



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

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**Revision history of this document**

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

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

Project title: Sichuan Tongjiang Gaokeng Hydropower Station Project

PDD Version: 5.0

PDD completion date: 07/08/2008

Revision History:

Version 1.0: First draft

Version 1.1: Second draft, submitted for Host Country Approval

Version 2.0: Minor editorial changes; submitted for validation / global stakeholder comments

Version 3.0: Update following comments from the validator

Version 4.0: Update following comments from the validator

Version 5.0: Update following comments from the validator

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

The Sichuan Tongjiang Gaokeng Hydropower Station Project (hereafter referred to as ‘the project’ or ‘project’) involves the construction of a run-of-river type hydropower station at the main stream of the Tongjiang River in Tongjiang county of Sichuan Province, China.

The purpose of the project is to generate electricity from clean renewable hydro power in Sichuan Province and contribute to the sustainability of power generation of the Central China Grid.

The power generated by the project will displace part of the electric power in Central China grid, which is predominantly based on coal-fired thermal power. Therefore greenhouse gas emissions will be reduced. The estimated annual emission reduction is 49,273 tCO₂e.

The project is a hydropower station consisting of an integrated dam/powerhouse design with a maximum height of 27.1 meters, and total crest length of 118.5 meters. The dam will include eight floodgates, one sand sluice and four water intakes that will lead water into the powerhouse through two penstocks. The hydropower station will install 2 turbine / generator units with an individual installed capacity of 7.5 MW, amounting to a total installed capacity of 15 MW.

The expected operating hours are 3,989 hrs annually, expected annual power generation is 59.84 million kWh, and net expected annual power supply to the grid is 50.56 million kWh.

Power generated by the project will be routed to the Sichuan Provincial Grid through The Tongjiang transformer station. The Sichuan Provincial Grid is part of the Central China Power Grid.

The project activity’s contributions to sustainable development are:

- Reducing the dependence on exhaustible fossil fuels for power generation;
- Reducing air pollution by replacing coal-fired power plants with clean, renewable power;
- Reducing the adverse health impacts from air pollution;
- Reducing the local power shortage in Tongjiang county
- Reducing the emissions of greenhouse gases, to combat global climate change;



- Contributing to local economic development through employment creation.

This project fits with the Chinese government objective to reduce the dependence on exhaustible fossil fuels for power generation, make the energy sector in general and the power sector in particular more sustainable.

A.3. Project participants:

The parties involved in the project are shown in Table A.1:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	the Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	Private entity: Sichuan Yili Energy Investment & Development Co., Ltd. (as the Project Entity)	No
Switzerland	Private entity: Cargill International SA (as the Purchasing Party)	No

For more detailed contact information on participants in the project activities, please refer to 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

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

Sichuan Province

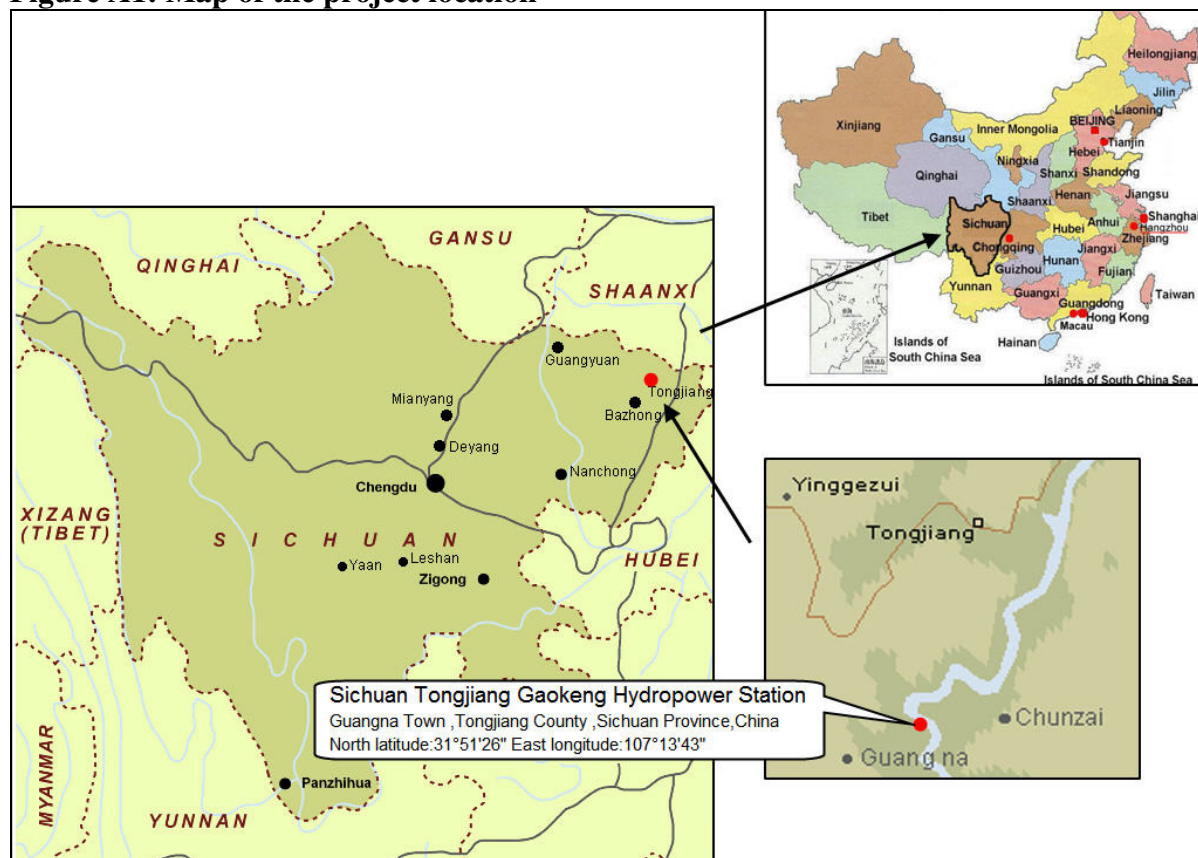
A.4.1.3. City/Town/Community etc:

Tongjiang county of Bazhong city

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

Gaokeng hydropower station project is located at the main stream of Tongjiang river in Tongjiang county of Bazhong city, Sichuan province and it is 12.8 kilometres away from Tongjiang County Seat. The site location's approximate coordinates are east longitude of 107°13'43" and north latitude of 31°51'26". Figure A.1 shows the location of the project.

Figure A1: Map of the project location



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

Sectoral Scope I: Energy Industries.

Category: I.D Grid connected renewable electricity generation

The project activity utilizes the hydro potential for power generation. Thus, the project type is renewable energy. Since the capacity of the proposed project is 15 MW, it satisfies the requirement that the capacity of the project should be at most 15 MW and the project activity can be regarded as a small scale CDM project activity. The power generated is exported to the grid. Thus, according to the small-scale CDM modalities, the project activity falls under Type – I – Renewable Energy Projects and category I.D – Renewable Electricity Generation for a grid.

The project will not expand beyond 15 MW. For technical reasons, the project cannot expand beyond the current installed capacity; additionally, the approval of the Chinese authorities is based on the current technical design of the project; in other words, expansion beyond the current capacity would not be possible without further government approvals.

Technology:

The design has been prepared by the Hydraulic and Hydroelectric Construction Survey Design Institute of Zigong city in Sichuan province. All technologies employed in the project are in accordance with the hydrological conditions and have been used in China before.



The project design consists of a dam with a low head of 14 meters, including a dam, water intake, penstocks, powerhouse, tailrace, stilling pond and a switching station. The dam comprises three sections, i.e. two water retaining sections and one main dam section with eight flood gates, one sand sluice and four water intakes. The structure will be constructed from concrete and kept in place by gravity. The powerhouse will be built behind the dam in the riverbed. The area flooded by the reservoir is 190,300 m² at full capacity, and the power density is 78.8 W/m².

The project will be connected to Tongjiang 110 KV transformer station via an on-site transformer station. The Tongjiang transformer is part of the Sichuan Provincial Grid, which belongs to the Central China Grid.

Two turbine/generator units with an individual capacity of 7.5MW will be installed. The specific technical data are listed in Table A.2.

Table A.2 Basic technical data of the turbine / generator units

Main Technical Data		Value (per unit)
Turbines	Units	2
	Type number	ZZK160-LH-310
	Type	Kaplan turbine
	Nominal capacity	7.772 MW
	Nominal flow rate	61 m ³ /s
	Maximum head	16.63 m
	Nominal head	14 m
Generators	Units	2
	Type number	SF7500-36/5500
	Type	Three pole, vertical axes
	Capacity	7.5 MW
	Nominal revolutions	166.7 rpm
	Power factor	0.8

The turbine/generator units and other auxiliary facilities are manufactured by Fujian Nanping Nandian Hydropower Equipments Manufacturing Co. Ltd. Domestic technology is applied, so it does not lead to technology transfer.

Training and maintenance requirements:

The project entity has made arrangements for its staff to become familiar with the operation and maintenance requirements of a hydropower station. A first training session took place on site from September 2006 and involved theoretical background in operating hydropower stations, emphasizing electricity principles, regulations and safety measures.

The second session starting October 2007 to March 2008 and organized at the Nanjiang hydropower station in Guizhou province which has just become operational mid-2007, covers general operational procedures, monitoring methods, maintenance and safety of the station.

Finally, staff completes its training with a last session on site from March 2008 until operationalization, which will focus on modus operandi of turbines/generators, including monitoring, maintenance and emergency procedures.

**Implementation schedule:**

An indicative schedule of the project's implementation is provided by table A.3 which lists the main past and future events of construction.

Table A.3 Implementation schedule of the proposed project

Period / date	Main activity
December 2005	Start of construction activities
Dec. 2005 – Mar. 2008	Construction of the dam
Dec. 2005 – Nov. 2007	Construction of the powerhouse
Nov. 2007 - March 2008	Construction of on-site transformer
Nov. 2007 - March 2008	Installation & testing of 1 st turbine and generator
March 2008- June 2008	Installation & testing of 2 nd turbine and generator
June 2008	Operationalization

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

A 7-year renewable crediting period (renewable twice) is selected for the proposed project activity. The estimation of the emission reductions in the first crediting period is presented in Table A.4.

Table A.4 Estimation of the Emission Reductions in the First Crediting Period

Years	Annual estimation of emission reductions (tCO ₂ e)
01/10/2008 – 30/09/2009	49,273
01/10/2009 – 30/09/2010	49,273
01/10/2010 – 30/09/2011	49,273
01/10/2011 – 30/09/2012	49,273
01/10/2012 – 30/09/2013	49,273
01/10/2013 – 30/09/2014	49,273
01/10/2014 – 30/09/2015	49,273
Total estimated reductions (tCO₂e) of the first crediting period	344,911
Total number of the first crediting period years	7
Annual average reductions over the first crediting period (tCO ₂ e)	49,273

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

There is no public funding from Annex I countries available for the project.

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

The project is a small-scale project activity of category I.D, because the capacity of the hydropower station is 15 MW. The project will not expand beyond 15 MW. Proof is that the project entity does not have government approval to expand the project above 15 MW; in other words, expansion beyond the current capacity would not be possible without further government approvals.

According to Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities, a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register



another 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 proposed small-scale activity at the closest point.

A proposed small-scale project activity shall not be deemed to be a debundled component of a large project activity if one of the criteria mentioned above does not apply to the project. It is possible to demonstrate that the project is not a debundled component of a larger project activity, because the project entity is not operating, developing or planning to develop another project in the direct vicinity of the project boundary.

Therefore, there is no other registered CDM project activity or another application to register another small-scale CDM project activity:

- With the same project participants;
- 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 proposed small-scale activity at the closest point.

Therefore, the project is not a debundled component of a larger project activity.

**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:**

Title: Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories: I.D ‘Grid connected renewable electricity generation’ (version 12)

Date of approval: 10 August 2007.

Reference: The methodology can be found at:

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

The AMS-I.D. methodology refers to the ACM0002 methodology (Version 6) for the calculation of baseline emissions. This methodology can be found at:

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

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

The AMS-I.D. methodology is applicable to small-scale project activities, under the following restrictions (see version 12 of AMS.I.D):

1. This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.
2. If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.
3. Combined heat and power (co-generation) systems are not eligible under this category.
4. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct¹ from the existing units.
5. Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.

The proposed project activity satisfies these applicability criteria:

- The project is a small-scale project activity; see Section A of this PDD. The project has an installed capacity of 15 MW. Therefore, the project will not surpass the threshold of 15 MW for the applicability of the AMS.I.D methodology. (Satisfying the general precondition for the use of an AMS methodology)
- The project involves hydro energy resources, one of the renewable energy generation technologies listed (see restriction 1 above).

¹ Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered “physically distinct”.



- The project provides power to the power grid. The existing power grid mainly utilizes fossil fuels as a power source, as described in Section A.2 and Section B.6 (see restriction 1 above).
- The project does not have a non-renewable component, meaning that the restrictions mentioned under point 2 above are not applicable.
- The project does not involve combined heat and power systems, meaning that the restrictions mentioned under point 3 above are not applicable.
- The project does not involve the addition of renewable energy generation units at an existing renewable power generation facility, meaning that the restrictions mentioned under point 4 above are not applicable.
- The project does not seek to retrofit or modify an existing facility for renewable energy generation, meaning that the restrictions mentioned under point 5 above are not applicable.

We therefore conclude that the project satisfies all conditions for the application of small-scale methodology AMS.I.D.

B.3. Description of the project boundary:

The project boundary, as stated in Appendix B of the simplified modalities and procedures for small-scale CDM project activities, is limited to the physical project activity. Project activities that displace energy supplied by external sources shall earn certified emission reductions (CERs) for the emission reductions associated with the reduced supply of energy by those external sources.

The physical project boundary of the project includes the area occupied by the components of the hydropower station until the connection with the grid, which includes:

- Small reservoir at the dam site
- Dam structure including flood gates and water retaining section
- Water diversion structure including water intake, water diversion tunnel and penstocks
- Power house including turbines/generators and auxiliary equipment
- On-site switching / transformer station (owned by the project entity)
- transmission lines to the grid

The AMS.I.D methodology does not provide guidance on how the system boundary of the project is to be determined. We therefore have applied the guidance available for the ACM0002 methodology.

According to the ACM0002 (version 6) methodology, the relevant grid definition should be based on the following considerations:

1. Use the delineation of grid boundaries as provided by the DNA of the host country if available; or
2. Use, where DNA guidance is not available, the following definition of boundary:
In large countries with layered dispatch system (e.g. state/provincial/regional/national) the regional grid definition should be used.

According to above requirements, the regional grid (Central China Grid) is selected as the project boundary.

As mentioned above, the boundary of the project is marked by the point where the project connects to the grid. The project is connected to the Sichuan Grid, which is part of the Central China Power grid, which includes the Sichuan, Henan, Hubei, Hunan, and Jiangxi and Chongqing city power grids. The geographical boundaries for the determination of the baseline emissions are therefore defined as the Central China Grid and direct emissions from all generation sources serving the grid.

**B.4. Description of baseline and its development:**

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

Leakage associated with the project does not have to be taken into account as the project employs new turbines / generators and does not involve the transfer of equipment from another activity. Furthermore, the project is a hydropower station with no significant water storage capacity. In fact, the power station has a power density of 78.8 W/m². Therefore, in accordance with the Executive Board decision on “Thresholds and criteria for the eligibility of hydroelectric power plants with reservoirs as CDM project activities” (EB23), the project emissions from the reservoir can be ignored. Thus, the emission reductions are equal to the baseline emissions.

In accordance with the small scale methodology I.D, baseline emissions are equal to power generated by the project activity and delivered to the grid, multiplied by the baseline emission factor. According to the small scale methodology I.D the baseline emission factor is calculated as either the “average of the approximate operating margin and the build margin”, or the “weighted average emissions (in kg CO₂/kWh of the current generation mix)”. Power consumption in the Central China Grid is growing rapidly, which requires the construction of additional generating capacity. The Sichuan Tongjiang Gaokeng Hydropower Station is therefore expected to displace predominantly new capacity that is added to the grid and power generated by plants at the operating margin. Therefore, the baseline emission factor has been calculated as the average of the approximate operating margin and the build margin.

The small scale methodology I.D refers to the ACM0002 methodology for the calculation of the operating margin and the build margin. We therefore refer to this methodology in the calculation of the baseline emission factor.

Detailed baseline calculations can be found in Annex 3 of this PDD.

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:**Additionality**

Hydropower has made significant contributions to the expansion of power supply in Sichuan Province over the last few decades. However, new hydropower additions to the grid, in particular small hydropower stations, experience increasingly unattractive economic returns on investment. The reasons for this are that the most suitable locations for hydropower projects have already been used, and new projects are located in remote areas driving up the costs of hydropower per kWh. In addition, the engineering costs in China are rapidly rising. In the absence of the project activity, the Central China Grid is expected to expand through the least-cost expansion, which in the case of Central China is through predominantly coal-fired thermal power generation, excluding the proposed project activity.

According to Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities the following categories of barriers are recognized as a basis for the additionality argument:

1. Investment barriers



2. Technological barriers
3. Barriers due to prevailing practice
4. Other barriers

The additionality argument is based on the proposition that the project faces an investment barrier that prevents the implementation of this type of project activity. The investment barrier is argued on the basis of two separate strands of argument: the project faces a barrier due to 1) poor economic return on investment, and 2) limited access to financial resources.

Return on investment

The project faces a barrier to implementation due to the poor returns on investment. To illustrate this, we performed a benchmark analysis in which we compare the Internal Rate of Return (IRR) of the proposed project activity to an industry benchmark. The parameters used in the calculation are presented in Table B.1.

Table B.1 Parameters used in the investment analysis.

Gaokeng hydropower station (15MW)			
No.	Item	Value	Data source
1	Static total investment	104.8471 million RMB	Preliminary Design Report
2	Expected annual power supply	50.5604 million kWh	Preliminary Design Report
2	Annual O&M costs (year 1)	2.9595 million RMB	Preliminary Design Report
3	Annual O&M costs (year 2 to year 10)	2.9615 million RMB	Preliminary Design Report
4	Annual O&M costs (year 10 onwards)	2.9455 million RMB	Preliminary Design Report
5	Expected power price (net)	0.266 RMB/kWh	Preliminary Design Report
6	Investment horizon	30 years	Preliminary Design Report
7	Expected CER price	8 EUR	Market price
8	Tax rate	15%	Preliminary Design Report

The investment analysis compares the project on the basis of internal rate of return (IRR) to the industry benchmark for small-scale hydropower projects in China, which is defined in the Gaokeng project Preliminary Design Report (PDR) and set at 10%² (as per “Economic Evaluation Code for Small Hydropower Projects (SL-16-95)”). The results of the analysis for the Gaokeng hydropower station are provided in Table B.2.

Table B.2 Results of economic analysis

Gaokeng hydropower station		
Internal rate of return (IRR), over a 20 year period	Without CDM revenues	8.59%
	With CDM revenues	12.33%

The results clearly indicate that the return on investment of the Gaokeng hydropower station is below the 10% benchmark.

² Chapter 14, section 14.1 of the project’s PDR lists benchmark documents and standards applicable to the project, which consist of “*Economic Evaluation Method and Parameters for Project Construction (second edition)*” and “*Interim provisions concerning hydropower construction project financial assessment*”. Only the latter provides a benchmark value for hydropower projects, set at 12%. In addition, the financial analysis of the PDR defines the applicable benchmark for this project (section 14.2.2.2) as 10%, which is in accordance with the “*Economic Evaluation Code for Small Hydropower Projects (SL16-95)*”.



Sensitivity analysis

To confirm the above we have considered variation of 10% in the critical assumptions. Figure B.1 shows the results of variations in critical assumptions on the IRR with and without CDM revenues.

The following parameters were used as critical assumptions:

- Total investment
- Power price
- Annual operating hours
- Annual operation and maintenance cost

In the sensitivity analysis, variations of $\pm 10\%$ have been considered in the critical assumptions. Such variation is considered appropriate as it is consistent with the approach taken by the official Chinese Standard document “*Interim provisions concerning hydropower construction project financial assessment*” (see footnote 3 previous page) and in accordance with the general guidance provided by the “Document for Registered Engineering Consultants in China”, published by the China Planning Press under the supervision of the National Development & Reform Commission.

In addition it is not considered likely that the project’s return will exceed the benchmark due to the following reasons:

- *Investment cost:*

Construction and engineering costs are rising in China, which is driving up the investment cost of construction projects.

- *Annual O&M cost:*

Annual O&M costs are expected to rise rather than fall due to increases in the wage level when relatively underdeveloped regions such as Sichuan Province will follow the development path of the more developed eastern coastal regions. In addition, variations in the annual O&M costs have a small impact on the return of the project. The IRR remains below the benchmark even if the O&M costs are decreased with 45%.

- *Annual power supply:*

Power generation is linked directly to the available water flow. The projected power supply is based on 44 years of water flow statistics (1959-2002). Analysis of water flow statistics shows that the probability of a deviation of more than 10% over the lifetime of the project is about 0.0003%.³

- *Power price:*

The value of 0.266RMB/KWh (after VAT deduction) applied in the above IRR calculations and referred to in the PDR as the standard power price follows a very conservative approach as the detailed financial analysis performed in the PDR considers a total of nine different power price estimates which are based on variations in the water flow (Dry, Normal and Wet seasons) and in the demand for electricity (Low, Normal, and High). The weighted average power price on the basis of the 9 scenarios is 0.2548RMB/KWh (after VAT deduction) and therefore it is expected that the power price will be more likely substantially lower than the 0.266 RMB/kWh rather than higher⁴. Furthermore, the official actual power prices published by the Sichuan Government for 2005 (0.2462RMB/KWh after VAT), 2006 (0.2462RMB/KWh after VAT) and 2008 (0.25043 after VAT) clearly confirm the conservative approach taken in this PDD.

³ A separate analysis on the probability of a 10% deviation in the power supply for the Gaokeng project has been provided to the validator

⁴ A separate explanation for selected power prices in Gaokeng Preliminary Design Report has been provided to the validator.

We conclude that it is considered unlikely that the granted power price will be substantially higher than the power price used in the IRR calculation.

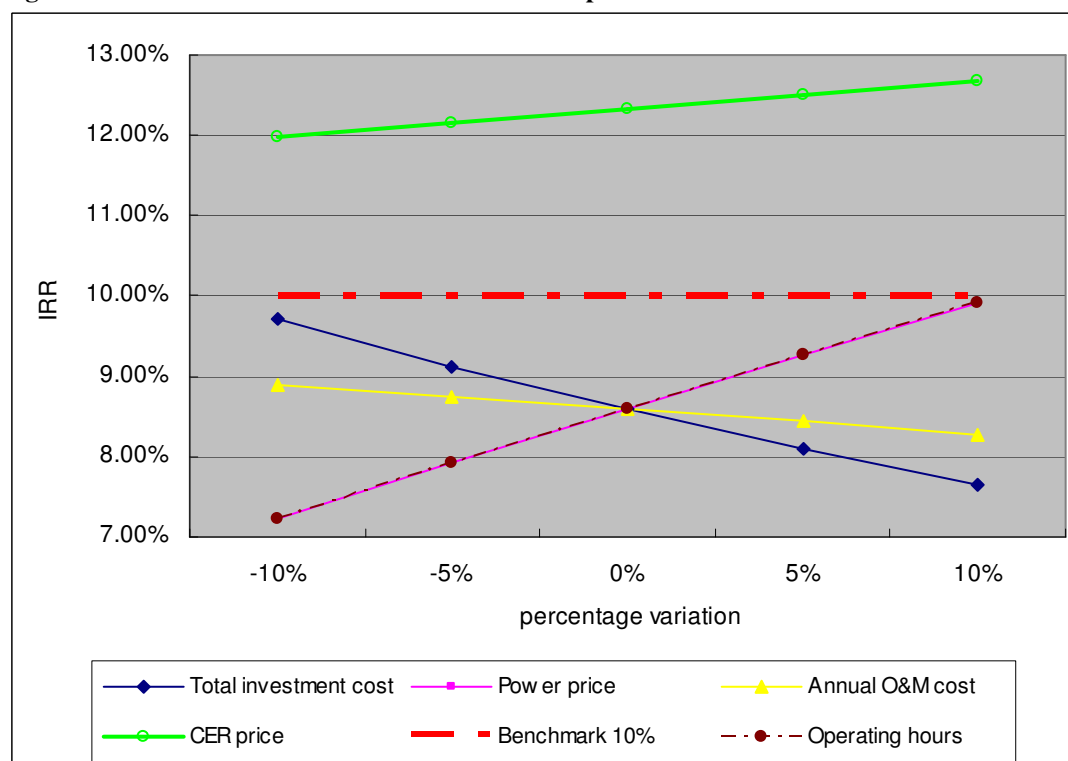
The conclusion may be clear that with reasonable modifications in the critical assumptions, the main results remain unaltered. Therefore, the proposed project activity faces an investment barrier due to its commercial unattractiveness.

The results of the sensitivity analysis for the IRR without CDM revenues are shown in Table B.3. Figure B.1 provides a graphic depiction.

Table B.3. Sensitivity analysis; impact of variations in assumptions on the IRR without CDM revenues

Percentage Variation Critical assumption	-10%	-5%	0%	+5%	+10%
Total investment	9.71%	9.13%	8.59%	8.10%	7.64%
Power price	7.22%	7.91%	8.59%	9.25%	9.91%
Annual operating hours	7.22%	7.91%	8.59%	9.25%	9.91%
Annual O&M Cost	8.90%	8.74%	8.59%	8.43%	8.28%

Figure B.1 Result of variations in the critical assumptions



The sensitivity analysis confirms that the project's IRR without CDM revenues is substantially below the benchmark and that revenues from the sale of CERs are required to make the project financially



attractive. Therefore, the proposed project activity faces an investment barrier due to its commercial unattractiveness.

Access to financial resources:

The Gaokeng hydropower station project also faces an investment barrier due to the limited access to financial resources. The financial services sector of Sichuan Province is not well developed and lacks the instruments to deal with financing of high-risk projects. In addition to the poor economic return on investment as argued above, the project also faces several other obstacles that make it difficult to attract financial resources. The revenues through CDM are therefore considered to be an essential part in arranging financing for the project. The barriers to attract financial resources are discussed below:

- **Project location:** The project is located in Tongjiang County, a very poor and remote area of China, and designated as a national poverty county. Industry in Tongjiang County is not developed and there are very few companies with sufficient financial resources to develop a hydropower station.
- **Adverse lending policies by banks:** The banking sector is reluctant to extend loans to small hydropower stations unless special circumstances apply. The high risks and poor returns associated with small hydropower projects make it difficult for project developers to receive loans without putting up a high share of equity capital.

The risk-adverse attitude of the banking sector was formalized in the summer of 2004, when under the guidance of the National Development and Reform Commission many banks adopted policies under which hydropower stations with a capacity under a certain threshold will not receive any loans or extensions of loans.⁵

The above-mentioned obstacles present a prohibitive barrier to attract financing. To conclude, the project faces an investment barrier due to the unattractive return on investment and problematic access to financial resources. The additional revenues from registration of the proposed project activity as a CDM activity help overcome this barrier.

Impact of CDM registration

Registration of the project as a CDM project would result in additional revenues for the project, significantly improving the economic attractiveness of the project. This is the most important contribution of CDM to the project realization, removing the crucial barrier towards its realization.

The income through CDM will raise the IRR for the project from 8.59 % to 12.33 %, making the project more attractive and overcome the benchmark hurdle rate of 10%.

The project activity started in December 2005. At this time the project entity, the main shareholders were knowledgeable about the possibilities offered by CDM. An overview of key events is given in table B.6.

⁵ A statement from the Industrial and Commercial Bank of China confirming that their restrictive policies were implemented from 2004 is available to the validator.

**Table B.6: Overview of key events in the development of the project**

Date	Key Event	Evidence
21 st July 2004	Sichuan Yili Energy Investment Development Company Limited is established.	Business licence
December 2004	The EIA is published.	EIA report
13 th December 2004	The project EIA is approved.	EIA approval
October 2004	The FSR is published.	FSR
2 nd December 2004	The FSR is approved.	FSR approval
December 2004	The PDR is published.	PDR
9 th March 2005	The project PDR is approved.	PDR approval
11 th April 2005	The financial incentive from the Clean Development Mechanism is acknowledged in the “Minutes of the Second Board Meeting of the First Session of Sichuan Yili Energy Investment & Development Co. Ltd” as a key element for the project’s profitability.	Board meeting report
23 rd July 2005	Main equipment is purchased	Contract
25 th September 2005	Fujian Shanghang Fuxing Mining Engineering Co. Ltd takes control of Sichuan Yili Energy Investment Development Co Ltd. Additional revenues from CDM are considered in the decision.	Memorandum of acquisition
December 2005	Start of construction activities	Construction permit
Winter 2005-2006	Sichuan Yili Energy Investment Development Co Ltd is considering hiring a CDM consultant	Email communication between the CDM consultant and Board Member of the project entity
10 th August 2006	The project entity signs a CDM development agreement with consultant	Contract with CDM consultant
September 2006	Preparation of a CDM Project Idea Note (PIN)	Email communication between CDM consultant and project entity.
3 rd Nov.-17 th Nov. 2006	The PIN is sent out to CER potential buyers for bidding	Email communication
3 rd February 2007	First meeting in Lanzhou city between the project entity and the buyer of CERs. Term sheet is signed	Term sheet
30 th March 2007	The stakeholders consultation meeting is organized on site	Meeting report
26 th April 2007	The project obtains a bank loan of 68 millions RMB	Bank loan agreement
19 th May 2007	ERPA is signed	ERPA
1 st September 2007	The Sichuan Tongjiang Gaokeng hydropower station project PDD is uploaded on the UNFCCC website for validation	UNFCCC website
November 2007	The Letter of Approval for the Sichuan Tongjiang Gaokeng Hydropower project as CDM project is issued by the National Development & Reform Commission of China.	LoA

The above events clearly demonstrate that the Project Entity was aware about the potential for CDM before the start of the CDM activity, and that it played a crucial role in overcoming the barriers towards the implementation of the proposed project activity.

B.6. Emission reductions:

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

In accordance with the small scale methodology I.D, baseline emissions are equal to power generated by the project activity and delivered to the grid, multiplied by the baseline emission factor. According to the small scale methodology I.D the baseline emission factor is calculated as either the “average of the approximate operating margin and the build margin”, or the “weighted average emissions (in kg CO₂/kWh of the current generation mix)”. Power consumption in Central China Grid is growing rapidly, which requires the construction of additional generating capacity. The Sichuan Tongjiang Gaokeng Hydropower Station is therefore expected to displace predominantly new capacity that is added to the grid and power generated by plants at the operating margin. Therefore, the baseline emission factor has been calculated as the average of the approximate operating margin (OM) and the build margin (BM).

The combined margin (CM) emission factor is in this particular case calculated *ex ante* on the basis of the latest additions to the grid.

The following description focuses on the key elements in the calculation of the emission factors and the subsequent calculation of emission reductions. The full process of the calculation of the emission factors and all underlying data are presented in English in Annex 3 to this PDD.

Selection of values for net calorific values, CO₂ emission factors and oxidation rates of various fuels.

The following table summarizes the values we used. Net Calorific Values (NCV) are in accordance with the China Energy Statistical yearbook 2004; Oxidation factors and carbon emission factors strictly apply IPCC 2006 default values. Note that the CO₂ emission factor has been obtained multiplying Carbon emission factors by 44/12. Rounded figures have been reported but exact figures have been used in the calculations in this PDD.

Table B.3. Default values used for net calorific values, oxidation factors, and CO₂ emission factors of fuels



Fuel	Unit	NCV	Oxidation factor	Carbon emission factor	CO2 emission factor
		(TJ/unit)	(Fraction)	(TC/TJ)	(TCO2/TJ)
Raw coal	10 ⁴ Tons	209.08	1	25.8	94.6
Clean coal	10 ⁴ Tons	263.44	1	25.8	94.6
Other washed coal	10 ⁴ Tons	83.63	1	25.8	94.6
Briquettes	10 ⁴ Tons	83.63	1	26.5	97.2
Coke	10 ⁴ Tons	284.35	1	29.2	107.1
Coke oven gas	10 ⁸ m ³	1672.6	1	12.1	44.4
Other gas	10 ⁸ m ³	522.7	1	12.1	44.4
Crude oil	10 ⁴ Tons	418.16	1	20	73.3
Gasoline	10 ⁴ Tons	430.7	1	18.9	69.3
Diesel	10 ⁴ Tons	426.52	1	20.2	74.1
Fuel oil	10 ⁴ Tons	418.16	1	21.1	77.4
LPG	10 ⁴ Tons	501.79	1	17.2	63.1
Refinery gas	10 ⁴ Tons	460.55	1	15.7	57.6
Natural gas	10 ⁸ m ³	3893.1	1	15.3	56.1
Other petroleum products	10 ⁴ Tons	383.69	1	20	73.3
Other coking products	10 ⁴ Tons	284.35	1	25.8	94.6
Other E (standard coal)	10 ⁴ Tce	292.7	1	0.0	0.0

Data source:

- Net calorific values: China Energy Statistical Yearbook, 2004 p. 302;
- Oxidation factors: IPCC default values, see 2006 IPCC Guidelines for National Greenhouse Gas Inventories,
- Carbon emission factors: IPCC default values see 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
- CO2 emission factors: calculated from carbon emission factors

Description of the calculation process

The key methodological steps are:

1. Calculation of the Operating Margin (OM) Emission Factor
2. Calculation of the Build Margin (BM) Emission Factor
3. Calculation of the Baseline Emission Factor
4. Calculation of the Baseline emissions
5. Calculation of Emission Reduction

The methodology is applied to the Central China Power grid which is defined as including the grids of Jiangxi, Hunan, Henan, Hubei, Chongqing and Sichuan, as discussed in Section B.3. Section B.3 also describes how the project boundary is defined.

Step 1. Calculation of the Operating Margin Emission Factor

The ACM0002 methodology offers several options for the calculation of the OM emission factor. Of these, the methodologically preferred one, dispatch analysis, cannot be used, because dispatch data, let alone detailed dispatch data, are not available to the public or to the project participants. For the same reason, the simple adjusted OM methodology cannot be used. The average OM cannot be used, because low cost/must run resources (hydropower and windpower) constitute less than 50% of total grid generation (see Table B.4). Therefore, the calculation method of simple OM is suitable for this project activity.

**Table B.4 Installed capacity and electricity generation of the Central China Power Grid, 2001-2005**

Year	Installed capacity (MW)				% Low cost/must run	Electricity generation (GWh)				% Low cost/must run
	Thermal	Hydro	Others	Total		Thermal	Hydro	Others	Total	
2001	42,569.2	30,397	0	72,966.2	41.66	178,156	103,554	0	281,710	36.76
2002	43,303.2	31,034.7	0	74,337.9	41.74	200,347	112,440	0	312,787	35.95
2003	46,893.5	32,357	0	79,250.5	40.83	240,839	126,448	0	367,287	34.43
2004	53,744.7	34,642	0	88,386.7	39.19	270,846	169,094	725	440,665	38.54
2005	60,167.2	38,405.2	24	98,596.4	38.95	303,976	187,734	10	491,720	38.18

Source Chinese DNA,

Accordingly, the OM emission factor is calculated as the generation-weighted average emissions per unit of electricity (measured in tCO₂/MWh) of all generating sources serving the system, excluding the low-operating cost and must run power plants.

$$EF_{OM, simple, y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}} \quad (B.1)$$

With:

- $F_{i,j,y}$ the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y . j refers to the power sources delivering electricity to the grid, not including low operating costs and must-run power plants, and including imports to the grid⁶.
- $COEF_{i,j,y}$ is the CO₂ emission coefficient of fuel i (tCO₂/mass or volume unit of the fuel), taking into account the carbon content of fuels used by relevant power sources j and the percentage oxidation of the fuel in year(s) y ;
- $GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j .

The CO₂ emission coefficient is equal to the net calorific value of fuel i , multiplied by the oxidation factor of the fuel and the CO₂ emission factor per unit of energy of the fuel i .

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

With:

- NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i ,
- $OXID_i$ is the oxidation factor of the fuel,
- $EFC_{O_2,i}$ is the CO₂ emission factor per unit of energy of the fuel i .

Data vintage selection

⁶ The Central China Grid is a net exporter of power and therefore imports have not been included in the calculations.



In accordance with the ACM0002 methodology and the choice for an ex-ante calculation of the OM Emission Factor, the formula (B.1) is applied to the three latest years for which data are available, and a full-generation weighted average value is taken for the OM Emission Factor.

Choice of aggregated data sources

The emission factor is calculated directly from publicly available aggregated data on fuel consumption, net calorific values, and power supply to the grid; IPCC default values for the CO₂ emission factor and the oxidation rate. According to the ACM0002 methodology, the selection of aggregated data for the calculation of the emission factors should be used, since the disaggregated data needed for all three more preferred methodological choices is not publicly available in China.

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

On the basis of these data, the Operating Margin emission factors for 2003, 2004 and 2005 are calculated. The three-year average is calculated as a full-generation-weighted average of the emission factors. For details we refer to the explanations and demonstration of the calculation of the OM emission factor provided in Annex 3. We calculate the Operation Margin Emission Factor as 1.29093 tCO₂/MWh.

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

Step 2. Calculation of the Build Margin Emission Factor (EF_{BM,y})

The Build Margin Emission Factor is, according to ACM0002, calculated as the generation weighted average emission factor (measured in tCO₂/MWh) of a sample of m power plants:

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

$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ in the formula above are analogous to those in equation 1, except for the fact that the index m is over specific power plants rather than types of power plants, and that low cost/must run sources are not excluded. The sample, according to the methodology, should be over the latest 5 power plants added to the grid, or over the last added power plants accounting for at least 20% of power generation, whatever is the greater.

A direct application of this approach is difficult in China. The Executive Board (EB) has provided guidance on this matter with respect to the application of the AMS-1.D and AM0005 methodologies for projects in China on 7 October 2005 in response to a request for clarification by DNV on this matter. The EB accepted the use of capacity additions to identify the share of thermal power plants in additions to the grid instead of using power generation. The relevance of this EB guidance extends to the ACM0002 methodology as 1) the AM0005 methodology has been discontinued and the ACM0002 methodology incorporates in terms of scope projects that would have been eligible to use AM0005, 2) the ACM0002 methodology is based, among others, on NM0023, which was the basis for AM0005, and thus ACM0002



among its possible calculation methods incorporates the AM0005 methodology, and 3) the AMS-1.D methodology refers to the ACM0002 methodology for the baseline emission factor calculation method.

The calculation of the published BM Emission Factor is based on this approach and is described below:

First we calculate the newly-added installed capacity and the share of each power generation technology in the total capacity. Second, we calculate the weights of each power generation technology in the newly-added installed capacity⁷. Third, emission factors for each fuel group are calculated on the basis of an advanced efficiency level for each power generation technology, IPCC default oxidation factors and a weighted average carbon emission factor on the basis of IPCC default carbon emission factors of individual fuels.

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

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

Detailed steps and formulas are as below:

First, we calculate the share of CO₂ emissions of the solid, liquid and gaseous fuels in total emissions respectively.

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (B.4)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (B.5)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

with:

⁷ Newly added capacity is determined as follows. First, the latest year (2005) for which data on total installed capacity is available is identified. Then, the last year is identified in which the total installed capacity was below 80% of the total installed capacity in 2005. This defines “newly added capacity”. Note that this approach does not follow the EB decision in response to the DNV request as mentioned in the main text to the letter, but the approach taken is the one that has been followed in numerous PDDs since the EB decision.



- $F_{i,j,y}$ the amount of the fuel i consumed in y year of j province (measured in tce);
- $COEF_{i,j,y}$ the emission factor of fuel i (measured in tCO₂/tce) while taking into account the carbon content and oxidation rate of the fuel i consumed in year y ;
- $COAL, OIL$ and GAS subscripts standing for the solid fuel, liquid fuel and gas fuel

Second, we calculate the emission factor of the thermal power

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (B.7)$$

While $EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ represent the emission factors of advanced coal-fired , oil-fired and gas-fired power generation technology, see detailed parameter and calculation in Annex 3.

Third, we calculate BM of the power grid

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

While CAP_{Total} represents the total newly-added capacity and $CAP_{Thermal}$ represents newly-added thermal power capacity.

The λ s are calculated on the basis of the weight of CO₂ emissions of each type of fuel in the total CO₂ emissions from thermal power. Subsequent calculation of the Build Margin emission factor yields a baseline emission factor of 0.66344 tCO₂/MWh.

For details we refer to Annex 3.

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

Step 3. Calculation of the Baseline Emission Factor (EF_y)

The Baseline Emission Factor is calculated as a Combined Margin, using a weighted average of the Operating Margin and Build Margin.

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \quad (B.9)$$

The latest version of ACM0002 (version 6) provides the following default weights: Operating Margin, $w_{OM} = 0.5$; Build Margin, $w_{BM} = 0.5$

Applying the default weights and the above calculated emission factors, we obtain a Baseline Emission Factor of **0.97718** tCO₂ / MWh.

Ad interim, we have compared our calculations to the emission factors published by the Chinese DNA on August 9th 2007. The Chinese DNA has entrusted key experts with the calculation of the grid emission



factors and choices have been made for the values of carbon coefficients and weighted average carbon coefficients.

For clarity, we refer to these emission factors as the “published emission factors”

For more information on the published OM and BM emission factors, please refer to:

- Calculation result of the baseline emission factor of Chinese power grid:
<http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf>
- Calculation process of the baseline OM emission factor of Chinese power grid:
<http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls>
- Calculation process of the baseline BM emission factor of Chinese power grid:
<http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf>

Published emission factors yield slightly lower emission factors for the China central grid:

Operating Margin (OM): 1.2899

Build Margin (BM): 0.6592

Baseline Emission Factor (default weights apply): **0.97455 tCO₂/MWh**.

Consequently, in keeping with principles of conservativeness, **we choose to apply the published emission factor** in the calculation of baseline emissions.

Step 4. Calculation of Baseline Emissions

Baseline Emissions are calculated by multiplying the Baseline Emission factor by annual power generation.

$$BE_y = EG_y \cdot EF_y \quad (B.10)$$

With:

- BE_y the baseline emissions in year y , EG_y the electricity supplied by the project activity to the grid,
- EF_y the emission factor in year y , calculated according to formulas (B.1)-(B.9).

The estimated baseline emissions (see Section B.4) are based on expected power generation and an *ex ante* calculation of the emission factor, and will hence be revised during the implementation of the project activity on the basis of actual power supply to the grid. The baseline emission factor, however, is left unchanged during the first crediting period.

Step 5. Calculation of emission reductions

Emission reductions are calculated according to the following formula:

$$ER_y = BE_y - PE_y - L_y \quad (B.11)$$

With:

- ER_y , emission reductions in year y ,
- BE_y , baseline emissions in year y ,



- PE_y , project emissions in year y ,
- L_y , leakage in year y

The project does not involve project emissions or leakage as further explained in section B.6.3, and therefore project emissions are equal to baseline emissions. Using the results of the preceding sections, we can calculate the emission reductions using formula B.13

$$ER_y = EG_y * 0.97455 \quad (B.12)$$

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

Data / Parameter:	Power generation by source
Data unit:	GWh (per annum)
Description:	Provincial level power generation data by source
Source of data used:	China Electric Power Yearbook (Editions 2003, 2004, 2005 and 2006)
Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

Data / Parameter:	Internal power consumption of power plants
Data unit:	Percentage
Description:	Internal consumption of power by source
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from China Electric Power Yearbook (Editions 2004, 2005 and 2006)
Value applied:	For detailed values, see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best and most recent data available, and use the same data publication (although more recent editions) as the calculation of the emission factors published by the Chinese authorities.
Any comment:	

Data / Parameter:	Primary fuel input for thermal power supply
Data unit:	10^4 tons, 10^8 m ³ , 10^4 tce, depending on the specific fuel. We refer to Annex 3 for details.
Description:	Physical amount of fuel input, for 17 different fuels
Source of data used:	China Energy Statistical Yearbook 2006, 2005 and 2004 Editions



Value applied:	For detailed values, see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

Data / Parameter:	Efficiency of advanced thermal power plant additions
Data unit:	%
Description:	
Source of data used:	See the downloadable files mentioned above for the full data set. Data are based on the best technologies available in China.
Value applied:	Coal: 35.82%; Oil: 47.67%; Gas: 47.67%
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

Data / Parameter:	Capacity by power generation source
Data unit:	MW
Description:	For the different power generation sources, installed capacity in 2003, 2004 and 2005 in the Central China Grid. Calculated by summing provincial data.
Source of data used:	China Electric Power Yearbook (Editions 2004, 2005 and 2006)
Value applied:	For detailed values, see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

Data / Parameter:	Oxidation Factor
Data unit:	Percentage
Description:	Oxidation factors for 17 different fuels
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories,
Value applied:	For detailed values see Annex 3
Justification of the choice of data or description of measurement methods and procedures	



actually applied :	
Any comment:	

Data / Parameter:	Carbon Emission Coefficients of fuels
Data unit:	Tons C/TJ
Description:	Carbon emission factors for 17 different fuels
Source of data used:	Data used are IPCC default values. See 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied:	For detailed values see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	CO2 Emission Coefficients of fuels
Data unit:	Tons C/TJ
Description:	CO2 emission factors for 17 different fuels
Source of data used:	Data used are IPCC default values. See 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied:	For detailed values see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	Electricity imports from connected grids
Data unit:	MWh (per annum)
Description:	Electricity imports of power from other grids
Source of data used:	Original data are from China Electric Power Yearbook (Editions 2004, 2005 and 2006)
Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	The Central Power Grid does not import electricity; imports are zero

Data / Parameter:	Net Calorific Value
Data unit:	TJ/10 ⁴ tons; TJ/10 ⁴ tce; TJ/10 ⁸ m ³



Description:	Net calorific values of 17 different fuels in TJ per unit.
Source of data used:	See the downloadable files mentioned above for the full data set. Original data are from China Energy Statistical Yearbook, (2004) p. 302.
Value applied:	For detailed values: see Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	These data are the best data available, and have been published by the Chinese authorities.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

The annual net power supply to the Central China Grid is estimated to be 50,560.4 MWh.

Application of the formulae presented in Section B to the baseline data presented in Annex 3 yields the following results:

$$EF_{OM} = 1.2899 \text{ t CO}_2/\text{MWh}$$

$$EF_{BM} = 0.6592 \text{ t CO}_2/\text{MWh}$$

$$EF_y = 0.5 \cdot 1.2899 + 0.5 \cdot 0.6592 = 0.97455 \text{ tCO}_2/\text{MWh}$$

The annual net power supply to the Central China Grid is estimated to be 50,560.4 MWh.

The annual baseline emissions BE_y are thus calculated to be 49,273 tCO₂. We obtain the values for the baseline emissions during the first crediting period provided in Table B.5:

Table B.5 The estimation of the emission reductions in crediting period

Year	Year	Annual net power supply to the grid (EGy) (MWh)	Baseline emission factor (tCO ₂ /MWh)	Baseline emissions (tCO ₂ e)
1	01/10/2008 – 30/09/2009	50,560.4	0.97455	49,273
2	01/10/2009 – 30/09/2010	50,560.4	0.97455	49,273
3	01/10/2010 – 30/09/2011	50,560.4	0.97455	49,273
4	01/10/2011 – 30/09/2012	50,560.4	0.97455	49,273
5	01/10/2012 – 30/09/2013	50,560.4	0.97455	49,273
6	01/10/2013 – 30/09/2014	50,560.4	0.97455	49,273
7	01/10/2014 – 30/09/2015	50,560.4	0.97455	49,273
	Total			344,911
	Average			49,273

In a given year, the emission reductions realized by the project activity (ER_y) is equal to baseline GHG emissions (BE_y) minus project direct emissions and leakages during the same year:

$$ER_y = BE_y - PE_y - L_y$$

Leakage:

The project activity involves the construction of a new hydropower station with a power density greater than 10 W/m² and therefore emissions from the reservoir do not have to be taken into account.



The project will install an on-site diesel generator with a capacity of at most 250 kW which will be maintained for emergency purposes in case all power lines to the grid are cut off. Government regulations require that the diesel generator is started up before every flood season⁸. The emissions of the diesel generator are significantly less than 1% of total emission reductions and are considered negligible⁹. In case of emergencies the project will not claim emission reductions and the use of the generator will be monitored. We conclude that the project does not involve leakage due to the presence of the emergency diesel generator.

In accordance with the ACM0002 methodology, leakage and project emissions are equal to zero, and hence, the emission reductions due to the project are equal to the baseline emissions. The emission reductions will be calculated *ex post* on the basis of actual power supply to the grid, using the baseline emission factor presented above in Section B.6.1.

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

Table B.6 provides the annual emission reductions in tabular form.

Table B.6 Ex-ante estimate of emission reductions due to the project

Year	Project Emissions (tCO ₂)	Baseline emissions (tCO ₂)	Leakage (tCO ₂)	Emission Reductions (tCO ₂)
Year 1: 01/10/2008 – 30/09/2009	0	49,273	0	49,273
Year 2: 01/10/2009 – 30/09/2010	0	49,273	0	49,273
Year 3: 01/10/2010 – 30/09/2011	0	49,273	0	49,273
Year 4: 01/10/2011 – 30/09/2012	0	49,273	0	49,273
Year 5: 01/10/2012 – 30/09/2013	0	49,273	0	49,273
Year 6: 01/10/2013 – 30/09/2014	0	49,273	0	49,273
Year 7: 01/10/2014 – 30/09/2015	0	49,273	0	49,273
Subtotal	0	344,911	0	344,911
Average	0	49,273	0	49,273

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

B.7.1 Data and parameters monitored:

Data / Parameter:	EG _y
Data unit:	MWh
Description:	Electricity supplied to the grid by the project

⁸ The *Hydropower Operation Safety Management Regulations (SERC document No.3)*, issued by the State Electricity Regulatory Commission of the People's Republic of China states that "The back-up power sources should be re-commissioned before each flood season annually". The regulation does not provide a guideline on the duration that the diesel generator should run each year, but the project entity has decided to operate the generator for one hour annually.

⁹ Emissions by the diesel generator associated with the start-up for annual re-commissioning and maintenance requirements can be calculated as follows: The diesel generator will have a capacity of at most 250 kW. As the generator is expected to be operating for 5 hours annually, the expected annual power generation can be calculated to be 1250 kWh. For the emission factor of the diesel generator we refer to the AMS.ID (version 10) methodology which provides emission factors for diesel generator systems. We apply the highest value listed in the methodology which is 2.4 kgCO₂e/kWh (generators below 15 kW), which is conservative considering the size of the generator used on-site. We estimate the annual emissions by the diesel generator as 3 tCO₂e, which would reduce annual emission reductions with about 0.006% and can therefore be considered negligible.



Source of data to be used:	Directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50,560.4 MWh
Description of measurement methods and procedures to be applied:	The net supply of power to the grid by the Sichuan Tongjiang Gaokeng Hydropower Station Project is measured through national standard electricity metering instruments. The metering instruments will be calibrated annually in accordance with the “ <i>Technical administrative code of electric energy metering (DL/T448—2000)</i> ”. The net amount of power supplied is measured and recorded monthly.
QA/QC procedures to be applied:	These data will be directly used for calculation of emission reductions. Sales record to the grid and other records are used to ensure the consistency.
Any comment:	The measured electricity supply will be double checked by receipts of sales to the grid. (see also Section B.7.2 for more details)

Data / Parameter:	Surface area of the reservoir
Data unit:	m ²
Description:	Surface area at full reservoir level
Source of data to be used:	Feasibility study
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3,800,000 m ²
Description of measurement methods and procedures to be applied:	The surface area will be calculated using the design schematics and area maps. Photographs of the reservoir at several key locations will be taken when the project becomes operational to check whether the actual reservoir does not deviate substantially for the design.
QA/QC procedures to be applied:	The power density of the project is well above 10 W/m ² and therefore substantial deviations from the calculated design surface area will not affect the calculation of emission reductions by the project. Therefore no further QA/QC procedures will be applied.
Any comment:	

Data / Parameter:	Operational hours of emergency back-up diesel generator
Data unit:	Hours / year
Description:	Annual hours that the emergency back-up diesel generator is running either for the purpose of commissioning/maintenance or actual emergencies
Source of data to be used:	Estimated
Value of data applied for the purpose of calculating expected emission reductions	5 hour / year. The Hydropower Operation Safety Management Regulations (SERC document No.3), issued by the State Electricity Regulatory

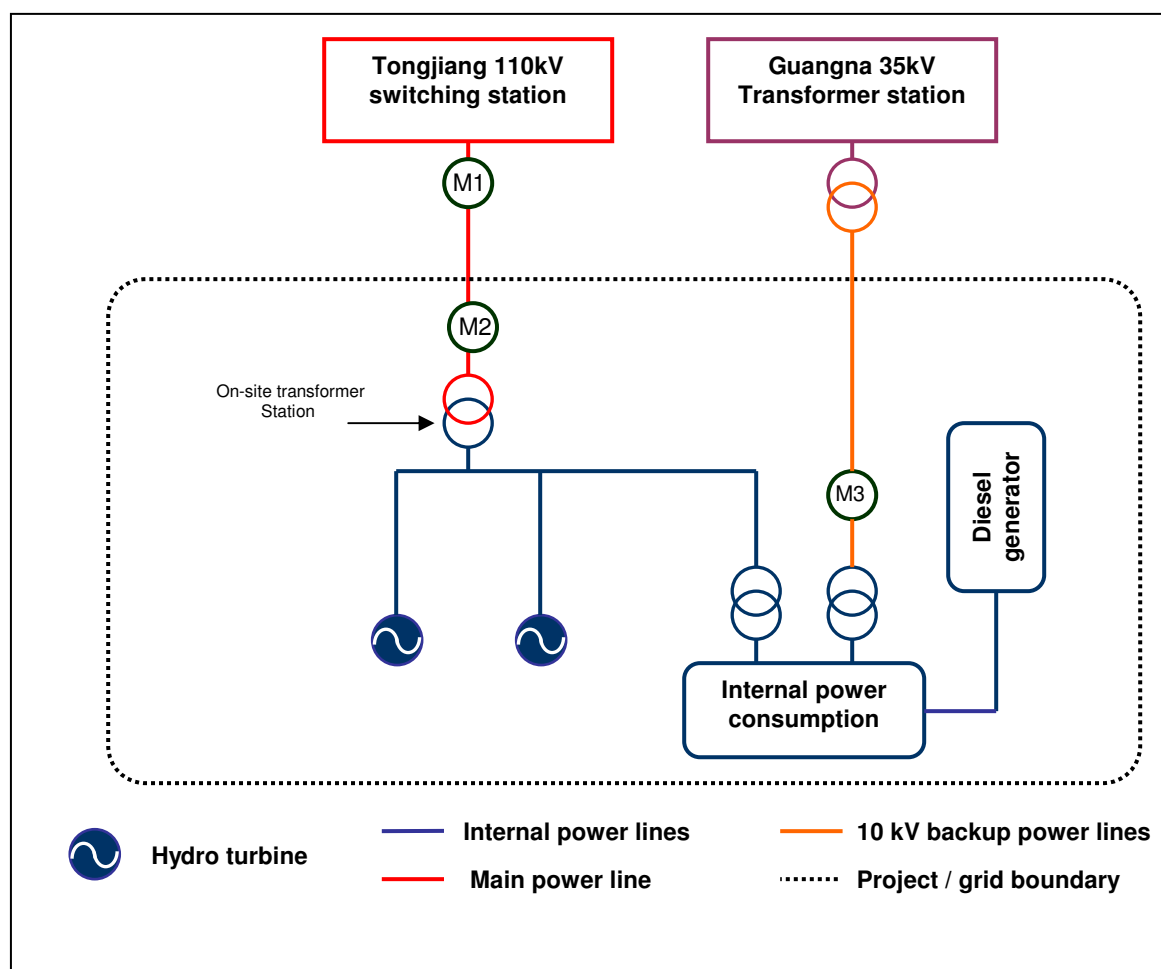


in section B.5	Commission of the People's Republic of China states that "The back-up power sources should be re-commissioned before each flood season annually". The regulation does not provide a guideline on the duration that the diesel generator should run each year. The project entity expects to operate the generator for no more than five hours annually.
Description of measurement methods and procedures to be applied:	The project entity will record the operational hours in the daily operation logs.
QA/QC procedures to be applied:	The expected annual emissions associated with the operation of the emergency back-up diesel generator amount to about 0.006% of total emission reductions and are therefore considered negligible. In case of actual emergencies the project entity will not claim emission reductions (see section B.7.2). Further QA/QC procedures are therefore not considered necessary.
Any comment:	

B.7.2 Description of the monitoring plan:

The project is connected to the grid through an on-site transformer station. The project connects to Tongjiang 110kV transformer, which functions as a switching station to connect the project to the grid. The power supplied to the grid is metered by the project entity at a point after power has been transformed (see figure B.3). Therefore, no further transformer losses will occur before the project is connected to the grid.

Figure B.3. Simplified electrical grid connection diagram



The net power supply of the project to the grid through the main power line will be metered by the project entity with meter M2, which is located at the high-voltage side of the step-up transformer station that will be constructed at the project site. The metering instrument M2 will record two readings, i.e. power delivered to the grid and power received from the grid. The project entity will log both readings and the difference, i.e. power delivered minus power received, will be taken as net power supply through this connection. The grid company will also meter the net power supply to the grid with its own metering equipment, i.e. meter M1. The regulations of the grid company require annual calibrations of both metering instruments. Calibrations are carried out by the grid company. After calibration, meters M1 and M2 will be sealed. If there are any substantial discrepancies between the readings of the metering instruments throughout the year, both instruments will be recalibrated. In case of emergencies, the project will receive electricity from the Guangna 35kV Transformer station. Power received from the grid will be metered by meter M3 (located on-site) which is owned by the grid company. Meter M3 will also be calibrated annually by the grid company.

The project entity will collect the sales receipts for power supplied to the grid and billing receipts for power received from the grid as evidence for the readings of meter M1 and M3. The net supply (i.e. gross supply minus supply by the grid to the project) will be used in the calculations. In case of discrepancies



between the metering instruments of the grid company and the project entity, the readings of the grid company will prevail. All records will be collected in a central place by the project entity.

The project entity will in principle report the monitoring data annually but may deviate to report at intervals corresponding to agreed verification periods and will ensure that these intervals are in accordance with CDM requirements. Data record will be archived for a period of 2 years after the crediting period to which the records pertain. An overview of the recording frequency, calibration procedures and available documentation is provided in Table B.11. The numbering of the metering equipment refers to Figure B.3 which shows the location of each meter.

Finally, the project entity will monitor the surface area of the reservoir by collecting photographic evidence of the surface level when the project becomes operational. This photographic evidence will be compared with the design reservoir dimensions to confirm whether or not the actual surface area substantially deviates from the design surface area.

In addition to the monitoring of net power supply the project entity will also monitor the use of an emergency back-up diesel back-up by logging its operational hours in daily logs. It is expected that the generator will be started-up for no more than five hours every year for maintenance purposes and reliability checks in accordance with government regulations. The emissions associated with the diesel generator are calculated as 0.006% of total emission reductions and are therefore considered negligible.

**Table B.11 Details of metering instruments**

Meter	Operated by	Electronic measurement	Manual measurement	Recording	Calibration	Accuracy	Documentation
M1	Grid company	-	-	Monthly	Grid Company (Annually)	Accuracy Class 1 or more accurate	Monthly sales receipts (for power delivered to grid) and billing invoices (for power received from the grid) provided by the grid company
M2	Project entity	Continuous	Daily (optional) ¹⁰	Monthly	Grid Company (Annually)	Accuracy Class 1 or more accurate	Print out of electronic record and optional paper log. Data will consist of two readings, i.e. power delivered to the grid and power received from the grid.
M3	Grid company	-	-	Monthly	Grid Company (Annually)	Accuracy Class 1 or more accurate	Monthly billing receipts (for power received from the grid) provided by the grid company.

¹⁰

The project entity intends to log the readings of meters M2 manually in daily logs, but these logs will not form a formal requirement during verification. The ACM0002 methodology only requires hourly electronic measurement and these manual log records will only be maintained for back-up purposes. The project entity may deviate from this procedure during actual operation of the project.

**PROCEDURES IN CASE OF DAMAGED METERING EQUIPMENT / EMERGENCIES****Damages to metering equipment:**

In case metering equipment is damaged and no reliable readings can be recorded the project entity will estimate net supply by the proposed project activity according to the following procedure:

1. **In case metering equipment operated by project entity is damaged only:**
The metering data logged by the grid company, evidenced by sales receipts will be used as record of net power supplied to the grid for the days for which no record could be recorded.
2. **In case both metering equipment operated by project entity and grid company is damaged:**
The project entity and the grid company will jointly calculate a conservative estimate of power supplied to the grid. A statement will be prepared indicating
 - ▶ the background to the damage to metering equipment
 - ▶ the assumptions used to estimate net supply to the grid for the days for which no record could be recorded
 - ▶ the estimation of power supplied to the gridThe statement will be signed by both a representative of the project entity as well as a representative of the grid company.
3. **In case the metering equipment operated by the grid company for metering of emergency power consumption is damaged:**
The project entity and the grid company will jointly calculate a conservative estimate of power supplied to the grid. A statement will be prepared indicating
 - ▶ the background to the damage to metering equipment
 - ▶ the assumptions used to estimate net supply to the grid for the days for which no record could be recorded
 - ▶ the estimation of power supplied to the gridThe statement will be signed by both a representative of the project entity as well as a representative of the grid company.

The project entity will furthermore document all efforts taken to restore normal monitoring procedures.

Emergencies:

In case of emergencies, the project entity will not claim emission reductions due to the project activity for the duration of the emergency. The project entity will follow the following procedure for declaring the emergency period to be over:

1. The project entity will ensure that all requirements for monitoring of emission reductions have been re-established.
2. The monitoring officer and the head of operations of the hydropower station will both sign a statement declaring the emergency situation to have ended and normal operations to have resumed.

OPERATIONAL AND MANAGEMENT STRUCTURE FOR MONITORING

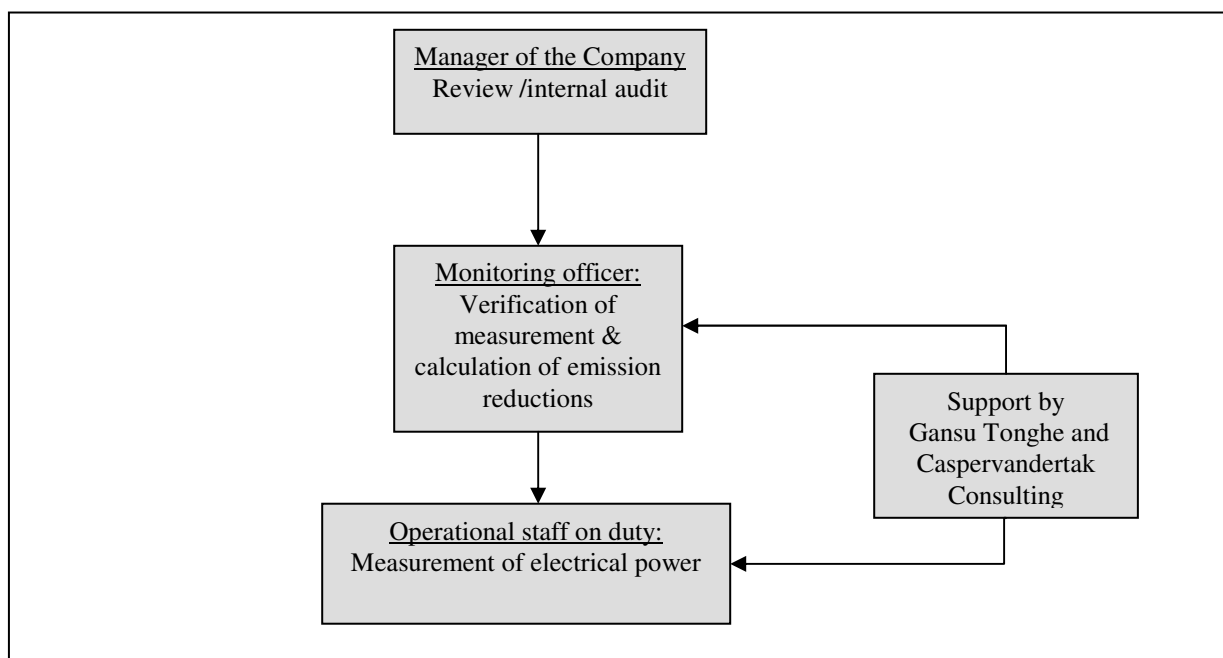
The monitoring of the emission reductions will be carried out according to the scheme shown in Figure B.4. The manager of the company will hold the overall responsibility for the monitoring process, but as indicated below parts of the process are delegated. The first step is the measurement of the electrical



energy supplied to the grid and reporting of daily operations, which will be carried out by the operational staff on duty.

The project owner will appoint a monitoring officer who will be responsible for verification of the measurement, collection of sales receipts, collection of billing receipts of the power supplied by the grid to the hydropower plant and the calculation of the emissions reductions. The monitoring officer will prepare operational reports of the project activity, recording the daily operation of the hydropower station including operating periods, power generation, power delivered to the grid, equipment defects, etc. The selection procedure, tasks and responsibilities of the monitoring officer are described in detail in Annex 4. Finally, the monitoring reports will be reviewed by the manager of the company.

Figure B.4. Management structure in order to monitor emission reductions



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

Date of completion of the baseline study and monitoring methodology: 31/07/2008

Name of persons determining the baseline study and the monitoring methodology:

Caspervandertak Consulting

Tel: +86-10-84505756 / Fax: +86-10-84505758

-Christophe Assicot:	Consultant/Gansu representative	Christophe@cdmasia.com
-Meskes Berkouwer:	Consultant:	Meskes@caspervandertakconsulting.com
-Joost van Acht:	Chief Representative China:	Joost@caspervandertakconsulting.com
-Casper van der Tak:	General Director:	Info@caspervandertakconsulting.com



Gansu Tonghe Investment Project Consulting Co., Ltd.

Tel: +86-931-4663436 / Fax: +86-931-4541296

-Zhao Yonghong: Consultant: mei.yang@126.com
-Jin Yuebing: General Director: jybing_gs@126.com; jybing_gs@163.com

Caspervandertak Consulting and Gansu Tonghe Investment Project Consulting Co., Ltd. are both not project participants.

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:

23/07/2005 (the day when the equipment purchase contract was signed)

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

30 years 0 months

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

C.2.1. Renewable crediting period

A renewable crediting period will be used.

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

01/10/2008 or the date after registration.

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

Not applicable, a renewable crediting period will be applied.

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

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

An Environmental Impact Assessment (EIA) was carried out and was accepted by the Environmental Protection Bureau of Sichuan Province on the 13th of December 2004. A summary of the main findings of the EIA is provided below:

SUMMARY OF ENVIRONMENTAL IMPACT ASSESSMENT**Main positive impacts of the project**

The main positive impacts of Gaokeng hydropower station are the sustainability of power generation, as well as environmental and social benefits.

The average annual power generation amounts to 58,874,700 kWh. The project will generate electricity from renewable energy. Therefore, no harmful substances such as waste water, waste gas and residues from combustion of fossil fuel will be released after operationalization. The project will also bring significant ecological benefits by replacing the use of wood in daily life with electricity, and contribute to the sustainability of power generation. In addition, the project also promotes local economic development, increases local tax revenues and creates employment opportunities.

Main negative impacts of the project*1. Construction period*

Construction activities will generate waste water, air and noise pollution. Excavation activities will create soil erosion and will have a temporary negative impact on the environment.

2. Operation period

After the project is put into operation, the creation of the reservoir will force birds, frogs and reptiles to relocate, but not as far as to endanger their lives.

3. Impact on Tongjiang river hydrological station

The Tongjiang hydrological station will have to be relocated due to the creation of the reservoir.

Environment protection measures

The following environment protection measures must be implemented to limit the negative impacts of the project on the environment during construction:

- Recycle and prohibit drainage of waste water into the river.
- Build septic tanks for domestic sewage, which can only be used for farm land irrigation after adequate treatment. At no time sewage must be drained into the river.
- Water must be sprayed to reduce dust created by construction activities.
- Noise prevention measures such as speed limit for vehicles must be enforced. Night blasting operations are prohibited.
- Vegetation and soil affected by excavation activities must be restored after completion of construction activities.
- Costs for the relocation of the Hydrological station must be included in the project total construction costs.

The Gaokeng project will invest a total of 50 Millions RMB for environment protection.

**Conclusion**

The main positive impact of Gaokeng hydropower station is the contribution to the sustainability of power generation in Central China, but the project also brings environmental and social benefits. There are temporary negative impacts on water and environment but those are restricted to the construction period. With appropriate environmental protection measures, negative impacts of the project can be mitigated. Therefore, the project is feasible.

Recommendations

- (1) The management of construction activities must strictly abide by applicable environmental protection regulations.
- (2) The site must be inspected on a regular basis and environmental impacts must be monitored.
- (3) The construction staff will receive specific training regarding environmental protection.

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:

The environmental impacts of the project are not considered significant by the Chinese government and the project participants. The Environmental Impact Assessment Form (EIA) was approved by the Environment Protection Bureau of Sichuan Province on the 13th of December 2004.

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

The project entity carried out a separate stakeholder consultation to confirm the impacts of the project on the relevant stakeholders. The consultation lasted for one month, from the 20th of March to the 20th of April of 2007, and consisted of the following elements:

- **Establishment of a website:**

The website (<http://www.cdmasia.org/CDMprojects.htm>) contained information on the project, CDM, the stakeholder consultation process and provided an opportunity to post comments by e-mail or by telephone.

- **Organization of a stakeholder consultation meeting near project site:**

Date / time: 30th of March 2007, from 9:00am till 11:30am.

Location: Second floor meeting room of Kaiyuan Hotel of Tongjiang County

Agenda of the meeting:

- Opening of the meeting
- Introduction of the project
- Introduction of the Clean Development Mechanism
- Explanation of the stakeholder consultation process
- Round of comments by each participant
- Further questions and answers
- Closing of the meeting

To ensure wide participation of stakeholders, announcements of the stakeholder consultation meeting and website were made through the following channels:

- Newspaper announcement on March 20th, 2007, in the Bazhong Daily (County's leading daily newspaper)
- Online announcement on the Tongjiang County Government Site: www.sctj.gov.cn on the 20th of January, 2007.

In addition to the above announcements, important stakeholders received personal invitations to attend the meeting. See for attendance of the meeting Table E.1. A report of the main comments and outcomes of the meeting is provided in section E.2.

**Table E.1. List of stakeholders that attended the stakeholder consultation meeting**

No.	Organization	Participant	Position
1	CPPCC Tongjiang commission	Zhao Hongbing	Vice chairman
2	Local government of Tongjiang county	Deng Qi	Vice secretary of the Party
3	Agricultural bank Tongjiang branch	Liu Dali	Director
4	Agricultural bank Tongjiang branch	Xu Zhixin	Project manager
5	Jintang village of Tongjiang county	Li Zhilan	Secretary of the Party
6	Jintang village of Tongjiang county	Zhao Lingde	Director of the village commission
7	Jintang village of Tongjiang county	Li Shaohong	Villager
8	Jintang village of Tongjiang county	Li Yong	Villager
9	Jintang village of Tongjiang county	Zhao Qianlie	Villager
10	Jintang village of Tongjiang county	Zhao Kezheng	Villager
11	Land resource bureau, Tongjiang county	Shao Zhihong	Director
12	Land resource bureau, Tongjiang county	Zhang Xiaoming	Representative
13	Environment Prot. Bureau, Tongjiang county	Li Guo	Representative
14	Guangna town at Tongjiang county	Zhang Zhiwen	Mayor of the town
15	Merchants bureau of Tongjiang county	Zhu Zhaoxuan	Representative
16	Poverty alleviation bureau, Tongjiang county	Wang Lixin	Director
17	CVDT consulting	Christophe Assicot	Consultant
18	Gansu Tonghe Investment project consulting	Zhao Yonghong	Project manager
19	Gansu Tonghe Investment project consulting	Wang Chunyun	Consultant
20	Sichuan Yili Energy Investment Development Co., Ltd.	Chen Tianfu	Vice general manager
21	Sichuan Yili Energy Investment Development Co., Ltd.	Chen Jie	General manager

Supplementary to the above consultation, four more villages located in the vicinity of the project area were subject to an opinion poll, to ensure exhaustive participation of stakeholders. The poll was conducted in the form of a questionnaire distributed in October 2007. A total of 26 people were interviewed, among them 5 residents from Chunzai village, 9 residents from Guangna town, 3 from Nuojiang town, 8 from Maoyu town and one from Xiaojiangkou village. See section E.2., table E.2. for details.

E.2. Summary of the comments received:

Comments and opinions received at stakeholder consultation meeting:

Each attendant of the stakeholder consultation meeting expressed his or her opinion on the proposed project. During the meeting many stakeholders asked general questions about the CDM procedures, these comments were omitted from the comments stated below.

The project entity was represented by Sichuan Yili Energy Investment Development Co., Ltd.:

- Mr. Chen Jie (General Manager)
- Mr. Chen Tianfu (General Vice-Manager)

An overview of the main comments/questions expressed during the meeting:



Name: Zhao Hongbing
Position / Affiliation: Vice-chairman of the CPPCC Tongjiang commission
Comments:

Mr. Zhao explains that the Gaokeng station will offer employment opportunities for local residents both during construction and operation period. After implementation, the power supplied to the grid will contribute to local development. He adds that there are no negative impacts on environment: No migrant fish, a design that takes into account a “once every 500 years” flooding probability, majority of flooded land is riverbed land.

Name: Deng Qi
Position / Affiliation: Vice-secretary of the Party’s commission, Tongjiang County
Comments:

Mr. Deng says that the local Government strongly supports the project because it is environment-friendly. The surface expropriated is small and only one family will be relocated. There’s a power shortage at present in Tongjiang County and power cuts are frequent. Therefore, Tongjiang County will undoubtedly benefit from the project.

Mr. Chen Jie, from the project entity made further explanation that the relocated family will be so only for safety purposes. Thus, the original house won’t be flooded by the reservoir but is located below the “once every 10 years” flood level. The family will simply be displaced on a higher part of the land.

Name: Li Shaohong
Position / Affiliation: Villager, Jintang village
Comments:

Mr. Li confirms that the villagers are satisfied with the compensation. He reckons the project will facilitate land irrigation since the water level will be raised.

Question asked by Mr. Christophe Assicot, from CVDT consulting: Where do the villagers get drinking water from?

Mr. Li replied that all drinking water comes from spring water in the mountains.

Name: Zhao Qianlie
Position / Affiliation: Villager, Jintang village

Mr. Zhao notes that local residents use donkeys for grain grinding at present. He believes that, when the project is finished, people will use electric grinding machines.

Name: Mr. Zhao Yonghong
Position / Affiliation: Project Manager Gansu Tonghe Investment Project Consulting Co., ltd.
Comments:

Mr. Zhao Yonghong wanted to know which village accounts for most land expropriations, and how the villagers’ life is changing after land expropriation?

Response by Mr. Shao Zhihong (general director of land resource bureau, Tongjiang County)
Jintang village is most impacted village with 3.15mu of land expropriated, most of this land being riverbed land. The population in the village is 1,000 and the plowland is amounts to 1,000mu.

Response by Mr. Li Zhilan (Jintang village leader)

Mr. Li assures there is no significant change in living standards because only 24% of the village’s income comes from agriculture. In addition, the output of expropriated land was low compared to remaining plowland.



Name: Mr. Zhao Zhihong

Position / Affiliation: Land resource bureau, general director, Tongjiang County

Comments:

Mr. Shao brings forward that expropriation work is executed in accordance with the law. The expropriated land is mostly riverbed or abandoned land. Only a limited part is actual plowland.

Name: Mr. Chen Jie

Position / Affiliation: General Manger, Project entity

Comments:

Mr. Chen explains that the hydropower station doesn't comprise a water diversion structure; therefore the volume excavated is relatively small. Restoration work such as tree & grass planting will start after construction.

Results of the opinion poll in surrounding villages:

The survey clearly showed that local residents approve the construction of the project and expect that the operationalization of the Gaokeng hydropower station will bring additional benefits and contribute to the development of Tongjiang County.

Table E.2. Main findings of the questionnaire

Impacts of Gaokeng hydropower station		Number of people who agree with the statement	Ratio
Economy	Promote local economic development	26	100%
	Help develop livestock breeding	19	73.08%
	Other positive impacts	1	3.85%
	Without negative impacts	26	100%
	With negative impacts	1	3.85%
Society	Employment opportunities	23	88.46%
	Increase local income	24	92.31%
	Improve stability of electric power	22	84.62%
	Improve communications (boats, dam)	21	80.77%
	Other positive impacts	1	3.85%
	Without negative impacts	26	100%
	With negative impacts	0	0%
Environment	Reduce tree cutting	25	96.15%
	Replace the use of wood in daily life	23	88.46%
	No discharge of pollutants	18	69.23%
	Other positive impacts	2	7.69%
	Without negative impacts	26	100%
	With negative impacts	0	0%
Water	Facilitate water fetching	22	84.62%
	Improve irrigation	20	76.92%
	Other positive impacts	2	7.69%
	Without negative impacts	26	100%
	With negative impacts	0	0%
Private life	With positive impacts	23	88.46%
	Make no difference	3	11.54%
General	Support the project	26	100%



opinion	Against the project	0	0%
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E.3. Report on how due account was taken of any comments received:

Given the generally positive (or neutral) nature of the comments received, no action will be taken to solve the comments received.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY.****The project entity:**

Organization:	Sichuan Yili Energy Investment & Development Co., ltd.
Street/P.O.Box:	The third floor of Xiaozhu garden on Chengnan road.
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State/Region:	Sichuan province
Postfix/ZIP:	636700
Country:	China
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FAX:	0827-7201315
E-Mail:	
URL:	
Represented by:	Chen Tianfu
Title:	vice manager and financing supervisor
Salutation:	Mr
Last Name:	Chen
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**The Purchasing Party:**

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Represented by:	Michael Dwyer
Title:	Trader
Salutation:	Mr.
Last Name:	Dwyer
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Direct tel:	0041 22 703 2955
Personal E-Mail:	Michael_dwyer1@cargill.com



Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The Project does not receive any public funding from Annex I countries.

**Annex 3****BASELINE INFORMATION**

The baseline uses basically the same methodology as used in the calculation of the OM and BM emission factors published by the Chinese authorities for climate change on the internet. Full information on the calculation of the baseline and underlying data can be found at:

<http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1364.pdf> : calculation result of the baseline emission factor of Chinese power grid.

<http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1358.xls> : calculation process of the baseline OM emission factor of Chinese power grid

<http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf> : calculation process of the baseline BM emission factor of Chinese power grid

Note: We recalculated the Operating Margin (OM) and Build Margin (BM) emission factors on the basis of the publicly available data quoted in the calculation of the published emission factors. We have also used the most recently published data from the China Electric Power Yearbook 2006 and the China Energy Statistical Yearbook. For these reasons, the calculated emission factors differ from the emission factors published by the Chinese authorities.

Below we provide the main data used in the calculation of the baseline emission factor.

Table A1. Calculation of the Combined Margin Emission Factor

	Emission factor A	Value and Source B	Weight C	Weighted value D = B * C
1	EF _{OM}	1.29093	0.5	0.64546
		Table A2		
2	EF _{BM}	0.66344	0.5	0.33172
		Table A5		
3	CM			0.97718
				D1 + D2

Table A2. Calculation of the Operating Margin Emission Factor

	Variable	2003 A	2004 B	2005 C	Total D
1	Supply of thermal power to Central China grid (MWh)	225,987,719	249,074,186	286,203,305	761,265,210
		Table A3c, C7	Table A3b, C7	Table A3a, C7	D1 = A1 + B1 + C1
2	Imports of power from other grids (MWh)	0	0	0	0
		Files cited above	Files cited above	Files cited above	D2 = A2 + B2 + C2



3	Total power supply for calculation EF _{OM} (MWh)	225,987,719	249,074,186	286,203,305	761,265,210
		A3 = A1 + A2	B3 = B1 + B2	C3 = C1 + C2	D3 = D1 + D2
4	CO2 emissions associated with thermal power generation on Central China grid (tCO2)	276,371,085	346,043,286	360,323,575	982,737,946
		Table A4c, E	Table A4b, E	Table A4a, E	D4 = A4 + B4 + C4
5	CO2 emissions associated with power imports from other grids (tCO2)	0	0	0	0
		Table A9c, E	Table A9b, E	Table A9a, E	D5 = A5 + B5 + C5
6	Total CO2 emissions for calculation EF _{OM} (tCO2)	276,371,085	346,043,286	360,323,575	982,737,946
		A6 = A4 + A5	B6 = B4 + B5	C6 = C4 + C5	D6 = D4 + D5
7	EFOM (tCO2/MWh)	1.22295	1.38932	1.25898	1.29093
		A6 / A3	B6 / B3	C6 / C3	D6 / D3

Table A3a. Calculation of thermal power supply to Central China Grid, 2005

	Grid	Thermal Power generation (MWh) A	Losses (%) B	Thermal power supply (MWh) C = A * (100 - B) / 100
1	Jiangxi	30,000,000	6.48	28,056,000
2	Henan	131,590,000	7.32	121,957,612
3	Hubei	47,700,000	2.51	46,502,730
4	Hunan	39,900,000	5.00	37,905,000
5	Chongqing	17,584,000	8.05	16,168,488
6	Sichuan	37,202,000	4.27	35,613,475
7	Central China			286,203,305
				C7 = C1 + C2 + C3 + C4 + C5 + C6

Source: China Electric Power Yearbook 2006, p. 559, 568.

Table A3b. Calculation of thermal power supply to Central China Grid, 2004

	Grid	Thermal Power generation (MWh) A	Losses (%) B	Thermal power supply (MWh) C = A * (100 - B) / 100
1	Jiangxi	30,127,000	7.04	28,006,059
2	Henan	109,352,000	8.19	100,396,071
3	Hubei	43,034,000	6.58	40,202,363
4	Hunan	37,186,000	7.47	34,408,206
5	Chongqing	16,520,000	11.06	14,692,888
6	Sichuan	34,627,000	9.41	31,368,599
7	Central China			249,074,186
				C7 = C1 + C2 + C3 + C4 + C5 + C6

Source: Files mentioned above. Original data are from China Electric Power Yearbook 2005, p. 472-474.



Table A3c. Calculation of thermal power supply to Central China Grid, 2003

	Grid	Thermal Power generation (MWh) A	Losses (%) B	Thermal power supply (MWh) C = A * (100 - B) / 100
1	Jiangxi	27,165,000	6.43	25,418,291
2	Henan	95,518,000	7.68	88,182,218
3	Hubei	39,532,000	3.81	38,025,831
4	Hunan	29,501,000	4.58	28,149,854
5	Chongqing	16,341,000	8.97	14,875,212
6	Sichuan	32,782,000	4.41	31,336,314
7	Central China			225,987,719
				C7 = C1 + C2 + C3 + C4 + C5 + C6

Source: Files mentioned above. Original data are from China Electric Power Yearbook 2004, p. 670, p. 709.



Table A4a. Calculation of CO2 emissions from fuels for thermal power production, Central China Grid, 2005.

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Central China	NCV	Oxidation factor	Carbon coefficient	CO2 emissions
								Grid	(TJ/unit)	(Fraction)	(TC/TJ)	(tCO2)
								A	B	C	D	E = A*B*C*D*44/12
Raw coal	10 ⁴ Tons	1,869.29	7,638.87	2,732.15	1,712.27	875.40	2,999.77	17,827.75	209.08	1	25.8	352,614,496.76
Clean coal	10 ⁴ Tons	0.02	0.00	0.00	0.00	0.00	0.00	0.02	263.44	1	25.8	498.43
Other washed coal	10 ⁴ Tons	0.00	138.12	0.00	0.00	89.99	0.00	228.11	83.63	1	25.8	1,804,669.00
Briquettes	10 ⁴ Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83.63	1	26.5	0.00
Coke	10 ⁴ Tons	0.00	25.95	0.00	105.00	0.00	0.00	130.95	284.35	1	29.2	3,986,695.05
Coke oven gas	10 ⁸ m ³	0.00	0.00	1.15	0.00	0.36	0.00	1.51	1672.6	1	12.1	112,053.61
Other gas	10 ⁸ m ³	0.00	10.20	0.00	0.00	3.12	0.00	13.32	522.7	1	12.1	308,896.88
Crude oil	10 ⁴ Tons	0.00	0.82	0.36	0.00	0.00	0.00	1.18	418.16	1	20	36,184.78
Gasoline	10 ⁴ Tons	0.00	0.02	0.00	0.00	0.02	0.00	0.04	430.7	1	18.9	1,193.90
Diesel	10 ⁴ Tons	1.30	3.03	2.39	1.39	1.38	0.00	9.49	426.52	1	20.2	299,797.78
Fuel oil	10 ⁴ Tons	0.64	0.29	3.15	1.68	0.89	2.22	8.87	418.16	1	21.1	286,959.09
LPG	10 ⁴ Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	501.79	1	17.2	0.00
Refinery gas	10 ⁴ Tons	0.71	3.41	1.76	0.78	0.00	0.00	6.66	460.55	1	15.7	176,572.11
Natural gas	10 ⁸ m ³	0.00	0.00	0.00	0.00	0.00	3.00	3.00	3893.1	1	15.3	655,208.73
Other petroleum products	10 ⁴ Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	383.69	1	20	0.00
Other coking	10 ⁴	0.00	0.00	0.00	1.50	0.00	0.00	1.50	284.35	1	25.8	40,349.27



products	Tons											
Other E (standard coal)	10 ⁴ Tce	0.00	2.88	0.00	1.74	32.80	0.00	37.42	292.7	1	0	0.00
Total												360,323,575.39
												$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2006. Net calorific values are from China Energy Statistical Yearbook, 2004 p. 302; Oxidation factors are the IPCC default values, see 2006 IPCC Guidelines for National Greenhouse Gas Inventories,; fuel emission coefficients are IPCC default values, see 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Table A4b. Calculation of CO2 emissions from fuels for thermal power production, Central China Grid, 2004.

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Central China	NCV	Oxidation factor	Carbon coefficient	CO2 emissions
								Grid	(TJ/unit)	(Fraction)	(TC/TJ)	(tCO2)
								A	B	C	D	E = A*B*C*D*44/12
Raw coal	10 ⁴ Tons	1,863.80	6,948.50	2,510.50	2,197.90	875.5	2,747.90	17,144.10	209.08	1	25.8	339,092,605.29
Clean coal	10 ⁴ Tons	0	2.34	0	0	0	0	2.34	263.44	1	25.8	58,316.13
Other washed coal	10 ⁴ Tons	48.93	104.22	0	0	89.72	0	242.87	83.63	1	25.8	1,921,441.23
Briquettes	10 ⁴ Tons	0	0	0	0.92	0	0	0.92	83.63	1	26.5	7,475.96
Coke	10 ⁴ Tons	0	109.61	0	0	0	0	109.61	284.35	1	29.2	3,337,011.41
Coke oven gas	10 ⁸ m ³	0	0	1.68	0	0.34	0	2.02	1672.6	1	12.1	149,899.53
Other gas	10 ⁸ m ³	0	0	0	0	2.61	0	2.61	522.7	1	12.1	60,527.09
Crude oil	10 ⁴ Tons	0	0.86	0.22	0	0	0	1.08	418.16	1	20	33,118.27
Gasoline	10 ⁴ Tons	0	0.06	0	0	0.01	0	0.07	430.7	1	18.9	2,089.33
Diesel	10 ⁴ Tons	0.02	3.86	1.7	1.72	1.14	0	8.44	426.52	1	20.2	266,627.32
Fuel oil	10 ⁴ Tons	1.09	0.19	9.55	1.38	0.48	1.68	14.37	418.16	1	21.1	464,893.14



LPG	10 ⁴ Tons	0	0	0	0	0	0	0.00	501.79	1	17.2	0.00
Refinery gas	10 ⁴ Tons	3.52	2.27	0	0	0	0	5.79	460.55	1	15.7	153,506.38
Natural gas	10 ⁸ m ³	0	0	0	0	0	2.27	2.27	3893.1	1	15.3	495,774.61
Other petroleum products	10 ⁴ Tons	0	0	0	0	0	0	0.00	383.69	1	20	0.00
Other coking products	10 ⁴ Tons	0	0	0	0	0	0	0.00	284.35	1	25.8	0.00
Other E (standard coal)	10 ⁴ Tce	0	16.92	0	15.2	20.95	0	53.07	292.7	1	0	0.00
Total												346,043,285.70
												$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2005. Net calorific values are from the China Energy Statistical Yearbook, 2004 p. 302; Oxidation factors are the IPCC default values, see 2006 IPCC Guidelines for National Greenhouse Gas Inventories; fuel emission coefficients are IPCC default values, see 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Table A4c. Calculation of CO2 emissions from fuels for thermal power production, Central China Grid, 2003.

Fuel	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Central China	NCV	Oxidation factor	Carbon coefficient	CO2 emissions
								Grid	(TJ/unit)	(Fraction)	(TC/TJ)	(tCO2)
								A	B	C	D	E = A*B*C*D*44/12
Raw coal	10 ⁴ Tons	1,427.41	5,504.94	2,072.44	1,646.47	769.47	2,430.93	13,851.66	209.08	1	25.8	273,971,539.89
Clean coal	10 ⁴ Tons	0	0	0	0	0	0	0.00	263.44	1	25.8	0.00
Other washed coal	10 ⁴ Tons	2.03	39.63	0	0	106.12	0	147.78	83.63	1	25.8	1,169,146.40
Briquettes	10 ⁴ Tons	0	0	0	0	0	0	0.00	83.63	1	26.5	0.00



Coke	10 ⁴ Tons	0	0	0	1.22	0	0	1.22	284.35	1	29.2	37,142.18
Coke oven gas	10 ⁸ m ³	0	0	0.93	0	0	0	0.93	1672.6	1	12.1	69,013.15
Other gas	10 ⁸ m ³	0	0	0	0	0	0	0.00	522.7	1	12.1	0.00
Crude oil	10 ⁴ Tons	0	0.5	0.24	0	0	1.2	1.94	418.16	1	20	59,490.23
Gasoline	10 ⁴ Tons	0	0	0	0	0	0	0.00	430.7	1	18.9	0.00
Diesel	10 ⁴ Tons	0.52	2.54	0.69	1.21	0.77	0	5.73	426.52	1	20.2	181,015.94
Fuel oil	10 ⁴ Tons	0.42	0.25	2.17	0.54	0.28	1.2	4.86	418.16	1	21.1	157,229.00
LPG	10 ⁴ Tons	0	0	0	0	0	0	0.00	501.79	1	17.2	0.00
Refinery gas	10 ⁴ Tons	1.76	6.53	0	0.66	0	0	8.95	460.55	1	15.7	237,285.34
Natural gas	10 ⁸ m ³	0	0	0	0	0.04	2.2	2.24	3893.1	1	15.3	489,222.52
Other petroleum products	10 ⁴ Tons	0	0	0	0	0	0	0.00	383.69	1	20	0.00
Other coking products	10 ⁴ Tons	0	0	0	0	0	0	0.00	284.35	1	25.8	0.00
Other E (standard coal)	10 ⁴ Tce	0	11.04	0	0	16.2	0	27.24	292.7	1	0	0.00
Total												276,371,084.63
												$\Sigma(E_i)$

Data source: Fuel consumption data are from China Energy Statistical Yearbook 2004, p. 246-261. Net calorific values are from the China Energy Statistical Yearbook, 2004 p. 302; Oxidation factors are the IPCC default values, see 2006 IPCC Guidelines for National Greenhouse Gas Inventories; fuel emission coefficients are IPCC default values, see 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

**Table A5. Calculation of the BM Emission Factor, Central China Grid**

EF_{thermal} (tCO₂/MWh)	Share of thermal power in added capacity, 2005- 2002	EF_{BM} (tCO₂/MWh)
A	B	C = A * B
0.95434	69.52%	0.66344
Table A6	Table A9	

Table A6. Calculation of EF thermal

	Fuel	λ	EF_{adv}	EF_{thermal} calculation
		A	B	C = A * B
1	Coal	99.48%	0.95678	0.95179
		Table A8	Table A7	
2	Gas	0.35%	0.44952	0.00156
		Table A8	Table A7	
3	Oil	0.17%	0.57012	0.00099
		Table A8	Table A7	
4	EF _{thermal}			0.95434

Table A7. Calculation of Emission factors of fuel using advanced technologies

Fuel	Efficiency (%)	Carbon coefficient (tc/TJ)	Oxidation factor	EF_{adv} (tCO₂/MWh)
	A	Table A7a B	C	D=(3.6/(A*1000))*B*C*44/12
Coal	35.82%	26.0	1	0.95677827
Gas	47.67%	16.2	1	0.449523224
Oil	47.67%	20.6	1	0.570120626

Source: Files downloaded and mentioned above.

Table A7a. Weighted average carbon coefficient (tc/TJ)

Weighted average carbon coefficient (tc/TJ)	
Coal	26.0
Gas	16.2
Oil	20.6

Source: Table A8

**Table A8. Calculation of λ s for the calculation of the BM, Central China Grid.¹¹**

Fuel	Unit	Central China	NCV	Total energy consumption Central China	Oxidation factor	Carbon coefficient	CO2 emissions
		Grid	(TJ/unit)	TJ	(Fraction)	(TC/TJ)	(tCO2)
		A	B		C	D	E = $A*B*C*D*44/12$
Raw coal	10 ⁴ Tons	17,827.75	209.08	3,727,425.97	1	25.8	352,614,497
Clean coal	10 ⁴ Tons	0.02	263.44	5.27	1	25.8	498
Other washed coal	10 ⁴ Tons	228.11	83.63	19,076.84	1	25.8	1,804,669
Briquettes	10 ⁴ Tons	0.00	83.63	0.00	1	26.5	0
Coke	10 ⁴ Tons	130.95	284.35	37,235.63	1	29.2	3,986,695
Other coking products	10 ⁴ Tons	1.50	284.35	426.53	1	25.8	40,349
Coal, total				3,784,170.24	1		358,446,709
Coke oven gas	10 ⁸ m ³	1.51	1672.6	2,525.63	1	12.1	112,054
Other gas	10 ⁸ m ³	13.32	522.7	6,962.36	1	12.1	308,897
LPG	10 ⁴ Tons	0.00	501.79	0.00	1	17.2	0
Refinery gas	10 ⁴ Tons	6.66	460.55	3,067.26	1	15.7	176,572
Natural gas	10 ⁸ m ³	3.00	3893.1	11,679.30	1	15.3	655,209
Gas total				24,234.55	1		1,252,731
Crude oil	10 ⁴ Tons	1.18	418.16	493.43	1	20	36,185
Gasoline	10 ⁴ Tons	0.04	430.7	17.23	1	18.9	1,194
Diesel	10 ⁴ Tons	9.49	426.52	4,047.67	1	20.2	299,798
Fuel oil	10 ⁴ Tons	8.87	418.16	3,709.08	1	21.1	286,959
Other petroleum products	10 ⁴ Tons	0.00	383.69	0.00	1	20	0
Oil total				8,267.41			624,136
Total							360,323,575
							$\Sigma(E_i)$

λ_{coal}	99.48%
λ_{gas}	0.35%
λ_{oil}	0.17%

Note: We have used the results of the above calculation for λ for the respective fuels in subsequent calculation of the BM. The carbon emission factor of the fuel groups (coal, gas and oil) have been calculated as a weighted average with the share of the fuels in terms of energy contents as weights.

¹¹ Data are from Table A4a.

**Table A9. Calculation of the share of thermal power in recently added capacity**

Installed capacity	2001	2002	2003	2004	2005	Capacity added in 2005-2002 D=C-A	Share in added capacity
			A	B	C		
Thermal (MW)	42569.2	43303.2	46893.5	53744.7	60167.2	16864	69.52%
Hydropower (MW)	30397	31034.7	32357	34642	38405.2	7370.5	30.38%
Nuclear (MW)	0	0	0		0	0	0.00%
Other (MW)	0	0	0		24	24	0.10%
Total (MW)	72966.2	74337.9	79250.5	88386.7	98596.4	24258.5	100.00%
Percentage of 2005 capacity	74.00%	75.40%	80.38%	89.64%	100%		

Source: China Electric Power Yearbooks 2006-2005-2004-2003-2002 and Chinese DNA.

**Annex 4****MONITORING INFORMATION****Selection procedure:**

The monitoring officer will be appointed by the general manager of Sichuan Yili Energy Investment Development Co., Ltd. The monitoring officer will be selected from among the senior technical or managerial staff. Before he/she commences monitoring duties, he/she will receive training on monitoring requirements and procedures by Caspervandertak Consulting and Gansu Tonghe Investment Project Consulting Co., Ltd.

The selection of the initial monitoring officer has taken place and the following person was appointed:

Name: Chen Tianfu

Position: Vice general manager of Sichuan Yili Energy Investment Development Co., Ltd.

Tasks and responsibilities:

The monitoring officer will be responsible for carrying out the following tasks

- **Supervise and verify metering and recording:**
The monitoring officer will coordinate with the plant manager to ensure and verify adequate metering and recording of data, including power delivered to the grid.
- **Collection of additional data, sales / billing receipts:**
The monitoring officer will collect sales receipts for power delivered to the grid, billing receipts for power delivered by the grid to the hydropower station and additional data such as the daily operational reports of the hydropower station.
- **Supervise preparation of photographic evidence reservoir surface area**
The monitoring officer will ensure that photographic evidence of the reservoir surface area is prepared and will provide the design dimensions of the reservoir to a DOE to allow for comparison.
- **Supervise and collect records of operational hours emergency back-up diesel generator**
The monitoring officer will collect the daily operational logs evidencing the use of the emergency back-up diesel generator and ensure that the operational hours are logged accurately.
- **Calculation of emission reductions:**
The monitoring officer will calculate the annual emission reductions on the basis of net power supply to the grid. The monitoring officer will be provided with a calculation template in electronic form by the project's CDM advisors.
- **Preparation of monitoring report:**
The monitoring officer will annually prepare a monitoring report which will include among others a summary of daily operations, metering values of power supplied to and received from the grid, copies of sales/billing receipts, a report on calibration and a calculation of emission reductions.

Support:

The monitoring officer will receive support from Caspervandertak Consulting and Gansu Tonghe Investment Project Consulting Co., Ltd in his/her responsibilities through the following actions:

- Initial training on CDM, monitoring methodology, monitoring procedures and requirements and archiving
- Provide the monitoring officer with a calculation template in electronic form for calculation of annual emission reductions
- Continuous advice to the monitoring officer on a need basis
- Review of monitoring report

