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

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

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

>>
Hejiang County Yuanxing Hydro Project

Version 2.0

23/03/2008

A.2. Description of the small-scale project activity:

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The Hejiang County Yuanxing Hydro Project (hereafter referred to as the "Project") developed by Luzhou Jiale Yuanxing Power Development Co.,Ltd (hereafter referred to as the "Project Developer") is a diversion type run-of-river small-scale hydropower project in Sichuan Province in the the People's Republic of China (hereafter referred to as the Host Country). The total installed capacity of the Project will be 15 MW, consisting of three 5 MW turbines, with a predicted electricity generation delivered to the grid of 53,730 MWh per annum.

The Project will utilise the hydrological resources of the Dachao river in a diversion type hydro project to deliver low emissions electricity to the South China Power Grid[1] (hereafter referred to as the "Grid"). The electricity currently generated by the grid is relatively carbon intensive, with an operating margin emission factor of 1.0120 tCO_2/MWh[2] and a build margin emission factor of 0.6748 tCO_2/MWh[3]. The Project is therefore expected to reduce emissions of greenhouse gases by an estimated 45,315 tCO2e per year during the first crediting period.

The Project is contributing to sustainable development of the Host Country. Specifically, the project:

- Increases employment opportunities in the area where the project is located (approximately 60 people will be permanently employed for the project operation and the construction of the projects secures jobs in the construction sector)
- Enhances the local investment environment and therefore improves the local economy
- Diversifies the sources of electricity generation, important for meeting growing energy demands and the transition away from diesel and coal-supplied electricity generation. In so doing, the project helps to alleviate local air quality issues.
- Makes greater use of renewable energy
- Contributes to poverty alleviation through income and employment generation by employing people throughout the project operation.

[1] The Project is located in Yuanxing County, which is near the border of Sichuan Province and Guizhou Province. The electricity generated will be finally supplied to Guizhou Province, which is part of the South China Power Grid.
[2] Calculated from the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2004-2006
[3] Calculated from the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2003-2006

A.3. Project participants:

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Table A.3 Project Participants

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)	Luzhou Jiale Yuanxing Power Development Co.,Ltd	No
Sweden	EcoSecurities Group plc	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 small-scale project activity:

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

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A.4.1.1. Host Party(ies):

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The 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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Hejiang County, Luzhou City

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

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The Project is located on the middle reaches of Dachao River. The low diversion dam is located in Dacuoba Village, and the power plant near the Yuanxing Village of Fubao Town, Hejiang County. The exact location of the Project is defined using geographic coordinates obtained with a Global Positioning System (GPS) receiver: E 106°09′04″ longitude, N28°46′11″ latitude for the power plant and E 106°10′06″ longitude, N28°42′07″ latitude for the diversion dam.

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

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The Project falls under UNFCCC sectoral scope 1: Energy industries (renewable - / non-renewable sources). According to Appendix B of the UNFCCC's published simplified procedures for small scale activities, the category of this project activity is:
Type I: Renewable Energy Project
Category I.D: Grid Connected Renewable Energy Generation

The Project is a diversion type hydropower project with a total installed capacity of exactly 15MW (consisting of 3 turbines generator sets with 5 MW capacity each) and a project lifetime of 20 years.

The Project consists of the intake structure, the water conveyance system and the power house. The water intake structure is located on the upstream portion of the Dachao River and consists of a low diversion gravity dam with two (including one for the use of inspection) sluice gates (1.5 m×1.5 m), which directs part of the river flow into the water conveyance system. The conveyance system comprises a tunnel (7,308m long), a pressure adjustment well and a penstock. The penstock consists of a main pipeline (484 m long) and three branch pipes (42m each) that transport the water to the three 5 MW turbines installed in the power house. After power generation the water is discharged into the Dachao River through a tailrace.

The electricity generated by the Project is transmitted to the 110kV Ganyu transformer station via a 22 km transmission line and finally to the Guizhou Power Grid which is a part of the South China Power Grid[4].

The Project will use state of the art but known technology in electricity generation and transmission. The turbines and generators are produced by Yibin Fuyuan Electricity Generation Facilities CO.,Ltd. which is proficient in producing middle and small-sized turbine generator units with a manufacturing history of more than 50 years. All other equipment used in the Project are produced domestically. The Project Developer is experienced in handling and operating this kind of equipment.

The main technical parameters of the proposed Project are shown in Tables A.4.1 and A.4.2 below.

Table A.4.1 Main technical parameters of the proposed project

	Value	**Source**
Installed capacity (MW)	15	Adjusted Preliminary Design Report (Adjusted PDR) *
Annual Operating Hours (hour)	4,369	Adjusted PDR
Expected annual electricity generation (effective supply to the grid) (MWh)	53,730	Adjusted PDR
Water head (m)	218.25	Adjusted PDR
Design discharge (turbines) (m^3/s)	8.53	Adjusted PDR
Power loss (%)	18%	Adjusted PDR

*the Adjusted Preliminary Design was made by the Sichuan Yibin Hydro Power Architecture, Survey and Design Institute in April 2005. The reason for the adjustment is the increase in installed capacity from 12MW (PDR, 2004) to 15MW (Adjusted PDR, 2005). The Adjusted PDR was approved by the Development and Reform Committee of Luzhou City in December 2005.

[4] See Power Purchase Agreement between the Project Developer and Luzhou Yuyu Power Co.,ltd.

See Clarification on electricity transmission of Hejiang County Yuanxing Hydro Project. The purchased electricity from the Project will be finally supplied to SCPG through Guizhou Power Grid.

Table A.4.2. Technical characteristics of the generating equipment

Turbine		**Generator**	
Turbine Type	HLA351-WJ-95	Generator Type	SFW-K5000-6/1730
Rated Head	217.00 m	Designed Capacity	6,250 kVA
Discharge	8.40 m^3/s	Rated Voltage	6,300 V
Rated speed	1000 r/min	Rated Current	572.7 A
Date of Ex-factory	25/01/2007	Capacity Factor	0.8
		Date of Ex-factory	25/01/2007

The Project is in accordance with the Dachao River Plan and therefore the Project is not expected to affect other projects planned on the lower reaches, with which it will share the water resources of the Dachao River.[5]

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

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Year	Estimation of annual emission reductions in tonnes of CO_2e
2008*	45,315
2009*	45,315
2010*	45,315
2011*	45,315
2012*	45,315
2013*	45,315
2014*	45,315
Total estimated reductions (tonnes of CO_2e)	317,205
Total number of crediting years	7
Annual average of the estimated reductions over the crediting period (tCO_2e)	45,315

***Full years from June to June**

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

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

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

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

Based on the information provided in Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities[6], the Hejiang County Yuanxing Hydro Project is not a part of any large scale project or program and is not a debundled component of a large project activity.

The project participants have not registered or are not applying to register any other small-scale CDM project activity

- With the same project participants;

[5] See the Project Summarization Part of the Adjusted Preliminary Design Report.

[6] http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf

- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the Hejiang County Yuanxing Hydro Project at the closest point.

SECTION B. Application of a baseline and monitoring methodology

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

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The category for the project activity according to Appendix B of the UNFCCC's published simplified procedures for small-scale activities is:
Type I: Renewable Energy Project
Category I.D.: Grid Connected Renewable Energy Generation

The simplified baseline and monitoring methodology AMS I.D., version 11, 18 May 2007, is applicable. For more information about the methodology, please refer to the following website:
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

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

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AMS I.D. Version 11, 18 May 2007[7] is applicable since:

- The project activity is a renewable electricity project (hydroelectric)
- The project has an output capacity of 15 MW (Decision -/CMP2 paragraph 28 (a)
- The electricity generated is supplied to a grid that is or would have been supplied by at least one fossil fuel fired generating unit (the South China Power Grid).

B.3. Description of the project boundary:

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As referred to in Appendix B for small-scale project activities, methodology AMS-1.D. Version 11, the project boundary for a small-scale hydropower project that provides electricity to a grid encompasses the physical, geographical site of the renewable generation source.
The project boundary for the baseline will include the emissions related to the electricity produced by the facilities and fossil fuel power plants to be displaced by the Hejiang County Yuanxing Hydro Project. The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the South China Power Grid. The geographic extent of South China Power Grid includes Guangdong Province, Guangxi Province, Guizhou Province and Yunnan Province. The geographic and system boundaries of SCPG can be clearly identified.

In order to conform to the guidance and rules for small-scale project activities, the emissions related to production, transport and distribution of the fuel used for the power plants in the baseline are not included in the project boundary.

[7] According to the definition of Small Scale renewable energy project activity in the Paragraph 6 of the Decision 17/cp.7 in the document. FCCC/CP/2001/13/ADD/2, and the Appendix B to the decision 21/cp.8 of the document FCCC/CP/2002/7/Add.3, of simplified procedures for small-scale activities: Type I.D – Renewable Electricity Generation for a Grid, as "This category comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal, and biomass, that supply electricity to an electricity distribution system that is or would have been supplied by at least one fossil fuel or non-renewable biomass fired generating unit.

B.4. Description of baseline and its development:

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The baseline scenario is made up of the following:
Electricity delivered to the grid by the Project that 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 in B.6.1.

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

Variable	Value / Unit	Source
Operating Margin Emissions factor	1.0120 tCO_2/MWh	Calculated from the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2002-2006
Build Margin Emissions Factor	0.6748 tCO_2/MWh	Calculated from the China Energy Statistics Yearbook 2006 and the China Electric Power Yearbooks 2003-2006
Combined Margin Emissions Factor	0.8434tCO_2/MWh	Calculated from the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2002-2006
Generation of the project in year y	53,730 MWh	Adjusted PDR

In the absence of the project activity, electricity will continue to be generated by the existing generation mix operating in the grid.

Four realistic and credible alternatives to the project activity are considered to determine the baseline:

Alternative 1: The proposed Project activity without CDM, i.e. the construction of a new hydroelectricity generation plant with an installed capacity of 15 MW connected to the local grid, 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 grid.

Alternative 3: Construction of a thermal power plant with the same installed capacity or the same annual power output.

Alternative 4: Construction of a power plant using another renewable energy resource with the same installed capacity or the same annual power output.

Alternative 3 is not in line with applicable laws and regulations, since legislation in China strictly forbids the construction of thermal power stations with an installed capacity lower than 135 MW[8]. Therefore this alternative is not considered further.

[8] See the announcement which strictly forbids the construction of thermal power stations with an installed capacity lower than 135 MW published by the State Council Office, Guo Ban Fa Ming Dian[2002] No.6

Sichuan Province lacks renewable sources, except water resources. According to the China Electric Power Yearbook (2003-2006), the installed capacity of wind farms and other renewable energy technologies is 0 MW. Therefore, *Alternative 4* is not realistic and credible and is not considered further.

Therefore there are two alternatives remaining after this assessment: alternative 1 and alternative 2. The two remaining alternatives will be assessed in detail in section B.5.

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

In accordance with Attachment A of Appendix B of the simplified modalities and procedures for small-scale CDM project activities, a qualitative analysis demonstrating that the project activity would otherwise not be implemented due to the existence of an investment barrier, substantiated by a benchmark analysis.

Investment Barriers:

Benchmark Analysis:

The likelihood of the development of this Project, as opposed to continued generation of electricity from the current electricity generation mix (i.e. its baseline), will be determined by comparing the Project IRR (without carbon) with benchmark rates available to a typical local investor. Benchmarks include both financial indicators determined by local banks, or by investment bonds in the Host Country. According to the "Economic Evaluation Code for Small Hydropower Projects (Document No. SL16-95)[9]", published by the Ministry of Water Resources of the PRC, the IRR of small-scale hydro power projects (smaller than 50 MW) should be higher than 10%. Therefore a 10% benchmark for the IRR of this Project applies.

The table below shows the financial analysis for the project activity, at the time that the decision to go ahead was made, with and without CDM financing. As shown, the Project IRR was lower than the benchmark rate of return applicable. This therefore indicates that in comparison to other alternative investments, the project was not financially attractive.

Table B.5.1. Summary of project financial analysis with and without CDM revenue

IRR without CDM	7.37%
IRR with CDM	12.37%

Details for calculating the IRR are provided in table B.5.3

A sensitivity analysis was conducted by altering the following parameters:

- Electricity Tariff
- Investment Costs
- Operating Costs
- Annual Operating Hours

Table B.5.2 summarizes the results of the sensitivity analysis, showing the variation of each parameter needed to reach the 10% benchmark.

[9] http://www.cws.net.cn/guifan/bz%5CSL16-95

Table B.5.2. Results of the sensitivity analysis

	Variation of the parameter needed to reach the 10% benchmark
Operating Costs	-134%
Investment Costs	-19%
Electricity Tariff	+20%
Annual Operating Hours	+19%

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

- **Operating costs:** The results of the sensitivity analysis mean that even if the project incurred zero operating costs, which is not feasible, the IRR of the project would remain below 10%.

- **Investment costs:** A 19% of decrease in investment costs is very unlikely to happen, as many hydro power projects experience cost increases rather than cost savings during construction. For the proposed Project, investment costs have been increased by 39%[10] compared to what was estimated in the Adjusted PDR due to the rise in the price of construction materials and of the staff salaries, together with some construction barriers caused by the flood in 2006[11], This shows that a decrease in investment costs is extremely unrealistic and that the IRR is not likely to reach the 10% benchmark.

- **Electricity tariff:** The average electricity tariff offered to small scale hydro power projects in Sichuan Province is 190 RMB/MWh and for Guizhou Province is even lower, only 178 RMB/MWh[12]. The project developer signed a Power Purchase Agreement (PPA) with the local power grid company in December 2005[13]. He managed to get tariffs above average: 230 RMB/MWh for the first 3,700 hours of operation and 190 RMB/MWh for the hours in excess of these 3,700 hours (the proposed Project is expected to operate 4,369 hours per year). Even with these favourable conditions the IRR does not reach the benchmark. This shows that a 20 % increase in the electricity tariff is not a realistic variation, and that the IRR is not likely to reach the benchmark.

- **Operating hours:** The expected operating hours of the proposed Project indicated in the Adjusted PDR was determined by kinetic calculation based on historical hydrological data, electricity demand of the Grid and technical performance of installed capacity. Assuming a 19% of increase in annual operating hours is thus not reasonable, and that the IRR is not likely to reach the benchmark.

[10] See Auditing Report of Hejiang County Yuanxing Hydro Project by Sichuan Changjiang Certified Public Accountant (CJCPA). January 2008

[11] See the Supervision log book by Sichuan Huashu Engineering Construction Supervision Co.,Ltd. The flood from March to May caused a big loss to the Project Developer. The cofferdam was broken down several times and materials (eg. Steel and cement) and construction machines (eg. drilling machines and pumps) were swept away.

[12] Li Qidao, Professor and Expert of Water Conservation and Power Generation Association:
*Sichuan Hydropower Engineering Association & Sichuan Qinggyuan Engineering Consulting Company (*http://www.powerfoo.com/article/html/1190013626140.html*);*
(Introduction of the writer: http://www.shp.com.cn/skins/shp/zt/grzy/liqidao/qj.htm)

[13] Only electricity tariff for the peak using hours (230RMB/MWh) is used for the IRR calculation for simplification. This is conservative.

Table B.5.3. Economic parameters used in the investment analysis

Name	Value	Source
Installed capacity (MW)	15	Adjusted PDR
Income tax (%)	15	Adjusted PDR
VAT (%)	6	Adjusted PDR
Tariff, excluding VAT (RMB/MWh)	230	Power Purchase Agreement[14]
Total investment (RMB)	102,300,000	Adjusted PDR
Operating costs (RMB/MWh)	33.35	Adjusted PDR

These results show that only with highly unrealistic very favourable circumstances would it be possible to reach the Project IRR benchmark. In reality, circumstances are typically more unfavourable than projected and the IRR would decrease even further away from the benchmark. We can conclude that the IRR is lower than the benchmark for a realistic range of assumptions for the input parameters of the sensitivity analysis, and therefore that the Project is not financially attractive. This demonstrates that the project activity would not be implemented without the CDM.

This barrier analysis shows that the project activity is not the baseline scenario and that without the CDM the project would not be implemented, and therefore is considered to be additional.

The CDM was seriously considered in the decision to proceed with the project activity, as discussed hereafter, since it helps alleviating the investment barrier the Project Developer faced. It is difficult for private entities to obtain financing from banks for small hydro projects in China. While the Agricultural Bank of China requires generating units to be over 5 MW in order to be eligible for financing, the minimum installed capacity required for projects in the Sichuan region (dealing with the local Sichuan Branch of the Agricultural Bank of China) is 10 MW, as stipulated in the loan policy issued in June 2005[15][16]. Initially, the Project Developer had planned in the Adjusted PDR, made in April 2005 before the policy was issued, to obtain 70% of overall project finance through loan financing from the Sichuan Branch of the Agricultural Bank of China bank, which represents about RMB 70 million. Given the installed capacity of the individual turbines (5 MW), which is under the requirement from the local Sichuan Branch of the Agricultural Bank of China, the Project was not eligible for a loan. Nevertheless, the Project Developer was aware of CDM early in 2005 since CDM was well advertised by Sichuan Provincial Government and attended a CDM conference in October 2005[17] to strengthen his knowledge of the CDM. Impacts of the CDM on projects cashflow and modalities of the CDM process were presented to the participants to the conference. Considering that CDM benefits could help to overcome the financing barrier, the Project Developer then made the decision to go ahead with the project despite the gap in financing and to continue with the loan application, emphasizing the impacts of CER revenue if the project is registered as CDM project activity in the loan application process[18]. The Agricultural Bank of China then agreed to grant the Project a RMB 50 million loan when considering these additional CDM revenues[19]. The Project Developer subsequently signed a contract with a CDM

[14] See the Power Purchase Agreement, December 2005.

[15] See Agriculture Bank of China: loan policy on the small scale hydro power project, 24/06/2005, document NO. [2005]176

[16] See Sichuan Branch of Agricultural Bank of China: Document about the implementation of the policy NO. [2005]176. , August 2005.

[17] See the Announcement of CDM conference by Sichuan Provincial Power Bureau, October 2005.

[18] See Loan Application Report to Agricultural Bank of China, October 2005

[19] See the Intent Letter from the Agriculture Bank of China in November 2005.

consultancy company in order to initiate the CDM process[20]. Construction of the project could finally start in January 2006 (start of the project activity)[21], after the CDM was seriously considered.
In the meantime, the consultancy, which had a cooperation agreement with EcoSecurities[22], put the Project Developer and EcoSecurities in touch. They started negotiating an Emissions Reduction Purchase Agreement (ERPA), which was signed in October 2006[23]. PDD development was then started. The Project was submitted to the Chinese DNA for host country approval in May 2007 and submitted for validation in July 2007.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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AMS I.D. (Version 11, 18 May 2007) offers the following choices for preparing the baseline calculation for this type of project activity:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered.

OR

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix.

ACM0002 offers four options to calculate the Operating Margin (OM) emission factor:
(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.

Of these procedures, Option (a) (Simple Operating Margin) will be applied. This is because low-cost must run resources constitute less than 50% of total grid generation (from 2001 to 2005 respectively, 34%, 33%, 31%, 30% and 30% of the electricity generated in the South China Power Grid came from the low-cost/must run resources[24]), making option (d) not applicable. Moreover, detailed data necessary to apply option (b) and option (c) is not available.

This PDD follows the calculation steps published by the Chinese DNA (the Director's Office of the Chinese National Climate Coordination body of NDRC[25]) to determine the Operating Margin (OM) emission factor and the Build Margin (BM) emission factor using the most recent data available[26].

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[20] See the Contract between the Project Developer and Sichuan Huayuan Rural Electrification Development Co.,Ltd. in December 2005.

[21] See the approval of start construction, 16/01/2006.

[22] See the Cooperation agreement between Sichuan Huayuan Rural Electrification Development Co.,Ltd and EcoSecurities in November 2005

[23] See ERPA co-signed by EcoSecurities and the Project Developer, 19/10/2006.

[24] China Electric Power Yearbooks 2002-2006; refer to Annex 3 for detailed calculation

[25] See http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls for the EF_{OM} and http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf for the EF_{BM} calculations

The description below focuses on the key process of the calculation of the emission factor. Please see Annex 3 for the baseline data underlying the calculations.

a) *Simple OM emission factor*

The simple Operating Margin (OM) emission factor ($EF_{OM,simple,y}$) is calculated *ex-ante* as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. A three-year average, based on the most recent fuel consumption statistics available at the time of PDD submission, is used.

Detailed data on the individual power plants connected to the grid is not available, therefore information by type of generating source has been used – please refer to Annex 3 for details.

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

Where:
$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in years y,
j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid,
$COEF_{i,j}$ is the CO_2 emissions coefficient of fuel i (tCO_2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in years y, and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient is obtained as

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \quad \textbf{(2)}$$

Where:
NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i (country-specific values are used);
$OXID_i$ is the oxidation factor of the fuel (IPCC 2006 default values are used);
$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i (IPCC 2006 default values are used).

$EF_{OM,y}$= 1.0120 tCO_2/MWh

For detailed information, please see Annex 3.

b) *BM emission factor*

The Build Margin (BM) emission factor ($EF_{BM,y}$) is calculated as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants m, as follows:

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

$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method above for plants m.

[26] China Energy Statistics Yearbook 2006, China Electric Power Yearbook 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories

The Build Margin emission factor $EF_{BM,y}$ is calculated *ex-ante* based on the most recent information available on plants already built for sample group *m* at the time of PDD submission.
However, due to the fact that data of power plant generation and fuel consumption is not currently available in China, EB guidance on the application of approved methodology AM0005 now consolidated into ACM0002 can be applied for the purpose of estimating the build margin (BM) for each fuel type[27].

The formula derived from the deviation from the methodology is expressed as:

$$EF_{BM,y} = \frac{CAP_{thermal,\,y-n,\,y}}{\sum_j CAP_{j,\,y-n,\,y}} \bullet EF_{thermal,adv} \quad \textbf{(4)}$$

Where:
$CAP_{thermal\_y\text{-}n,y}$ is the incrementally installed capacity of thermal power generation sources (MW) in year *y* compared to that of year *y-n*;
$\sum_j CAP_{j,\,y-n,\,y}$ is the aggregate incrementally installed capacity of all kinds of power generation sources (MW) in year *y* compared to that of year *y-n*;

The way of defining "*n*" is the following:
The generation capacity addition used to calculate the BM has to be above 20 % of the current electricity generation capacity in year *y*. "n" is therefore the number of years (y-1, y-2, …, y-n) which have to be considered to achieve the 20% capacity addition to the current electricity generation capacity.

The result for "n" should mean that:

$$\frac{\sum_j CAP_{j,y-n}}{\sum_j CAP_{j,y}} \geq 20\% \quad \textbf{(5)}$$

From 2002 to 2005 (2005 being the most recent year for which data is available), the amount of capacity additions made up over 20% of the total capacity in 2005 in the South China Power Grid. Therefore "n" = 3 (Please see Annex 3 for detailed information).

$EF_{thermal,adv}$ is the emission factor of thermal power generation sources of the applicable electricity system with the efficiency level of the best commercially available technology in China. It is calculated as follows:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad \textbf{(6)}$$

Where:
$EF_{i,.adv,}$ is the CO_2 emission factor of fuel *i* (tCO_2/MWh) using the best commercially available technology in China and taking into account the carbon content and the oxidation factor of fuel *i*[28]
COAL, OIL and *GAS* represent solid fuel, liquid fuel and gaseous fuel respectively, and
λ_i is 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.

$EF_{BM,y}$ = 0.6748 CO_2/MWh.

For detailed information, please see Annex 3.

c) *Combined margin emission factor*

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

[28] See http://cdm.ccchina.gov.cn/website/cdm/upfile/file1374.pdf

The baseline emission factor (EF_y) is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$), as follows:

$$EF_y = \omega_{OM} \cdot EF_{OM,y} + \omega_{BM} \cdot EF_{BM,y} \quad \textbf{(7)}$$

EF_y=0.5*1.0120+0.5*0.6748=0.8434 tCO_2/MWh

Where:

EF: baseline emission factor (tCO_2/MWh)
ω_{OM}: Operating Margin weight, which is 0.5 by default
$EF_{OM,y}$: Operating Margin emission factor (tCO_2/ MWh)
ω_{BM}: Build Margin weight, which is 0.5 by default
$EF_{BM,y}$: Build Margin emission factor (tCO_2/MWh)
y: a given year

Then baseline emissions (BE_y) are obtained as:

$$BE_y = EG_y * EF_y \quad \textbf{(8)}$$

Where:

BE: Baseline emissions (tCO_2)
EG: Electricity supplied by the project to the grid (MWh)
EF: baseline emission factor (tCO_2/MWh)
y: a given year

The baseline emission factor is fixed during the first crediting period.

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

Data / Parameter:	***Installed Capacity of the project activity***
Data unit:	**MW**
Description:	The installed capacity of the project activity
Source of data used:	The Adjusted PDR
Value applied:	15
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Adjusted PDR approved by Development and Reform Committee of Luzhou City.
Any comment:	-

Data / Parameter:	$F_{i,j,y}$
Data unit:	**t, m^3**
Description:	The amount of fuel *i* consumed by relevant power source *j* in years *y*.
Source of data used:	China Energy Statistics Yearbooks
Value applied:	See Annex 3 (2004-2006)
Justification of the choice of data or	Official released statistics; publicly accessible and reliable data source

description of measurement methods and procedures actually applied :	
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 SCPG
Source of data used:	China Electric Power Yearbooks(2002-2006)
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:	***Internal use rate of power station***
Data unit:	**%**
Description:	The internal use rate of power source *j* in each province connected to the SCPG.
Source of data used:	China Electric Power Yearbooks(2004-2006)
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:	NCV_i
Data unit:	**MJ/t, kJ/m^3**
Description:	The net calorific value (energy content) per mass or volume unit of fuel *i*.
Source of data used:	China Energy Statistics Yearbook (2006)
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:	$EF_{CO2,i}$
Data unit:	**tC/TJ**
Description:	The CO_2 emission factor per unit of energy of the fuel *i*.
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:	$OXID_i$
Data unit:	**%**
Description:	The oxidation factor of the fuel
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:	$CAP_{m,y,j}$
Data unit:	**MW**
Description:	The installed capacity of power source *j* of province *m* in years *y*.
Source of data used:	China Electric Power Yearbooks(2003-2006)
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:	

B.6.3 Ex-ante calculation of emission reductions:

>>

The ex-ante emission reductions calculations are as follows:

$$ER_y = BE_y - PE_y - L_y$$

Where:

ER: Emission reduction (tCO_2)
BE: Baseline emissions (tCO_2)
PE: Project Emissions (tCO_2)
L: Leakage emissions (tCO_2)
y: a given year

According to AMS.I.D Version 11, project emissions need not be considered.
Therefore, $PE_y = 0$.

According to AMS I.D Version 11, a leakage calculation is only needed if the renewable energy technology equipment is transferred from another activity or to another activity. This is not the case with the project activity.

Therefore, $L_y = 0$.

As a result: $ER_y = BE_y$

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

Table B.6.1 Key Information and Data Used to Determine the Baseline Scenario

	Per year (average)	**7 years**
Operating Margin Emissions Factor ($EF_{OM,y}$ in tCO_2/MWh)	1.0120	1.0120
Build Margin Emissions Factor ($EF_{BM,y}$ in tCO_2/MWh)	0.6748	0.6748
Baseline Emissions Factor (EF_y in tCO_2/MWh)	0.8434	0.8434
Electricity supplied to the grid by the Project (EG_y MWh)	53,730	376,110
Baseline Emissions (BE tCO_2)	**45,315**	**317,205**

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

>>

Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
2008*	0	45,315	0	45,315
2009*	0	45,315	0	45,315
2010*	0	45,315	0	45,315
2011*	0	45,315	0	45,315
2012*	0	45,315	0	45,315
2013*	0	45,315	0	45,315
2014*	0	45,315	0	45,315
Total (tonnes of CO_2e)	**0**	**317,205**	**0**	**317,205**

***Full years from June to June**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	Electricity quantity $\mathbf{EG_y}$
Data unit:	MWh
Description:	Electricity delivered to the grid
Source of data to be used:	Directly measured
Value of data	53,730
Description of measurement methods and procedures to be applied:	Hourly measured and monthly recording
QA/QC procedures to be applied:	According to national standards, meters will be calibrated periodically. Data measured by meters will be cross checked by electricity sales receipt. The main meter will be read by the project developer and the grid company.
Any comment:	Data will be archived during the crediting period and two years thereafter.

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 on a regular basis the greenhouse gas emissions reductions from the Hejiang County Yuanxing Hydro Project in P.R.China.

The Monitoring Plan 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. Monitoring organisation

Prior to the start of the crediting period, the organisation of the monitoring team will be established. Clear roles and responsibilities will be assigned to all staff involved in the CDM project 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 employees involved in CDM monitoring will have clearly defined roles and responsibilities. A CDM Manager or an appropriate senior manager will manage the process of training new staff, ensuring trained staff performs the monitoring duties and that where trained monitoring staff are absent, and the integrity of the monitoring system is maintained by other trained staff.

All staff involved in the CDM project will receive some relevant training from either EcoSecurities, or a contracted consultant (further details of the training procedure are provided in Annex 4). Records of trained CDM staff will be retained by the Project Developer. The CDM Manager, or the appropriate senior manager, will ensure that only trained staff are involved in the operation of the monitoring system.

A formal set of monitoring procedures will be established prior to the start of the crediting period. A description of these procedures is provided in Annex 4. These procedures will detail the organisation, control and steps required for certain key monitoring system features.

The procedures will be agreed and signed off by the Luzhou Jiale Yuanxing Power Development Co.,Ltd and EcoSecurities. Any changes to procedures will need to be agreed by both parties. The CDM Manager or an appropriate senior manager will be responsible for ensuring that the procedures are followed on site and for continuously improving the procedures to ensure a reliable monitoring system is established.

2. Monitoring equipment and installation

Given that the emission factor is calculated *ex-ante*, and referring to the Monitoring Methodology AMS.I.D, the only data to be monitored is electricity supplied to the grid by the Project (detailed in B.7.1).

There are two meters used to obtain the amount of electricity effectively supplied to the grid, hereafter known as the “revenue meters”. These two meters, used to obtain what is known as an “Electricity Transaction Note” (or similar statement defining power supplied to the grid), will be the meters of primary concern for this hydropower project. In the event of erroneous meter readings (where there are either data gaps, or data outliers present), data can be cross-checked against other invoices, bills power generation statements, or other meters.

The revenue meters for this project is located on the site and are owned by the Project Developer. They will be calibrated by a testing facility accredited under Chinese law based on the relevant national standard. Please refer to Annex 4 for the line diagram of the Project.

Electricity meters should meet the relevant standards at the time of installation. Records of the meters (type, make, model and calibration documentation) will be retained in the quality control system.

3. Data recording procedure, management and archiving

In accordance with Chinese practise, the Project Developer and the grid company will take a meter reading on a monthly basis. This number is confirmed in the form of an “Electricity Transaction Note” (ETN); whereby both parties sign a statement indicating that they agree with the recorded value. This ETN will be checked with against the power generation at the site.

Each month the monitoring data needs to be filed electronically. The electronic files need to have print-out and/or electronic back-up. The Project Developer needs to keep electricity sale and purchase receipts.

All written documentation such as maps, drawings, the Environmental Impact Assessment (EIA) and the PDR should be stored and should be available to the verifier so that the reliability of the information may be checked. All the data shall be kept until two years after the end of credit period.

For details of the operational and management structure used for the monitoring of the project activity, please see Annex 4.

4. Quality Assurance and Quality Control

The quality of data generated by this project will be maintained through the development of an overarching monitoring system. This system may include procedures used to double check data, for staff training, meter calibration, accreditation of the facility completing calibration, and the adherence to the relevant standards. Some other complementary procedures are further outlined in Annex 4.

B.8 Date of completion of the application of the baseline 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 09/05/2007. The entity determining the baseline study and the monitoring methodology and participating in the project as the Carbon Advisor is EcoSecurities Group PLC, listed in Annex 1 of this document as a project participant.

Contact: Yuhuan Shen, EcoSecurities Group PLC
Address: Unit 708, China Resources Building, No.8, JianGuoMen Bei Avenue, Beijing 100005, China
Telephone: +8610-65181081 Email: yuhuan.shen@ecosecurities.com

Detailed baseline information is attached 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:

>>
16/01/2006 (Permission for the construction of the Project[29])

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

>>
20 years

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

C.2.1. Renewable crediting period

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

>>
The crediting period will start on 01/06/2008, 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 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>
Not applicable

[29] See the Permission for the construction of the Project by the Water Resources Bureau of Luzhou City, dated 16/01/2006

SECTION D. Environmental impacts

>>

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

>>

According to the clauses 13 and 19 of the Environmental Protection Law of the People's Republic of China, the project entity must analyse the environmental impacts of project activities in China before exploiting natural resources and beginning project construction. The project developer therefore commissioned a third party, the Chengdu science & technology university environmental protection institute, to conduct the required environmental impact assessment (EIA) in 2005 and the EIA report was approved by the Environmental protection agency of Sichuan Province on 30 December 2005. The EIA report was adjusted to comply with the Adjusted PDR in May 2006, and the EIA report was later approved by the Environmental protection agency of Sichuan Province on 14 June 2006.

The environmental impacts of Small Hydro Power stations are not considered to be significant, social and environmental influences of this project are partial, short-term and reversible.

Biodiversity and Ecosystem
The project activity will not have a negative influence on biodiversity and ecosystems during the project operation period.

Water Quality
The project activity will not have a negative influence on water quality during its operation.

Atmosphere/Air
The project activity will not have a negative influence on the atmosphere/air during its operation.

Noise
The noise influence during the operation period is mainly from the water turbine generator unit. However there are no residents within 500 m of the power station, so it is unlikely that noise from the water turbine generator unit will cause problems for local residents.

Soil
The project activity will not have a negative influence on soil during project operation.

During the construction period noise disturbance can not be avoided but the impacts will be minimised by using low noise equipment and by allowing construction only at reasonable times of the day so that the normal life of surrounding residents will be not affected. Sewage occurring during the construction will be treated by sedimentation biochemical treatment, therefore the local water quality will not be affected.

Resettlement
A small number of people (11 households or 39 people） were resettled and 1,714m^2 of farmland was affected by the construction of the power house and the inundation of the reservoir area. The resettlement plan was made in line with the national regulations and Sichuan provincial regulation on the construction land use and resettlement[30]. The resettlement plan was approved by the Hejiang County Government[31]. The Territorial Bureau of Hejiang

[30] See Territorial Bureau of Sichuan Province: [2005]349

[31] See the Approval on Construction Land Use and Resettlement Plan of the Project

County was responsible for carrying out all resettlement compensation measures. Copies of all the resettlement compensation contracts and receipts of the compensation are available from the Project Developer.

A stakeholder consultation with 100 people was conducted as part of the EIA. The stakeholders consulted were mainly local residents of the Dachuo Village and Modanxi Village in Fubao Town of Yuanxing County who were the most affected area by the reservoir inundation. The stakeholder consultation received 83% participation, and the results of the survey have shown that 100% of the stakeholders who responded supported the construction of the proposed project[32]. It is the general opinion that the construction of this Project could help to solve the conflict between power supply and demand, and promote sustainable development of the national economy.

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 environment. Mitigation measures ensure that there are no residual significant adverse impacts associated with the project.

[32] See the results of the Stakeholder consultation from EIA.

SECTION E. Stakeholders' comments

>>

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

>>

In addition to the stakeholder consultation in the EIA, a CDM stakeholder consultation for the project activity took place from 25/05/2007 to 08/06/2007. The local stakeholders were invited to submit comments on the project activity filling a questionnaire sent out by the project developer on the 25th May 2007 and collected within two weeks.

The questionnaires included a technical description of the project as well as a brief explanation of what the Clean Development Mechanism of the Kyoto Protocol is and how it mitigates climate change and brings sustainable development benefits to the Host Country. 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?
- Are there any negative impacts on your livelihood during the construction of the CDM project?
- What would be the overall positive effects of the construction and operation of the CDM Project?
- What would be the overall negative effects of the construction and operation of the CDM Project?
- What is your attitude towards the construction of the CDM Project?
- Do you support the construction of the CDM Project?

50 questionnaires were sent to the stakeholders by the project developer. The stakeholders included local governmental officials (5 people), local residents (40 people) and related employees (5 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 (50 questionnaires returned out of 50). The survey shows the stakeholders believe that the proposed CDM project activity will have positive impacts on the local ecology, environment, employment and social life. All stakeholders expressed their support to the proposed project. A full list of the filled-in questionnaires is available from the project developer and was made available to the DOE during the validation.

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

>>

No negative comments have been received regarding the project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project developer:

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URL:	
Represented by:	ShiqiDong
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding.

Annex 3

BASELINE INFORMATION

Calculation of the Operating Margin Emission Factor of the South China Power Grid

Table A1 CO_2 emissions from thermal power plants of the South China Power Grid (2003)

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	EF (tC/TJ)	Oxidation factor （%）	NCV （MJ/t, kJ/m^3）	CO_2 emissions（tCO_2e） I=G*H*F*E*44/(12*100)（mass unit）
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/(12*10) (volume unit)
Raw Coal	10000t	4491.79	831.84	2169.11	1405.27	8898.01	25.80	100	20908	175993455.05
Clean Coal	10000t	0.05				0.05	25.80	100	26344	1246.07
Other washed coal	10000t			36.38	20.37	56.75	25.80	100	8363	448971.84
Coke	10000t				0.5	0.5	29.20	100	28435	15222.20
Coke Oven Gas	10^8m^3				0.04	0.04	12.10	100	16726	2968.31
Other Coal Gas	10^8m^3	3.21			11.27	14.48	12.10	100	5227	335797.81
Crude oil	10000t	6.85				6.85	20.00	100	41816	210055.71
Gasoline	10000t	0.02				0.02	18.90	100	43070	596.95
Diesel	10000t	31.9			0.76	32.66	20.20	100	42652	1031759.27
Fuel Oil	10000t	627.22	0.3			627.52	21.10	100	41816	20301304.48
LPG	10000t					0	17.20	100	50179	0.00
Refinery Gas	10000t	2.85				2.85	15.70	100	46055	75560.14
Natural Gas	10^8m^3					0	15.30	100	38931	0.00
Other petroleum products	10000t	11.35				11.35	20.00	100	38369	319357.98
other coking products	10000t					0	25.80	100	28435	0.00
Other energy	10000tce	93.21			22.35	115.56	0.00	0	0	0.00
									total	198736295.81

Data source: China Energy Statistics Yearbook 2004

Table A2 Electricity Generation of South China Power Grid (2003)

Province	Electricity generation (MWh)	Used by the power station (%)	Power output (MWh)
Guangdong	143351000	5.50	135466695
Guangxi	17079000	8.43	15639240
Guizhou	43295000	7.40	40091170
Yunnan	19055000	8.01	17528695
total			208725800

Data source: China Electric Power Yearbook 2004

Table A3 CO_2 emissions from thermal power plants of the South China Power Grid (2004)

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	EF (tC/TJ)	Oxidation factor (%)	NCV (MJ/t, kJ/m³)	CO_2 emissions (tCO_2e) I=G*H*F*E*44/(12*100) (mass unit) I=G*H*F*E*44/(12*10) (volume unit)
		A	B	C	D	E=A+B+C+D	F	G	H	
Raw Coal	10000t	6017.7	1305	2643.9	1751.28	11717.88	25.80	100	20908	231767573.55
Clean Coal	10000t	0.21				0.21	25.80	100	26344	5233.50
Other washed coal	10000t					0	25.80	100	8363	0.00
Coke	10000t					0	29.20	100	28435	0.00
Coke Oven Gas	10^8m^3					0	12.10	100	16726	0.00
Other Coal Gas	10^8m^3	2.58				2.58	12.10	100	5227	59831.38
Crude oil	10000t	16.89				16.89	20.00	100	41816	517932.98
Gasoline	10000t					0	18.90	100	43070	0.00
Diesel	10000t	48.88			1.83	50.71	20.20	100	42652	1601975.28
Fuel Oil	10000t	957.71				957.71	21.10	100	41816	30983494.25
LPG	10000t					0	17.20	100	50179	0.00
Refinery Gas	10000t	2.86				2.86	15.7	100	46055	75825.26
Natural Gas	10^8m^3	0.48				0.48	15.30	100	38931	104833.40
Other petroleum products	10000t	1.66				1.66	20.00	100	38369	46707.86
other coking products	10000t					0	25.80	100	28435	0.00
Other energy	10000tce	79.42				79.42	0.00	0	0	0.00
									total	265163407.45

Data source: China Energy Statistics Yearbook 2005

Table A4 Electricity Generation of South China Power Grid (2004)

Province	Electricity generation (MWh)	Used by the power station (%)	Power output (MWh)
Guangdong	169389000	5.42	160208116
Guangxi	20143000	8.33	18465088
Guizhou	49720000	7.06	46209768
Yunnan	24322000	7.56	22483257
total			247366229

Data source: China Electric Power Yearbook 2005

Table A5 CO_2 emissions from thermal power plants of the South China Power Grid (2005)

Fuel Type	Unit	Guangdong	Guangxi	Guizhou	Yunnan	Subtotal	EF (tC/TJ)	Oxidation factor （%）	NCV （MJ/t, kJ/m^3）	CO_2 emissions（tCO_2e） I=G*H*F*E*44/(12*100)（mass unit）
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/(12*10) (volume unit)
Raw Coal	10000t	6696.47	1435	3212.31	1975.55	13319.33	25.80	100	20908	263442601.85
Clean Coal	10000t				0.15	0.15	25.80	100	26344	3738.21
Other washed coal	10000t			10.39	33.88	44.27	25.80	100	8363	350237.59
Coke	10000t	4.79			8.05	12.84	29.20	100	28435	390906.18
Coke Oven Gas	10^8m^3				0.79	0.79	12.10	100	16726	58624.07
Other Coal Gas	10^8m^3	1.87			15.96	17.83	12.10	100	5227	413485.84
Crude oil	10000t	10.91				10.91	20.00	100	41816	334555.88
Gasoline	10000t	0.68				0.68	18.90	100	43070	20296.31
Diesel	10000t	31.96	2.02		1.81	35.79	20.20	100	42652	1130638.84
Fuel Oil	10000t	887.21				887.21	21.10	100	41816	28702703.26
LPG	10000t					0	17.20	100	50179	0.00
Refinery Gas	10000t	4.92				4.92	15.7	100	46055	130440.66
Natural Gas	10^8m^3	0.93				0.93	15.30	100	38931	203114.71
Other petroleum products	10000t	1.7				1.7	20.00	100	38369	47833.35
other coking products	10000t					0	25.80	100	28435	0.00
Other energy	10000tce	104.66	133.15		59.72	297.53	0.00	0	0	0.00
									total	295229176.74

Data source: China Energy Statistics Yearbook 2006

Table A6 Electricity Generation of South China Power Grid (2005)

Province	Electricity generation (MWh)	Used by the power station (%)	Power output (MWh)
Guangdong	176080000	5.58	166606923
Guangxi	24800000	7.95	23033672
Guizhou	58076000	7.34	54141238
Yunnan	27933000	6.94	25387699
total			269169531

Data source: China Electric Power Yearbook 2006

Table A7 Power transferred from the Central Power Grid to the South China Power Grid

		2003	2004	2005
Power transferred	MWh	11100	10951240	96363000
Emission factor	tCO_2/MWh	0.7973	0.8273	0.7722

Table A8 Operating Margin Emission Factor of the South China Power Grid

		2003	2004	2005	Average EF_{OM} (tCO_2/MWh)
Total CO_2 emissions	tCO_2	198745146.3	274223576.0	369636773.2	**1.0120**
Electricity generation	MWh	208736899.8	258317469.1	365532530.7	

Calculation of the Build Margin Emission Factor of the South China Power Grid

Table A9 Calculation of the relevant emission factor of coal based power station

	Efficiency A	**Carbon content (tC/TJ)** B	**Oxidation factor (%)** C	**Emission factor (tCO_2/MWh)** D=3.6/A/1000*B*C*44/12
EF coal,Adv	35.82%	25.8	100%	0.9508
EF gas,Adv	47.67%	15.3	100%	0.4237
EF oil,Adv	47.67%	21.1	100%	0.5843
Source	Statistics by the State Electricity Regulatory Commission (SERC) on newly built thermal plants in the 10th "Five-Year Plan" period 2000-2005, and Data from the NDRC (http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf	2006 IPCC Guidelines for National Greenhouse Gas Inventories	2006 IPCC Guidelines for National Greenhouse Gas Inventories	

Table A.10 Share of different fossil fuels in the total CO_2 emissions from thermal power plants of the South China Power Grid

Item	**Value**
λcoal	89.49%
λoil	10.24%
λgas	0.27%

Therefore $EF_{thermal}$ =89.49%*0.9508 + 10.24%*0.4237 + 0.27%*0.5843 = 0.9118 tCO_2e/MWh

Table A11 Installed capacity in the South China Power Grid in 2005

Type	Unit	**Guangdong**	**Guangxi**	**Guizhou**	**Yunnan**	**Tianshenqiao**	**Total**
thermal power	MW	35182.6	4931.2	9634.8	4758.4	0.0	54507.0
hydro power	MW	9035.7	6085.3	4713.0	7993.1	2520.0	30347.1
nuclear power	MW	3780.0	0.0	0.0	0.0	0.0	3780.0
wind farm and others	MW	83.4	0.0	0.0	0.0	0.0	83.4
total	MW	48081.7	11016.5	14347.8	12751.5	2520.0	88717.5

Data source: China Electric Power Yearbook 2006

Table A12 Installed capacity in the South China Power Grid in 2004

Type	Unit	**Guangdong**	**Guangxi**	**Guizhou**	**Yunnan**	**Total**
thermal power	MW	30172.9	4378.1	7801.8	4306.9	46659.7
hydro power	MW	8584.6	5040.4	6896.5	7058.6	27580.1
nuclear power	MW	3780.0	0.0	0.0	0.0	3780.0
wind farm and others	MW	83.4	0.0	0.0	0.0	83.4
total	MW	42620.9	9418.5	14698.3	11365.5	78103.2

Data source: China Electric Power Yearbook 2005

Table A13 Installed capacity in the South China Power Grid in 2003

Type	Unit	**Guangdong**	**Guangxi**	**Guizhou**	**Yunnan**	**Tianshenqiao**	**Total**
thermal power	MW	27231.4	3190.1	6465.8	3556.8		40444.1
hydro power	MW	8107.2	4525.2	3713.7	6543.2	2520.0	25409.3
nuclear power	MW	3780.0	0.0	0.0	0.0		3780.0
wind farm and others	MW	83.4	0.0	0.0	0.0		83.4
total	MW	39202.0	7715.3	10179.5	10100.0	2520.0	69716.8

Data source: China Electric Power Yearbook 2005

Table A14 Determination of the Build Margin Emission of the South China Power Grid

Type	**installed capacity in 2003** A	**installed capacity in 2004** B	**installed capacity in 2005** C	**new added installed capacity from 2003 to 2005** D=C-A	**Split of new capacity**
thermal power	40444.1	46659.7	54507.0	14062.9	**74.01%**
hydro power	25409.3	27580.1	30347.1	4937.8	25.99%
nuclear power	3780.0	3780.0	3780.0	0.0	0.00%
wind farm and others	83.4	83.4	83.4	0.0	0.00%
total	69716.8	78103.2	88717.5	19000.7	100.00%
compared to the capacity in 2005	78.58%	88.04%	100.00%		

Therefore, EF_{BM} = 0.9118*74.01% = 0.6748 tCO_2/MWh

Table A15 Baseline Emission Factor of the South China Power Grid (tCO_2/MWh)

A	Operating Margin Emission Factor (tCO_2/MWh)	1.0120
B	Build Margin Emission Factor (tCO_2/MWh)	0.6748
C	Combined Emission Factor (C=0.5*A+0.5*B) (tCO_2/MWh)	**0.8434**

Baseline Calculation

Table A16 Generation of the South China Power Grid in 2001

	Guangdong	Guangxi	Guizhou	Yunnan	Total in South China Grid
	A	B	C	D	E=A+B+C+D
Thermal generation(GWh)	109119	12110	27376	14305	162910
Hydro generation(GWh)	19073	17609	9565	21648	67895
Generation from other sources(GWh)	15000				15000
Total generation in province(GWh)	143192	29719	36941	35953	245805

Percentage of thermal generation in 2001	66%
Percentage of all other resouces in 2001	34%

Data source: China Electric Power Yearbook 2002

Table A17 Generation of the South China Power Grid in 2002

	Guangdong	Guangxi	Guizhou	Yunnan	Total in South China Grid
	A	B	C	D	E=A+B+C+D
Thermal generation(GWh)	123081	13069	33231	15787	185168
Hydro generation(GWh)	16913	18634	9512	25062	70121
Nuclear generation(GWh)	20811	0	0	0	20811
Generation from other sources(GWh)	135	0	0	0	135
Total generation in province(GWh)	160940	31703	42743	40849	276235

Percentage of thermal generation in 2002	67%
Percentage of all other resources in 2002	33%

Data source: China Electric Power Yearbook 2003

Table A18 Generation of the South China Power Grid in 2003

	Guangdong	Guangxi	Guizhou	Yunnan	Total in South China Grid
	A	B	C	D	E=A+B+C+D
Thermal generation(GWh)	143351	17079	43295	19055	222780
Hydro generation(GWh)	17136	19288	8019	26837	71280
Nuclear generation(GWh)	28930		0	0	28930
Generation from other sources(GWh)	159	0	0	0	159
Total generation in province(GWh)	189576	36367	51314	45892	323149

Percentage of thermal generation in 2003	69%
Percentage of all other resources in 2003	31%

Data source: China Electric Power Yearbook 2004

Table A19 Generation of the South China Power Grid in 2004

	Guangdong	Guangxi	Guizhou	Yunnan	Total in South China Grid
	A	B	C	D	E=A+B+C+D
Thermal generation(GWh)	169389	20143	49720	24322	263574
Hydro generation(GWh)	14114	17229	23379	29350	84072
Nuclear generation(GWh)	28481	0	0	0	28481
Generation from other sources(GWh)	149	0	0	0	149
Total generation in province(GWh)	212133	37372	73099	53672	376276

Percentage of thermal generation in 2004	70%
Percentage of all other resources in 2004	30%

Data source: China Electric Power Yearbook 2005

Table A20 Generation of the South China Power Grid in 2005

	Guangdong	Guangxi	Guizhou	Yunnan	Total in South China Grid
	A	B	C	D	E=A+B+C+D
Thermal generation(GWh)	176453	25023	58430	27281	287187
Hydro generation(GWh)	20774	19582	21335	33228	94919
Nuclear generation(GWh)	30476	0	0	0	30476
Generation from other sources(GWh)	156	0	0	0	156
Total generation in province(GWh)	227859	44605	79765	60509	412738

Percentage of thermal generation in 2005	70%
Percentage of all other resources in 2005	30%

Data source: China Electric Power Yearbook 2006

Annex 4

MONITORING INFORMATION

FURTHER DETAILS OF THE MONITORING PLAN

Table 4.1.: CDM Monitoring System Procedures

Procedure name	Description	Scope
CDM Staff training	This procedure outlines the steps to ensure that staff receive adequate training to collect and archive complete and accurate data necessary for CDM monitoring.	This procedure should be followed by all CDM staff prior to performing any monitoring duties for the CDM project.
CDM data and record keeping arrangements	This procedure provides details of the sites data and record keeping arrangements. The arrangements ensure that complete and accurate records are retained by the CDM Manager within the quality control system.	All data and records should be managed following this procedure. All CDM staff are responsible for ensuring that any data or records are dealt with according to this procedure.
Data collection	This procedure will outline the steps to collect the data from the main grid company electricity meter and the cross check meter (on site).	The procedure for the data collection of the revenue meter should be agreed on by the grid company and the project developer
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 two electricity meters, and checks of the electricity figures on the receipts. All records will be checked for completeness.	The CDM Manager is responsible for ensuring that QA is carried out on all data.
Internal audits	This procedure will outline the process of internal audits, where the performance of the project will be assessed. It will also provide details on the follow-up of corrective actions arising after a third party verification.	This procedure should be followed by all CDM staff involved in internal audits.

Electricity meter check	This procedure outlines the steps to provide regular and preventative check to the main electricity meter and the cross-check electricity meter.	This procedure should be followed by all staff involved in checking and maintaining the on site electricity meter. The revenue meter will be sealed by the project developer and the grid company jointly. One party cannot unseal or modify the electricity meter in the absence of the other party.
Equipment failure	This procedure details the process of data collection in the case that a problem with any meter occurs.	This procedure should be agreed on by the grid company and the project developer.
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 the calibration to the relevant standards.	The calibration of the electricity meters will be conducted by a suitable company according to the relevant standards. The CDM Manager is responsible for organising the calibration and ensuring that records are retained.

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.

Table 4.2. : **(E = responsible for executing data collection, R = responsible for overseeing and assuring quality, I = to be informed)**

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

Legend: *E = responsible for executing data collection, R = responsible for overseeing and assuring quality, I = to be informed*

Figure 4.1. Line Diagram of the Project