



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

CONTENTS

- A. General description of the small scale project activity
- B. Application of a baseline and monitoring methodology
- C. Duration of the project activity / crediting period
- D. Environmental impacts
- E. Stakeholders' comments

Annexes

- Annex 1: Contact information on participants in the proposed small scale project activity
- Annex 2: Information regarding public funding
- Annex 3: Baseline information
- Annex 4: Monitoring Information

**Revision history of this document**

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

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

Changtan Hydro Power Project in Guizhou Province
Version 02
04 December 2007

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

The Changtan Hydro Power Project in Guizhou Province (hereafter referred to as “the Project”) developed by Sinan Tengyuan Shuanghe Electric Power Co., Ltd (hereafter referred to as the “Project Developer”) is a small-scale reservoir-based hydropower project in China (hereafter referred to as the “Host Country”). Total installed capacity of the Project will be 5 MW, consisting of two 2.5 MW turbines, with a predicted power supply of 19,501 MWh per annum.

The Project will utilise the hydrological resources of the Shiqian River in a small scale hydropower facility that will generate low emissions electricity for the South China Power Grid (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 tCO₂/MWh and a build margin emission factor of 0.6748 tCO₂/MWh. The Project is therefore expected to reduce emissions of greenhouse gases (GHG) by an estimated 16,447 t CO₂e 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
- Enhances the local investment environment and therefore improves the local economy
- Diversifies the sources of electricity generation, which is important for meeting growing energy demands and the transition away from diesel and coal-supplied electricity generation
- Makes greater use of renewable hydroelectric resources
- Contributes to poverty alleviation through income and employment generation by employing people throughout the project operation.

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)
P.R. China (host)	Sinan Tengyuan Shuanghe Electric Power 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:

A.4.1.1. Host Party(ies):

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

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

Guizhou Province

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

Sinan County

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

The proposed project is located on the common boundary of the towns of Dabachang and Xinglongchang, which both belong to the Sinan County, in the northeast of Guizhou Province. It is situated on the medium and lower reaches of Shiqian River, which is the first branch of the Wujian System. Its exact location defined using geographic coordinates obtained with a Global Positioning System (GPS) receiver is as follows: Longitude 108°18'09" E and Latitude 27°43'41" N¹.

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

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 proposed Project is a new reservoir hydro power station. The increased flooded area due to the project is 256,041 m² and the installed capacity is 5 MW, so the power density is 19.5 W/m². There is an overflow in the middle of the dam, close to the right bank. The water intake is situated on the left portion of the dam. The water flow is transported to the power house through a pressure steel pipeline, creating a 14.2 m water head. Two SF2500-24/3250 turbines and two ZDJP502-LJ-190 generators, the installed capacity of which is 2.5 MW each for a total of 5 MW, are used to generate electricity. After power generation the water is discharged into the Shiqian River through a tailrace.

The power generated will be transmitted into the local grid through a 35kV line, then into the Guizhou Power Grid and finally into the South China Power Grid.

The proposed Project belongs to the development plan for the Shiqian River and will not impact the hydro power stations located on the upper or low reach.

¹ See: the Preliminary Design Report of Changtan Hydro Power Station in Sinan County



Table A.4.1 below presents the main technical parameters of the Changtan Hydro Power Project in Guizhou Province.

Table A.4. 1. Main technical parameters of the proposed project

	Value	Source
Installed capacity (MW)	5	Preliminary Design Report*
Annual operating time (hours)	4,020	Preliminary Design Report
Expected annual power supply to the grid (MWh)	19,501	Preliminary Design Report
Water head (m)	14.2	Preliminary Design Report
Design flow (m ³ /s)	42.32	Preliminary Design Report
Power loss (%)	3	Calculated according to Preliminary Design Report

*the Preliminary Design Report of Changtan Hydro Power Station in Sinan County was carried out by Zunyi Design Institute for Water Resources and Hydroelectric Power in 2004 was approved by the Development and Reform Bureau of Tongren District in Guizhou Province in 2004, document No. 608[2004]

The Project started construction in November 2004, after the CDM was considered² (refer to section B.5 for more details), and the total construction period was estimated to be 24 months. The first generator started operation in August 2006 and the second one in November 2006.

The Project uses state of the art but known technology in electricity generation and transmission. The Project Developer is experienced in handling and operating this kind of equipment. According to the Environmental Impact Assessment of the Project, the impact of the Changtan hydropower station on the local environment is not considered significant. Moreover, with the contribution made by the Project to the local and national sustainable development, the Project is expected to have an overall positive impact on the local and global environment. As a result, it can be considered environmentally safe.

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

Year	Estimation of annual emission reductions in tonnes of CO₂e
2008*	16,447
2009*	16,447
2010*	16,447
2011*	16,447
2012*	16,447
2013*	16,447
2014*	16,447
Total estimated reductions (tonnes of CO₂e)	115,130
Total number of crediting years	7

² See: Letter from the local government suggesting the project developer to develop Changtan Hydro Power Project as a CDM project – August 2004



Annual average of the estimated reductions over the crediting period (tCO₂e)	16,447
--	--------

* full years from 1 June to 1 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:

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 activities³, the Changtan Hydro Power Project in Guizhou Province 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;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the Changtan Hydro Power Project in Guizhou Province at the closest point.

³ <http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf>

**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:**

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 therefore applicable. For more information about the methodology, please refer to the website below:

<http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>

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

AMS I.D. Version 11, 18 May 2007⁴ is applicable since:

- The project activity is a renewable electricity project (hydroelectric);
- The Project activity is no a combined heat and power (co-generation) system
- The project has an output capacity lower than 15 MW (Decision -/CMP2 paragraph 28 (a)): the project has an installed capacity of 5 MW;
- 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:

As referred to in Appendix B for small-scale project activities methodology AMS I.D, 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 (see Table B.3.1 below).

The baseline includes the emissions related to the electricity produced by the facilities and power plants to be displaced by the Changtan Hydro Power Project in Guizhou Province. This involves emissions from displaced fossil fuel use at power plants connected to the South China Power grid (SCPG) (see Table B.3.1 below).

The power generated by the Project will be transmitted into the Guizhou Power Grid, and then into the SCPG. The SCPG is a regional power grid in China, including Guizhou, Yunnan, Guangxi and Guangdong Grids. Therefore, the spatial extent of the project boundary includes the project site and all power plants connected physically to the SCPG.

⁴ According to the definition of Small Scale renewable energy project activities in Paragraph 6 of Decision 17/cp.7 in document FCCC/CP/2001/13/ADD/2, and Appendix B to decision 21/cp.8 of document FCCC/CP/2002/7/Add.3, of the simplified procedures for small-scale activities: Type I.D – Renewable Electricity Generation for a Grid is defined 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.

**Table B.3.1.** Emission sources and gases included in the project boundary for the purpose of calculating project emissions and baseline emissions.

	Source	Gas	Included?	Justification / Explanation
Baseline	South China Power Grid electricity production	CO ₂	Included	According to AMS.I.D, only CO ₂ emissions from electricity generation should be accounted for.
		CH ₄	Excluded	According to AMS.I.D.
		N ₂ O	Excluded	According to AMS.I.D.
Project Activity	Changtan Hydro Power Project in Guizhou Province electricity production	CO ₂	Excluded	According to AMS.I.D.
		CH ₄	Excluded	According to AMS.I.D.
		N ₂ O	Excluded	According to AMS.I.D.

B.4. Description of baseline and its development:

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

Alternative 1: The proposed project activity without CDM, i.e. the construction of a new hydroelectricity generation plan with an installed capacity of 5 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

The barrier analysis in Section B.5 shows that the proposed project faces an investment barrier that would prevent its implementation without the CDM but not the implementation of the relevant alternative, i.e. the continuation of the current situation (See Table B.4.1. below). Alternative 2 is the baseline scenario.

Table B.4.1. Assessment of the alternatives

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Barrier Evaluated	The proposed project activity undertaken without being registered as a CDM project activity	Continuation of the current situation	Construction of a thermal power plant with the same installed capacity or the same annual power output	Construction of a power plant using another renewable energy resource with the same installed capacity or the same annual power output
Investment	Yes	No		

This is not in line with



<i>Conclusion of the barrier analysis</i>	<i>The project is deemed to be additional.</i>	<i>This is the baseline scenario.</i>	applicable laws and regulations, and is not considered in the assessment of alternatives ⁵ .	renewable sources, such as wind resources ⁶ , solar energy ⁷ . So far, there was little use of the other renewable sources in Guizhou Province, the installed capacity of wind farms and other renewable energy technologies is 0 MW ⁸ . Therefore, <i>Alternative 4</i> is not realistic and credible and is not considered further in the assessment of the alternatives
---	--	---------------------------------------	---	---

For the full assessment of alternatives and the identification of the baseline, see section B.5.

Therefore there are two alternatives remaining after this assessment: *alternative 1* and *alternative 2*. *Alternative 2* is identified as the baseline scenario (the full assessment of the remaining alternatives is presented in section B.5).

Electricity delivered to the grid by the project 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.4.2: Key Information and Data Used to Determine the Baseline Scenario

Variable	Value / Unit	Source
Operating Margin Emission Factor	1.0120 tCO ₂ /MWh	Calculated from the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2004-2006
Build Margin Emission Factor	0.6748 tCO ₂ /MWh	Calculated from the China Energy Statistics Yearbook 2006 and the China Electric Power Yearbooks 2003-2006
Combined Margin Emission Factor	0.8434tCO ₂ /MWh	Calculated from the China Energy Statistics Yearbooks 2004-2006 and the China Electric Power Yearbooks 2003-2006
Power supplied to the grid by the project in year y	19,501 MWh	Preliminary Design Report

⁵ 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

⁶ <http://www.newenergy.org.cn/html/2003-9/2003991.html>

⁷ <http://www.newenergy.org.cn/html/2003-8/2003883.html>

⁸ CHINA ELECTRIC POWER YEARBOOKS (2006)

**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:**

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 profile⁹. There are no laws compelling the project developer to develop hydroelectric plants.

The main sectoral policy relevant to this project activity is the promotion of renewable energy in China, the Renewable Energy Law of the People's Republic of China, which came into effect 1 January 2006. 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 sources¹⁰. However, there are no direct incentives such as financial grants, higher tariffs or subsidised loans available for these types of project. In addition to that, moves to increase energy efficiency and renewable energy are set in the China's 11th Five-Year Plan, but these are a target, and the Plan is not a law¹¹.

Below, in accordance with Attachment A of Appendix B of the simplified modalities and procedures for small-scale CDM project activities, appears a qualitative analysis which demonstrates that the project activity would not be implemented without CDM financing due to the existence of an investment barrier.

Investment Barriers:***Benchmark Analysis:***

The likelihood of the development of this project, as opposed to the continuation of the purchase of grid electricity from the current electricity generation mix (i.e. the baseline) will be determined by comparing the project IRR (without CDM) with benchmark rates available to a local investor, i.e. those provided by local banks, or investment bonds in the Host Country. According to the "Economic Evaluation Code for Small Hydropower Projects SL16-95 (Document No. SL16-95)¹²", published by the Ministry of Water Resources of the PRC, the IRR of small-scale hydro power projects in China (smaller than 50 MW) should be higher than 10%, which is also the minimum IRR the project developer can accept. Thus a 10% benchmark for the IRR of this project applies.

Table B.5.1 below shows the financial analysis for the project activity at the time that the decision to go ahead was made, without and with CDM financing. As shown, the project IRR without CDM financing was lower than the benchmark rate of 10%. This therefore indicates that in comparison to other alternative investments, the project was not financially attractive in the absence of CDM financing.

⁹ Source: State Council's Decision on Reforming Investment Approval Process, July 16, 2004.

¹⁰ This Law does not question the baseline, since it is being implemented only now i.e. after the entry into force of decision 17.CP 7, and therefore does not need to be taken into account.

¹¹ See: Point Carbon. CDM & JI Monitor: *Chinese official defends additionality of renewables in CDM*. 21 March 2007

¹² <http://www.cws.net.cn/guifan/bz%5CSL16-95>

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

	Without CDM	With CDM
IRR	6.30 %	10.28%

Details for calculating the IRR are provided in table B.5.2

Table.B.5.2. Economic parameters used in the financial analysis of the project

Name	Value	Source
Installed capacity (MW)	5	Preliminary Design Report*
Operating time (hours)	4,020	Preliminary Design Report
Income tax (%)	33	Preliminary Design Report
VAT (%)	6	Preliminary Design Report
Tariff, including VAT (RMB yuan/MWh)	240.00	Preliminary Design Report
Total investment (RMB yuan)	34,235,300	Preliminary Design Report
Operating costs (RMB yuan/MWh)	31.64	Preliminary Design Report

*the Preliminary Design Report of Changtan Hydro Power Station in Sinan County was carried out by Zunyi Design Institute for Water Resources and Hydroelectric Power in 2004 was approved by the Development and Reform Bureau of Tongren District in Guizhou Province in 2004, document No. 608[2004]

A sensitivity analysis was conducted by altering the following parameters:

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

Table B.5.3 summarizes the results of the sensitivity analysis, in showing the variations needed to reach the 10% benchmark.

Table B.5.3. Results of the sensitivity analysis

	Variation of the parameter needed to reach the 10% IRR benchmark
Operating Costs	218.0% decrease ¹³
Investment Costs	26.4% decrease
Electricity Tariff	30.8% increase
Operating hours	30.8% increase

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

- **Operating costs:** a 218% decrease is not realistic and not achievable. 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%.

¹³ This indicates that even if the project incurred zero operating costs, the IRR of the project would remain below 10%.



- **Investment costs:** a 26.4% decrease in investment costs is very unlikely to happen, as it is much more likely that hydro power projects will experience cost *increases* rather than cost decreases during construction¹⁴.
- **Electricity tariff:** the tariff fixed by the Price Control Bureau of Guizhou Province in November 2006 is only 0.2084 yuan/MWh, which is lower than what expected in PDR. Moreover, P. R. China has been applying a new electricity tariff control policy, known as the “Price Competition for Power Supply to the Grid” policy¹⁵, in the power industry since 2002. Free competition between power plants is encouraged in order to lower cost of power production and thereby electricity tariffs. This shows that a 30.8% increase in the electricity tariff is highly unrealistic; therefore, the IRR is not likely to reach the benchmark due to an increase in electricity tariff.
- **Operating hours:** the operating hours in Preliminary Design Report based on the long time series of historical hydrological statistics made by Zunyi Design Institute for Water Resources and Hydroelectric Power. As these calculations are made based on historical data, the operating hours are likely to fluctuate only within a small range. Assuming a 30.8% increase in annual operating hours is thus illogical and the IRR is not likely to reach the benchmark from an increase in operating hours.

These results show that very favourable circumstances, which are not realistic, are needed for the Project IRR to reach 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 financial analysis, and therefore that the project is also not financially attractive. This demonstrates that the project activity would not be implemented without the CDM.

The barrier analysis shows that the proposed Project faces an investment barrier that would prevent its implementation without the CDM but not the implementation of the relevant alternative, i.e. *Alternative 2* - the continuation of the current situation, which is identified as the baseline scenario. i.e. the continuation of the current situation. The Project activity is thus not the baseline scenario and is deemed to be additional.

Considering the low expected returns and high risks, the project developer was hesitating on going ahead until the Sinan County Development and Reform Bureau informed the Project Developer about the benefits of the CDM and the additional cash flow for the project that CER revenues would provide in August 2004¹⁶. The Project Developer decided to go ahead with the project as a CDM project, given that the CER revenues raises the IRR up to 10.28%, which is above the 10% benchmark. CDM financing brings many other attendant benefits for the project developer including international participation in the Project and an enhanced sustainability image and profile. After the decision to proceed, construction of the Project started in November 2004.

¹⁴ The construction of the Project is finished and the actual investment costs are higher than what expected in the PDR. The survey and audit for construction cost is ongoing, the audited value already reach RMB 52,000,000yuan, much higher than the expected value in PDR. See the Information letter from Guizhou XinQianrui Accounting Firm Co. Ltd.

¹⁵ the Notice of the State Council on Printing and Distributing the Plan Regarding the Restructuring of the Power Industry (No.5 [2002] of the State Council)

¹⁶ See: Letter from the Sinan Development and Reform Bureau - 11th August 2004

**B.6.1. Explanation of methodological choices:**

AMS I.D. (Version 11, 18 May 2007) offers two 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 CO₂equ/kWh) of the current generation mix.

Option (a) above will be applied for this project, which uses a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures described in ACM0002.

This PDD follows the calculation steps published by the Chinese DNA (the Director's Office of the Chinese National Climate Coordination body of NDRC) to determine the Operating Margin (OM) emission factor¹⁷ and the Build Margin emission factor (BM)¹⁸ using the most recent data available.

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) OM emission factor

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 resources¹⁹), making option (d) not applicable. Moreover, detailed data to apply option (b) is not available, and detailed data to apply option (c) is also unavailable.

The simple Operating Margin (OM) Emission Factor ($EF_{OM, simple, y}$) is calculated *ex-ante* as the generation-weighted average emissions per electricity unit (tCO₂/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.

¹⁷ See <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls> for the EF_{OM}

¹⁸ See <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf> for the EF_{BM}

¹⁹ China Electric Power Yearbooks 2002-2006; refer to Annex 3 for detailed calculation.



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.

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

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 CO₂ emissions coefficient of fuel i (tCO₂/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 CO₂ emission coefficient is obtained as

$$COEF_i = NCV_i \cdot EF_{CO_2,i} \cdot OXID_i \quad (2)$$

Where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i (country-specific values are used);

$OXID_i$ is the oxidation factor of the fuel (IPCC 2006 default values are used);

$EF_{CO_2,i}$ is the CO₂ emission factor per unit of energy of the fuel i (IPCC 2006 default values are used).

$EF_{OM,y} = 1.0120$ tCO₂/MWh.

For detailed information, please see Annex 3.

The Operating Margin emission factor ($EF_{OM,y}$) is calculated *ex-ante*, and cannot be changed during the crediting period.

b) BM emission factor

The Build Margin (BM) emission factor ($EF_{BM,y}$) is calculated as the generation-weighted average emission factor (tCO₂/MWh) of a sample of power plants m , as follows:

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

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

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 type²⁰.

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

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

Where:

$CAP_{thermal,y-n,y}$ 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 ($y-1, y-2, \dots, y-n$) which have to be considered to achieve the 20% capacity addition to the current electricity generation capacity.

The result for “ n ” should lead to the following equation being realised:

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

From 2003 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 ” = 2 (Please see Annex 3).

$EF_{thermal,adv}$ 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:

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

Where:

$EF_{i,adv}$ is the CO₂ emission factor of fuel i (tCO₂/MWh) using the best commercially available technology in China and taking into account the carbon content and the oxidation factor of fuel i ²¹
 $COAL$, OIL , and GAS represent solid fuel, liquid fuel and gaseous fuel respectively, and

λ_i is the weight of CO₂ emissions from fuel i fired power plants in the total CO₂ emissions from thermal power, using the most recent available data.

²⁰ See: <http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM> and http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

²¹ See <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf>



Therefore, the Build Margin emission factor $EF_{BM,y}$ of the South China Power Grid is 0.6748 tCO₂/MWh.

For detailed information, please see Annex 3.

The Build Margin emission factor ($EF_{BM,y}$) is calculated ex-ante, and cannot be changed during the crediting period.

c) Combined margin emission factor

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:

$$EF_y = \omega_{OM} \cdot EF_{OM,y} + \omega_{BM} \cdot EF_{BM,y} = 0.5 \cdot 1.0120 + 0.5 \cdot 0.6748 = 0.8434 \text{ tCO}_2/\text{MWh} \quad (7)$$

Where:

- EF : baseline emission factor (tCO₂/MWh)
- ω_{OM} : Operating Margin weight, which is 0.5 by default
- $EF_{OM,y}$: Operating Margin emission factor (tCO₂/ MWh)
- ω_{BM} : Build Margin weight, which is 0.5 by default
- $EF_{BM,y}$: Build Margin emission factor (tCO₂/MWh)
- y : a given year

Then baseline emissions (BE_y) are obtained as:

$$BE_y = EG_y * EF_y \quad (8)$$

Where:

- BE : Baseline emissions (tCO₂)
- EG : Electricity supplied by the project to the grid (MWh)
- EF : baseline emission factor (tCO₂/MWh)
- y : a given year

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

Data / Parameter:	<i>Installed Capacity of project activity</i>
Data unit:	MW
Description:	The installed capacity of the project
Source of data used:	<i>Preliminary Design Report</i>
Value applied:	5
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is from the Preliminary Design Report.
Any comment:	
Data / Parameter:	$F_{i,j,y}$



Data unit:	t, m³
Description:	The amount of fuel <i>i</i> consumed by relevant power source <i>j</i> in years <i>y</i> .
Source of data used:	<i>China Energy Statistics Yearbooks (2004-2006)</i>
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:	$GEN_{j,y}$
Data unit:	MWh
Description:	The electricity generation by source <i>j</i> in year <i>y</i> of each province connected to the SCPG.
Source of data used:	<i>China Electric Power Yearbooks (2002-2006)</i>
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:	<i>Internal use rate of power Station</i>
Data unit:	%
Description:	The internal use of power source <i>j</i> in each province connected to the SCPG.
Source of data used:	<i>China Electric Power Yearbooks (2004-2006)</i>
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/m³
Description:	The net calorific value (energy content) per mass or volume unit of fuel <i>i</i> .
Source of data used:	<i>China Energy Statistics Yearbook 2006</i>
Value applied:	See Annex 3
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:	$EF_{CO_2,j}$
Data unit:	tC/TJ
Description:	The CO ₂ emission factor per unit of energy of the fuel <i>i</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, IPCC default value.
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 <i>j</i> of province <i>m</i> in years <i>y</i> .
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:	



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

The ex-ante emission reduction calculations are as follows:

$$ER_y = BE_y - PE_y - L_y$$

Where:

ER: Emission reduction (tCO₂)

BE: Baseline emissions (tCO₂)

PE: Project Emissions (tCO₂)

L: Leakage emissions (tCO₂)

y: a given year

$PE_y = 0$ since hydroelectric power is considered a zero CO₂ emissions source of energy.

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, $L_y = 0$.

And:

$$ER_y = BE_y$$

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

$$BE_y = EG_y * EF_y$$

Where:

BE: Baseline emissions (t CO₂)

EG: Electricity supplied by the project to the grid (MWh)

EF: baseline emission factor (tCO₂/MWh)

y: refers to a given year

Electricity supplied annually by the project to the grid (*EG*) = 19,501 MWh. The baseline emission factor as a combined margin (*EF*) = 0.8434 tCO₂e/MWh

Therefore using the above approach, and the data shown in Annex 3, the baseline emissions will be 16,447 tCO₂e/year 115,130 tCO₂e for the 7-year crediting period.

See Table B.4. below for a summary of the values used and the results of the calculation.

**Table B.4.** Summary of the values used and the results of the calculation

	Per year (average)	7 years
Operating Margin Emissions Factor (EF_{OM} , in tCO ₂ /MWh)	1.0120	1.0120
Build Margin Emissions Factor (EF_{BM} , 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 MWh)	19,501	136,507
Baseline Emissions (BE tCO ₂)	16,447	115,130

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

Year	Estimation of project activity emissions (tCO ₂ e)	Estimation of baseline emissions (tCO ₂ e)	Estimation of leakage (tCO ₂ e)	Estimation of overall emission reductions (tCO ₂ e)
2008*	0	16,447	0	16,447
2009*	0	16,447	0	16,447
2010*	0	16,447	0	16,447
2011*	0	16,447	0	16,447
2012*	0	16,447	0	16,447
2013*	0	16,447	0	16,447
2014*	0	16,447	0	16,447
Total (tonnes of CO₂e)	0	115,130	0	115,130

* full years from 1 June to 1 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 EG_y
Data unit:	MWh
Description:	Electricity delivered to the grid
Source of data to be used:	Measured
Value of data	19,501
Description of measurement methods and procedures to be applied:	Measured continuously and recorded monthly



QA/QC procedures to be applied:	According to national standards, meter(s) will be calibrated periodically. Data measured by meter(s) will be cross checked using electricity sales receipts. The revenue meter(s) will be frequently read by the project developer and the grid company.
Any comment:	Data will be archived at least for two years after the end of the crediting period.

B.7.2 Description of the monitoring plan:

This section details the steps taken to monitor on a regular basis the GHG emissions reductions from the Changtan Hydro Power Project in Guizhou Province in 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

The organisation of the monitoring team will be established prior to the start of the crediting period. 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.

The applicable monitoring procedures will be defined prior to the start of the crediting period. A description of these procedures is provided in Annex 4. They include issues such as training, data quality assurance and control, and relevant back-up procedures.

The procedures will be agreed to and signed off by the Sinan Tengyuan Shuanghe Electric Power Co. Ltd and EcoSecurities. Any changes to procedures will need to be agreed by both parties.

All staff involved in the CDM project will receive some relevant training 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 an appropriate senior manager, will ensure that only trained staff are involved in the operation of the monitoring system.

2. Monitoring equipment and installation

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

Metering of Net Electricity Supplied to the Grid (Revenue Meter)

The main meter(s) used to measure the quantity of electricity supplied to the grid by the hydroelectric power station as well as the electricity purchased from the grid company. As such, the net electricity supplied to the grid can be determined. As the main meter(s) provides the main CDM measurement, which will be the key part of the verification process. The meter(s) will be installed by the grid company according to the following national Chinese standard “electricity meter installation technical management code”.



Electricity meters should meet the relevant local standards at the time of installation. Before the installation of the meters, they should be calibrated by the third accredited equipment testing organisation. Records of the meter (type, make, model and calibration documentation) will be retained in the quality control system.

3. Quality Assurance and Quality Control

The quality assurance and quality control procedures involves of data monitoring, recording, maintaining and archiving, internal check, staff training and monitoring equipment calibration.

The electricity supplied to the Grid will be double-checked against the electricity sale receipt. Calibration for the main meter(s) will be implemented according to the national standards and rules. And all the records will be documented and maintained by the project developer and available to the verifier.

The project developer will discuss with the grid company to specify the QA procedure for measurement and calibration to ensure the measurement accuracy of the revenue meter. Periodic checks should be conducted according to the relevant national standard. For further details on the CDM data quality control and quality assurance see the CDM Monitoring System Procedures in Annex 4.

For the following circumstances, all the meters installed should be tested by an accredited monitoring inspection organisation jointly appointed by the project developer and the grid company:

- a) the error of the revenue meter(s) exceeds the allowable range specified in the relative national standard;
- b) either meter is repaired or replaced due to the faults of the meter parts.

4. Data recording procedure, management and archiving

The process for collecting the electricity meter data will be detailed in a procedure which is summarised below.

Metering Electricity Supplied to the Grid (the main meter(s))

The electricity power supplied into the Grid will be continuously monitored through the main meter and recorded monthly both by the project developer and the grid company. After confirmed with each other, this number will be the amount of the power supplied to the grid.

Each month the monitoring data needs to be filed electronically. The electronic files need to have a back-up. The project developer needs to keep a copy of electricity sale and purchase receipt.

All written documentation such as maps, drawings, the EIA and the Preliminary Design Report, should be stored and should be available to the verifier so that the reliability of the information may be checked.

In order to make it easy for the verifier to retrieve the documentation and information in relation to the project emission reduction verification, the project developer should provide a document register. The document management system will be developed as part of an applicable procedure. 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**.

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 28/06/2007. 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: ying.li@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:**28/11/2004²²**C.1.2. Expected operational lifetime of the project activity:**

20 years

C.2 Choice of the crediting period and related information:**C.2.1. Renewable crediting period****C.2.1.1. Starting date of the first crediting period:**

01/06/2008 (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 and 0 months

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

Not applicable

C.2.2.2. Length:

Not applicable

²² The decision to start construction was made on this date, when the project developer got the construction permit from the supervisory company. This is the earliest date of implementation, construction or real action on the Project.

**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 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 utilising natural resources and beginning project construction. The project developer has therefore commissioned a third party to conduct the environmental impact assessment (EIA) and the EIA report was approved by the Guizhou Province Tongren Territory Environmental Protection Bureau in 2005.

The environmental impact of the Changtan hydropower station is not considered significant. There is no resettlement or relocation of buildings required, therefore social and environmental influences are partial, short-term and reversible.

The main environmental impacts and the mitigation measures taken are summarised in the table below.

Identified environmental impacts	Measures taken
<i>Water pollution</i>	
On the construction site	Waste water from construction will be treated to meet the national discharging standard and then discharged.
Wastewater from the staff	Waste water from the staff will be digested and treated before being reused as farmyard manure.
<i>Air pollution</i>	
Dust and pollution during the construction	Pollution from blasting will be controlled via the installation of dust-abatement devices. This pollution will be restricted to the construction period.
<i>Noise pollution</i>	
Noise during construction	Closest residents live at 500 m from the construction site. As a result they do not suffer from noise pollution. During night time, construction activities will be arranged in order to minimise noise pollution and activities such as blasting and piling will be banned. Noise pollution for the workers will be minimised by the use of personal protective equipment against noise.
<i>Solid waste</i>	
Waste from the construction	Waste from construction will be used as backfill as much as possible and the remaining waste will be disposed of in a special landfill. Protective measures will be taken in order to prevent water and soil losses at the landfill site.
Waste from the staff	Waste from the staff will be collected, treated and disposed.
<i>Biodiversity and ecosystems</i>	
No protected, rare or migratory species (flora or fauna) will be affected by the project.	



<i>Erosion impact assessment</i>	
Some land erosion and associated water and soil loss in the project area will occur prior to the project activity, e.g. due to rock excavation and to the onsite movement of construction-related vehicles.	Additional erosion will be prevented through implementation of measures such as installation of residue blocking walls during construction, vegetation of the special landfill after construction, and re-vegetation of the area surrounding the hydro station and the reservoir.
<i>Reservoir inundation area</i>	
A total of 25.6 ha will be flooded, including mainly barren land, some arable land, and 100 m of road.	The small area that was flooded did not include valuable land. Owners of the flooded lands will be compensated according to Chinese laws and regulations. The compensation plan was signed by the project developer and the Territorial Bureau of Sinan County ²³ . The project does not involve resettlement or relocation of population.

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.

²³ See the agreement on Compensation for the Land Use of Changtan Project signed by the project developer and the Territorial Bureau of Sinan County.

**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 December 2006. The event was publicly announced on a notice board near the project site and questionnaires inviting submission of comments on the project were sent out to local stakeholders.

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 project activity will have on the local environment?
- What impacts do you think the 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 project?
- What would be the overall positive effects of the construction and operation of the Project?
- What would be the overall negative effects of the construction and operation of the Project?
- What is your attitude towards the construction of the Project?
- Do you support the construction of the Project?

74 questionnaires were sent to the stakeholders by the project developer. The stakeholders included local governmental officials (7 people), local residents (21 people) and related employees (46 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 (74 questionnaires returned out of 74). The results show that:

- 100% of stakeholders believe that the proposed CDM project activity will have positive impacts on the local ecology, environment, employment and social life;
- 100% of stakeholders support the construction of the proposed CDM project activity.

All the filled-in questionnaires are available from the project developer.

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

No negative comments have been received on the project.

Annex 1CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY.**Project developer:**

Organization:	Sinan Tengyuan Shuanghe Electric Power Co. Ltd.
Street/P.O.Box:	No.85 Zhonghe Street Sitang Township
Building:	Fourth floor, Industrial and Commercial Bank Building
City:	Sinan County
State/Region:	Guizhou Province
Postfix/ZIP:	550002
Country:	China
Telephone:	86-0856-7229488
FAX:	86-0856-7229488
E-Mail:	XMGLB@126.com
URL:	
Represented by:	www.gzty.com
Title:	Hang Chen
Salutation:	Engineer
Last Name:	Chen
Middle Name:	/
First Name:	Hang
Department:	Market Develop Department
Mobile:	86-13985111038
Direct FAX:	86-0851-5784182
Direct tel:	86-0851-5784182
Personal E-Mail:	XMGLB@126.com

**Project Annex 1 participant:**

Organization:	EcoSecurities Group Plc.
Street/P.O.Box:	40 Dawson Street
Building:	
City:	Dublin
State/Region:	
Postfix/ZIP:	02
Country:	Ireland
Telephone:	+353 1613 9814
FAX:	+353 1672 4716
E-Mail:	info@ecosecurities.com
URL:	www.ecosecurities.com
Represented by:	
Title:	President
Salutation:	Dr.
Last Name:	Moura Costa
Middle Name:	
First Name:	Pedro
Mobile:	
Direct FAX:	
Direct tel:	+44 1865 202 635
Personal E-Mail:	cdm@ecosecurities.com



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 CO₂ 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 ₂ e) 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 ⁸ m ³				0.04	0.04	12.10	100	16726	2968.31
Other Coal Gas	10 ⁸ m 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 ⁸ m 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 CO₂ 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	CO ₂ emissions (tCO ₂ e)
								(%)	(MJ/t, kJ/m ³)	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	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 ⁸ m ³					0	12.10	100	16726	0.00
Other Coal Gas	10 ⁸ m 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 ⁸ m 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 CO₂ 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 ₂ e) 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 ⁸ m ³				0.79	0.79	12.10	100	16726	58624.07
Other Coal Gas	10 ⁸ m 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 ⁸ m 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 CO₂ emissions from thermal power plants of the South China Power Grid

Item	Value
λ _{coal}	89.49%
λ _{oil}	10.24%
λ _{gas}	0.27%

Therefore $EF_{thermal} = 89.49\% * 0.9508 + 10.24\% * 0.4237 + 0.27\% * 0.5843 = 0.9118 \text{ tCO}_2\text{e/MWh}$



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, $EF_{BM} = 0.9118 * 74.01\% = 0.6748 \text{ tCO}_2/\text{MWh}$

Table A15 Baseline Emission Factor of the South China Power Grid (tCO₂/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 resources 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: CDM Monitoring System Procedures**

Procedure name	Description
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.
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.
Data collection	This procedure will outline the steps to collect the data from the main electricity meter.
CDM data quality control and quality assurance	Data and records will be checked prior to being stored and archived. The data checks will include checks of the electricity figures on the receipts. All records will be checked for completeness.
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.
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.
Equipment failure	This procedure details the process of data collection in the case that 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 the calibration to the relevant standards.



The above procedures 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: Operational procedures and responsibilities for monitoring and quality assurance of emissions reductions from the project activity
(E = responsible for executing data collection, R = responsible for overseeing and assuring quality, I = to be informed)

Task	On-site operator	On-site Statistician	CDM Manager (or Appropriate Senior Manager)	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 monthly and annual reports	N/A	E	E/R	N/A	I
Archive data & reports	N/A	E	R	N/A	N/A
Calibration/ Maintenance	I	I	R	E	I
