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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Shiyazi Hydro power Project in Guizhou Province China.

Version: 6.0
Data: 22/08/2011

Revision history

Version number	Date	Reason
Version 1.0	**Jun., 2009**	**Draft PDD**
Version 2.0	**Aug., 2009**	**Revised according to "Tool to calculate emission factor an electricity system" (version 02)**
Version 3.0	**Feb, 2010**	**Revised according to ACM0002-Consolidated baseline methodology for grid-connected electricity generation from renewable sources (Version 11)**
Version 4.0	**May 2010**	**Revised according to validation protocol**
Version 5.0	**Jan.,2011**	**Revised according to validation protocol**
Version 6.0	**Aug., 2011**	**Revised according to validation protocol**

A.2. Description of the project activity:

Shiyazi 140MW Hydro Power Project (here after referred to as "the proposed project") is a diversion type hydropower station which locates in Meilin canyon lying between Daping town and Baicun town, Wuchuan Country, Zunyi City, Guizhou Province, China. The proposed project total installed capacity is 140MW (2×70MW), the design of quoted discharge is 145 m^3/s, thus the power density of the project will be 17.4 W/m^2. The estimated annual operation time of the proposed project is 3416h and the average electricity generated is 478,200 MWh and the expected annual feed-in electricity to the grid is 467,300MWh. The electricity generated by the proposed project will meet the electricity demand of industrial and agricultural production and Zunyi City people's life, assume the task to adjust the peak in the local grid, and finally is delivered to China Southern Power Grid (CSPG).

Electricity generated by the proposed project will displace part of the electricity generated by China Southern Power Grid (CSPG) which is dominated by fossil fuel-fired power plants, and thus greenhouse gas (GHG) emission reductions could be achieved. The estimated annual GHG emission reductions are 368,209 tCO_2e.

As a renewable hydro power project, the proposed project will produce positive environmental and economic benefits and contribute to the local sustainable development through following aspects:

- To be in accordance with Chinese national energy policy and the Western Development Strategy, the proposed project will alleviate power shortage in Zunyi City, will boost the social and economic development of local minority areas, will increase the income of local governments and people, will improve the local poor condition and will advance the standard of living of local people.
- To displace part of the electricity from coal-fired power plants in CSPG, and thus will avoid environmental pollution caused by coal burning.

- To create new job opportunities for the local people: temporary job opportunities will be available during the construction period and 40 permanent jobs during the operation time;[1]
- After the operation of the proposed project, the local people can make good use of electricity

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R.China (host)	Guizhou Zhongshui Energy Co., Ltd (owner)	No
Japan	Eco Asset Incorporated（buyer）	No

The details of participation are shown in annex 1

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

P.R. China

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

Guizhou Province

A.4.1.3. City/Town/Community etc:

Wuchuan Country, Zunyi District

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

The proposed project is located at Meilin canyon which lies between Daping town and Baicun town, Wuchuan Country, Zunyi City, Guizhou Province. The geographical coordinates of the dam are 107°58 ˊ 7″ E and 28°39 ˊ 9″N, and the geographical coordinates of the powerhouse are 107°58 ˊ 7″ E and 28°39 ˊ 9″N. Figure 1 below shows the location of the proposed project.

[1] Feasibility Study Report of Shiyazi Hydropower Plant

Figure 1. Geographical Location of the Proposed Project

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

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The project falls into:
Sectoral Scope 1: energy industries (renewable sources)
Subclass: hydro power

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

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The proposed project is a new diversion conduit type hydro power station with reservoir and the total installed capacity of the proposed project is 140MW(2×70MW). The square meter of reservoir with full level is 8.06km^2, and the power density of the project will be 17.4 W/m^2. The main construction building tasks include barrage, intake tower, pressure tunnel, steel penstock, power plant, substation and power transmission sequence etc. The height of the gravity dam is 134.5 m. The length of the diversion tunnel is 594.6m. The water flow would drive two vertical shaft water turbines and the electrical energy will be delivered to CSPG. Table 1 shows the information of the turbine and the generator and the substation. These equipments are domestic.
The technology applied in this project is domestic and does not involve international transfer of technology.

Table 1 Design features & characteristics of the project

Turbine	Quantity	2
	Model	HLA630-LJ-280
	Manufacturer	Sichuan Dongfeng Electric Machinery Co., Ltd
	Rated rotate speed	272.7 r/min
	Rated water head	109 m
	Rated flow rate	72.37m^3/s
Generator	Quantity	2
	Model	SF70-22/6400
	Manufacturer	Sichuan Dongfeng Electric Machinery Co., Ltd
	Single capacity	70 MW
	Rated voltage	105K V

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

It is expected that the proposed project activities will generate annual emission reductions 368,209tCO_2e. The renewable crediting period is chosen, and in the first crediting period from 2011 to 2018, the total amount of the emission reduction is 2,577,463tCO_2e over the first 7 years. For detailed calculation, please refer to section B, Annex 3 and the Report on Determination of Baseline Grid.

Table 2 Ex-ante estimation of emission reductions over the first crediting period

Year	Annual emission reductions（tCO_2e）
01/11/2011-31/10/2012	368,209
01/11/2012-31/10/2013	368,209
01/11/2013-31/10/2014	368,209
01/11/2014-31/10/2015	368,209
01/11/2015-31/10/2016	368,209
01/11/2016-31/10/2017	368,209
01/11/2017-31/10/2018	368,209
Total emission reductions of the first crediting (tCO_2e)	2,577,463
The length of the first crediting period	7
Annual emission reductions in the Crediting period (tCO_2e)	368,209

A.4.5. Public funding of the project activity:

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There is no public funding involved in this proposed project.

SECTION B. Application of a baseline and monitoring methodology

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

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Title of the approved methodology: ACM0002-Consolidated baseline methodology for grid-connected electricity generation from renewable sources (Version 12.1.0)

Tool: "Tool to calculate the emission factor for an electricity system" (Version 02.0)
"Tool for the demonstration and assessment of additionality" (Version 05.2)
"Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02)

Please click following link for more information about the methodology and reference:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

The methodology ACM0002(Version 12.1.0)is applicable for the proposed project, and the proposed project meets all applicability conditions of the methodology ACM0002(Version 12.1.0) as follows:

- The proposed project is a water diversion hydro power project, and the electricity generated by the proposed project will be connected to China Southern Power Grid, so it is a grid-connected electricity generation project from renewable sources.

- The proposed project activity is a new hydro electric power project with reservoir and the reservoir's surface area at the full reservoir level is 8.06km^2, and the installed capacity of the proposed project is 140MW, so the power density is 17.4W/ m^2, greater than 4W/ m^2.The ACM0002(Version 12.1.0) can be fully used for the proposed project.

- The proposed project does not involve switching from fossil fuels to renewable energy at the site of the project activity.

- The geographic and system boundaries for the China Southern Power Grid can be clearly identified and information and data on the characteristics of the grid is available.

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

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The main emission sources and type of GHGs in project boundary are listed in Table 3 below:

Table 3 Sources and gases in project boundary

	Source	Gas	Included?	Justification /Explanation
Baseline	**Electricity generation of China Southern Power Grid**	**CO_2**	**Yes**	**Main emission source.**
		CH_4	**No**	**Minor emission source**
		N_2O	**No**	**Minor emission source.**
		CO_2	**No**	**Minor emission source.**

Activity	**combustion to the project activity**	**CH_4**	**No**	**Excluded, the project activity is a renewable energy project which will not create emission itself. The power density is above 10W/m^2, and reservoir emission do not have to be taken into account.**
		N_2O	**No**	**Minor emission source.**

According to methodology ACM0002(Version 12.1.0), the project boundary for new hydropower project includes the physical site of the plant as well as the reservoir area. The spatial extent of the project boundary includes the project power, the project site and all power plants connected physically to the electricity system that the proposed project is connected to. For this project, the delineation of grid boundaries is used as provided by the DNA of P.R. China. The generated electricity of the project will be delivered to CSPG, which covers Guangdong Province, Guangxi Province, Yunnan Province and Guizhou Province. Furthermore, there is power imported from Central China Power Grid to CSPG, the power import is considered when calculating the power grid emission factors of CSPG (Please see Annex 3 for details).
The flow diagram below physically delineates the project boundary and its relevant information.

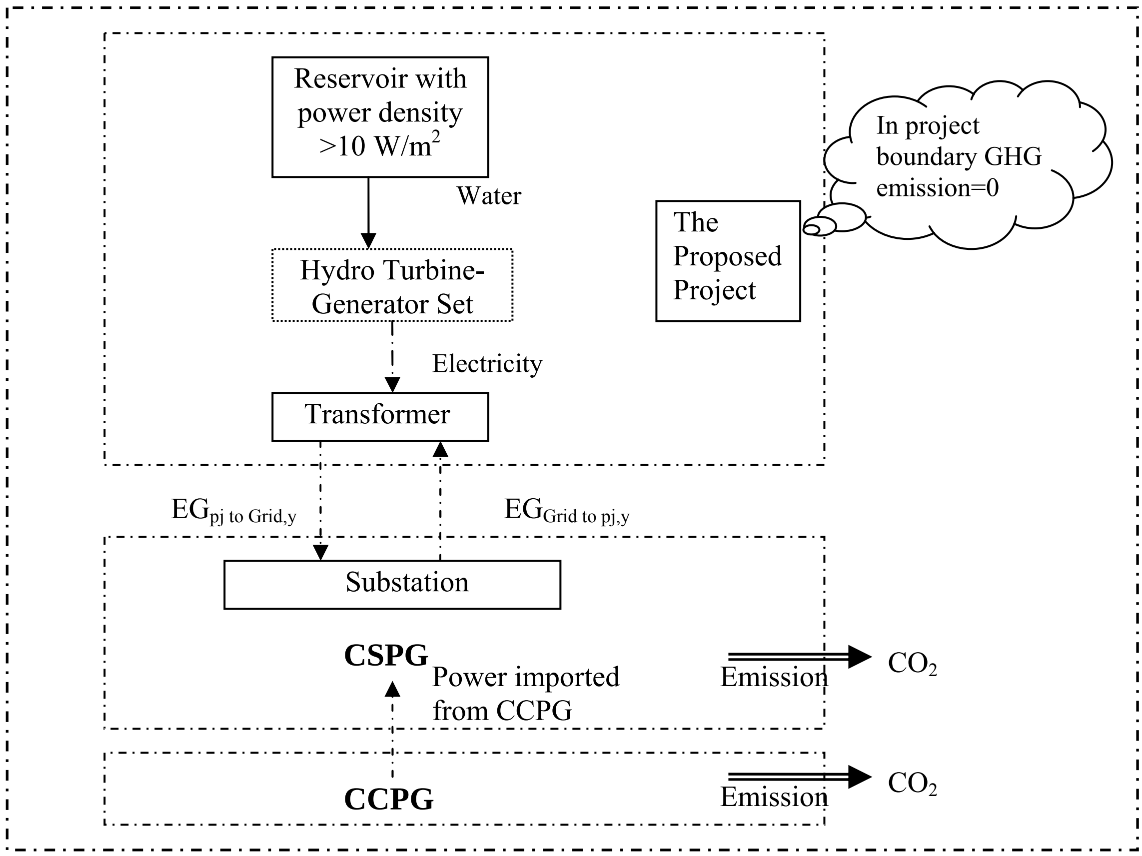

Figure 2 Flow diagram of the project boundary

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

According to ACM0002(Version 12.1.0), if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

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

Therefore, the baseline scenario for the proposed project activity is the provision of equivalent annual power output by the CSPG to which it is connected.

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

According to "Tool for the demonstration and assessment of additionality", the additionality of the project is demonstrated and assessed through the following steps:

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

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

The alternatives to the project activity are as follows:

1) The proposed project activity undertaken without being registered as a CDM project activity;

2) Fossil fuel power generation with equivalent annual power generation;

3) Other renewable energy power generation with equivalent annual power generation;

4)The equivalent annual power is supplied by the grid (China Southern Power Grid) where the proposed project is connected into.

These are credible and realistic alternatives and these alternatives are in accordance with the description of the methodology (the additionality tool requires that the proposed project activity be included as an alternative, without the benefit from CDM).

As Guizhou province is located in the Southeast of China with Karst Landform, the project area is poor in renewable source especially the wind energy resources[2]. It can be looked up from the China Electric Power Yearbook 2008 that the renewable resources power generation installation capacity is zero. So it is not provided with condition for constructing wind power plant with the equivalent installed capacity. Moreover until now there are no wind farms in this area. There is not enough other renewable energy, such as solar resources[3], and geothermal resource[4] , which can provide comparable power with the project in local area. The Guizhou Province is far away from seaside, so there is also not enough wave and tidal sources to build a wave and tidal plant. In addition biomass power generation plants were in the demonstration phase, with many projects operating at a loss due a lack of development of biomass fuel supply and operational expertise in the operation of biomass fired boiler systems together with comparatively low power tariffs[5] Biomass fired power plants were installed with a maximum capacity of 50MW, due to supply constraints on localised biomass, and were facing high operational risks[6].Furthermore, there is not enough such kind of renewable resources at

[2] http://www.newenergy.org.cn/html/0039/2003991.html

[3] http://www.21tyn.com/news/echo.php?id=2678

[4] http://www.crein.org.cn/view/viewnews.aspx?id=20080131100255406

[5] http://www.86ne.com/Biomass/200712/Biomass_103227.html

[6] http://www.ce.cn/cysc/ny/dl/200608/08/t20060808_8055237.shtml

project site. Limited by technology development and high costs, constructing an alternative renewable power plant is not financially attractive compared to the proposed project.

As a result construction of an alternative renewable power plant is not feasible.

Continuation of the current situation is not realistic in the context of this project, because power demand has been increasing rapidly over the last few years. China has experienced severe power shortages and hence the grids have been expanding rapidly. For example, the total supply of the CSPG grew by 45% between 2004 and 2007[7].

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

In China, it is regulated that the construction of a fossil fuel power with a capacity below 135MW is forbidden[8].

Moreover the annual electricity generated by the proposed project is 478,200MWh. A 84MW fossil fuel power station can generate equal electricity with average annual operation hour 5666h[9]. However construction a 84MW fossil fuel power station is forbidden according to the national policies. So the alternative 2) is not feasible.

Construction of an alternative renewable power plant with equivalent annual electricity generation is not credible in absence of sufficient other renewable resources in project area, and the first scenario is not feasible as a baseline scenario due to insurmountable economic barriers as we will argue in following step, however, is a feasible and credible alternative that is in compliance with Chinese laws and regulations.

Step 2. Investment analysis.

The following sub-steps are used for determining whether the proposed project activity is less economically or financially attractive than other alternatives without the revenue from the sale of certified emission reductions (CERs).

Sub-step 2a. Determine appropriate analysis method.

According to "Tool for the demonstration and assessment of additionality", there are three analysis methods recommended, including simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

Option I: Simple cost analysis. This analysis method can be used if the project activity produces no economic benefits other than CDM related income. However, this option is not applicable to the project because the project activity generates the revenue from the sale of generated electricity.

Option II: Investment comparison analysis. This analysis method can be only used if the alternatives to the project are similar investment projects. However, this option is not applicable to the project because the alternative to the proposed project is equivalent annual electricity supplied by CSPG, which is irrelevant for the project owner to make business decision.

Option III: Benchmark analysis. It provides the simplest method of analysis which is the least demanding in terms of data availability.

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[7] China Electric Power Yearbook 2005 and 2008

[8] http://www.gov.cn/gongbao/content/2002/content_61480.htm

[9] China Electric Power Yearbook 2008

Conclusion: We conclude that both option **II** and **III** are appropriate for the analysis of the additionality of the proposed project. This PDD used Option III**.** The choice for Option III as the appropriate analysis method is based on the fact that it is the simplest method of analysis that is the least demanding in term of data, while a clearly defined benchmark rate exists. Moreover, for this particular project owner the relevant decision is whether or not to implement a given hydropower project, and not a decision whether to invest a certain amount of capital in a thermal power plant or a hydropower plant.

Sub-step 2b. –Option III. Apply benchmark analysis.

We conduct the benchmark analysis through a calculation of the Internal Rate of Return (IRR) of the project and compare this with a benchmark of 8%. An IRR of 8% for investments in the areas of thermal power projects, wind power projects and transmission projects is in line with the Interim Rules of Electrical Engineering Retrofit Projects issued by the State Power Corporation of China.

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

The main assumptions for the investment analysis are shown in Table 4 below:

Table 4 Basic parameters for financial evaluation

Parameter	Unit	Value	Data source
Installed capacity	MW	140	Feasibility Study Report (FSR)
Net electricity generation	MWh	467,300	FSR
The total static investment	RMB Million	842.82	FSR
Electricity tariff (VAT Incl.)	RMB￥/kWh	0.243	FSR
Valued-added tax (VAT)	/	17%	FSR
Town building maintenance tax (based on VAT)	/	5%	FSR
Surtax for education (based on VAT)	/	3%	FSR
Income tax	/	33%	FSR
Annual O&M costs	RMB Million	17.37 (it is an average value. From the 6th year to 20th year, the O&M cost is 17.72; From the 21st year to 35th year, the O&M cost is 17.02.)	FSR
Include: Repair fee	/	1% of original fixed assets value	
Salary and welfare	RMB￥10,000	58.31	
Reservoir region maintenance	RMB￥/kWh	0.001	
Water resources fee	RMB￥/kWh	0.001	
Fund for relocation	RMB Million	0.7 (Only from the 6th year to the 20th year)	
Materials	RMB/kW	5.00	
insurance	/	0.25%	
Other costs	RMB￥/kW	24.00	
Expected CERs Price	EUR/ tCO_2e	8.2	Expected

Project life time	Year	30	FSR
CERs crediting time	Year	7×3	
Discount Rate	/	3.17%	FSR

The FIRRs with and without the income from CERs sale are listed in table 5 below. Without the income from CERs, the FIRR of the proposed project is 6.43%, much lower than the benchmark FIRR, thus the proposed project is financially unacceptable. With the income from CERs, the FIRR is increased to 9.51%. Therefore, CERs can improve the IRR of the proposed project.

Table 5 Comparison of financial indicators with and without income from CERs

Item	Unit	Without the income from CERs	Benchmark rate	With the income from CERS
Project IRR	%	6.43	8	9.51

Sub-step 2d. Sensitivity analysis.

A sensitivity analysis has been conducted, in order to check whether, under reasonable variations in the critical assumptions, the results of the analysis remain unaltered. We have used the four following parameters as sensitive factors:

- Fixed assets investment;
- Operation and maintenance cost;
- The amount of electricity supplied to the Grid;
- Electricity price.

Variations of ±10% have been considered in the critical assumptions. Table 6 summarizes the results of the sensitivity analysis, while Fig. 3 provides a graphic depiction.

Table 6 Impact of Variations in Critical Assumptions on IRR

	-100%	-16.1%	-10%	-5%	100%	5%	10%	23.5%
Sensitivity analysis for net electricity generation			5.67%	6.07%	6.43%	6.77%	7.11%	8.00%
Sensitivity analysis for electricity tariff			5.66%	6.07%	6.43%	6.77%	7.12%	8.00%
Sensitivity analysis for fixed assets investment		8.00%	7.35%	6.87%	6.43%	6.02%	5.63%	
Sensitivity analysis for O&M costs	7.68%		6.56%	6.49%	6.43%	6.37%	6.30%	

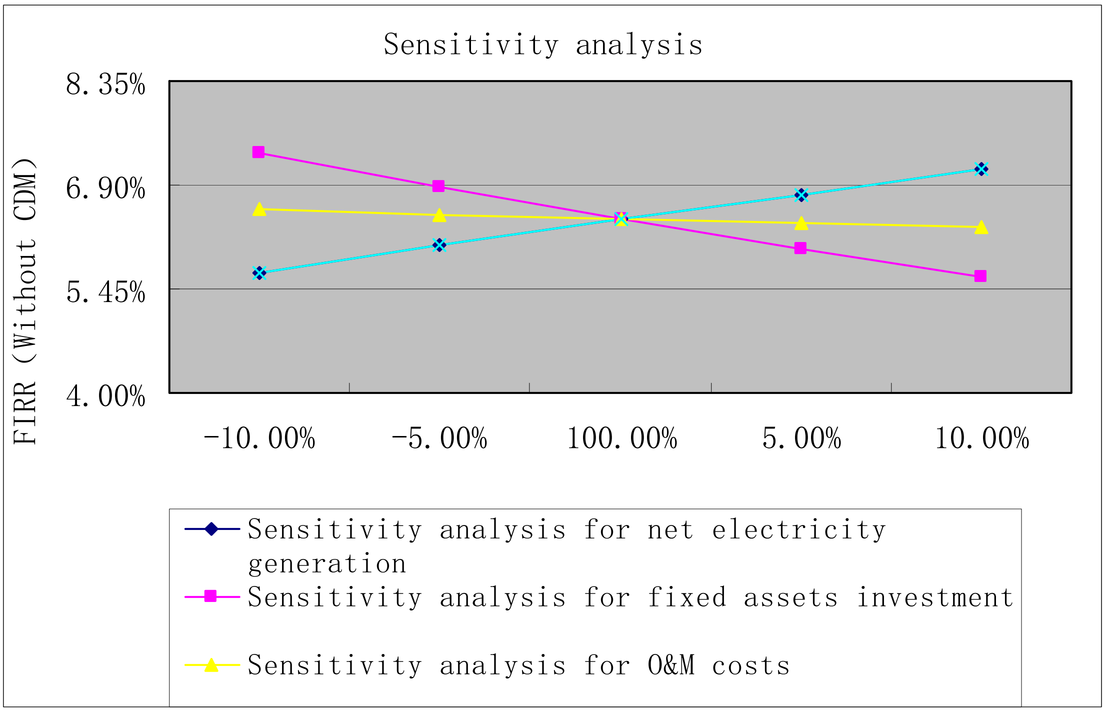

Figure 3 Sensitivity analysis

Tab.6 shows that none of variations can raise the IRR of the proposed project higher than the benchmark 8%.

When a decrease in the fixed assets investment could reach 16.1% the IRR of the project is 8.00%. That is to say if the fixed assets investment decreased to 83%, the IRR can get the benchmark. However the price of equipment , material etc have been increasing actually[10], and likely to continue doing so, thus it is impossible improve the economic attraction by lowering the fixed asset investment.

The IRR only raise to 7.68% when the annual operational cost fall 100%, however it is impossible to do so. It is difficult to adjust annual operational cost to raise the IRR. The annual operational cost would not decrease conversely increase at this time that the goods price are increasing rapidly. According to data issued by the National Statistical Bureau, the Consumer Price Index was raised by 5.9% in 2008 (ref. to Note 9). Even if the O&M cost can be decreased, the benchmark IRR can not be got.

When the electricity supplied to the grid raised by 23.5%, the IRR of the project can reach benchmark of 8%. However, the estimated electricity generation is considered according to the water resource of the river in past 40 years(1965-2005), so the dramatic change of electricity generation of the project in the whole crediting period will rarely happen. Therefore, it is also impossible to increase electricity supplied to the grid to improve IRR.

The IRR is 8.00% when the grid price increase 23.2%. The grid price 0.243 RMB￥/kWh in FSR is estimated based on the material price in this area by qualified design institute for a long period so it is reasonable moreover such assumption of price increase is unrealistic, because the local grid price is regulated by the local government, and rather unlikely to increase. The highest grid price in Guizhou

[10] http://news.xmhuaren.com/money/2009/01/22/1157486.html

province is 0.25 RMB￥/kWh (CDM Project 2955)[11], if applied 0.25 RMB￥/kWh as price the IRR of the project would not exceed the benchmark. As a result, it is not possible to improve the economic revenue through an increase in the grid price.

On the other hand, the whole investment IRR will increase greatly when the project receives the CERs revenues. If we take the CERs price into account, the IRR of the project reaches9.51%, thus the repayment of capital and interest will be raised and the financial situation will be improved. It is obvious that the benefits come from the CDM will help release the financing pressure that would otherwise obstruct the project activity.

The CDM for the proposed project was considered seriously at the very beginning. It can be found from FSR that the financial indicator of the proposed project is weak and the project IRR is below the benchmark. The project owner consulted Science and technology department of Guizhou province about CDM development and decided application CDM project.

If the proposed project can be registered as a CDM project, the CDM revenues can improve the poor financial index of the proposed project making the project more financially attractive, reduce the pressure from long-term investment needed by the proposed project and cash flow risks, and reduce the risks of low bus-bar tariff and unstable electricity generation. If the proposed project can't be registered as a CDM project, the revenue which could contribute to the local finance and the job opportunity offered by the project would be impossible.

The timeline of key events of the project is as follow:

Table 8 Time schedule of the proposed project

Event	Time	Note
Accomplishment of Environmental Impact Assessment (EIA)	**06/2005**	
Approval of EIA	**18/08/2006**	
Accomplishment of Feasibility Study Report	**08/2006**	
Board decision to carry out CDM.	**18/09/2006**	
The CDM development service contract has been signed with Guizhou Zhongshui Hengyuan Project Management and Consulting Co., Ltd.	**05/12/2006**	
Approval of FSR by the Guizhou Development and Reform Commission	**12/02/2007**	
Construction Contract Signed	**15/7/2007**	**Project start date**
The proposed project was developed as Phase II of Sino-Japanese ICS-CDM Project.	**07/2007**	**Website: Clean Development Mechanism in China**
Communication with New Energy and Industrial Technology Development Organization (NEDO) who is the delegate of Japan government about ERPA	**19/11/2007**	**E-mail correspondence dated from19/11/2007 to 22/11/2007**
Stakeholder consultation meeting for	**17/12/2007**	

[11] http://cdm.unfccc.int/Projects/DB/TUEV-SUED1252312816.45/view

project activity		
The purchase contract of the generator and turbine	**10/03/2008**	
Contact new buyers and negotiation with them about CER price	**06/2008**	**E-mail correspondence dated from 06/2008 to 03/2009**
Communication with Eco Asset Inc.	**03/2009**	**E-mail correspondence dated March 2009**
Draft PDD	**12/06/2009**	
The purchase contract of the main transformer	**21/07/2009**	
Modified PDD according to "Tool to calculate emission factor for an electricity system" (version 02)	**20/08/2009**	
Emission Reductions Purchase Agreement was signed with Eco Asset Inc.	**11/09/2009**	
Presentation of CDM project at NDRC	**13/11/2009**	
Modified PDD according to "ACM0002(Version 11)-Consolidated baseline methodology for grid-connected electricity generation from renewable sources"	**22/11/2009**	
Commissioning date	**05/2011**	

The project construction contract was signed in 15th July 2007. According to the CDM Glossary of Terms, Version 03, the starting date of a CDM project activity is the earliest date at which either the implementation or construction or real action of a project activity begins. Thus the project starting date was July 2007.
The FSR was accomplished in August 2006. The IRR in the FSR was low, and the project was not financially attractive. The project owner consulted Guizhou Development and Reform Commission for advice and was told to invite CDM as a solution. In September 18, 2006, the board decided to carry out CDM to overcome the project's barriers. To accelerate CDM progress, the project owner wanted to get the support from the CDM consultation company.

On December 5th 2006, the consultant was found out and the consultation contract was signed. Guizhou Zhongshui Hengyuan Co., Ltd promised to accomplish the PDD and find buyer for the project owner. Then, the proposed project was developed as Phase II of Sino-Japanese ICS-CDM Project in July, 2007. As New Energy and Industrial Technology Development Organization (NEDO) is the delegate of Japan government, communication with them via e-mail started in November 2007. However, it did not success. After that, finding new buyers was prioritized on the agenda from June 2008 to March 2009. Finally, consensus between Eco Asset Inc. and the project owner had reached and followed by the signed ERPA. Meanwhile, PDD was finished and revised according to the methodologies. The above evidence could exhibit that the CDM was seriously considered at the beginning of the project.

Step 3. Common practice analysis

Common practice analysis is a credibility check to complement the investment analysis. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. The common practice analysis is identified and discussed through the following sub-steps:

Sub-step 3a. Analyze other activities similar to the proposed project activity:

The development of hydropower projects greatly relies on the hydrological resources available. According to Standard for Classification and Flood Control of Water Resources and Hydroelectric Projects (SL252-2000) issued by the Ministry of Water Resources of China (MWR) in 2000, the hydropower plants with installed capacity below 50 MW are defined as small scale hydropower projects. As a result, projects between 50MW and 210 MW[12] were chosen for the common practice analysis. Other hydropower projects in Guizhou Province which are similar to the proposed project activity, that is, with an installed capacity of 50MW~210 MW in Guizhou Province are shown in Table 9 in the following.

Table 9 Hydropower Project with capacity between 50MW to 210MW in Guizhou

No.	Project name	Installed capacity (MW)	Operation time	Annual operation time (h)	Investment of unit kW (RMB￥/kW)
1	Yunguixiang Hydropower Plant[13]	100	2003	6,020	4539.6
2	Puding Hydropower Plant[14]	75	2003	4,213	2,573
3	The proposed project	140	/	3,416	6020

Sub-step 3b. Discuss any similar options that are occurring:

Firstly, the common practice analysis is limited to the provincial level as the investment environment for each province differs (e.g. with regards to taxes, loan policy and electricity tariffs). In Guizhou Province the Provincial Government is responsible for setting taxes, loan policies and electricity tariff policies that are applicable specifically to the Province. In addition, grid planning, construction, operation and electricity supply in the Guizhou Province are organized and regulated by the Guizhou Electric Power Corporation, while the China Southern Power Grid is responsible for the grid planning and electricity dispatch of different provincial grids included in CSPG and electricity dispatch with other grids of China (e.g. The Central China Power Grid).

In addition, China started electricity mechanism reform from 2002, the Electricity Mechanism Reform Scheme was approved in 2002. The scheme said that the plant and the grid should be separated; the electricity generation enterprises and the grid company should be rebuilt. It is also said that the new electricity market should be build. Therefore the project started before 2002 should be excluded.

As shown in Table 9, the investment per kW of Puding and Yunguixiang Hydropower Project were 4

[12] Selected activities in a capacity range of +/- 50% (resulting in a range of 50 - 210 MW) are used to do the common practise analysis. The reason for selecting range is shown in the web: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1218656122.69/Review/V0E4YLROO0SJQDEP7RWNBP3G2YOHG6/display

[13] http://www.gzlps.gov.cn/art/2009/9/7/art_4594_274545.html

http://gzdsb.gog.com.cn/system/2003/02/28/000346201.shtml

[14] http://www.hudong.com/wiki/%E6%99%AE%E5%AE%9A%E6%B0%B4%E7%94%B5%E7%AB%99

539.6 RMB and 2573 RMB, which are much lower than that of the proposed project of 6020 RMB. The project is located at Meilin canyon inlets far from the county, and the engineering geology condition is complex, the project developer need to construction a road to the project site from the town to the project site. As the project list in Table 9, Puding and Yunguixiang Hydropower Project were constructed much earlier than the project. It is easily seen that the CPI is rising with a rate of around 5% during the year 2003 to 2007,[15]especially in 2007 the products price[16] in Guizhou is increased higher than the other province. The proposed project started at a higher product price level comparing with the other two project.. As for the other two projects, they enjoyed low products price and material costs which allow them better and easier to finance than the project owner of the proposed project. Due to the low investment per kW, Yunguixiang Hydropower Plant is more financially attractive than the proposed project and does not face the same financial difficulties.

With regard the proposed project annual operation time is 3,416 Hours which is reasonable[17] and for the other two projects the annual operation time is higher than the project because the water resource for other two projects is better than the proposed project. It can be found that the average flow rate of the Yunguixiang and Puding hydropower project are $81.1m^3/s$[18] and $123m^3/s$[19] respectively which are higher than the $59.6m^3/s$ of the proposed project., It means the proposed project is not a common project in the region with less beneficial attractive and more financial risk than the other projects. The owner of this project has very limited financial capacity to deal with the project risk.

And the proposed project shall be deemed to be additional according the tool for the demonstration and assessment of additionality.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Project Emissions

According to formula (6) of ACM0002(Version 12.1.0), the power density of the project activity is calculated as follows:

$$PD = (Cap_{PJ} - Cap_{BL})/(A_{PJ} - A_{BL})$$

Where:

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[15] http://www.360doc.com/content/10/0320/17/231593_19544300.shtml

[16] http://money.163.com/07/1225/11/40IAJG5O002524SJ.html

http://www.smegz.gov.cn/web/assembly/action/browsePage.do?channelID=1106363217848&contentID=1184200349586

[17] Sourced from document “The Explanation about Design Parameters of Shiyazi 140MW Hydropower Project”

[18] <Guizhou Liupanshui City Medium- Small Scale Water Resoure Investigation And Assessment Report >pblished by Liupanshui local power bureaue.

[19] http://baike.baidu.com/view/1970596.htm#sub1970596

PD＝Power density of the project activity, in W/m2.

Cap_{PJ}＝Installed capacity of the hydropower plant after the implementation of the project activity (W).

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

A_{PJ}＝Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m2).
A_{BL}＝Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero.

The project is a new hydropower plant resulting in new reservoir, thus both of Cap_{BL} and A_{BL} are zero. Then the power density equals to:

$$PD = Cap_{PJ}/A_{PJ} = 140\ MW/8.06\ km^2 = 17.4\ W/m^2$$

The power density of the project is 17.4 W/m^2, greater than 10 W/m^2, thus PE_y=0

Baseline Emissions

According to ACM0002(Version 12.1.0), the baseline emissions include only CO_2 from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. All project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions of the project are calculated as follows:

$$BE_y = EG_{,y} \cdot EF_{grid,CM,y} \quad (1)$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2/yr)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the “Tool to calculated the emission factor for an electricity system” (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ is different for (a) Greenfield plants, (b) retrofits and replacements, and (c) capacity additions. The project is the installation of a new grid-connected hydropower plant at a site where no renewable power plant was operated prior to the implementation of the project. Then the $EG_{PJ,y}$ is calculated as follow:

$$EG_{PJ,y} = EG_{facility,y} \quad (2)$$

Where:

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

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

Calculation of $EF_{grid, CM, y}$

The latest data prior to the commencement of validation of the project are used for $EF_{grid, CM, y}$ in the PDD. According to latest "Tool to calculate the emission factor for an electricity system", the following seven steps are applied to calculate the e $EF_{grid, CM, y}$:

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

Step 1: Identify the relevant electricity systems

According to "Tool to calculate the emission factor for an electricity system", if the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If such delineations are not available, project participants should define the project electricity system and any connected electricity system and justify and document their assumptions in the CDM-PDD.

The project is connected to CSPG, according to the delineation of grid boundaries defined by Chinese DNA, the CSPG covers Guangdong Province, Guangxi Zhuang Autonomous Region, Yunnan Province and Guizhou Province[20].

There are net power imports from Central China Power Grid (CCPG) to CSPG. The weighted average operating margin (OM) emission rate of the exporting grid is used to determine the CO2 emission for net power imports.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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

Option I is chosen by project participants for the project, i.e. only grid power plants are included in the calculation.

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

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

[20] Chinese DNA's Guideline of emission factors of Chinese grids

(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM

The method (a) can only be used if low-cost/must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages data for hydroelectricity production. It can be found from Table 10 that the low-cost/must run resources constitute less than 50% of CSPG during year 2003 to 2007. Thus, method (a) is used to calculate $EF_{grid,\ OM,\ y}$.

Table 10 Constitution of low-cost/must run resources in CSPG during year 2003～2007[21]

Year	2003	2004	2005	2006	2007
Percentage (%)	33.53%	29.95%	30.42%	29.75%	29.28%

For the simple OM, the emissions factor is calculated using *ex ante* option: The emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation

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

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

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Due to the data on fuel consumption, net electricity generation, average efficiency etc of each specific power plant/unit serving the grid are not available publicly in China, the Option A can not be used for simple OM emission factor calculation. Thus, Option B is used for calculating simple OM emission factor under following conditions for the project:

(1) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(2) Off-grid power plants are not include in the calculation (i.e., Option I has been chosen in Step 2).

Under Option B, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

[21] *China Electric Power Yearbook 2004～2008*

$$EF_{grid,OMsimple,y} = \frac{\sum_{i} FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{y}} \quad (3)$$

Where:

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

For the project, the subscript *m* refers to the power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid (if any).

For the project, $EF_{grid,\ OMsimple,\ y}$ is calculated according to the statistics information of recent 3 years (from 2005 to 2007), the data are the latest and available at the time of this PDD submission. The result of $EF_{grid,\ OMsimple,\ y}$ is 0.9987 tCO_2e/MWh, the detailed calculations are shown in Table 3.1-Table 3.4 of Annex 3.

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

The sample group of power units *m* used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The set of power units that comprises the larger annual generation should be used.

The direct application of the approach is difficult in China. The Executive Board (EB) has provided guidance on this matter with respect to the application of the AMS-I.D and AM0005 methodologies for projects in China on 7 October 2005 in response to a request for deviation 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 is also applicable to the “Tool to calculate the emission factor for an electricity system”. The calculation details are described in step 5 below.

According to “Tool to calculate the emission factor for an electricity system”, there are two options regarding vintage of data choices:

Option 1: For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex-ante*, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

For the project, the option 1 is chosen for BM calculation.

Step 6: Calculate the build margin emission factor

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

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (4)$$

Where:

$EF_{grid,\ BM,\ y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,\ y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,\ m,\ y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO2/MWh)
m = Power units included in the build margin
y = Most recent historical year for which power generation data is available

Because of the unavailability of the data at the power plant level in China, the 22nd CDM EB meeting agreed the following deviation[22] approaches for $EF_{grid,\ BM,\ y}$ calculation:

1) Use the efficiency level of the best technologies commercially available in the provincial/regional or national grid of China, as a conservative proxy, for fuel *i* consumption estimation to estimate the $EF_{grid,\ BM,\ y}$.

2) Use capacity additions during last several years for estimating the $EF_{grid,\ BM,\ y}$, i.e. the capacity addition over last several years, whichever results in a capacity addition that is closest to 20% of total installed capacity.

3) Use installed capacity to replace annual power generation to estimate weights.

22 http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

Due to the difficulty of separating the coal-fired, gas-fired or oil-fired installed capacity from the total thermal installed capacity, the $EF_{grid, BM, y}$ will be calculated as:

1) Based on the most recent years energy balance of the CSPG, calculating the proportions of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total CO_2 emissions of thermal power plants;

2) Based on the best technologies commercially available which applied by the coal-fired, oil-fired and gas-fired power plants, calculating the emission factor of thermal power plants in CSPG. This approach is more conservative as it assumes all recently built plants have the fuel efficiency as that of the most advanced commercialized technologies;

3) Calculating the $EF_{grid, BM, y}$ through emission factor of thermal power plants times the percentage share of thermal power plants installed capacity addition within all recently built installed capacity. The proper year is selected so that it is the closest time when the last 20% of installed capacity was built.

The above calculation approach has been used by several recently registered China projects. The BM emission factor in this PDD is calculated as following sub-steps.

Sub-Step 6a: Calculating the percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in CO_2 emissions from total thermal power plants

$$\lambda_{coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad \lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad \lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \qquad (5)$$

Where:

λ_{Gas}, λ_{Oil} and λ_{Coal} = Respectively the percentages of CO_2 emissions from the gas-fired, oil-fired, coal-fired power plants in CO_2 emissions from total thermal power plants;
$F_{i, j, y}$ = Amount of fuel *i* (tce) consumed by the power sources province *j* in year *y*;
$COEF_{i, j}$ = CO_2 emission coefficient (tCO_2/tce) of fuel *i*, taking into account the carbon content of the fuels used by the grid and the percent oxidation of the fuel in year *y*.

Sub-Step 6b: Calculating the fuel-fired emission factor ($EF_{Thermal}$)

$$EF_{Thermal} = \lambda_{Coal} \times EF_{coal, adv} + \lambda_{Oil} \times EF_{oil, adv} + \lambda_{Gas} \times EF_{gas, adv} \quad (6)$$

Where:

$EF_{Thermal}$ is the emission factor of thermal power plants;
$EF_{Coal, Adv}$, $EF_{Oil, Adv}$ and $EF_{Gas, Adv}$ are corresponding to the emission factors of coal, oil and gas, which are applied by the most advanced commercialized technologies.

Sub-Step 6c: Calculating the Build Margin (BM) emission factor ($EF_{grid, BM, y}$)

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

Where:

$EF_{grid, BM, y}$ = Build Margin (BM) emission factor with advanced commercialized technologies for year *y*;
CAP_{Total} = Installed capacity of all recently built power plants;
$CAP_{Thermal}$ = Newly installed capacity of recently built thermal power plants;
$EF_{Thermal}$ = Emission factor of thermal power plants.

For the project, $EF_{grid, BM, y}$ is calculated according to the statistics information of recent 3 years (from 2005 to 2007), the data are the latest and available at the time of this PDD submission. The result of $EF_{grid, BM, y}$ is 0.5772 tCO_2e/MWh, the detailed calculations are shown in Table 3.6-Table 3.9 of Annex 3.

Step7: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

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

Where:

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

According to "Tool to calculate the emission factor for an electricity system", the weighs w_{OM} and w_{BM}, by default, are 50% and 50% for the project (i.e., w_{OM}=50%, w_{BM}= 50%). The calculated result of $EF_{grid, CM, y}$ is 0.78795tCO_2e/MWh.

The $EF_{grid, CM, y}$ applied in this PDD is fixed for a crediting period and may be revised at the renewal of the crediting period.

Leakage

According to baseline methodology ACM0002(Version 12.1.0), there is no need for the project to consider leakage (L_y).

Emission Reductions

The annual emission reduction (ER_y) of the project is the difference between baseline emission and project activity emission. The final GHG emission reduction is calculated as follows:

$$ER_y\ (tCO_2e/yr) = BE_y - PE_y - L_y \quad (9)$$

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

Data / Parameter:	$NCV_{i, y}$
Data unit:	GJ/mass or volume unit

Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	The values are derived from *China Energy Statistical Yearbook 2008*.
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	Used for OM and BM calculation

Data / Parameter:	$F_{i, j, y}$
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by the relevant provinces *j* in year *y*
Source of data used:	*China Energy Statistical Yearbook 2005-2008*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	Used for OM and BM calculation

Data / Parameter:	$EF_{CO2, i, y}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of fossil fuel type *i* used in year *y*
Source of data used:	*Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	No specific local value available, IPCC default values at the lower limit of the uncertainty at a 95% confidence internal as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories are used.
Any comment:	Used for OM and BM calculation

Data / Parameter:	Electricity generation of power plants in CSPG
Data unit:	MWh
Description:	The electricity generated by province *j* in CSPG in year *y*.
Source of data used:	*China Electric Power Yearbook 2005-2008*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.

Any comment:	Used for OM and BM calculation

Data / Parameter:	Electricity imported from Central China Power Grid
Data unit:	MWh
Description:	The electricity imported from Central China Power Grid in year *y*.
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	Used for OM calculation

Data / Parameter:	Internal use rate of power plant
Data unit:	%
Description:	The internal power consumption rate of power plants in province *j* in CSPG in year *y*.
Source of data used:	*China Electric Power Yearbook 2005-2008*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	Used for OM calculation

Data / Parameter:	$CAP_{i, j, y}$
Data unit:	MW
Description:	Installed capacities of power plant category *i* of province *j* in years *y*.
Source of data used:	*China Electric Power Yearbook 2005-2008*
Value applied:	See Annex 3 for details.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	Used for OM and BM calculation

Data / Parameter:	$GENE_{best, coal,}$
Data unit:	/
Description:	The power supply efficiency of most advanced commercialized coal-fired power plants
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	38.10%
Justification of the	Data used are from Chinese authorities.

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Used for BM calculation

Data / Parameter:	$GENE_{best, oil/gas}$
Data unit:	/
Description:	The power supply efficiency of most advanced commercialized oil-fired power plants and gas-fired power plants
Source of data used:	Chinese DNA's Guideline of emission factors of Chinese grids
Value applied:	49.99%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data used are from Chinese authorities.
Any comment:	Used for BM calculation

Data / Parameter:	Surface Area
Data unit:	km^2
Description:	Surface area at the full reservoir level
Source of data used:	Feasibility Study Report of Shiyazi Hydropower Plant
Value applied:	8.06
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data measured by professional design institute is reliable and creditable.
Any comment:	Used for power density calculation

B.6.3 Ex-ante calculation of emission reductions:

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Project Emissions

The power density of the project is 17.4 W/m^2, greater than 10 W/m^2, thus PE_y=0

Baseline Emissions

According to formulae (3)-(9) in section B.6.1, the calculation results of $EF_{grid, OM, y}$, $EF_{grid, BM, y}$ and $EF_{grid, CM, y}$ are listed in Table 11, the detailed calculation processes are shown in Annex 3.

Table 11 EF_{OM}, EF_{BM} and EF_y of CSPG (tCO_2e/MWh)

$EF_{grid, OM, y}$	$EF_{grid, BM, y}$	$EF_{grid, CM, y}$
0.9987	0.5772	0.78795

According to formula (1) and (2) in section B.6.1, the annual baseline emission (BE_y) of the project in a typical year is calculated as follow:

$$BE_y = EG_{facility,y} \cdot EF_{grid,CM,y} = 467{,}300 \times 0.78795 = 368{,}209 tCO_2/yr$$

Leakage

According to baseline methodology ACM0002(Version 12.1.0), $L_y = 0$

Emission Reductions

According to formula (9) in section B.6.1, the annual emission reductions (ER_y) of the project in typical year is calculated as follow:

$$ER_y = BE_y - PE_y - L_y = 368{,}209 - 0 - 0 = 368{,}209\ tCO_2e/yr$$

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

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The summary of the ex-ante estimation of emission reductions are listed in Table 12 below:

Table 12 Summary of the ex-ante estimation of emission reductions

Year	Project emission (tCO_2e)	Baseline emission (tCO_2e)	Leakage (tCO_2e)	Total reduce emission(tCO_2e)
01/11/2011-31/10/2012	**0**	**368,209**	**0**	**368,209**
01/11/2012-31/10/2013	**0**	**368,209**	**0**	**368,209**
01/11/2013-31/10/2014	**0**	**368,209**	**0**	**368,209**
01/11/2014-31/10/2015	**0**	**368,209**	**0**	**368,209**
01/11/2015-31/10/2016	**0**	**368,209**	**0**	**368,209**
01/11/2016-31/10/2017	**0**	**368,209**	**0**	**368,209**
01/11/2017-31/10/2018	**0**	**368,209**	**0**	**368,209**
Total(tCO_2e)	**0**	**2,577,463**	**0**	**2,577,463**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{PJ\ to\ Grid,y}$
Data unit:	MWh
Description:	Electricity exported to the grid by the proposed project
Source of data to be used:	The ammeter data
Value of data applied for the purpose of calculating expected emission reductions in section B.5 :	467,300MWh
Description of measurement methods	The electricity supplied to the grid will be monitored hourly and recorded monthly by the Main Meter. Data will be archived for 2 years following the

and procedures to be applied:	end of the crediting period by means of electronic and paper backup.
Monitoring frequency:	Measure every hour, record every today
QA/QC procedures to be applied:	The uncertainty level of this data is low. The data will be hourly measured and monthly recorded. Measurements are being continuously recorded, and then the output will be aggregated so that monthly output electricity can be shown. Electricity sales receipts will also be obtained as an additional check. The meters will be calibrated periodically in accordance with the regulation(DL/T448-2000). The accuracy of the meter selected is 0.5s class.
Any comment:	

Data / Parameter:	$EG_{Grid\ to\ PJ,\ y}$
Data unit:	MWh
Description:	Electricity imported by the proposed project bought from the power grid
Source of data to be used:	The ammeter data
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	
Description of measurement methods and procedures to be applied:	The electricity supplied to the grid will be monitored hourly and recorded monthly by the Main Meter. Data will be archived for 2 years following the end of the crediting period by means of electronic and paper backup.
Monitoring frequency:	Measure every hour, record every today
QA/QC procedures to be applied:	The uncertainty level of this data is low. The data will be hourly measured and monthly recorded. Measurements are being continuously recorded, and then the output will be aggregated so that monthly output electricity can be shown. Electricity sales receipts will also be obtained as an additional check. The meters will be calibrated periodically in accordance with the regulation(DL/T448-2000). The accuracy of the meter selected is 0.5s class.
Any comment:	

Data / Parameter:	CAP_{PJ}
Data unit:	MW
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data used:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.6:	140
Measurement procedures (if any)	The data based on the *equipments purchasing contract 、nameplates*
Monitoring frequency:	Yearly
QA/QC procedures to	

be applied:	
Any comment:	

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data used:	Project site
Value of data applied for the purpose of calculating expected emission reductions in section B.6:	8,060,000
measurement procedures (if any)	The data come form the topographical surveys, maps and satellite imageries
Monitoring frequency:	Yearly
QA/QC procedures to be applied:	
Any comment:	

B.7.2 Description of the monitoring plan:

The project owner is the user of this monitoring plan and will be responsible for this monitoring plan. The project owner must maintain credible, transparent, and adequate data estimation, measurement, collection, and tracking systems to maintain the information required for an audit of an emission reduction project. These records and monitoring systems are needed to allow the selected DOE to verify project performance as part of the verification and certification process. This process also reinforces that CO_2 reductions are real and credible to the buyers of the Certified Emissions Reductions (CERs).

Emission reductions will be achieved through avoided power generation of fossil fuel electricity due to the power generated by the proposed project. The grid-connected output is therefore defined as the key data to monitor.

Operational and Management Structure For Monitoring

The monitoring of the emissions reductions will be carried out according to Figure 3 below. The General Manager 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 plant manager.

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 project and the calculation of the emissions reductions. The monitoring officer will prepare operational reports of the project activity, record the daily operation of the project including operating periods, power generation, power delivered to the grid, and equipment defects, etc. Finally, the monitoring reports will be reviewed by the General Manager.

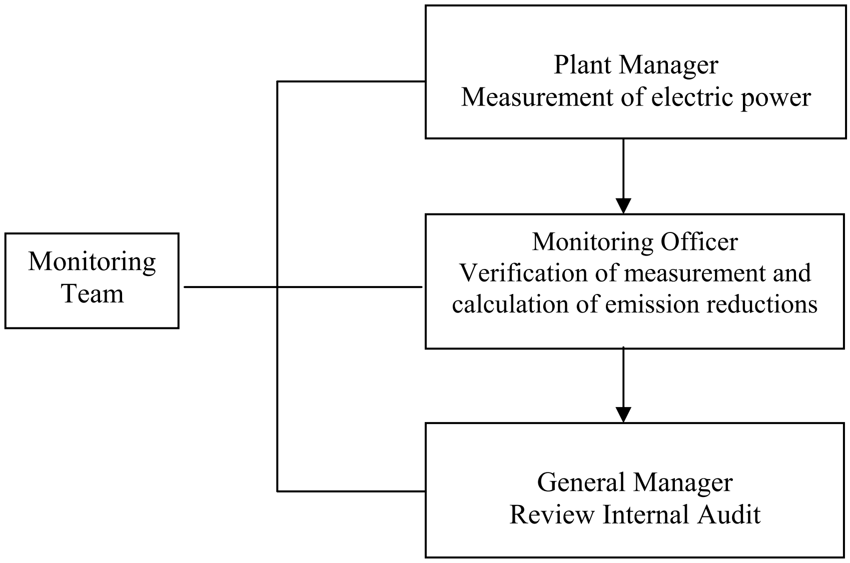

Figure 4 Operation and management structure

Monitoring Plan

The approved monitoring methodology ACM0002(Version 12.1.0) is used for developing the monitoring plan.

Monitoring tasks must be implemented according to the monitoring plan in order to ensure that the real, measurable and long-term greenhouse gas (GHG) emission reduction for the proposed project is monitored and reported.

1. Responsibility

Overall responsibility for daily monitoring and reporting lies with the project owner. A CDM group will be established by the project owner to carry out the monitoring work.

2. Reporting

Table 13 Information of the meters

Meter	Accuracy	Location	Function	Calibration
M_1	0.5s	The output of the project at project site belonging to the project owner	To monitor electricity exported to the power grid and consumed from power grid of the project (main meter)	Once every three month
M_2	0.5s	The output of the project at project site belonging to the project owner	To monitor electricity exported to the power grid and imported from power grid of the project (backup meter)	Once every three month

The specific steps for data collection and reporting are listed below:

(1) The readings of M_1 will be measured hourly and recorded monthly. The data of electricity exported to power grid and electricity imported from power grid are recorded monthly and monitored hourly. The difference of exported and imported data is the net power generation of the project;

(2) Both of the Power Grid Company and Project Owner record the the net electricity generation data according to the reading of M1;
(3) The power grid company provides project owner the electricity trade note. The project owner crosschecks the net electricity generation data and provides the Power Grid Company with sales receipts and preserves the copies of the sales receipts.
(4) If one's readings are not consistent with the other, the readings will be crosschecked with readings of backup meter M2. Then a right reading would be used to calculate.
(5) The project owner provides DOE with readings record of Main Meters and copies of sales receipts.

The principle of the processes is to guarantee the DOE could obtain the actual and precise data of net generated electricity.

If any errors of the meters are detected, the party owning the meters shall repair, recalibrate or replace them, and give the other party sufficient notice to allow a representative to attend during any corrective activity. If the readings of M_1 is beyond allowable error, the data should be determined firstly by M_2 ,if it is also beyond allowable error the electricity during the meters malfunction period will be abandoned in order to be conservative.

3. Calibration

The meters will be calibrated periodically in accordance with the regulation(DL/T448-2000). The main meters will be calibrated once every three month.

4. Data management system
Physical document such as paper-based maps, diagrams and environmental assessments will be collected in a central place, together with this monitoring plan. In order to facilitate auditors' reference of relevant literature relating to the project, the project material and monitoring results will be indexed. All paper-based information will be stored by the technology department of the project owner and all the material will have a copy for backup. And all data including calibration records are kept until 2 years after the end of the total credit time of the CDM project.

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

The baseline study and monitoring methodology of the proposed project was completed on 20/08/2009.

Name of person/entity determining baseline study and monitoring methodology:

- Liu Bo, Guizhou zhongshui Hengyuan Project Management and Consulation Co.,Ltd. Email: bob.liu@vip.163.com；
- Shen keye, Guizhou zhongshui Hengyuan Project Management and Consulation Co.,Ltd. Email: keye001@sina.com

Guizhou zhongshui Hengyuan Project Management and Consulation Co.,Ltd is not one of the 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:

>>
15/07/2007 (The date of the project starts)

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

>>
30 years

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

C.2.1. Renewable crediting period

>>

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

>>
01/11/2011 or registration date whichever is later

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable.

C.2.2.2. Length:

>>
Not applicable.

SECTION D. Environmental impacts

>>

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

>>

The Environmental Impact Assessment (EIA) for this project was carried out by Institute of Geochemistry, Chinese Academy of Science. The EIA report has already been approved by Guizhou Province Environmental Protection Bureau on 18th August, 2006 (Qinhuanhan [2006] No. 326). Combined with the EIA report, the influences of the proposed project on the environment are summarized as follows in the construction period and the operation period.

According to the EIA report, the impacts rising from the proposed project were identified, the mitigation measures were suggested and defined in the following two phase:

Construction Phase

Wastewater:
In order to protect the water of lower reaches from being polluted, the wastewater from sand and rock processing and concrete mixing is not allowed to discharge into River directly.-+ The wastewater from foundation pit, sand and rock processing must be disposed in the sedimentation pond with sediment separator before recycled or discharged. The wastewater from concrete mixing is to be treated with consolidated rectangular sedimentation tank. The oil water from vehicles must be retained for at least one day after treated with sediment separator in the rectangular sedimentation tank used to dispose the wastewater from domestic sewage. The domestic sewage generated from labour forces must be treated by using integrated treatment equipments. Temporarily dry septic tank will be settled to dispose the other wastewater during construction period. The disposed water must meet Integrated Wastewater Discharge Standard of the People’s Republic of China (GB8978-1996) grade I.

Exhaust gases and dust
The exhaust gases and dust rising from the construction equipment and vehicles, earth-rock excavation and concrete mixing is confined to the construction site during the construction period by dustproof measures including watering, wet operation method and selection and proper conservation of construction equipment and vehicles in compliance with relevant sanitary regulations. Furthermore, unique technologies generating lower dust will be employed in accordance with Environment Air Quality Standard (GB3095-1996) grade II, hence the negative impacts mentioned above is short-lived and limited.

Noise
The noise mainly generated from construction equipments and vehicles during the construction period will be controlled in accordance with Noise Limits for Construction Site (GB12523-90), National Urban Environmental Noise Standard (GB3096-93),and Allowable Noise Limits for Motor Vehicle (GB1495-79) using the following measures: adoption of necessary precautionary measures to protect the construction personnel on site, reasonable construction layout of indoor operation of noisy equipment, avoidance from livelihood area of vehicles. Rationally operate the inhibition of blasting schedule in the nights. Afforestration projects will be conducted in the construction and livelihood areas and along the access road to minimize the noise effectively. Hence the short-term noise impact to the labour force on site who is granted to be the main casualties is not significant.

Solid waste

The solid waste generated from earth-rock excavation will be backfilled and piled up in two designated dumpsites set on the barren site near the construction area which will be sheltered by afforestation to avoid soil losses. The daily solid waste from construction and livelihood area will be collected in metallic garbage can and regularly delivered to the designated dumpsites mentioned above to be filled with the other waste.

Ecosystem impact
Soil and water erosion might be induced attribute to slope exploration, earth-and-rock excavation, and the utilization of dump sites. Rehabitation of vegetation and other technique methods will be conducted to minimize the negative impact once the construction activities completed.

Attribute to the noises generated from the construction equipment and human activities, the animals inhabit there will migrate to comparatively silent areas. But this negative impact will be eliminated once the construction work finished. In addition, cultural relic, mineral resources or protected flora species were not identified during the EIA survey.

Operation phase

Domestic sewage
The domestic sewage mainly generated from the permanent staffs during the operation and maintenance period will be treated by using the integrated treatment equipment before discharged. And the daily solid waste will be collected and filled in the designated dumpsites.

Ecosystem impact
Since there are no rare animals based on the EIA, which need to be protected based on the relevant regulations, around the project site the operation of the project will lead to little impact on the ecosystem of the area. As a clean and renewable energy, its impact on local ecosystem is minimal. The project will supply electricity to local residential some of whom are used to cut and fire vegetation as a way to acquire warm and light. Therefore, the project will change the life style of local people and improve the standard of livings.

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:

>>
Both of the host Party and the project owners regard that the proposed project will not bring significant impacts on the environment. There are no transboundary environmental impacts involved with the project activity. After the completion of the project construction, the project will be put into operation only after the inspection and acceptance of local environmental protection department.

SECTION E. Stakeholders' comments

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

In order to consult the public's opinions and suggestions about the proposed project, the project owner published the *Suggestion Consultation of Shiyazi Hydropower Plant CDM Project* on *Zunyi Daily* on 20 July, 2007. Furthermore, the project owner held a meeting through local government to consult the stakeholders' opinions about construction and operation of the proposed project at Wuchuan town, Zunyi City in 17 December, 2007.
Detail content see E2

E.2. Summary of the comments received:

Content of the Public Participation Survey
The occupations, cultural degrees and age structures of the individual investigation are as follows:

Table 11 Summary of stakeholders

Item	Category	Quantity	Percentage
Education level	Above technical secondary school	3	9.7
	Middle school	12	38.7
	Elementary school	16	51.6
Age	18~30	14	45.2
	31~50	13	41.9
	Above 51	4	12.9
Occupation	Farmer	30	96.8
	Worker	1	3.2
	Others	0	0

31questionnaires were distributed to the local people, and 31questionnaires had been returned. The response rate is 100%. Comments from these questionnaires for local people are summarized in the following table.

Table 12 Summary of questionnaires

The number	Item	Choice	Numbers(persons)	share（%）
1	Whether to know the proposed project	Know	27	87.1
		Don’t know	4	12.9
2	The attitude to the construction of the proposed project	Agree	31	100
		Disagree	0	0
		Don’t care about	0	0
3	The impact on the local economy	Boost	22	70.9
		Negative impact	0	0
		Don’t care about	9	29.1
4	Whether the construction of the proposed project affected the local environment	Yes	0	0
		no	12	38.7
		don’t care about	19	61.3
5	Whether the construction of the proposed project affected the habit of natives	Yes	0	0
		No	31	100
		Don’t care about	0	0
6	Whether the construction of the proposed project affected the local basic facilities	Yes	16	51.6
		No	2	6.5
		Don’t care about	13	41.9

The result of this investigation shows that 100% of the public people supported the start of the proposed project, and 70.9% thought the proposed project would improve the local economy. Therefore, the local people supported the construction of the proposed project, and they figured out that the power plant had positive meaning for local economy development. They had a positive and optimistic attitude for the environmental impacts because of the construction of the proposed project. The public generally hope that the project will start as soon as possible in order to spur local economic development, increase incomes and social benefits.

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

The project owner will pay much attention to the comments and suggestions of the stakeholders, especially the environmental impacts problems in the construction period and the land compensation for the related farmers. During the construction period and operation period of the project, the project owner will do the work of ecological environmental protection and soil & water conservation, finish the design of environmental protection to make sure that all the measures and funds should be put into effect, and strengthen the environmental management during construction period, environmental monitoring and onsite supervision and law enforcement to make sure the environmental quality can reach the quality standard and the related requirement.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in this project activity.

Annex 3

BASELINE INFORMATION

The installed capacity and fuel consumption data used for OM and BM calculation are derived from <China Energy Statistical Yearbook>, <China Electric Power Yearbook>.

The low calorific value, CO_2 emission factor and oxidation factor of fuels are listed in Table A1 below.

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

Fuel	Low Calorific Value	Emission Factor (kgCO2/TJ)	Oxidation Factor
Raw Coal	20,908 kJ/kg	87,300	1
Cleaned Coal	26,344 kJ/kg	87,300	1
Moulded Coal	20,908kJ/kg	87,300	
Other Washed Coal	8,363 kJ/kg	87,300	1
Coke	28,435 kJ/kg	95,700	1
Crude Oil	41,816 kJ/kg	71,100	1
Gasoline	43,070 kJ/kg	67,500	1
Diesel Oil	42,652 kJ/kg	72,600	1
Fuel Oil	41,816 kJ/kg	75,500	1
Other Petroleum Products	41,816kJ/kg	75,500	
Natural Gas	38,931 kJ/m3	54,300	1
Coke Oven Gas	16,726 kJ/m3	37,300	1
Other Gas	5,227 kJ/m3	37,300	1
LPG	50,179 kJ/kg	61,600	1
Refinery Dry Gas	46,055 kJ/kg	48,200	1

Data Source:

The net calorific values are quoted from <China Energy Statistical Yearbook 2006>, Page 287.

The emission factors and oxidation factors are quoted from <Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories >, Table 1.4, Page 1.24, Chapter 1, Volume 2.

Step 1: Calculating the Operating Margin emission factor ($EF_{OM,y}$)

Table 3.1 Simple OM Emission Factors Calculation of CSPG for Year 2005

Fuel	Unit	Net calorific value	Unit	Fuel emission factor	OXID	Guang dong (Mt/Gm3)	Guangxi	Guizhou	Yunnan	CO_2 Emission (tCO^2e)
		A		B	C	D	E	F	G	J=(D+E+F+G) *A*B*C/1000 Mass J=(D+E+F+G) *A*B*C/100 Volume
Raw Coal	MJ/t,km^3	20908	kgCO_2/TJ	87,300	1	66.9647	14.35	32.1231	19.7555	243,113,522
Cleaned Coal	MJ/t,km^3	26344	kgCO_2/TJ	87,300	1				0,0015	3,450
Other Washed Coal	MJ/t,km^3	8363	kgCO_2/TJ	87,300	1			10.39	0.3388	323,211
Coke	MJ/t,km^3	28435	kgCO_2/TJ	95,700	1	0.0479			0.0805	349,406
Coke Oven Gas	MJ/t,km^3	16726	kgCO_2/TJ	37,300	1				0.079	49,287
Other Gas	MJ/t,km^3	5227	kgCO_2/TJ	37,300	1	0.0187	0.3077		0.1596	347,626
Crude Oil	MJ/t,km^3	41816	kgCO_2/TJ	71,100	1	0.1091				324,367
Gasoline	MJ/t,km^3	43070	kgCO_2/TJ	67,500	1	0.0068				19,769
Diesel Oil	MJ/t,km^3	42652	kgCO_2/TJ	72,600	1	0.3196	0.0202		0.0181	1,108,250
Fuel Oil	MJ/t,km^3	41816	kgCO_2/TJ	75,500	1	8.8721				28,010,178
LPG	MJ/t,km^3	50179	kgCO_2/TJ	61,600	1					0
Refinery Gas	MJ/t,km^3	46055	kgCO_2/TJ	48,200	1	0.0492				109,217
Natural Gas	MJ/t,km^3	38931	kgCO_2/TJ	54,300	1	0.093				196,598
Other Petroleum Products	MJ/t,km^3	41816	kgCO_2/TJ	75,500	1	0.0170				53,671
Other Coking Products	MJ/t,km^3	28,435	kgCO_2/TJ	95,700	1					0
Other energy sources	MJ/t,km^3	0	kgCO_2/TJ	0	1	1.0466	1.3315		0.503	0

Total		***a***								**274,008,550**
Generating capacity	MWh	***b***				176,453,000	25,023,000	58,430,000	27,281,000	287,187,000
Auxiliary Power rate		***c***				5.58%	7.95%	7.34%	6.94%	
Power supply	MWh	***d=b*(1-c)***				166,606,923	23,033,672	54,141,238	25,387,699	269,169,531

Calculation of the OM:
a : total emission of CAPG: 274,008,550 **tCO_2**
d: Thermal power capacity of the CSPG:269,169,531 **MWh**
e: power capacity from the CCPG to the CSPG: 20,26,000 MWh
f: average emitting factor of CCPG: 0.77216tCO_2/MWh
$OM=(a+e*f)/(d+e/1000)*10^{-6}=1.07409$
$\lambda coal=89.48\%$
$\lambda oil=10.24\%$
$\lambda gas=0.28\%$

Data Source:
China Energy Statistical Yearbook 2006, China Statistics Press, 2007.
China Electricity Statistical Yearbook 2006, China Electric Power Press, 2006
2008 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2 Energy.

Table 3.2 Simple OM Emission Factors Calculation of CSPG for Year 2006

Fuel	Unit	Net calorific value	Unit	Fuel emission factor	OXID	Guangdong (Mt/Gm3)[3)]	Guangxi (Mt/Gm3)[3)]	Guizhou (Mt/Gm3)[3)]	Yunnan (Mt/Gm3)[3)]	CO_2 Emission
		A		B	C	D	E	F	G	J=(D+E+F+G)*A *B*C/1000Mass J=(D+E+F+G)*A

										*B*C /100 Volume
Raw Coal	MJ/t,km^3	20908	$kgCO_2/TJ$	87.300	1	73.0319	14.9001	40.0154	27.3588	283,475,499
Cleaned Coal	MJ/t,km^3	26344	$kgCO_2/TJ$	87,300	1					0
Other Washed Coal	MJ/t,km^3	8363	$kgCO_2/TJ$	87,300	1			0.1953	0.458	476,968
Lump-coal	MJ/t,km^3	20908	$kgCO_2/TJ$	87,300	1	1.3375				2,441,296
Coke	MJ/t,km^3	28435	$kgCO_2/TJ$	95,700	1				0.0131	35,648
Crude Oil	MJ/t,km^3	41816	$kgCO_2/TJ$	71,100	1	0.0087				25,866
Other energy sources	MJ/t,km^3	43070	$kgCO_2/TJ$	0	1	0.935	1.8968	0	0.2029	0
Gasoline	MJ/t,km^3	43070	$kgCO_2/TJ$	57,500	1					0
Diesel Oil	MJ/t,km^3	42652	$kgCO_2/TJ$	72,600	1	0.2992	1.26			1,058,396
Fuel Oil	MJ/t,km^3	41816	$kgCO_2/TJ$	75,500	1	6.8585	0.0009			21,655,867
Other Petroleum Products	MJ/t,km^3	41816	$kgCO_2/TJ$	75,500	1	0.0067				21,153
Other Coking Products	MJ/t,km^3	28435	$kgCO_2/TJ$	95,700	1					0
Natural Gas	MJ/t,km^3	38931	$kgCO_2/TJ$	54,300	1	0.792				1,674,2511
LPG	MJ/t,km^3	50179	$kgCO_2/TJ$	61,600	1					0
Coke Oven Gas	MJ/t,km^3	16726	$kgCO_2/TJ$	37,300	1		0.084		0.206	180,925
Other Gas	MJ/t,km^3	5227	$kgCO_2/TJ$	37,300	1	0.089			1.915	390,714
Refinery Gas	MJ/t,k	46055	$kgCO_2/TJ$	48,200	1	0.0285				0

	m^3									
Total		***a***								**311,436,583**
Generating capacity	MWh	***b***				188,429,000	27,967,000	76,039,000	39791000	332,226,000
Auxiliary Power rate		***c***				5.27%	4.45%	6.06%	4.12%	
Power supply	MWh	***d=b*(1-c)***				178,498,792	26,722,469	71,431,037	38,151,611	314,803,908

Calculation of the OM:
a : total emission of CAPG: 311436583 **tCO_2**
d: Thermal power capacity of the CSPG: 31480400 **MWh**
e: power capacity from the CCPG to the CSPG: 21730840 MWh
f: average emitting factor of CCPG: 1.12157 tCO_2/MWh
$OM=(a+e*f)/(d+e/1000)*10^{-6}=0.99754$
λcoal=92.35%
λoil=6.94%
λgas=0.72%

Data Source:
China Energy Statistical Yearbook 2007, China Statistics Press, 2008.
China Electricity Statistical Yearbook 2007, China Electric Power Press, 2007
2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2 Energy.

Table 3.3 Simple OM Emission Factors Calculation of CSPG for Year 2007

Fuel	Unit	Net calorific value	Unit	Fuel emission factor	OXID	Guangdong	Guangxi	Guizhou	Yunnan	CO2 Emission
		A		B	C	D	E	F	G	**J=(D+E+F+G)*A*B*C /1000Mass J=(D+E+F+G)*A*B*C /100 Volume**
Raw Coal	MJ/t,km^3	20,908	$kgCO_2$/TJ	87,300	1	82.1478	17.5063	42.988	31.7079	318,235,546
Cleaned Coal	MJ/t,km^3	26,344	$kgCO_2$/TJ	87,300	1	0.0346				79,574
Other Washed Coal	MJ/t,km^3	8,363	$kgCO_2$/TJ	87,300	1		0.065	0.2158	0.1464	269,184

Lump-coal	$MJ/t,km^3$	20,908	$kgCO_2/TJ$	87,300	1	2.7125				4,951,041
Coke	$MJ/t,km^3$	28,435	$kgCO_2/TJ$	95,700	1	0.0004	0.0169		0.0215	105,584
Coke Oven Gas	$MJ/t,km^3$	16,726	$kgCO_2/TJ$	37,300	1		0.0096	0.0319	0.018	371,208
Other Gas	$MJ/t,km^3$	5,227	$kgCO_2/TJ$	37,300	1		0.3077		0.2163	1,021,628
Crude Oil	$MJ/t,km^3$	41,816	$kgCO_2/TJ$	71,100	1					0
Gasoline	$MJ/t,km^3$	43,070	$kgCO_2/TJ$	67,500	1				0	0
Diesel Oil	$MJ/t,km^3$	42,652	$kgCO_2/TJ$	72,600	1	0.2137	0.0213		0.0229	798,596
Fuel Oil	$MJ/t,km^3$	41,816	$kgCO_2/TJ$	72,500	1	4.6797	0.0041			14,787,262
LPG	$MJ/t,km^3$	50,179	$kgCO_2/TJ$	61,600	1					0
Refinery Gas	$MJ/t,km^3$	46,055	$kgCO_2/TJ$	48,200	1	0.0037				8,213
Natural Gas	$MJ/t,km^3$	38,931	$kgCO_2/TJ$	54,300	1	0.3217				6,800,588
Other Petroleum Products	$MJ/t,km^3$	41,816	$kgCO_2/TJ$	75,500	1	0.0847				267,407
Other Coking Products	$MJ/t,km^3$	28,435	$kgCO_2/TJ$	95,700	1					0
Other energy sources	$MJ/t,km^3$	0	$kgCO_2/TJ$	0	1	1.1804	0.8189	0.441	0.503	0
Total		a								**347,695,831**
Generating capacity	MWh	b				215,700,000	36,100,000	84,300,000	47,400,000	383,500,000
Auxiliary Power rate		c				6.01%	7.42%	6.62%	7.23%	
Power supply	MWh	d=b*(1-c)				202,736,430	33,421,380	78,719,340	43,972,980	358,850,130

Calculation of the OM:

a : total emission of CAPG: **347,695,831**tCO_2

d: Thermal power capacity of the CSPG: 358,850,130 MWh

e: power capacity from the CCPG to the CSPG: 24,237,240 MWh

f: average emitting factor of CCPG: 1.10197 tCO_2/MWh

OM=(a+e*f)/(d+e/1000)*10^{-6}=**0.97733**

λcoal=93.08%

λoil=4.56%

λgas=2.36%

Data Source: *China Energy Statistical Yearbook 2005*, China Statistics Press , 2009
China Electricity Statistical Yearbook 2008, China Electric Power Press, 2008
2008IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2 Energy.

Table 3.4 OM Emission Factors Calculation of CSPG

	2005	2006	2007	OM (tCO_2/MWh)
OM(tCO_2/MWh)	1.02802	0.99784	0.97733	0.99871
Generating capacity (MWh)	269,169,531	314,803,908	358,850,130	

Table 3.5 Parameters used for calculating fuel-fired emission factor

	Parameter	Efficiency of Power Suppy	Fuel emission factor ($kgCO_2$/TJ)	Oxidation Factor	Emission Factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1,000,000*B*C
Coal-fired Power Plant	$EF_{Coal,Adv}$	38.10%	87,300	1	0.8249
Gas-fired Power Plant	$EF_{Gas,Adv}$	49.99%	75,500	1	0.5437
Oil-fired Power Plant	$EF_{Oil,Adv}$	49.99%	54,300	1	0.3910

The $EF_{Thermal}$ is $EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$ = 0.8018 tCO_2e/MWh 。

Table 3.6 Installed Capacities of CSPG for Year 2007

	Guangdong	**Guangxi**	**Guizhou**	**Yunnan**	Total
	A	**B**	**C**	**D**	**G=A+B+C+D**
Fuel-fired (MW)	44,710	9,310	10,630	15,960	80,610
Hydro (MW)	10,110	10,440	11,580	8,210	40,340
Nuclear (MW)	3,780	0	0	0	3,780
Others (MW)	250	0	0	0	250

Total (MW)	58,850	19,750	22,210	24,170	124,980

Data sources:*China Electricity Statistical Yearbook 2008*, China Electric Power Press, 2008

Table 3.7 Installed Capacities of CSPG for Year 2006

	Guangdong	**Guangxi**	**Guizhou**	**Yunnan**	Total
	A	**B**	**C**	**D**	**G=A+B+C+D**
Fuel-fired (MW)	40,615	5,434	14,350	8,564	68,963
Hydro (MW)	9,320	7,624	7,534	9,698	34,176
Nuclear (MW)	3,780	0	0	0	3,780
Others (MW)	183	0	0	0	183
Total (MW)	53,898	13,058	21,884	18,262	107,102

Data sources:*China Electricity Statistical Yearbook 2007*, China Electric Power Press, 2007

Table 3.8 Installed Capacities of CSPG for Year 2005

	Guangdong	**Guangxi**	**Guizhou**	**Yunnan**	Total
	A	**B**	**C**	**D**	**G=A+B+C+D**
Fuel-fired (MW)	35182.6	4931.2	4758.4	9634.8	54507
Hydro (MW)	9035.7	6085.3	7993.1	7233	30347.1
Nuclear (MW)	3780	0	0	0	3780
Others (MW)	83.4	0	0	0	83.4
Total (MW)	48081.7	11016.5	12751.5	16867.8	88717.5

China Electricity Statistical Yearbook 2006, China Electric Power Press, 2006

Table 3.9 Boundary Emission Factor:BM for CSPG

	2005 (MW)	2006 (MW)	2007 (MW)	2005-2007 (MW)	Newly capacity additions
	A	B	C	D=C- A	
Fuel-fired (MW)	54507	68963	80,610	26,103	71.98%
Hydro (MW)	30347.1	34176	40,340	9,992.9	27.56%
Nuclear (MW)	3780	3780	3,780	0	0.00%

Others (MW)	83.4	183	250	166.6	0.46%
Total（MW）	88717.5	107102	124,980	36,262.5	100.00%
Percentage of newly installed capacity to 2007	70.99%	85.70%	100%		

$EF_{BM,y}$ = 0.8018 × 71.98%% =0.5772 tCO_2/MWh

Calculating the baseline emission factor (*EF_y*)

According to formula (9) in section B.6.1, the baseline emission factor of CSPG is calculated as:

$$EF_y = 0.78795\ tCO_2e/MWh$$

The EF_y applied in this PDD is fixed for a crediting period and may be revised at the renewal of the crediting period.

Annex 4

MONITORING INFORMATION