* The Preliminary Design Report was completed by Sichuan Investigation Design & Research Institute of Water Conservancy & Electric Power in April 2006 and approved by Development and Reform commission of Sichuan Province on 8th June 2006.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted using assumptions that are conservative from the point of view of analysing additionality, i.e. the 'best-case' conditions for the Project IRR were assumed by altering the following parameters:

- Operating costs
- Investment costs
- Electricity tariff
- Annual power supplied to the grid

Table B.5.2 summarizes the results of the sensitivity analysis, showing the variation of each parameter required to reach the 8% benchmark.

Table B.5.3. Results of the sensitivity analysis

	% Variation of the parameter required to reach the 8% benchmark
Operating costs	-62%
Investment costs	-15.6%
Electricity tariff	13.8%
Annual power supplied to the grid	17.6%

These variations do not reflect a realistic range of assumptions for the input parameters of the financial analysis.

- **Operating costs:** Due to sustained increases in labour and raw material costs in China (See Figure B.5.2 and Table B.5.4 below), it is unlikely that the operating costs will reduce during the project lifetime. The construction materials and fuel prices have been increasing in China for the past 5 years[10], so the total investment and operating costs are unlikely to be reduced by more than 62% [11].

[10] See Statistical Communiqué of the People's Republic of China National Bureau of Statistics of China: (http://www.stats.gov.cn/english/StatisticalCommuniques/)

[11] http://www.stats.gov.cn/tjsj/ndsj/2007/html/I0913e.htm

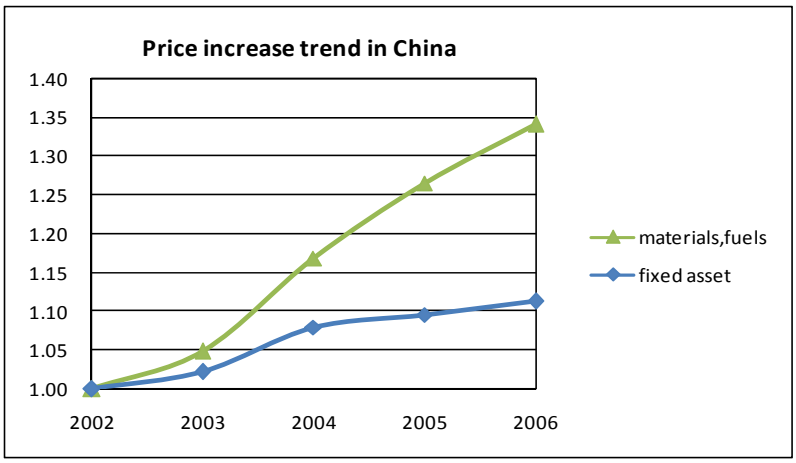

Figure B.5.2 Price index for fixed asset and materials (2002-2006)
Source: Table 9-2, Chapter 9, China Statistical Yearbook 2007, issued by National Bureau of Statistics of China

Table B.5.4 Annual average salary in China (2000-2006)

	2000	2001	2002	2003	2004	2005	2006
Salary (RMB)	9,371	10,870	12,422	14,040	16,024	18,364	21,001

Source: Table 5-22, Chapter 5, China Statistical Yearbook 2007, issued by National Bureau of Statistics of China

- **Investment costs:** Since the cost of materials is the main expense of the total investment during construction, a decrease in investment costs is highly unlikely, given that the prices of materials, such as iron and cement, have been increasing in recent years[12]. According to the statistics of China Renewable Energy Distribution Centre[13], the construction & installation costs of hydropower stations raised 11.8% from 2004 to 2007. These increases demonstrate that a decrease in investment costs is extremely unrealistic, such that the IRR is not likely to reach the 8% benchmark.

- **Electricity tariff:** The electricity tariff used in the financial analysis is also consistent with the PDR. The Project will supply electricity to Sichuan Provincial Power Grid Company, and the electricity tariff assumed in the PDR was 288RMB/MWh. This was already higher than the average electricity tariff paid (250.1RMB/MWh) by Sichuan Provincial Power Grid Company[14], at the time when the PDR was made in April 2006, and therefore is considered conservative from the point of view of additionality.

  In March 2005, The National Development and Reform Commission, which regulates power production, issued the "Provisional Measures for the Administration of On-Grid Electricity Tariffs" – document NDRC [2005] NO.514, which aims to regulate the determination of the electricity tariff offered to power producers in order to stabilize tariffs and increase competitiveness in the electricity market. Since then, Consistent Tariff policy regulations have

[12] http://www.qjy168.com/forum/d_29809.html and http://www.qjy168.com/forum/d_67695_top1.html

[13] http://www.hydrocost.org.cn/price/priceIndex.jsp

[14] See Sichuan Provincial Price Bureau: ChuanJiaHan (2005)No.46 (http://www.scpi.gov.cn/newzcfg/zcfg-content.asp?id=930)

also been issued in Sichuan Province: according to recent regulations (ChuanJiaFa (2005) No. 123[15] and ChuanJiaFa (2006) No.145[16] and ChuanJiaDianFa [2009] No.59[17]), the benchmark electricity tariff of 288RMB/MWh for hydropower plants regulated by Sichuan Provincial Price Bureau has not changed over the past 5 years.

Due to the above mentioned price controls by the Chinese central and provincial Governments, and because of a large increase in the installed capacity operating in the grid due to the construction of many new power stations, which increases competition in the supply of electricity, future rises in the electricity tariff are likely to be limited. Given the electricity pricing structure in China and in Sichuan Province, estimating a 13.8% increase in electricity tariff was highly unrealistic for the Project developer at the time of the investment decision and as such, the IRR is not likely to reach the 8% benchmark.

- **Annual power supplied to the grid:** The expected annual power supplied to the grid by the Project indicated in the Preliminary Design Report is calculated based on 44 years' worth of historical hydrological data and therefore the long term average annual power supplied is unlikely to be significantly different to the value used in the financial analysis. Assuming a 17.6% of increase in the long term average annual power supplied to the grid is not reasonable, and the IRR is therefore not likely to reach the 8% benchmark.

These results show that only under very unrealistic and highly favourable circumstances would it be possible to reach the Project IRR benchmark which are not feasible. We can conclude that the IRR is lower than the benchmark for a realistic range of assumptions for the key input parameters and therefore, that the Project is not financially attractive. This demonstrates that the project activity would not be implemented without the CDM.

Discussion of alternatives (except the proposed project activity) and baseline determination:

Alternative 1: The proposed Project activity undertaken without being registered as a CDM project activity, i.e. the construction of a new hydroelectricity generation plant with an installed capacity of 100 MW connected to the local grid, and implemented without considering CDM revenues.

This alternative would face each of the investment constraints outlined above.

Alternative 2: Continuation of the current situation, i.e. electricity will continue to be generated by the existing generation mix operating in the grid.

None of the investment constraints identified above would be faced by this alternative. This alternative is thus identified as the baseline scenario

Therefore, *Alternative 1*, the construction of a new hydroelectricity generation plant with an installed capacity of 100 MW, connected to the local grid, is unlikely to be implemented in the absence of the CDM (i.e. it is not the baseline scenario).

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[15] http://www.scpi.gov.cn/newzcfg/zcfg-content.asp?id=3238

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

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

Step 3. Barrier Analysis

The latest version of the "Tool for the demonstration and assessment of additionality" states that project participants may choose to apply Step 2 (Investment Analysis), OR Step 3 (Barrier Analysis) to demonstrate Project additionality.

Given the low IRR of the Project, Step 3 is not used to demonstrate additionality of the proposed Project.

Step 4. Common Practice Analysis

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

Other hydropower projects that are currently operational in Sichuan Province that are similar to the proposed Project activity and not undertaken as CDM projects are listed in Table B.5.5 below. According to "Classification & Design Safety Standard of Hydropower Projects (DL5180-2003)", hydropower plants with capacity of 50MW to 300MW are defined as medium -sized hydropower project in China. Therefore, the proposed project defines the activities with the installed capacity 50MW to 300MW similar to the proposed project.

The common practice analysis is limited to the provincial level, as the investment environment for each province differs (e.g. with regards to taxes, loan policy, and electricity tariffs). In Sichuan Province, with an area of 485,000 km^2, and a population of approximately 90 million[18], the Provincial Government is responsible for taxes, loan policies, electricity tariff policies etc., that are specifically applicable to the Province. In addition, grid planning, construction, operation, and electricity supply in Sichuan Province are organized and regulated by the Sichuan Electric Power Corporation[19], while the CCPG Company Ltd, is responsible for grid planning and electricity dispatch of different provincial grids included in CCPG, and electricity dispatch with other grids of the Host Country (e.g. the SCPG).

Furthermore, only the projects which were developed after 2002 are considered in the common practice analysis below. 2002 was a landmark year for the power industry in the Host Country. The power industry in the Host Country underwent a significant suite of reforms in 2002[20]. Chiefly, under the reforms, the China State Power Corporation was diversified into five separate regional grids in 2002[21], modifying the tariffs and permitted quantities of electricity supplied to the grid[22]. Secondly, under the

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[18] http://www.sc.gov.cn/scgk1/index.shtml

[19] http://www.sc.sgcc.com.cn/outer/main/index.jsp

[20] See "Electric Power Reform", 2003 Yearbook of China Electric Power, pp.10-14 .

[21] The first reform consisted of the reorganisation of the power companies in order to break the monopoly of the China State Power Corporation and ensure fair competition, and to separate generation from transmission. The second reform consisted of the bureaucratic centralisation of the power sector through the inclusion of the State Economic and Trade Commission in the National Development and Reform Commission (NDRC), which then opened a renewable energy department under the Energy Bureau, enabling the creation of coherent policies in the power sector. *Source*: Lemaa, A and Rubyb K. (2007) - Between fragmented authoritarianism and policy coordination: Creating a Chinese market for wind energy, Energy Policy, 35, 3879-3890. Also see: http://english.people.com.cn/200204/12/eng20020412_93913.shtml

[22] Sections 5-7, 2003 Yearbook of China Electric Power, p.14.

reform, there were changes to the existing electricity tariff mechanisms[23]. As a result, the investment environment of power production projects in the Host Country changed significantly in 2002, and projects developed before 2002 cannot be considered similar to the proposed Project.

Table B.5.5.

Similar hydropower projects that are currently operational in Sichuan Province

Name of power plant	Installed capacity (MW)	Operation start date	Unit capacity investment cost (RMB/kW)	Unit electricity production investment cost (RMB/kWh)
1. Yangcun Power station	66	2003	6060[24]	1.14[25]
2. Jiangsheba Power Station	128	2006	5992[26]	0.98[27]
3. Kehe Power Station	72	2006	4819 [28]	0.93[29]
4. Wan'er Power Station	66	2005	5144[30]	1.07[31]
5. Huilongqiao Power Station	50	2005	4400[32]	0.88[33]
6. Tianlonghu Power Station	180	2004	4416[34]	0.8
7. Zhugeduo Power Station	80	2005	5183[35]	1.03[36]
8. Jinkang Power Station	150	2006	6480[37]	1.21[38]
9. Hongba Power Station	100	2006	4152[39]	0.88[40]

[23] Electricity tariff was made up according to local demands and grid structure, and is divided into: Tariff of electricity to grid, transmission tariff, distribution tariff, and sales tariff. Sections 17-22, 2003 Yearbook of China Electric Power, pp.11-12 .

[24] http://news.yonghua.net.cn/htmldata/2005_02/2/3/article_255678_1.html

[25] http://www.schj.gov.cn/index.php?option=com_content&task=view&id=11030&Itemid=2986

[26] http://www.abazhou.gov.cn:8008/publicfiles/business/htmlfiles/abzzfw/s7780/200601/44252.shtml

[27] http://www.scbid.com/zh/news/web_show_430935.shtml

[28] http://www.ls666.com/html/News_Center/LS_News/2008-2/16/08216223414779DF4F1A3EK9292J8.html

[29] http://www.ls666.com/html/News_Center/LS_News/2008-2/16/08216223414779DF4F1A3EK9292J8.html

[30] http://www.ctguly.com/view.asp?id=95

[31] http://baike.baidu.com/view/1970532.htm?func=retitle

[32] http://www.cqhyw.cn/jxzy/news_detail.aspx?id=10067

[33] http://download.hexun.com/ftp/all_stockdata_2009/all/017%5C003%5C17003614.PDF

[34] http://www.hudong.com/wiki/%E5%A4%A9%E9%BE%99%E6%B9%96%E6%B0%B4%E7%94%B5%E7%AB%99

[35] http://www.chinapower.com.cn/article/1114/art1114034.asp

[36] http://www.chinapower.com.cn/article/1114/art1114034.asp

[37] http://www.gzjdb.cn/yjss/sxdd/200701/470.html

[38] http://www.gzjdb.cn/yjss/sxdd/200701/470.html

[39] http://www.schj.gov.cn/index.php?option=com_content&task=view&Itemid=2986&id=5405

[40] http://www.schj.gov.cn/index.php?option=com_content&task=view&Itemid=2986&id=5405

10. Hongyanzi Power Station	90	2002	N/A	N/A

Data sources:
Yearbook of China Water Resources 2005 - 2008

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

Table B.5.5. shows the hydropower plants developed after 2002 with a comparable installed capacity as the Project and implemented in the same area according to the Yearbook of China's Water Resources and data from web sources.

As shown from the table, the first nine projects have lower unit capacity investment cost, which is no more than 6480RMB/kW, while the unit capacity investment cost of the proposed project is 8778RMB/kW[41]. And the unit electricity production investment cost of the Project is 2.0 RMB/kWh[42], which is much higher than these nine projects. The proposed project faced big investment barrier other than these nine projects.

For Hongyanzi Power Station, it is an accumulation reservoir power station with shipping function. As a shipping channel, it has better social and economic benefits (IRR: 15%)[43] than the proposed project. Therefore, it cannot be considered similar to the proposed project.

It can therefore be concluded that no similar hydropower projects that are currently operational in Sichuan Province face the same conditions as the proposed Project, and therefore the Project cannot be considered common practice.

In conclusion, the proposed Project is deemed to be additional according to ACM0002 and the 'Tool for the demonstration and assessment of additionality'.

CDM Consideration:

The project developer only decided to invest and go ahead with the project after additional CDM revenue was considered. Also CDM revenues helped the project to reduce its financial risk and obtain loan from the bank.

The table below provides actions taken to secure CDM status for the project in parallel with its implementation:

Project activity	**Time**	**CDM activity**
Completion of Environmental impact assessment (EIA) by Sichuan Investigation Design & Research Institute of Water Conservancy & Electric Power	02/2006	

[41] Refer to IRR calculation sheet/ Inputs/ Cell I16

[42] Refer to IRR calculation sheet/ Inputs/ Cell I17

[43] http://www.topper.cn/westdatadetail.asp?id=12159

EIA approval by the Environmental Protection Bureau of Sichuan Province	29/04/2006	
Completion of PDR of Diluo project by Sichuan Investigation Design & Research Institute of Water Conservancy & Electric Power	04/2006	Completion of PDR of Diluo project by Sichuan Investigation Design & Research Institute of Water Conservancy & Electric Power. The PDR concluded that the project is financially unattractive without CDM income.
PDR approval by Development and Reform commission of Sichuan Province	08/06/2006	
Minutes of Board Meeting considering CDM revenues.	20/06/2006	Based on the fact that the project is financially unattractive, Board Meeting held; Project owner decided to seek financial support from CDM.
	15/07/2006	China Development Bank and Bank of China, agreed to provide loan to the proposed project based on the fact that the proposed project can obtain CDM income to overcome its financial barrier
The Civil Works Contract was signed between the Project Developer and the 5th Engineering Bureau of Sinohydro Corporation	18/07/2006	Project Start date
The Equipment Purchase Agreement was signed between the Project Developer and the Dongfang Electric Corporation for the Turbine Generator Units	09/2006	
Construction Permit was issued by the Construction Supervision Company (China Zhongnan Water Conservancy & Hydropower Engineering Consulting Company)	01/12/2006	
	11/06/2007	The stakeholder consultation for the CDM Project activity was conducted by the Project Developer.
	11/12/2007	The project developer and EcoSecurites signed a Strategic Co-operation Agreement
	03/2008	The project developer made an Inquiry Document that ask the price of Emission Reduction
	07/07/2008	The project developer and EcoSecurites signed an Emission Reduction Purchase Agreement (ERPA) with EcoSecurities
	13/11/2008	Applied for HNA Approval

	18/03/2009	LOA obtained from Chinese DNA.
The two turbo-generator units passed the commissioning test	26/12/2009	

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the latest version of ACM0002 and the tool to calculate the emission factor for electricity system, since the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

> **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, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".**

The Project therefore applies the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

This PDD uses the calculations published by the DNA of P. R. China[44] to determine the Operating Margin (OM) emission factor[45] and the Build Margin (BM) emission factor[46] using the most recent data available.

The description below follows the steps of the latest version of the "Tool to calculate the emission factor for an electricity system" and focuses on the key process of the calculation of the emission factors. Please see Annex 3 for the baseline data underlying the calculations.

The "Tool to calculate the emission factor an electricity system" is applied in the context of the Project in the following seven steps:
Step 1. Identify the relevant electricity systems
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 OM emission factor according to the selected method
Step 5. Identify the group of power plants to be included in the build margin
Step 6. Calculate the build margin emission factor
Step 7. Calculate the combined margin emission factor

Step 1. Identify the relevant electric power system
P. R. China is divided into regional electricity systems which are defined by the DNA of P. R. China[47].

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[44] National Coordination Committee on Climate Change – National Development and Reform Commission (NDRC)

[45] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2331.xls for the EF_{OM}

[46] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2332.doc for the EF_{BM}

[47] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2333.pdf

The Project is located in Sichuan Province which belongs to the CCPG. Therefore, the relevant electric power system is identified as the CCPG.

As CCPG has electricity import from the Northwest China Power Grid, for the purpose of determining the operating margin emission factor, "Tool to calculate the emission factor for an electricity system" offers four options to determine the CO2 emission factor(s) for net electricity imports ($EF_{grid,import,y}$) from a connected electricity system within the same host country:

(a) 0 tCO2/MWh, or

(b) The weighted average operating margin (OM) emission rate of the exporting grid; or

(c) The simple operating margin emission rate of the exporting grid; or

(d) The simple adjusted operating margin emission rate of the exporting grid.

Option (c) will be applied for this project, which uses the simple operating margin emission rate of the exporting grid. Please refer Annex 3 for detail information.

Step 2. Choose whether to include off-grid power plants in the project electricity system

The "Tool to calculate the emission factor for an electricity system" offers two options to calculate the operating margin and build margin emission factor:

- 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.

Option I is applied and only grid power plants are included in the calculation.

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

The "Tool to calculate the emission factor for an electricity system" offers four methods to calculate the OM emission factor ($EF_{grid,OM,y}$):

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

Of these procedures, Option (a) (Simple OM) is applied. This is because low-cost / must run resources constitute less than 50% of total grid generation in average of the five most recent years. From 2003 to 2007 respectively, 33%, 38%, 38%, 35% and 35% of the electricity generated in the CCPG came from low-cost / must run resources[48].

Power plants registered as CDM project activities are included in the sample group that is used to calculate the OM as long as the criteria for including the power sources in the sample group apply.

The "Tool to calculate the emission factor for an electricity system" offers the choice between two data vintages calculate the Simple OM emission factor ($EF_{grid,OMsimple,y}$):

[48] China Electric Power Yearbooks 2004-2008; see Annex 3 for detailed calculation.

- *Ex-ante* option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.
- *Ex-post* option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

$EF_{grid,OMsimple,y}$ is calculated *ex-ante* using the data from 2005 to 2007, available in the China Energy Statistics Yearbooks 2006-2008 and the China Electric Power Yearbooks 2006-2008. This data vintage remains fixed during the crediting period.

Step 4. Calculate OM emission factor according to the selected method

The "Tool to calculate the emission factor for an electricity system" offers three options to calculate $EF_{grid,OMsimple,y}$:

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

Detailed data on the individual power plants connected to the CCPG necessary for applying option A is not available; therefore, options A cannot be used. Since only nuclear and renewable power generation are considered as low-cost / must-run power sources and since the quantity of electricity supplied to the grid by these sources is known, option B is applicable and used to calculate the Simple OM emission factor.

$EF_{grid,OMsimple,y}$, using option B is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

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

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) (country-specific values are used)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
$EG_{y,grid}$[49]	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y* (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year *y*
y	=	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation

[49] $EG_{y,grid}$ = GEN x (1-rate of internal use by the power station). See Annex 3 and section B.6.2. for details.

$EF_{grid,OMsimple,y}$ = 1.1255 tCO_2/MWh

For detailed information, please see Annex 3.

Step 5. Identify the group of power units to be included in the build margin

According to the "Tool to calculate the emission factor for an electricity system", the sample group of power units *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.

However, due to the fact that data on electricity generation of each power plant / unit in the grid is currently not available in P. R. China (see Step 3), EB guidance on the estimation of the build margin in P.R. China can be applied for the purpose of defining the sample group[50]. In accordance with the guidance, the build margin consists of the set of power capacity additions in the electricity system that comprises 20% of the system generation capacity (in MW) and that have been built most recently. Therefore, the set of power capacity additions included in the build margin is determined as follows:

$$\frac{\sum_j CAP_{j,y-n}}{\sum_j CAP_{j,y}} > 20\% \qquad \textbf{(2)}$$

$\sum_j CAP_{j,\,y-n}$	=	The aggregate incrementally installed power capacity of all kinds of power generation sources *j* (MW) in year *y-n*
$\sum_j CAP_{j,\,y}$	=	The aggregate incrementally installed power capacity of all kinds of power generation sources *j* (MW) in year *y*
n	=	The number of years (y-1, y-2, …, y-n) which have to be considered to comprise 20% of the system generation capacity (in MW) and that have been built most recently

In the period from 2005 to 2007 (2007 being the most recent year for which data is available), the amount of power capacity additions made up over 20% of the total CCPG generation capacity in 2007. Therefore $n = 2$.

Since data on the electricity generation of each individual power plant / unit in the grid is not available in P. R. China, power plants registered as CDM project activities cannot be isolated and are taken into account in the build margin.

The "Tool to calculate the emission factor for an electricity system" offers the choice between two data vintages to calculate the BM:

- *Option 1*. For the first crediting period, the build margin emission factor is calculated *ex-ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation.

[50] See: EB guidance on estimating the build margin for AM0005, consolidated in ACM0002 which refers to the Tool to calculate the emission factor for an electricity system http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM and http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

- *Option 2*. For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity

The BM emission factor ($EF_{grid,BM,y}$) is calculated *ex-ante* using the data from 2005 to 2007, available in the China Energy Statistics Yearbook 2008 and the China Electric Power Yearbooks 2006-2008. This data vintage remains fixed during the first crediting period and will be updated for the second crediting period.

Step 6. Calculate the build margin emission factor

According to the "Tool to calculate the emission factor for an electricity system", $EF_{grid,BM,y}$ is the generation-weighted average emission factor of all power units *m* during the most recent year *y* for which power generation data is available. However, due to the fact that data on both electricity generation and emission factor of each power plant / unit in the grid is currently not available in P. R. China (see Step 3), EB guidance on the estimation of the build margin in P.R. China can also be applied for the purpose of estimating the BM emission factor[51] and $EF_{grid,BM,y}$ is calculated as follows:

$$EF_{grid,BM,y} = \frac{CAP_{thermal,y-n,y}}{\sum_j CAP_{j,y-n,y}} \times EF_{thermal,adv} \quad \textbf{(3)}$$

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$CAP_{thermal,y-n,y}$	=	The incrementally installed power capacity of thermal power generation sources (MW) in the CCPG in year *y* compared to that of year *y-n*
$\sum_j CAP_{j,y-n,y}$	=	the aggregate incrementally installed power capacity of all kinds of power generation sources *j* (MW) in the CCPG in year *y-n* compared to that of year *y-n*
$EF_{thermal,adv}$	=	The emission factor of thermal power generation sources of the CCPG with the efficiency level of the best commercially available technology in P. R. China, for *y* the most recent historical year for which power generation data is available

$EF_{Thermal,Adv}$ is calculated as follows:

$$EF_{Thermal,Adv} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad \textbf{(4)}$$

Where:

$EF_{i,Adv}$	=	The CO_2 emission factor of fuel *i* (tCO_2/MWh) using the best commercially available technology in P. R. China and taking into account the carbon content and the oxidation factor of fuel *i*[52]
Coal, Oil and *Gas*	=	Solid fuel, liquid fuel and gaseous fuel respectively
λ_i	=	The weight of CO_2 emissions from fuel *i* fired power plants in the total CO_2 emissions from thermal power, using the most recent available data

[51] See: http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM and http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

[52] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1875.pdf

And

$$\lambda_{Coal} = \frac{\sum_{i=Coal} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_{i} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}} \quad \textbf{(5)}$$

$$\lambda_{Oil} = \frac{\sum_{i=Oil} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_{i} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}} \quad \textbf{(6)}$$

$$\lambda_{Gas} = \frac{\sum_{i=Gas} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_{i} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}} \quad \textbf{(7)}$$

Where $FC_{i,y}$, $NCV_{i,y}$ and $EF_{CO2,i,y}$ are defined as in equation 1.

$EF_{grid,BM,y}$ = 0.5802 tCO_2/MWh

For detailed information, please see Annex 3.

Step 7. Calculate the combined margin emission factor

The combined margin (CM) emissions factor ($EF_{grid,CM,y}$) is calculated as follows:

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

Where:

$EF_{grid,CM,y}$	=	Combined margin CO_2 emissions factor in year *y* (tCO_2/MWh)
$EF_{grid,BM,y}$	=	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, which is 0.5 by default
w_{BM}	=	Weighting of build margin emissions factor, which is 0.5 by default

$EF_{grid,CM,y}$ = 0.5 * 1.1255 + 0.5 * 0.5802 = 0.85285 tCO_2/MWh

For detailed information, please see Annex 3.

Then baseline emissions *(BE_y)* are obtained as:

$$BE_y = EG_{facility,y} \times EF_{grid,CM,y} \quad \textbf{(9)}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2/yr)

$EG_{facility,y}$ = Quantity of net supply of electricity to 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 emissions factor in year *y* (tCO_2/MWh)

And

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

Where

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid in year *y* (MWh/yr)

EC_y = Quantity of electricity that is imported by the power plant and the dam in year y (MWh/yr)

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

Since the project activity results in a new reservoir, project emissions from the reservoir have to be considered if the power density (PD) of the power plant if greater than 4 W/m^2 and less than or equal to 10 W/m^2. The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

PD = Power density of the project activity, in 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). Since the project activity is a new hydro power plant, 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). Since the project activity is a new hydro power plant, this value is zero

For the proposed Project, PD = 342 W/m^2.

Since the PD of the power plant is greater than 10 W/m^2, the project emission is 0 tCO_2e/y.

According to ACM0002, no leakage needs to be considered. Therefore, $L_y = 0$ tCO_2e/y.

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

Data / Parameter:	$FC_{i,y}$
Data unit:	**t, m^3**
Description:	Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
Source of data used:	China Energy Statistics Yearbooks (2006-2008)
Value applied:	See Annex 3
Justification of the choice	Official released statistics; publicly accessible and reliable data source

of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	***$NCV_{i,,y}$***
Data unit:	**MJ/t, kJ/m^3**
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	China Energy Statistics Yearbook 2008
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	***$EF_{CO2,i,y}$***
Data unit:	**tCO_2/TJ**
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
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:	

Data / Parameter:	***$GEN_{j,y}$***
Data unit:	**MWh**
Description:	The electricity generation by source *j* in year *y* of each province connected to the CCPG (this includes electricity imports to the CCPG)
Source of data used:	China Electric Power Yearbooks(2004-2008)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	***Rate of internal use by the power station***

Data unit:	**%**
Description:	The rate of internal use of power source *j* in each province connected to the CCPG.
Source of data used:	China Electric Power Yearbooks (2006-2008)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$CAP_{j,y}$
Data unit:	**MW**
Description:	The aggregate incrementally installed power capacity of all kinds of power generation sources *j* (MW) in the CCPG in year *y*
Source of data used:	China Electric Power Yearbooks (2006-2008)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$CAP_{thermal,y-n,y}$
Data unit:	**MW**
Description:	The aggregate incrementally installed power capacity of thermal power generation sources (MW) in the CCPG in year *y* compared to that of year *y-n*
Source of data used:	China Electric Power Yearbooks (2006-2008)
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$EF_{Coal,Adv}$
Data unit:	**tCO_2/MWh**
Description:	The CO_2 emission factor of Coal (tCO_2/MWh) using the best commercially available technology in P. R. China
Source of data used:	Data from the NDRC http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2332.doc
Value applied:	See Annex 3

Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$EF_{Oil,Adv}$
Data unit:	**tCO_2/MWh**
Description:	The CO_2 emission factor of Oil (tCO_2/MWh) using the best commercially available technology in P. R. China
Source of data used:	Data from the NDRC http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2332.doc
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	$EF_{Gas,Adv}$
Data unit:	**tCO_2/MWh**
Description:	The CO_2 emission factor of Gas (tCO_2/MWh) using the best commercially available technology in P. R. China
Source of data used:	Data from the NDRC http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2332.doc
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official released statistics; publicly accessible and reliable data source
Any comment:	

Data / Parameter:	Cap_{BL}
Data unit:	**W**
Description:	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data to be used:	Project Design Report
Value applied:	0.
Justification of the choice of data or description of measurement methods and procedures actually applied :	

Any comment:	-

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured at the surface of the water, before the implementation of the project activity, when the reservoir is full
Source of data to be used:	Project Design Report
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

The *ex-ante* emission reductions (ER_y) are calculated as follows:

$$ER_y = BE_y - PE_y - L_y$$

Where:

ER_y = Emission reductions in year y (tCO_2)

BE_y = Baseline emissions in year y (tCO_2)

PE_y = Project Emissions in year y (tCO_2)

L_y = Leakage emissions in year y (tCO_2)

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

Since the project activity results in a new reservoir, project emissions from the reservoir have to be considered if the power density (PD) of the power plant if greater than 4 W/m^2 and less than or equal to 10 W/m^2. The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

PD = Power density of the project activity, in 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). Since the project activity is a new hydro power plant, 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). Since the project activity is a new hydro power plant, this value is zero

For the proposed Project, PD = 342 W/m^2.

Since the PD of the power plant is greater than 10 W/m^2, $PE_y = 0$ tCO_2e/y.

According to ACM0002, no leakage needs to be considered. Therefore, $L_y = 0$ tCO_2e/y.

As a result: $ER_y = BE_y$

Refer to Section B.6.1. for equations used to estimate baseline emissions.

See Table B.6.1. below for a summary of the values used and the results of the calculation.

Table B.6.1 Key Information and Data Used to calculate the Baseline Emissions

	Per year (average)	**7 years**
Operating Margin Emissions Factor ($EF_{OM,y}$ in tCO_2/MWh)	1.1255	1.1255
Build Margin Emissions Factor ($EF_{BM,y}$ in tCO_2/MWh)	0.5802	0.5802
Baseline Emissions Factor (EF_y in tCO_2/MWh)	0.85285	0.85285
Power supplied to the grid (EG_y MWh)	395,816	2,770,712
Baseline Emissions (BE tCO_2)	337,572	2,363,004

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

Year	**Estimation of project activity emissions (tonnes of CO_2e)**	**Estimation of baseline emissions (tonnes of CO_2e)**	**Estimation of leakage (tonnes of CO_2e)**	**Estimation of overall emission reductions (tonnes of CO_2e)**
01/07/2011 – 31/12/2011	0	168,786	0	168,786
2012	0	337,572	0	337,572
2013	0	337,572	0	337,572
2014	0	337,572	0	337,572
2015	0	337,572	0	337,572
2016	0	337,572	0	337,572
2017	0	337,572	0	337,572
01/01/2018 – 30/06/2018	0	168,786	0	168,786
Total (tonnes of CO_2e)	0	2,363,004	0	2,363,004

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{pj,y}$
Data unit:	**MWh**
Description:	Quantity of electricity exported by the project plant to the grid in year y
Source of data to be used:	Project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	395,816
Description of measurement methods and procedures to be applied:	Two bidirectional revenue meters with accuracy level of 0.5S (or more accurate) will be installed at the output of the plant according to the *Technical administrative code of electric energy metering (DLT448-2000)* for continuous measurement and electricity output measured by the meters will be recorded monthly by the project developer. Quantity of electricity exported by the project plant to the grid ($EG_{pj,y}$) will be the electricity output measured by the revenue meters minus the agreed transmission loss[53] between the Project Developer and the grid company.
QA/QC procedures to be applied:	The revenue meters will be calibrated according to the *Verification Regulation of Electrical Energy Meters with Electronics (JJG 596-1999)* or subsequent version. Electricity exported by the project plant to the grid ($EG_{pj,y}$) will be cross-checked against records for sold electricity. In case of inconsistency, the smaller value will be used for being conservative.
Any comment:	-

Data / Parameter:	EC_y
Data unit:	**MWh**
Description:	Quantity of electricity imported by the project plant from the grid in year y
Source of data to be used:	Project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	As mentioned in above table, two bidirectional revenue meters will be installed at the output of the plant according to the *Technical administrative code of electric energy metering (DLT448-2000)* for continuous measurement and electricity consumptions measured by the meters will be recorded monthly by the project developer.

[53] According to the Metering Agreement issued by the project developer and the Sichuan Electric Power Corporation on 2 August 2010, the transmission loss rate was fixed to be 0.8%.

	Quantity of electricity imported by the project plant from the grid (***EC_y***) will be the electricity consumptions measured by the revenue meters plus the agreed transmission loss[54] between the Project Developer and the grid company.
QA/QC procedures to be applied:	The revenue meters will be calibrated according to the *Verification Regulation of Electrical Energy Meters with Electronics (JJG 596-1999)* or subsequent version. Electricity imported by the project plant from the grid (***EC_y***) will be cross-checked against records for purchased electricity. In case of inconsistency, the larger value will be used for being conservative.
Any comment:	-

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:	Project activity site
Measurement procedures (if any):	Measure the installed capacity based on recognized standards
Monitoring frequency:	Yearly
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	***A_{PJ}***
Data unit:	**m^2**
Description:	Area of the reservoir measured in the surface of the water, when the reservoir is full
Source of data:	Project activity site
Measurement procedures (if any):	The area of the reservoir has been determined on the basis of the measurement of the crest level of the dam and topography of the area. The Project routinely measures water levels. An average level below design level as stated in the Preliminary Design Report means that the flooded area is less than the area estimated in the Preliminary Design Report. This value will be monitored yearly.
Monitoring frequency:	Yearly
QA/QC procedures:	-
Any comment:	-

Please refer to Annex 4 for further background documentation.

B.7.2 Description of the monitoring plan:

This section details the steps taken to monitor the GHG emissions reductions on a regular basis from Diluo Hydroelectric Project in the Host Country.

[54] According to the Metering Agreement issued by the project developer and the Sichuan Electric Power Corporation on 2 August 2010, the transmission loss rate was fixed to be 0.8%.

The monitoring set-up for this Project has been developed to ensure that from the start, the Project is well-organised in terms of the collection and archiving of complete and reliable data.

1. CDM monitoring Organisation

Roles and responsibilities will be defined for relevant staff involved in CDM monitoring, and the prospect of nominating a CDM Manager will be considered. If appointed, the CDM Manager will have the overall responsibility for the monitoring system on this project. All staff involved in the collection of data and records will be coordinated by him.

2. Staff training

Training is conducted on-site to ensure that staffs are capable of performing their designated tasks to high standards. This will include CDM specific training to warrant that they understand the importance of complete and accurate data and records for CDM monitoring.

3. Maintenance and calibration of monitoring equipment

The two bidirectional revenue meters will be calibrated in line with the relevant national standard. This will ensure that the equipment operates at the stated level of accuracy.

4. Data collection and record-keeping arrangements

All CDM relevant data will be measured and collected as detailed in Section B.7.1. All data required for verification and issuance will be backed-up and retained for at least two years after the end of the crediting period or the last issuance of CERs of the Project, whichever occurs later.

Data collected on-site will be compiled in an electronic format which will be sent to EcoSecurities on a regular basis.

5. Data Quality Control and Quality Assurance

All data collected on-site will be checked internally before being compiled in an electronic format, to ensure that it is complete and of appropriate quality. EcoSecurities will perform a final check of the data, and analyse project performance prior to any verification.

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

The application of the baseline study and monitoring methodology was completed on 19/05/2011. The entity determining the baseline study and the monitoring methodology, and participating in the Project as Carbon Advisor is EcoSecurities International Limited listed in Annex 1 of this document as a project participant.

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Detailed baseline information is provided in Annex 3.

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:

>>
18/07/2006. This is the date when the Civil Works Contract was signed between the Project Developer and the 5th Engineering Bureau of Sinohydro Corporation.

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

>>
30 years, 0 month[55]

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:

>>
The crediting period will begin on 01/07/2011, or on the date of registration of the CDM project activity, whichever is later.

C.2.1.2. Length of the first crediting period:

>>
7 years, 0 month.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable.

C.2.2.2. Length:

>>
Not applicable.

[55] PDR 15-2

SECTION D. Environmental impacts

>>

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

>>

According to Clauses 13 and 19 of the Environmental Evaluation Law of the Host Country, the Project entity must analyse the environmental impacts of project activities in the Host Country before utilising natural resources and beginning Project construction. The Project Developer therefore commissioned a third party, Sichuan Investigation Design & Research Institute of Water Conservancy & Electric Power, to conduct the required Environmental Impact Assessment (EIA) in February 2006, and the EIA report was approved by the Environmental Protection Bureau of Sichuan Province in April 2006.

Where impacts of the Project were identified, mitigation measures were suggested and defined. The EIA highlights the following with regards to the Project, as shown in the table below.

Identified environmental impacts	Measures taken
Water pollution	
On the construction site	Connect the drain to the sedimentation tank, and water reused after sedimentation
Oil water from vehicles	Circulating usage after treatment of using Oil filter.
Wastewater from the staff	Used for agriculture after being treated by biological contact oxidation process.
Air pollution	
Dust during the blast	Buffer blast or wet blast. Use personal protection equipment on site.
Dust during the construction and transportation	A showering system is to be installed to dampen and control dust/particulate matter, particular importance should be given to sprinkling to prevent dust.
Noise pollution	
Blast and excavation during construction	Choose equipment with low noise, construction time to be arranged sensitively. Construction activity is not permitted in the evenings. Building a sound barrier wall at the side of Direction Altering Works around the dam
Solid waste	
Waste from the construction	To the specific landfill.
Waste from the staff	Waste separating: organic substance used for fertilizer by harmless treatment, and inorganic substance be carried to landfill nearby.
Biodiversity and ecosystems	
Parts of agriculture and forest will be removed	Reforest and restore the previous ecosystem after the construction has finished.
Erosion impact assessment	
Land erosion in the Project area occurring prior to the Project activity, e.g. the movement onsite of construction-related vehicles	Prevent land erosion according to Soil and Water Conservation Plan, and establish environmental management measures during construction.

Land acquisition and Compensation Measures:

According to the EIA, 0.035 km^2 of land will be permanently requisitioned and 21 people will be affected by land acquisition.
The compensation standard regulated by County Government was adopted to determine the level of compensation for land acquisition. The compensation budget was established in the Preliminary Design Report by the project developer since the project planning stage, and has been paid by the project developer under the supervision of the Land resource Bureau of the County Government. In addition to the direct compensation measures for the affected people the compensation package includes the construction of roads, bridge and a school for the local people.

The results of the survey have shown that the public has a positive attitude toward the construction of the Project. It is the general opinion that the construction of this Project could help local residents to solve the serious conflict between power supply and demand, and promote sustainable development of the national economy, especially improve living conditions for the local villagers.

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:

>>
With mitigation controls planned as part of the Project construction and EIA process, and the contribution made by the project to sustainable development for the local and national area, the Project is expected to have an overall positive impact on the local and global environments. Mitigation measures will ensure that there are no significant residual impacts associated with the Project.

SECTION E. Stakeholders' comments

>>

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

>>

The stakeholder consultation for the Project activity took place in 11/06/2007. The local stakeholders were invited to submit comments on the project activity by completing a questionnaire sent out by the project developer. In addition, the project developer visited some residents in their homes. The questionnaire was delivered to the addresses of stakeholders directly. Because the stakeholders have low education level and had little environmental knowledge, the project developer explained the meaning of CDM aim and the questions of the stakeholders survey. It is separate and in addition to the EIA stakeholder event.

The questionnaires included a technical description of the project as well as a brief explanation of how the project activity mitigates climate change through the Clean Development Mechanism of the Kyoto Protocol and brings sustainable development benefits. The questions asked were as follows:

- What impacts do you think the CDM project activity will have on the local environment?
- What impacts do you think the CDM project activity will have on employment and social welfare in the local area?
- What impacts do you think the CDM project activity will have on your livelihood during the construction of the CDM project?
- What impacts do you think the CDM project activity will have on the local economic development
- What would be the overall effects of the construction and operation of the CDM Project?
- What is your attitude towards the construction of the CDM Project?

80 questionnaires were sent to the stakeholders by the Project developer. The stakeholders included local governmental officials (6 people), local residents (38 people) and related employees (36 people). A full list of stakeholders consulted is available from the Project developer.

E.2. Summary of the comments received:

>>

The survey received 100% participation. The survey shows the stakeholders believe that the proposed CDM project activity will have positive impacts on the local ecological, environmental, employment and social life. All stakeholders expressed their support to the proposed project. A full list of the completed questionnaires is available from the Project developer.

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

>>

No negative comments were received on the project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project developer:

Organization:	Sichuan Huadian Xixi River Hydro-electricity Development Co., Ltd.
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Project Annex 1 participant:

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Represented by:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This Project will not receive any public funding from Annex 1 Parties.

Annex 3
BASELINE INFORMATION

Baseline Information for the CCPG (including Henan, Hubei, Hunan, Jiangxi, Sichuan, Chongqing)

Calculation of the Operating Margin Emission Factor of the CCPG

Table A1 CO_2 emissions from thermal power plants of the CCPG (2005)

Fuel Type	**Unit**	**Jiangxi** A	**Henan** B	**Hubei** C	**Hunan** D	**Chongqing** E	**Sichuan** F	**Subtotal** G=A+B+C+D+E+F	**EF (kgCO2/TJ)** H	**NCV (MJ/t,kJ /m^3)** I	**CO2 emissions (tCO2e)** J= G*H*I /100000 (mass unit) J= G*H*I /10000 (volume unit)
Raw Coal	10000t	1,869.3	7,638.9	2,732.2	1,712.3	875.4	2,999.8	17,827.8	87,300	20,908	325,404,287
Clean Coal	10000t	0.0						0.0	87,300	26,344	460
Other washed coal	10000t		138.1			90.0		228.1	87,300	8,363	1,665,408
Coke	10000t		26.0		105.0			131.0	95,700	28,435	3,563,450
Coke Oven Gas	10^8m^3			1.2		0.4		1.5	37,300	16,726	94,206
Other Coal Gas	10^8m^3		10.2			3.1		13.3	37,300	5,227	259,696
Crude oil	10000t		0.8	0.4				1.2	71,100	41,816	35,083
Gasoline	10000t		0.0			0.0		0.0	67,500	43,070	1,163
Diesel	10000t	1.3	3.0	2.4	1.4	1.4		9.5	72,600	42,652	293,861
Fuel Oil	10000t	0.6	0.3	3.2	1.7	0.9	2.2	8.9	75,500	41,816	280,035
LPG	10000t							0.0	61,600	50,179	0
Refinery Gas	10000t	0.7	3.4	1.8	0.8			6.7	48,200	46,055	147,842
Natural Gas	10^8m^3						3.0	3.0	54,300	38,931	634,186
Other petroleum products	10000t							0.0	75,500	41,816	0
other coking products	10000t				1.5			1.5	95,700	28,435	40,818
Other energy	10000t ce		2.9		1.7	32.8		37.4	0	0	0
										subtotal	332,420,496

Data source: China Energy Statistics Yearbook 2006

Table A2 Electricity Generation of the CCPG (2005)

Province	Electricity generation (MWh)	Used by the power station (%)	Power output (MWh)
Jiangxi	30,000,000	6.48	28,056,000
Henan	131,590,000	7.32	121,957,612
Hubei	47,700,000	2.51	46,502,730
Hunan	39,900,000	5	37,905,000
Chongqing	17,584,000	8.05	16,168,488
Sichuan	37,202,000	4.27	35,613,475
total			286,203,305

Data source: China Electric Power Yearbook 2006

Table A3 CO_2 emissions from thermal power plants of the CCPG (2006)

Fuel Type	**Unit**	**Jiangxi** A	**Henan** B	**Hubei** C	**Hunan** D	**Chongqing** E	**Sichuan** F	**Subtotal** G=A+B+C+D+E+F	**EF (kgCO2/TJ)** H	**NCV (MJ/t,kJ/m^3)** I	**CO2 emissions (tCO2e)** J= G*H*I /100000 (mass unit) J= G*H*I /10000 (volume unit)
Raw Coal	10000t	1,926.0	8,098.0	3,179.8	2,454.5	1,184.3	3,285.2	20,127.8	87,300	20,908	367,386,738
Clean Coal	10000t					5.8		5.8	87,300	26,344	133,160
Other washed coal	10000t	4.5	104.1		8.6	79.2		196.4	87,300	8,363	1,434,116
Briquette							0.0	0.0	87,300	20,908	183
Coke	10000t		17.2		0.3			17.6	95,700	28,435	477,576
Coke Oven Gas	10^8m^3		0.5	1.1	4.2	0.4	0.0	6.2	37,300	16,726	388,053
Other Coal Gas	10^8m^3	12.7	4.0		1.7	4.4	0.0	22.7	37,300	5,227	442,770
Crude oil	10000t		0.5					0.5	71,100	41,816	14,568
Gasoline	10000t		0.0					0.0	67,500	43,070	291
Diesel	10000t	0.9	2.2	1.4	1.8	1.0		7.3	72,600	42,652	225,737
Fuel Oil	10000t	0.5	1.3	1.3	0.8	0.6	3.5	7.9	75,500	41,816	250,674
LPG	10000t							0.0	61,600	50,179	0
Refinery Gas	10000t	0.9	8.1	1.0	1.0			10.9	48,200	46,055	242,630
Natural Gas	10^8m^3			0.3		0.2	18.6	19.1	54,300	38,931	4,031,309
Other petroleum products	10000t							0.0	75,500	41,816	0
other coking products	10000t						0.0	0.0	95,700	28,435	272
Other energy	10000tce	17.5	37.4	31.6	18.3	29.4		134.0	0	0	0
										subtotal	375,028,077

Data source: China Energy Statistics Yearbook 2007

Table A4 Electricity Generation of the CCPG (2006)

Province	Electricity generation (MWh)	Used by the power station (%)	Power output (MWh)
Jiangxi	34,449,000	6.17	32,323,497
Henan	151,235,000	7.06	140,557,809
Hubei	54,841,000	2.75	53,332,873
Hunan	46,408,000	4.95	44,110,804
Chongqing	23,487,000	8.45	21,502,349
Sichuan	44,193,000	4.51	42,199,896
total			334,027,226

Data source: China Electric Power Yearbook 2007

Table A5 CO_2 emissions from thermal power plants of the CCPG (2007)

Fuel Type	**Unit**	**Jiangxi** A	**Henan** B	**Hubei** C	**Hunan** D	**Chongqing** E	**Sichuan** F	**Subtotal** G=A+B+C+D+E+F	**EF (kgCO2/TJ)** H	**NCV (MJ/t,kJ/m^3)** I	**CO2 emissions (tCO2e)** J= G*H*I /100000 (mass unit) J= G*H*I /10000 (volume unit)
Raw Coal	10000t	2200.57	9357	3479.81	2683.81	1547.7	3239	22507.89	87,300	20,908	410,829,404
Clean Coal	10000t		3.07			3.8		6.87	87,300	26,344	157,998
Other washed coal	10000t	0.04	87.16		2.06	96.42		185.68	87,300	8,363	1,355,631
Briquette	10000t						0.01	0.01	87,300	20,908	183
Coke	10000t							0	95,700	28,435	0
Coke Oven Gas	10^8m^3	0.08	2.61	0.25	0.31	0.91		4.16	37,300	16,726	259,534
Other Coal Gas	10^8m^3	29.17	25.79		24.69		23.98	103.63	37,300	5,227	2,020,444
Crude oil	10000t		0.43					0.43	71,100	41,816	12,784
Gasoline	10000t				0.04	0.01		0.05	67,500	43,070	1,454
Diesel	10000t	0.98	3.21	2.51	2.83	1.93		11.46	72,600	42,652	354,863
Fuel Oil	10000t	0.42	1.25	1.33	0.63	0.64	1.74	6.01	75,500	41,816	189,742
LPG	10000t							0	61,600	50,179	0
Refinery Gas	10000t	1.43	10.01	0.97	0.7			13.11	48,200	46,055	291,022
Natural Gas	10^8m^3		0.12	0.18		0.2	1.87	2.37	54,300	38,931	501,007
Other petroleum products	10000t							0	75,500	41,816	0
other coking products	10000t							0	95,700	28,435	0
Other energy	10000tce	23.43	63.65	35.95	29.46	23.21		175.7	0	0	0
										subtotal	415,974,066

Data source: China Energy Statistics Yearbook 2008

Table A6 Electricity Generation of the CCPG (2007)

Province	**Electricity generation (MWh)**	**Used by the power station (%)**	**Power output (MWh)**
Jiangxi	42,100,000	7.72	38,849,880
Henan	177,300,000	7.55	163,913,850
Hubei	60,900,000	6.69	56,825,790
Hunan	54,200,000	7.18	50,308,440
Chongqing	28,800,000	9.2	26,150,400
Sichuan	45,100,000	8.68	41,185,320
total			377,233,680

Data source: China Energy Statistics Yearbook 2008
China Electric Power Yearbook 2008

Table A7 Electricity imported from the Northwest China Power Grid to the CCPG

		2006	2007
Electricity imported	MWh	3,028,950	3,005,400
Emission factor	tCO_2/MWh	0.99148	1.01129

Table A8 Operating Margin Emission Factor of the CCPG

		2005	2006	2007	**Average EF_{OM}** (tCO_2/MWh)
Total CO_2 emissions	tCO_2e	332,420,496	378,031,235	419,013,395	1.1255
Electricity generation (including imports)	MWh	286,203,305	337,056,176	380,239,080	

Calculation of the Build Margin Emission Factor for the CCPG

According to the recent research[56] undertaken by National Development and Reform Commission ("NDRC", Chinese DNA), the generating systems with a capacity of over 600MW shares of 54% of total installed capacity and represents the most advanced technology commercially used in domestic coal-fired plants. The weighted value based on the coal consumption by 30 sets of 600MW generating units installed in 2007 is calculated as 322.5 gce/kWh, which also means the power supply efficiency of these plants is weighted as 38.10%.
The combined cycle technology with a capacity of 200MW stands for the most advanced technology used in thermal plants fired by gas or oil in China. Based on the statistics in 2007, the thermal plant with the maximum power supply efficiency 49.99% consumed the equivalent fuel of 246 gce/kWh.

Table A9 Emission factor of coal-fired plants, gas-fired plants and oil-fired plants in the CCPG

	Efficiency A	**EF (kgCO2/TJ)** B	**Oxidation factor (%)** C	**Emission factor (tCO_2/MWh)** D=3.6/A/1,000,000*B*C
EF coal,Adv	38.10%	87,300	1	0.8249
EF gas,Adv	49.99%	75,500	1	0.3910
EF oil,Adv	49.99%	54,300	1	0.5437
Source	Data from the NDRC http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2332.doc	2006 IPCC Guidelines for National Greenhouse Gas Inventories	2006 IPCC Guidelines for National Greenhouse Gas Inventories	

[56] http://qhs.ndrc.gov.cn/qjfzjz/t20090703_289357.htm

Table A10. Fuel consumption and emission on the CCPG in 2007

Fuel Type	**Unit**	**Jiangxi** A	**Henan** B	**Hubei** C	**Hunan** D	**Chongqing** E	**Sichuan** F	**Subtotal** G=A+B+C+D+E+F	**EF (kgCO2/TJ)** H	**NCV (MJ/t,kJ/m^3)** I	**CO2 emissions (tCO2e)** J= G*H*I /100000 (mass unit) J= G*H*I /10000 (volume unit)
Raw Coal	10000t	2200.57	9357	3479.81	2683.81	1547.7	3239	22507.89	87,300	20,908	410,829,404
Clean Coal	10000t		3.07			3.8		6.87	87,300	26,344	157,998
Other washed coal	10000t	0.04	87.16		2.06	96.42		185.68	87,300	8,363	1,355,631
Briquette	10000t						0.01	0.01	87,300	20,908	183
Coke	10000t							0	95,700	28,435	0
other coking products	10000t							0	95,700	28,435	0
Sub-total											412,343,216
Crude oil	10000t		0.43					0.43	71,100	41,816	12,784
Gasoline	10000t				0.04	0.01		0.05	67,500	43,070	1,454
Diesel	10000t	0.98	3.21	2.51	2.83	1.93		11.46	72,600	42,652	354,863
Fuel Oil	10000t	0.42	1.25	1.33	0.63	0.64	1.74	6.01	75,500	41,816	189,742
Other petroleum products	10000t							0	75,500	41,816	0
Sub-total											558,843
LPG	10000t							0	61,600	50,179	0
Coke Oven Gas	10^8m^3	0.08	2.61	0.25	0.31	0.91		4.16	37,300	16,726	259,534
Other Coal Gas	10^8m^3	29.17	25.79		24.69		23.98	103.63	37,300	5,227	2,020,444
Refinery Gas	10000t	1.43	10.01	0.97	0.7			13.11	48,200	46,055	291,022
Natural Gas	10^8m^3		0.12	0.18		0.2	1.87	2.37	54,300	38,931	501,007
Sub-total											3,072,007
Total											415,974,066

$$\lambda_{Coal} = \frac{\sum_{i=Coal} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_{i} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}} \qquad \lambda_{Oil} = \frac{\sum_{i=Oil} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_{i} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}} \qquad \lambda_{Gas} = \frac{\sum_{i=Gas} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_{i} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}$$

λ_{coal} = 412,343,216 / 415,974,066 = 0.9913

λ_{oil} = 558,843 / 415,974,066 = 0.0013

λ_{gas} = 3,072,007 / 415,974,066 = 0.0074

Therefore $EF_{thermal}$ =0.9913*0.8249 + 0.0013*0.5437+ 0.0074*0.3910 = 0.8213 tCO_2e/MWh

Table A11 Installed capacity in the CCPG in 2007

Type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
thermal power	MW	9,270	38,540	13,040	13,360	6,370	12,000	92,580
hydro power	MW	3,570	2,740	24,020	9,220	2,240	19,860	61,650
nuclear power	MW	0	0	0	0	0	0	0
wind farm and others	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, http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2332.doc

Table A12 Installed capacity in the CCPG in 2006

Type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
thermal power	MW	6,568	32,603	11,623	10,715	5,594	9,555	76,658
hydro power	MW	3,288	2,553	18,320	8,648	1,979	17,730	52,518
nuclear power	MW	0	0	0	0	0	0	0
wind farm and others	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, http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2332.doc

Table A13 Installed capacity in the CCPG in 2005

Type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
thermal power	MW	5,906	26,267.8	9,526.3	7,211.6	3,759.5	7,496	60,167.2
hydro power	MW	3,019	2,539.9	17,888.9	7,905.1	1,892.7	14,959.6	48,205.2

nuclear power	MW	0	0	0	0	0	0	0
wind farm and others	MW	0	0	0	0	24	0	24
total	MW	8,925	28,807.7	27,415.2	15,116.7	5,676.2	22,455.6	108,396.4

Data source: China Electric Power Yearbook 2006, http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2332.doc

Table A14 Determination of the Build Margin of the CCPG

Type	**installed capacity in 2005** A	**installed capacity in 2006** B	**installed capacity in 2007** C	**new added installed capacity from 2005 to 2007** D = C – A	**Split of new capacity**
Thermal power	60,167.2	76,658	92,580	32,412.8	70.64%
Hydro power	48,205.2	52,518	61,650	13,444.8	29.30%
Nuclear power	0	0	0	0	0.00%
Wind farm and others	24	41	51	27	0.06%
Total	108,396.4	129,217	154,281	458,84.6	100.00%
Compared to the capacity in 2007	70.26%	83.75%	100%		

Therefore, EF_{BM} = 0.8213*70.64% = 0.5802tCO_2e/MWh

Table A15 Baseline Emission Factor of the CCPG (tCO_2/MWh)

A	Operating Margin Emission Factor (tCO_2/MWh)	1.1225
B	Build Margin Emission Factor (tCO_2/MWh)	0.5802
C	Combined Emission Factor (C=0.5*A+0.5*B) (tCO_2/MWh)	**0.85285**

Baseline Calculation – Choice of Simple OM

Table A16 Generation of the CCPG in 2003

	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total in CCPG G=A+B+C+D+E+F
Thermal generation (GWh)	27,165	95,518	39,532	29,501	16,341	32,782	240,839
Hydro generation (GWh)	3,864	5,457	30,168	24,401	3,951	50,000	117,841
Generation from other sources (GWh)	0	0	0	0	0	0	0
Total generation in province (GWh)	31,029	100,975	69,700	53,902	20,292	82,782	358,680
Percentage of thermal generation in 2003		67%					
Percentage of generation by all other resources in 2003		33%					

Data source: China Electric Power Yearbook 2004

Table A17 Generation of the CCPG in 2004

	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total in CCPG G=A+B+C+D+E+F
Thermal generation (GWh)	30,127	109,352	43,034	37,186	16,520	34,627	270,846
Hydro generation (GWh)	3,890	6,884	69,512	24,236	5,670	58,902	169,094
Generation from other sources (GWh)	0	0	0	0	0	0	0
Total generation in province (GWh)	34,017	116,236	112,546	61,422	22,190	93,529	439,940
Percentage of thermal generation in 2004		62%					
Percentage of generation by all other resources in 2004		38%					

Data source: China Electric Power Yearbook 2005

Table A18 Generation of the CCPG in 2005

	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total in CCPG G=A+B+C+D+E+F
Thermal generation (GWh)	30,000	131,590	47,700	39,900	17,584	37,202	303,976
Hydro generation (GWh)	5,000	6,700	81,400	24,100	6,036	64,498	187,734
Generation from other sources (GWh)	0	10	0	0	0	0	10
Total generation (GWh)	35,000	138,300	129,100	64,000	23,620	101,700	491,720
Percentage of thermal generation in 2005		62%					
Percentage of generation by all other resources in 2005		38%					

Data source: China Electric Power Yearbook 2006

Table A19 Generation of the CCPG in 2006

	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total in CCPG G=A+B+C+D+E+F
Thermal generation (GWh)	34,746	150,226	56,247	47,182	23,460	43,593	355,454
Hydro generation (GWh)	8,832	7,027	75,051	27,640	5,300	68,445	192,295
Generation from other sources (GWh)					102		
Total generation (GWh)	43,578	157,253	131,298	74,822	28,862	112,038	547,749
Percentage of thermal generation in 2006	65%						
Percentage of generation by all other resources in 2006	35%						

Data source: China Electric Power Yearbook 2007

Table A20 Generation of the CCPG in 2007

	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total in CCPG G=A+B+C+D+E+F
Thermal generation (GWh)	42,100	177,300	60,900	54,200	28,800	45,100	408,400
Hydro generation (GWh)	7,300	9,100	93,300	29,400	7,700	77,500	224,300
Generation from other sources (GWh)				90	110		200
Total generation (GWh)	49,400	186,400	154,200	83,690	36,610	122,600	632,900
Percentage of thermal generation in 2007	65%						
Percentage of generation by all other resources in 2007	35%						

Data source: China Electric Power Yearbook 2008

Annex 4

MONITORING INFORMATION

Table 4.1. CDM Monitoring System Procedures

Procedure name	Description
CDM staff training	This procedure outlines the steps to ensure that staff receives adequate training to collect and archive complete and accurate data necessary for CDM monitoring.
CDM data and record keeping arrangements	This procedure provides details of the site's data and record-keeping arrangements. The arrangements ensure that complete and accurate records are retained by the CDM Manager, or an appropriate senior manager, within the quality control system.
Data collection	This procedure will outline the steps to collect data from the meters.
CDM data Quality Control and Quality Assurance	Data and records will be checked prior to being stored and archived. Data from the Project will be checked to identify possible errors or omissions. The data checks will include cross-checks of the electricity figures on the receipts. All records will be checked for completeness.
Electricity meter check	This procedure outlines the steps to provide regular and preventative checks to the main electricity meters.
Equipment failure	This procedure details the process of data collection in the event a problem with any meter occurs.
Equipment calibration	This procedure details the process of organising and managing the calibration process. The procedure includes details of how a suitable company or organisation is commissioned to undertake calibration to the relevant standards.

The above procedures will be available during the verification, and will be documented as part of the monitoring support material. The procedures may be contained in a single document (e.g. a 'Monitoring Manual') for CDM monitoring rather than separate procedures. Some of these procedures may exist in the form of existing on-site practises.

Table 4.2. Operational procedures and responsibilities for monitoring and quality assurance of emissions reductions from the project activity

Task	On-site technician	Operations manager	Project developer's head office	Head of Maintenance / External company	EcoSecurities
Collect Data	E	R	-	-	-
Enter data into Spreadsheet	-	E	R	-	-
Make monitoring reports	-	E	R	-	I
Archive data & reports	-	E	R	-	-
Calibration/ Maintenance	I	I	I	E	I

Legend: *E = responsible for executing data collection, R = responsible for overseeing and assuring quality, I = to be informed, - = not applicable*

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