Voluntary Carbon Standard 2007.1
Project Description Template

18 November 2008

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[Table of Contents]

1 Description of Project:

1.1 Project title

48 MW Houqiao Hydropower Project, Yunnan, China

1.2 Type/Category of the project

According to the categorization system of VCS, which is part of a greenhouse gas (GHG) program that has been approved by the VCS Board, the project is categorized as:

Sectoral Scope Number: 1
Sectoral Scope: Energy industries (renewable-/non-renewable sources)
Project Activity: Grid-connected renewable power generation project activities from hydropower plants with accumulated reservoir.

1.3 Estimated amount of emission reductions over the crediting period including project size:

The renewable crediting period is applied to the project. The annual average emission reduction is estimated to be 178,615 tCO_2e per year over the first 10-year crediting period. The total emission reduction of the project will be 1,786,147 tCO_2e during the first crediting period. The proposed project is a medium-sized project, because the annual emission is more than 5,000 tCO_2e and less than 1,000,000 tCO_2e.

Table 1 Emission reductions of the project

The first crediting period of 10 years is selected for the project activity. The first credit period (Apr.1th, 2006-Mar.31th, 2016).	
Years	**Annual estimation of emission reductions in tones of CO_2e**
2006.4.1-2006.12.31	98,139
2007.1.1-2007.12.31	191,267
2008.1.1-2008.12.31	163,768
2009	183,893
2010	183,893
2011	183,893
2012	183,893
2013	183,893
2014	183,893
2015	183,893
2016.1.1-2016.3.31	45,722
Total estimated reductions (tones of CO_2e)	1,786,147
Total number of years in the first crediting period	10
Annual average over the crediting period of estimated reductions	178,615

(tones of CO_2e)	
Note: The emission reductions from 2006 to 2008 are calculated based on the actual data, others are calculated based on the estimated data.	

Based on the estimated amount of annual emission reduction of the project, which is 178,615 tCO_2e, the project is “project” according to the classification system of the VCS 2007.1.

1.4 A brief description of the project:

Description of the project activity

The Houqiao Hydropower Station had an installed capacity of 48MW, provided by three 16 MW hydro turbines, with an annual generated power of 235,000MWh. The project is located on Binglang River in Tengchong County, Baoshan City, Yunnan Province, P. R. China. It is the second level of total four levels in the hydropower development plan of Binglang River. The surface area is 0.17 km^2 and power density is 282.4 W/m^2.

Project Objective

The main objective of the proposed project is to generate power from a hydropower station in Yunnan Province and contribute to the sustainability of power generation of the China Southern Power Grid (CSPG). The proposed project is a grid-connected renewable energy project, from which the electricity generated will mostly supply to the Tengchong Power Grid and be connected to the other level of hydropower grid to support safe operation and transportation of Baoshan Power Grid, an integral part of the CSPG.

Electricity generated by the proposed project will displace part of the electricity generated by fuel fired power plants, and thus reduce CO_2 emissions from thermal power plants. The estimated annual average GHG emission reduction over the first crediting period is 1,786,147 tonnes of CO_2e.

Contribution to sustainable development

The construction of the proposed project will bring prominent environmental and social benefit, and also contribute to region sustainable development through following aspects:

- 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 emissions of greenhouse gases, to combat global climate change;
- Raising the quality of the local power supply and contributing to local government with more tax revenues;
- Contributing to local economic development and employment creation;
- Investing and exploiting natural resource in southwestern inland areas, in compliance with China western development strategies and the Renewable

Energy Laws of the People's Republic of China.

1.5 Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:

The proposed project is located on the Binglang River in Tengchong County, Baoshan City, Yunnan Province, P. R. China. The pivotal project is located in the Houqiao town, 70 kilometers away from Tengchong County seat. Detailed geographic coordinate of plant powerhouse site and map information (see Fig1.) is as follows:

The geographical coordinates of location of the power house are lat. 25°22′14″N, long. 98°11′32″E.

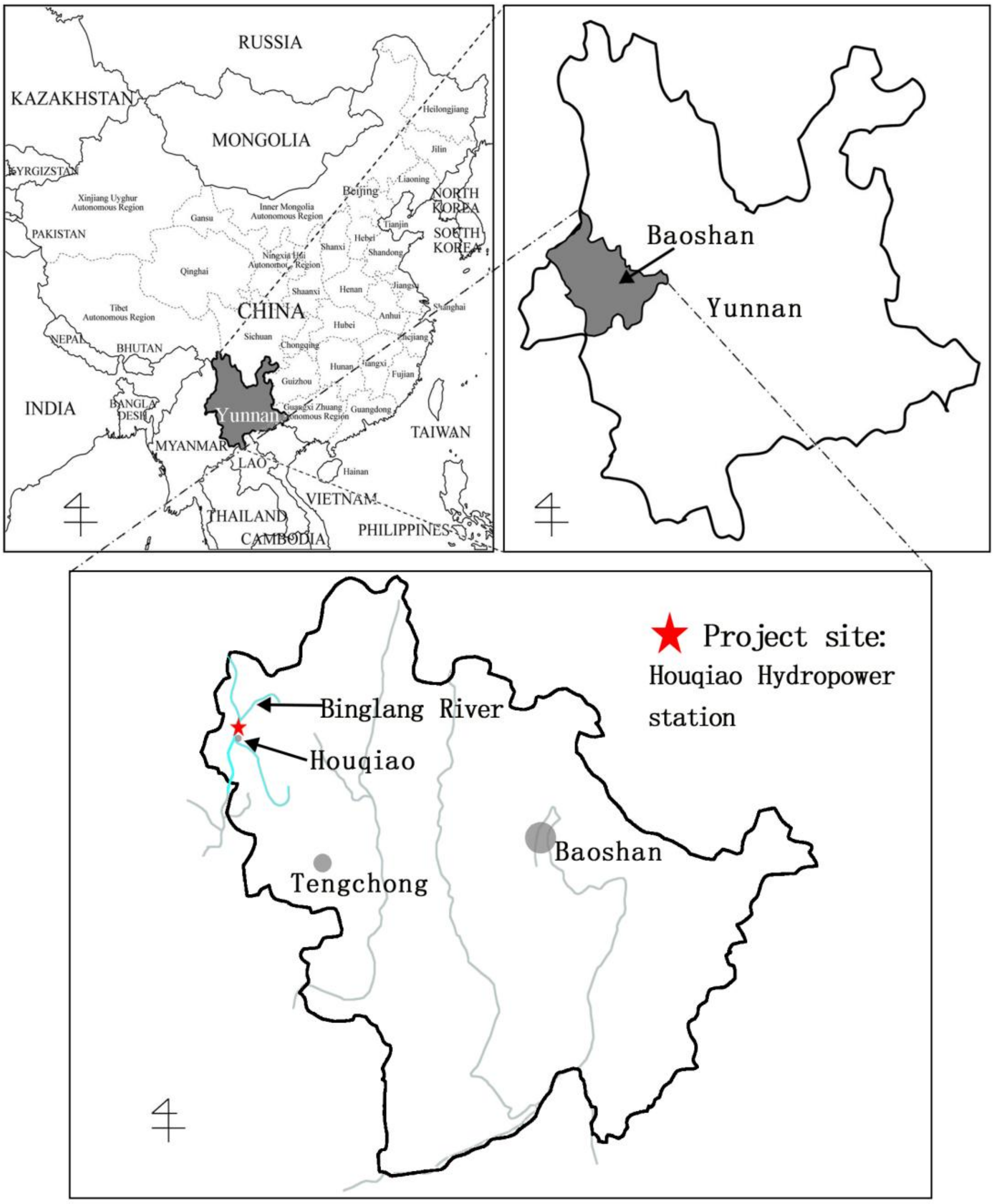

Figure 1 Geographical location of the proposed project site

1.6 Duration of the project activity/crediting period:

According to "Policy Announcement from the VCS Association"[1] published on 10 September 2008, the VCS 2007.1 definition for project start date has changed from the "date on which the project reached financial closure" to "the date the project activity began reducing or removing GHG emissions", So the proposed project start date is determined as 23 September 2005[2]. However, the Project Crediting Period Start Date under the VCS 2007.1 is defined as should not be earlier than 28 March 2006. Hence, we determined the Project Crediting Period Start Date of the proposed project as 1 April 2006 according to the conservative principle.

The crediting period for VCS project is a maximum of ten years which may be renewed at most two times. The life time of the project is generally considered longer than 30 years; therefore, the first crediting period of ten years is applied to the emission reduction estimation in this PD.

1.7 Conditions prior to project initiation:

（1） The local social and economic condition before the project[3]

Yunnan is one of China's relatively undeveloped provinces with more poverty-stricken counties than the other provinces. In 2004, Yunnan's nominal GDP was 295.9 billion Yuan, and the GDP per capita was 6,733 Yuan, which was only higher than that of Gansu and Guizhou in China. The share of primary, secondary, and tertiary industries in GDP were 20.4%, 44.4% and 35.2% respectively. Yunnan's four pillar industries are tobacco, agriculture, mining, and tourism. The electricity industry is another important economic pillar which plays an important role in the "West-East Electricity Transmission Project". The electricity produced in Yunnan is mainly transported to Guangdong Province.
Tengchong County is a major city with well-developed commerce and culture in the southwest border of Baoshan city, Yunnan province. In 2002, the county's GNP consisted 24.5% of Baoshan city. Its total industrial and agricultural output value was 1669.95 million Yuan, thereinto industrial output value was 608.99 million Yuan accounted for 36.47%, and that of agriculture was 1060.96 million Yuan accounted for 63.53%. It confirmed guidance ideology on the energy construction that would accelerate the construction of power being regulating ability and translate water resources into economic benefits in the Tengchong "tenth five-year plan" of national economics and social development.

（2） The local power grid condition before the project[4]

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[1] Refer to http://www.v-c-s.org/docs/Policy%20Announcement%20-%20Validation%20Date%20Deadline.pdf

[2] http://www.ynepb.gov.cn/ynepb/2007-6/2007622162229.htm

[3] Refer to Yunnan Statistics Bureau: http://www.stats.yn.gov.cn/

[4] Refer to Yunnan Government http://www.eng.yn.gov.cn/yunnanEnglish/144115188075855872/index.html

Yunnan Power Grid (YNPG) is an important component of the CSPG. YNPG's annual power supply accounts for about 79.78% of that for the Yunnan province and covers most of areas in the whole province. YNPG possesses total power transformation capacity of 24,147 MVA and total length of transmission line of 14,235 km. Among them, there are six 500kV substations with total transformation capacity of 6,500 MVA and 500 kV power transmission lines of 1,569 km, thirty-seven 220kV substations with total transformation capacity of 9,540 MVA and 220 kV power transmission lines of 4,962 km, as well as 110 kV power transmission lines of 7,703 km. The power network interconnection between YNPG and CSPG realizes annual energy transmission to the southeast China of about 7,000 GWh.

After the reform and opening-up, the Tengchong County power industry has also been rapid development with rapid industrial, agricultural and tourism development. But power shortage had been an important factor which restricted the local economical and social development along with implementation of West Development strategy, especially in the condition of substantial hydropower station of runoff hydropower and no regulating ability which resulted in serious power shortage in low water season. By the end of 2002, there were one 110kV substations with total transformation capacity of 25MVA and the power transmission lines of 25km, thirteen 35kV substations with total transformation capacity of 44.75MVA and the power transmission lines of 295km, as well as 10 kV power transmission lines of 1,930 km. So the total installed capacity was 47,736MW, annual generation capacity was 212,610,000kWh. But the power system of Tengchong County need at least 140MW installed capacity including 117MW main capacity and backup in 2010 as far as load forecasting is concerned. So it had a huge gap on the power capacity between electricity requirement and power supply, especially in low water season. If new hydropower station wouldn't be built, it would rely on the supply of Baoshan grid to deal with power shortage. But it would surely affect the normal power supply and restrict the economical development of Tengchong for great transmission loss and limited power supply.

（3） The climate and hydrological condition before the project

Yunnan has been rich in rainfall and distributed many rivers and lakes. The total annual water flow is about 360 cubic kilo-meters: partly about 200 cubic kilo-meters originating in the province is three times that of the Yellow River of China. Another part flowing into the province from outside is about 160 cubic kilo-meters, which means there are more than ten thousand cubic meters of water for each person in the province. This is four times the average in China. The rich water resources offer abundant hydro-energy.

The project locality has high 1477.9 mm of annual precipitation and uneven precipitation distribution throughout the year, which the rainfall mainly focuses on May to October accounting for 84.3% of the annual total amounts in the area. Tengchong County has rich water resources and better development conditions which owned Longchuan river, Daying river, Binglang river e.g., but less developed. Theoretical reserves of river hydropower resources are 2032MW in the county, thereinto installed capacity can be developed is 625MW accounted for 31%. But the total installed capacity of Tengchong County accounted for 7.6% of the amount that can be developed by the end of 2002.

The project site is located on the 800 meters downstream of Sanchahe Hydropower Station, which is the upstream of the Binglang River. Due to frequently large amount of rainstorm, in addition steep slope mountain and riverway, there are high risk of flooding in the area. The drainage area has the characteristic of mountain river flood. According to the historical data of the Zhanxi hydrometric station locating in the lower reaches of the Binglang River, Houqiao is considered to have 3 historical floods in 1788, 1907(P=0.99％), and 1946(p=3.45%).

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

The objective of the proposed project is to generate clean electricity by using water resource of Binglang River to mitigate electricity shortage in Yunnan Province. The proposed project activity is a renewable energy project, has not any emissions of anthropogenic greenhouse gas (GHG) by the sources itself. By using zero emission renewable resource, electricity generated by the proposed project will displace part of the electricity generated by fuel fired power plants of the CSPG, and the estimated annual GHG emission reductions over the first crediting period is 1,786,147 tCO_2e, which will contribute to slower global warming.

1.9 Project technologies, products, services and the expected level of activity:

The Houqiao Hydropower Project consists of three 16 MW turbine-generator sets, and the total installed capacity of which is 48 MW. The surface area of reservoir is 0.17 km^2 and the total storage is 0.773million m^3. The generated electricity is distributed to the Tengchong Power Grid and finally integrated by the CSPG.

Construction of the proposed project includes the following major components: dam, flood discharge structures, diversion structures, powerhouse, and power distribution system. According with the Classification & Design Safety Standard of Hydropower Projects (DL5180-2003) and the Design specification for river-bank spillway (DL/T5166-2002), the dam is designed in accordance with the standard of coping with floods of 50 year frequency and the check floods of 500 years frequency; the powerhouse is designed in accordance with the standard of coping with floods of 50 year frequency and the check floods of 100 years frequency; the energy-dissipating structures in the lower reach are designed in accordance with the standard of coping with floods of 20 years frequency. Each of the components is detailed as follows:

(1) Dam
A concrete gravity dam as the water-retaining structure is designed to withstand floods of 50 year frequency, whose maximum height is 35.5m, crest width is 4m, and crest length is 196.3m.

(2) Flood discharge structures
The flood discharge structures built on the dam body include the surface holes spillway and the flood way (sand-washing) bottom-holes; the maximum discharge is 1040m^3/s in the level of design flood (P=0.2%).

- **Surface holes spillway**

The surface holes spillway is arranged in the riverbed adopt the method of ski-jump energy dissipation, with 3 holes, one of which has a width of 8m and a height of 6m. Concrete protective covering with 10m length for river bed is distributed in the downstream of overflow dam to avoid the dam foundation washed out.

- **Flood way bottom-holes**

The flood way bottom-holes are designed with the energy dissipation by hydraulic jump in the right bank dam. Grouted rubble covering with 20m length for river bed is distributed in the downstream of overflow dam to protect the downstream riverbed.

(3) Diversion Structures

- **Water intake**

The water intake used the type of bank tower is located at the right bank of the dam, which consists of two trash racks (6.0 m high and 5.0 m wide) and an emergency gate (4.5 m high and 4.5 m wide). The intake is connected with water- tunnel.

- **Water-tunnel**

The water-tunnel, which carries water downhill from the intake to surge shaft, has inner diameter of 4.5m, and the length of 4074.5m. The maximum headrace flow rate is designed as51.5m^3/s.

- **Surge shaft**

The inner diameter and height of the throttled shaft are 15m and 47.6m respectively. Water from tunnel is passed through the surge shaft to adjust the water pressure for electricity generation at powerhouse.

- **Penstock**

The penstock buries underground, with the total length of 357.1m. The reinforced concrete penstock with steel lining has inner-diameter of 3.5m and outer-diameter of 4.1m. In order to handle the increasing water pressure, it sets a drainage culvert with 247.4m length arranged in the right of the penstock. The penstock finally carries water downhill from the surge shaft to turbines that located in powerhouse.

(4) Powerhouse

There are five hinge parts to the plant, main power house, auxiliary power house, erection bay, tailrace channel, and booster stations, which are lined down the river. The dimension of the main powerhouse is 51.3m×14.9m, with the height of 25.4m, which includes three hydraulic turbine generators of 16MW. The dimension of the booster station is 65m×53m.

The detailed technical parameters of the turbine and generator are shown in Table 2.

Table 2 Technical specifications of the turbines and generators

Turbines	Generators
Quantity: 3	Quantity: 3
Model: HLA696-LJ-130	Model: SF16-10 / 2860
Rated Output: 16.6MW	Rated Capacity: 16 MW
Rated Revolution: 600r/min	Rated Revolution: 600 r/min
Rated Head: 115m	Rated Voltage: 10.5 kV
Rated Flow: 15.82 m^3/s	Power Factor: 0.8

(5) Power distribution

Part of generated electricity is connected to third-fourth level power station of Binglang River as construction power supply in 35kV, and the most of the generated electricity is connected to Tengchong Grid with 110kV which is finally integrated to the CSPG.

Three generators were put into operation in September, October and December of 2005 separately, and run well until now. The safety assessment of the proposed project has been completed by China Kunming Water Conservancy and Hydropower Engineering Consultancy Company in November, 2008, indicating that the project was operating normally. And the project has met the requirements of ISO 14064: 2006 and VCS 2007.1. The project is expected to operate continuously, using operational procedures to maximize the generator use.

1.10 Compliance with relevant local laws and regulations related to the project:

The Provisions on Administration of Hydraulic Engineering Construction Project (Ministry of Water Resources SJ [1995] No.128) and the Temporary Provisions on Administration of Hydraulic Engineering Construction Procedure (Ministry of Water Resources SJ [1998] No.16) determine that the hydraulic engineering should be operated strictly according with legal procedure and will be managed and supervised to be legitimate and normative during overall process. And it is indicated in the Decision of the State Council on Retaining Administrative Examinations and Approval to Given Items (Chinese Order No. 412 of the State Council) that the starting up of hydraulic engineering in China should be examined and approved by local people's governments of water administration at or above the county level.

The Houqiao Hydropower Project complies with all local laws and regulations, and has been examined and approved by related local government; part of the permit documents obtained are as follows:

(1) The approval of the report of hydropower planning of Binglang River (YJNJ[97] No.421), issued by Yunnan Planning Committee.

(2) The message for proposals for the Houqiao Hydropower projects of Binglang River in Baoshan city, Yunnan (YZF [2003] No.25), issued by Yunnan Engineering Consultation Center.

(3) The FSR approval, ref YFGNY [2004] No.1031, issued by Yunnan Development and Reform Commission.

(4) The land use certificate (BGY [2006] No.01567), issued by Baoshan People’s Government.

According to the law of People’s Republic of China on Land Management, the Binglang River Hydropower Development Co., Ltd. of Baoshan, Yunnan must maintain the permits of land use for the Houqiao station. The approved land transfer letter by Baoshan National Land and Resources Management Bureau can show the project compliance with local law on land use.

(5) The approval of EIA, ref YHS [2004] No.599, issued by Yunnan Environmental Protection Bureau.

According to the Environmental Protection Law of the People's Republic of China and the Law of the People's Republic of China on Evaluation of Environmental Effects, the project would be permitted to start its construction only on the premise that the EIA of the proposed project has been approved. Meanwhile, the project activity would meet the emission standard of pollutants by taking effective environmental protection action, and it has acquired the approval of EIA. So it is in accordance with all state and local laws and regulations on environmental protection.

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

Nature disasters

- The potential risk induced by storm may be mud-rock flow and/or slope instability landslides.
- Risk induced by flood may be flood over controlling and/or deformation of river channel.
- Insufficiency of reservoir storage would happen in the great dry season to decrease the power generation.
- Thunderstorms occasionally occurring in summer may be dangerous to staff and/or equipment.

Accident

- For some accidental occasions caused by disobeying the rules and regulations, such as fire resulted from smoking, malfunction of power supply and electrical equipment, turbines and generators may be suddenly shut down in emergency.
- Suffering from the effect of the global economic crisis, the demand and price of energy both decrease observably, hence the generation time and revenue of power plan is thereupon reduced.
- Because of the prolific generation of solid waste with the development of local society and economy and the lack of environmental protection supervision, solid waste are discharged to the river directly and may jam the gate dam, which lead to the power station can't generate energy as normal.

In the above circumstances, they will reduce the power output and affect the project's GHG emission reductions.

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

Yunnan province is lack of coal and oil, with abundant water resource and low hydropower development. Along with the increasing demand of electricity, there is a huge gap between electricity supply and demand. The government of Yunnan Province has promoted development of hydropower station; Houqiao Hydropower Station is such a promoted project. Therefore, the proposed project was not built to create GHG emissions removal.

1.13 Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates).

The host country, China, so far does not have regulations to issue any credits for GHG emission reductions. And the proposed project is not CDM. Hence, the proposed project could not create another form of environmental credit.

1.14 Project rejected under other GHG programs (if applicable):

Not applicable.

1.15 Project proponents roles and responsibilities, including contact information of the project proponent, other project participants:

The proposed project will have two participants: Yunnan Baoshan Binglang River Hydropower Development Co., Ltd. and Tepia Corporation Japan, Co., Ltd.

Yunnan Baoshan Binglang River Hydropower Development Co., Ltd. is the proprietor of the Houqiao Hydropower Station，and it mainly undertakes the development of hydropower, electricity trading, engineering construction, operating and maintenance of the power plant. It has as shareholders the companies: 1) Baoshan Power Development Co., Ltd., 51%; 2) Guangdong Electrical Power Development Co., Ltd., 29%, 3) Kunming Exploration and Design Institute, 20%.

Tepia Corporation Japan, Co., Ltd. advises Yunnan Baoshan Binglang River Hydropower Development Co., Ltd. to develop VCS Project and to monitor the VCUs to be generated from BAESA Project.

Detailed information for contact with private entities involved in the project activity is related in tables below.

Table 3 Contact information on participants in the project activity

Project participants (as applicable)	Project Owner and Operator	VER Buyer
Name of Party involved	The People’s Republic of China (the host party)	Japan
Private and/or public entity(ies)	Yunnan Baoshan Binglang River Hydropower Development Co., Ltd.	Tepia Corporation Japan, Co., Ltd.
Street/P.O.Box:	No.208, Zhengyang North Road, Yongchang Town, Longyang Section	1-7-4, Minamihorie, Nishi-ku
City:	Baoshan	Osaka

State/Region:	Yunnan Province, China	Japan
Postfix/ZIP:	678000	5500015
Telephone:	+ 86 875 5897067	+ 81 6 6533 8018
E-Mail:	MXP8448@126.com	info@tepia.co.jp
URL:		http://www.tepia.co.jp
Represented by:	Yibin Liu	Xuefeng Wen
Note: Both the Parties involved don't wish to be considered as project participant.		

Contact information of developer of the PD:

Department: Beijing Tepia Technology Co., Ltd.
First developer of the PD: Huan Fu
Second developer of the PD: Wenjing Chen
Third developer of the PD: Pengcheng Zhang
Phone: +86 10 6878 1998
E-mail: fuh@tepia.com.cn

1.16 Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements (including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information):

As described in 1.10, the proposed project has been operated strictly according with legal procedure and been managed and supervised to be legitimate and normative during overall process, its starting up has been examined and approved by local people's governments of water administration.

Seeing the following described, the emission reductions of the proposed project will be quantized according to the approved methodology ACM0002 (Ver.10). So the information relevant for the eligibility of the project and quantification of emission reductions can be captured in other sections of this PD. Otherwise, since the beginning of its implementation, the proposed project considered revenues from the sales of assets related to the evidence of emission reductions.

1.17 List of commercially sensitive information (if applicable):

The project financial analysis spreadsheet has been excluded from the public version of the VCS PD. And all assumptions used in the spreadsheet elaboration will be supplied to the auditors and, if necessary, can also be available in the VCS Project Database.

2 VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

Reference of the methodology applied to the proposed project activity is ACM0002 (Ver.10) – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

ACM0002 refers to the following tools:

- Tool for the demonstration and assessment of additionality (Ver.05.2)
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Ver.02)
- Tool to calculate the emission factor for an electricity system (Ver.01.1)

The more information about the methodology is available on the following website:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The approved consolidated methodology ACM0002 (Ver.10) is applied here to determine the baseline of the proposed project. The project activity is a newly installed electricity capacity from hydropower in the CSPG. The grid can be clearly identified and information on its characteristics is available, which is in line with the ACM0002 requirements. The proposed project meets all applicability conditions of methodology ACM0002 which are listed as follows:

- The proposed project is new hydro electric power with reservoirs having power density of 282.4 W/m^2, which is greater than 10 W/m^2.
- The proposed project is not an activity that involve switching from fossil fuels to renewable energy at the site of the project activity;
- The geographic and system boundaries for the CSPG where the proposed project will be connected can be clearly identified and information on the characteristics of the gird is available.

Based on the above reasons, the proposed project meets applicable conditions of ACM0002 (Ver.10), and project emissions from the reservoir submerging are ignored.

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

According to ACM0002, the spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system that the proposed project is connected to. The geographic and system boundaries for the electricity system is clearly defined in "Bulletin on determining baseline emission factor of China's grid" published by the National Development and Reform Commission (NDRC) of China (DNA of China)[5].

[5] http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=3239

The proposed power plant will be connected to the Tengchong substation which be connected to Yunnan Power Grid, finally will get into China Southern Power Grid (CSPG). The CSPG also covers other provincial power grids such as Guangdong Power Grid, Guangxi Power Grid, and Guizhou Power Grid. Furthermore, the project boundary also includes China Central Power Gird (CCPG) for it sending some of its power generation to CSPG.

In summary, the project boundary of this project is composed of the project site, CSPG and CCPG. CCPG is a regional power grid in China, including Henan province, Hubei province, Hunan province, Jiangxi province, Sichuan province and Chongqing city. The GHG emission sources included in or excluded from the project boundary are as shown in the following.

Table 4 Emission sources included or excluded from the project boundary

	Source of Emission	Gas	Included	Instruction
Baseline	Power Generation by China Southern Power Grid	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplifying; being conservative
		N_2O	No	Excluded for simplifying; being conservative
Project Activities	Project Activity Emission	CO_2	No	The project is a renewable energy power generation, no CO_2 emission
		CH_4	No	It's negligible for the power density of the project is greater than $10W/m^2$
		N_2O	No	There is no N_2O emission

2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario:

According to the Methodology ACM0002, plausible and credible alternatives available to the project that provides similar outputs or services comparable to the VCS project activity include:

- Alternative Ⅰ: The project activity not undertaken as a VCS project activity;
- Alternative Ⅱ: Construction of a fossil fuel power plant with equivalent amount of annual electricity generation;
- Alternative Ⅲ: Construction of a power plant using other sources of renewable energy with equivalent amount of annual electricity generation;
- Alternative Ⅳ: Equivalent amount of electricity supplied by CSPG.

For Alternative Ⅰ, the project activity is undertaken without being registered as a VCS project, it does comply with China's laws and regulations, and is not implemented with any mandatory requirements. However, the FIRR of the project is less than the benchmark FIRR (8%)[6], which please see the following section 2.5 for detailed analysis. Therefore, Alternative Ⅰ is not financially attractive for the project owner.

For Alternative Ⅱ, the average annual utilization hours of the fossil fuel plants are much more than annual running hour of a hydropower plant. Thus, the installed capacity of the fossil fuel-fired plants with equivalent annual electricity generation to the project will be smaller than 48MW. However, according to current laws and regulations in China, the fossil fuel-fired power plant with installed capacity of 135MW or below are prohibited for construction in the areas covered by large power grids[7]. Therefore, Alternative Ⅱ is omitted for further consideration.

For Alternative Ⅲ, there is no enough exploitable wind resource[8] to build a wind power plant with equivalent amount of annual electricity generation of the project. Furthermore, because the cost for straw power generation is too high and hasn't been used effectively[9], the project site can not provide economical biomass resource for power generation with a commensurate scale to the project. Moreover, other renewable energy, such as solar PV, is suffered with high cost and not commercially available in China at the moment[10]. Otherwise, the cost of geothermal power plant is very high and the technology is not mature[11]. Therefore, Alternative Ⅲ is not the most plausible baseline scenario for the project.

For Alternative Ⅳ, the installed capacity of the CSPG for both existing power plants and the power plants to build in a foreseeable future satisfies China's regulations, which is also economically feasible.

According to the above analysis, the baseline scenario of the project is to obtain electricity equivalent to the project from CSPG, which is Alternative Ⅳ.

2.5 Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

According to VCS 2007.1, the project proponent shall demonstrate that the project is additional using one of the tests, the project test, the performance test, and technology test. The project test is chosen for this PD, as the other two tests are not currently available.

Step 1 Regulatory Surplus

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6 Refer to Chinese hydropower industry benchmark, also see the section 2.5 for detailed analysis.
7 Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with the Capacity of 135 MW or below issued by the General Office of the State Council, decree no. 2002-6.
8 http://www.newenergy.org.cn/html/0062/2006217_7650.html
9 http://www.86ne.com/Biomass/200712/Biomass_103227.html
10 Refer to China Solar PV Report • 2007, source from http://www.greenpeace.org/china/zh/press/reports/china-pv-report
11 http://eei.sjtu.edu.cn/news/CUS-EPSA/2006_10_12/pdf/01/A086.pdf

The project was not mandated by enforced law, statute and other regulatory framework.

Step 2 Implementation Barriers

The project shall face one (or more) distinct barriers(s) compared with barriers faced by alternative projects.

- Investment Barrier – Project faces capital or investment return constraints that can be overcome by the additional revenues associated with the generation of VCUs.
- Technological Barriers – Project faces technology-related barriers to its implementation.
- Institutional Barriers – Project faces financial, organizational, cultural or social barriers that the VCU revenue stream can help overcome.

The purpose of this step is to determine whether the project activity faces one or more distinct barriers compared to the barriers faced by alternative projects. The Investment Barriers are applicable for the project, for the impact of other two barriers is limited.

Sub-step 2a Determine appropriate analysis method

Tools for the demonstration and assessment of additionality suggest three analysis methods, i.e. simple cost analysis (option Ⅰ), investment comparison analysis (option Ⅱ) and benchmark analysis (option Ⅲ). We use these tools to evaluate alternative Ⅰ whether can be the baseline for the proposed project. Since

Option Ⅰ: The proposed project will obtain the revenues not only from the electricity sales but also from VCS, the simple cost analysis method is not appropriate.
Option Ⅱ: Investment comparison analysis method is applicable to projects whose alternatives are also investment projects. Only on such basis, comparison analysis can be conducted. The alternative baseline scenario of the project is the China Southern Power Grid other than new investment projects. Therefore the option II is not an appropriate method for the decision-making context.
Option Ⅲ: For the proposed project, we will use benchmark analysis method as below, because we can get the benchmark IRR on total investment and on self raising capital of the power sector in China. From the result of evaluation, we can know it is lower than benchmark IRR which is national financial requirement of construction. So these tools are used to justify additionality of proposed project. The course of analysis is presented below.

Sub-step 2b Benchmark Analysis Method (Option Ⅲ)

With reference to *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects,* the financial benchmark rate of return (after tax) of Chinese power industries accounts for 8% of the project IRR. On the basis of above benchmark, calculation and comparison of financial indicators are carried out in sub-step 2c.

Sub-step 2c Calculation and comparison of financial indicators

(1) Basic parameters for calculation of financial indicators

Based on the feasibility report[12] and the actual data of the project in the past three years, basic parameters for calculation of financial indicators are as follows:

Table 5 Main Parameters for the Calculation of Financial Indicators

Item		Unit	Value	Comments
Installed capacity		MW	48	Feasibility Study
Annual onto-grid power	2006	MWh	149514	Actual data
	2007		219545	Actual data
	2008		187980	Actual data
	After 2009		211080	Feasibility Study
Annual power generated		MWh	235,000	Feasibility Study
Project lifetime	Construction period	years	4	Feasibility Study
	Operation period	years	30	Feasibility Study
Static investment		million RMB Yuan	297.9	Actual data
Liquid Capital		million RMB Yuan	0.48	Feasibility Study
Annual O&M cost	2006	million RMB Yuan	4.10	Actual data
	2007		4.59	Actual data
	2008		6.02	Actual data
	After 2009		9.64	Calculated according to the FS and actual data.
Tax	value added tax	%	17	Feasibility Study
	urban maintenance and construction tax	% of VAT	5	Feasibility Study
	surtax for education	% of VAT	3	Feasibility Study
	income tax	%	33	Feasibility Study
On-grid power tariff		RMB Yuan/kWh (exclude VAT)	0.1709	Calculated according to the notification of renewed tariff.
Crediting period		years(renewable)	10 ×3	Selected
Expected VCUs price		EUR / t CO_2e	3.3	Estimation

Note: The recent average on-grid power tariff without VAT is calculated as follows: according to PPA in 2009, on-grid power tariff with VAT is 0.19 RMB yuan/kWh in the wet season from June to November and 0.24 RMB yuan/kWh in the dry season

[12] The feasibility study report issued by the HydroChina Kunming Engineering Corporation

from December to May in the next year respectively, and in accordance with notice on supportance of special industry tariff and down-regulation of tariff, tariff with VAT in the wet and dry season respectively reduce 0.01 RMB and 0.02 RMB yuan/kWh. VAT is 17%, so the average on-grid power tariff without VAT for is calculated as follows: [(0.19 - 0.01) * 6 + (0.24 - 0.02) * 6] / 12 / (1+0.17) = 0.1709 RMB yuan/kWh.
Actual static investment is higher than that of FSR, based on the data of FSR, the total additional static investment has been quartered to add to estimated static investment of four years respectively from 2003 to 2006 in the spread sheet for investment analysis.

(2) Comparison of IRR for the proposed project and the financial benchmark

In accordance with benchmark analysis (Option Ⅲ), if the financial indicators (such as IRR) of the project are lower than the benchmark, the proposed project is not considered as financially attractive.

IRRs of the project, with and without VCU revenues, are shown in Table 6. Without VCU revenues, the IRR of the project is 6.97% (after tax), which is much lower than the 8.0% benchmark. The proposed project without VCU would be considered as financially unattractive to investors. It is infeasible in business.

However, taking into account the VCU revenues, the project IRR after tax will significantly improve to exceed 8% the benchmark. Therefore, the project with VCU revenues can be considered as financially attractive to investors with relatively high profits, and the business feasibility will also be improved.

Table 6 Financial indicators of the Houqiao Hydropower Project

	IRR on total investment (benchmark=8%)
Without VCU	6.97%
With VCU	8.35%

Sub-step 2d ***Sensitivity analysis***

Three factors are considered in following sensitivity analysis:

- Electricity exports.
- Electricity tariff.
- Annual O&M cost.

In the context of IRR calculation to the proposed project, assuming that the above three factors fluctuate within the range of –10%~10%, the corresponding impacts on the IRR of total investment of the Project are shown in Table 7 and Figure 2.

Table 7 Impact of Variations in Critical Assumptions on IRR of Houqiao Station

	10.0%	5.0%	0.0%	-5.0%	-10.0%
Electricity exports	7.69%	7.33%	6.97%	6.59%	6.19%
Electricity tariff	7.74%	7.36%	6.97%	6.56%	6.13%
O&M cost	6.75%	6.86%	6.97%	7.08%	7.18%

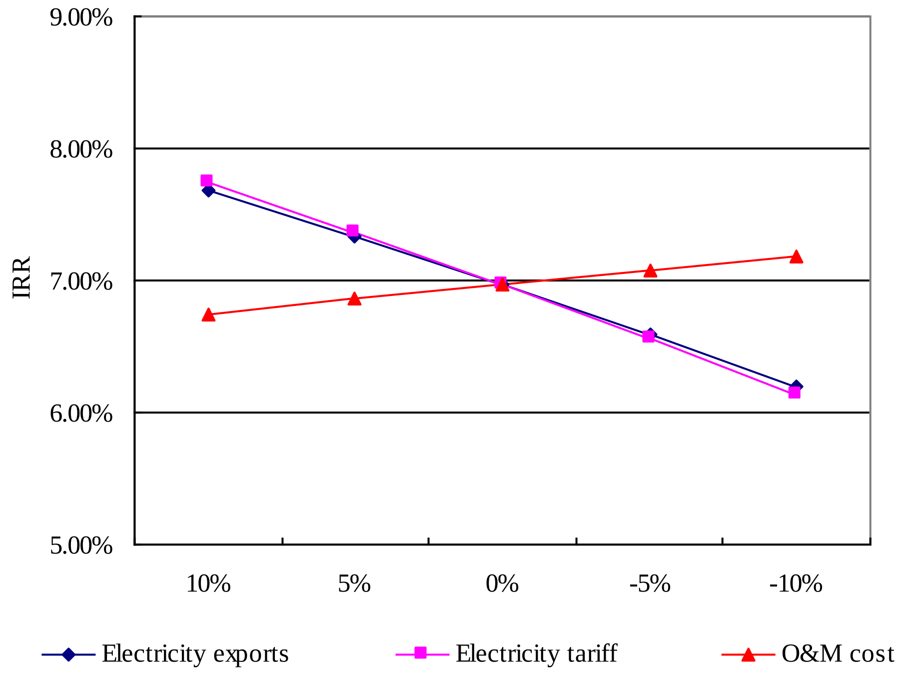

Figure 2 the IRR Sensitivity Analysis when Electricity exports, Electricity tariff or Annual Operating and Maintenance Cost changed

As shown in the sensitivity analysis above, even when the major factors fluctuated in the range of 10%, the IRR of the total investment of the project could not reach the benchmark (8%) and the conclusion stated above is still tenable. Thereinto, electricity exports and tariff increase by 10%, the project IRR are 7.69% and 7.74% respectively which close to the benchmark. But according to the actual electricity exports in 2006, 2007, 2008, the actual electricity exports of the project wouldn't increase by 10% even though there was rich in rainfall and high income in 2007, so the situation which the project IRR closes to 8% will hardly happen. Moreover, the electricity tariff is estimated according to the notification regarding standardizing and temporary reducing the onto-grid tariff of Development and Reform Commission of Baoshan City in recent year. Because the adjustment of electricity tariff needs to negotiation with Baoshan Power Grid Company and several government department, and the adjustment of tariff is related closely to national economy and livehood of people, in order to keep the tariff steady, the electricity tariff will hardly increase by 10%. Therefore, it is unlikely for the project to become commercially attractive through the fluctuation of the electricity tariff. The project faces significant economic and financial barriers without VCU revenues. On the contrary, when the revenues of VCU have been taken into account, the IRR will increase greatly. The ability for repaying back loan could be strengthened, the financial index could be improved. So this project could be implemented and operated smoothly.

Step 3 Common practice analysis

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

The following table summarizes the similar activities in Yunnan region in terms of the technology (hydropower plant), the installed capacity (comparable capacity around 48 MW), the operational time (after 2002), and the project owner (stated-owned entity). 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). Projects developed before 2002 are not considered, as in 2002 the China State Power Corporation was split into five regional grids with substantial effects on the investment environment for power production projects in China[13]. The hydropower stations with stated-owned entity have been in common conditions, because these stations will face the similar investment environment and barriers compared with the privately owned project entities.

Table 8 Development of Hydropower Projects in Yunnan Province

No.	Name	Location	River Basin	Installed capacity （MW）	Date of starting	Annual operating hours (h)	Investment per kWh (Yuan/kWh）
1	Hongshiyan[14]	Zhaotong	Niulan River	80	2003	4900	1.057
2	Nanting River[15]	Wenshan	Panlong River	34	2003	5726	0.790
3	Sanjiangkou[16]	Baoshan	Supa River	32	2005	7467	0.580
4	Tucang[17]	Kunming	Binglang River	35	2005	5131	0.691
5	Songshanhekou[18]	Baoshan	Binglang River	168	2007	4101	1.094

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

According to main parameters for the calculation of financial indicators of the proposed project in table 5, because the actual power generated from 2006-2008 is much lower than estimated power generated, in order to prove much more investment barrier compared with other project, the investment cost per kWh of the proposed project is 1.2677 Yuan/kWh calculated by actual static investment (297.9 million RMB Yuan) divide by annual estimated power generated (235000MWh). The actual costs per installed capacity of the proposed project is 6206 Yuan/kW calculated by actual static investment (297.9 million RMB Yuan) divide by actual installed capacity (48MW). As it is demonstrated in Sub-step 3a, there are similar hydropower developments in Yunnan Province. These projects enjoy much lower investment cost per kWh than the proposed project. Therefore the above projects are not similar with the proposed project, they could obtain better power generation conditions and higher grid revenues for lower investment cost and longer annual operating hours.

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[13] See: http://english.people.com.cn/200204/12/eng20020412_93913.shtml

[14] See: http://ludian.mofcom.gov.cn/aarticle/qiye/200604/20060402039388.html

[15] Data source comes from: http://www.ydxw.cn/showinfo.asp?id=25717

[16] Data source comes from: http://finance.sina.com.cn/g/20050524/094778496.shtml、http://www.ynepb.gov.cn/color/ContentDisplay_906.aspx?nContentId=22369

[17] http://hh.xxgk.yn.gov.cn/canton_model44/newsview.aspx?id=41598

[18] http://cdm.unfccc.int/Projects/Validation/DB/S7KX3ILW26TQ6V6M60ZEI53FJ2B60V/view.html

In addition, due to the worse construction condition and lower the investment return, the Tucang Hydropower Station is also developing CDM project and has recently succeeded in the registration at the CDM Executive Board at 26 May 09. Moreover the Sanjiangkou Hydropower Station has been successfully registered by the CDM Executive Board at 21 Apr 09. However, according to the above table 8, the investment cost per kWh of Tucang and Sanjiangkou Hydropower Station are much lower than that of the proposed project. Moreover, Yunnan Baoshan Songshanhekou Hydropower Station which is the fourth level of total four levels in the hydropower plan of Binglang River is developing the CDM project and had just been approved by the National Development and Reform Commission in Mar 2009. Otherwise, Songshanhekou Hydropower Station has lower investment cost of per kWh than the proposed project. So the proposed project has been confronted with more financial difficulties, and it's more necessary to acquire VCS revenues. The proposed project is not a common practice with the above two projects, and the project additionality is not affected.

Impact of VCS registration

From the above analysis, the investment return of the proposed project proves the investment barrier. The proposed project activity is an ambitious challenge and could not be considered business as usual.

In addition, after the proposed project started, for confronting the barriers of the investment finance and difficulties of operating and maintenance, the construction of the project once stopped. When the project owner realized that there were carbon emission reductions from the hydropower project, they had considered to apply the additional assist of CDM revenues to overcome the difficulties. The proposed project owner agreed with applying the assist of CDM revenues for project construction and operation at the third Session of the First Shareholder and Board meeting in 5 November 2004.

Although had considered essential to implement its entrepreneurship the revenues from selling emission reductions assets because of the lack of knowledge about how to develop Emission Reduction projects and the lack of definition existing in this market, the project owner decided to wait for more knowledge accumulation and for a greater maturity in the CDM market and in the Emission Reduction Voluntary Market to begin its projects.

Therefore, the proposed project is not a common practice in the region. It has additionality which is in line with all criteria addressed in the *Tool for the Demonstration and Assessment of Additionality*. It is economically unfeasible and need VCU revenues to maintain the ongoing operation.

3 Monitoring:

3.1 Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:

The approved methodology applied in the proposed project activity is ACM0002 (Ver.10) – "Consolidated methodology for grid-connected electricity generation from renewable sources" is chosen for the monitoring.

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches:

- **Purpose of monitoring**

The monitored data will be used to calculate the emission reduction of the project in verification during crediting period. Based on the monitoring, those data, electricity exported to CSPG, electricity imported from CSPG can be used to confirm the baseline emission, leakage and emission reduction.

- **Types of data and information to be reported, including units of measurement**

Because the data relevant to baseline emission are most ex-ante calculated, the data to be monitored only refers to the following:

- Electricity Exports (EG_{ex}, MWh), annual electricity export to CSPG through Yunnan Grid;
- Electricity Imports (EG_{im}, MWh), annual electricity imported from CSPG. When the turbines and generators of the project are not working, there is need to import electricity from Yunnan Grid for maintenance. Although it is very limited compare to Electricity Exports, yet in verification it will be used to determine emission reductions.
- Net Electricity Exports (EG_y, MWh), annual net electricity supplied to CSPG by the project equals to subtract Electricity Imports from Electricity Exports.
- Area of reservoir (km^2), as the project is a newly built hydropower station, result in new reservoirs, it refers to the surface area of the water when the reservoir is full. The project emission of the hydropower station with reservoir is relevant to power density.

- **Origin of the data**

Electricity Exports and Electricity Imports can be obtained from the readings of the gateway meters. The gateway meters record the data automatically every month. The value of reservoir area applied is derived from FSR, and the reservoir area is 0.17 km^2.

- **Monitoring, including estimation, modelling, measurement or calculation approaches**

Based on FSR, Electricity Exports (EG_{ex}) is 211080 MWh since 2008.

- **Monitoring times and periods, considering the needs of intended users**

EG_{ex} and EG_{im} will be continually measured, monthly recorded and aggregated annually. The two parameters can be read from Gateway Meter every month. The difference between EG_{ex} and EG_{im} is EG_y.

- **Monitoring roles and responsibilities**

In order to operate and manage the VCS project, the project owner will set up a special VCS team to be in charge of data collection, supervision, verification and recordation. The group director will be trained by VCS consultation organization. The team consists of a Monitoring Section and an Audit Section. The respective responsibilities are described on item 3.4.

- **Managing data quality**

100% of the data should be monitored in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period.

Some parameters related to baseline estimation need to be calculated only once for one crediting period. For example, the calculation of the operating margin and build margin emission factors. It is documented electronically in a spreadsheet that is attached to the VCS-PD.

3.3 Data and parameters monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

Data / Parameter:	EG_{ex}
Data unit:	MWh
Description:	Electricity delivered to the Grid by the proposed project activity
Source of data to be used:	Directly measured by ammeter at transformer station.
Value of data applied for the purpose of calculating expected emission reductions in section 2.5	211080
Description of measurement methods and procedures to be applied:	Electricity delivered to the Grid by the proposed project activity will be measured by electricity meter(s) according to the relevant national electric industry standard and regulations.
QA/QC procedures to be applied:	Readings on ammeter. Check whether the reading is the same as that is shown on power sales invoice provided by the grid company which the proposed project is

	connected. Please refer to Monitoring Plan for detailed information.
Any comment:	Copies in electronic format and paper documents. Keep 2 years after the proposed project is completed.

Data / Parameter:	EG_{im}
Data unit:	MWh
Description:	Electricity supplied by the grid to project activity
Source of data to be used:	Directly measured by ammeter at transformer station.
Value of data applied for the purpose of calculating expected emission reductions in section 2.5	0
Description of measurement methods and procedures to be applied:	Electricity supplied by the grid to project activity will be measured by electricity meter(s) according to the relevant national electric industry standard and regulations.
QA/QC procedures to be applied:	Readings on ammeter. Check whether the reading is the same as that is shown on power sales invoice provided by the grid company to which the proposed project is connected. Please refer to Monitoring Plan for detailed information.
Any comment:	Copies in electronic format and paper documents. Keep 2 years after the proposed project is completed.

Data / Parameter:	Cap_{PJ}
Data unit:	MW
Description:	Installed capacity of the hydropower plant after the implementation of the project activity.
Source of data to be used:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section 2.5	48
Description of measurement methods and procedures to be applied:	Verified on site
QA/QC procedures to be applied:	

Any comment:	

Data / Parameter:	A_{PJ}
Data unit:	km^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 to be used:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section 2.5	0.17
Description of measurement methods and procedures to be applied:	The data will be measured by professional design institute yearly.
QA/QC procedures to be applied:	
Any comment:	

3.4 Description of the monitoring plan

This section details the steps taken to monitor on a regular basis the GHG emissions reductions from the Houqiao Hydropower Project in China. A Monitoring Plan will be made to serve as a guideline for the project owner to monitor the proposed project during the project implementation. The contents of the Monitoring Plan are highlighted as follows:

（1） Monitoring organization

The monitoring plan will be responsibly implemented by the project owner; it will ensure the emission reduction of the project during crediting period.

Prior to the start of the crediting period, a VCS monitoring office to take charge of data collection, supervision, verification and recordation will be established by the project owner. To monitor the project emission reductions and any leakage effects, the project owner will designate qualified staff responsible for all relevant matters, including monitoring of emission reductions, data collection and archiving, QA/QC, and verification. All assigned staff will have clear roles and responsibilities. The organization of the monitoring group is illustrated in the figure below:

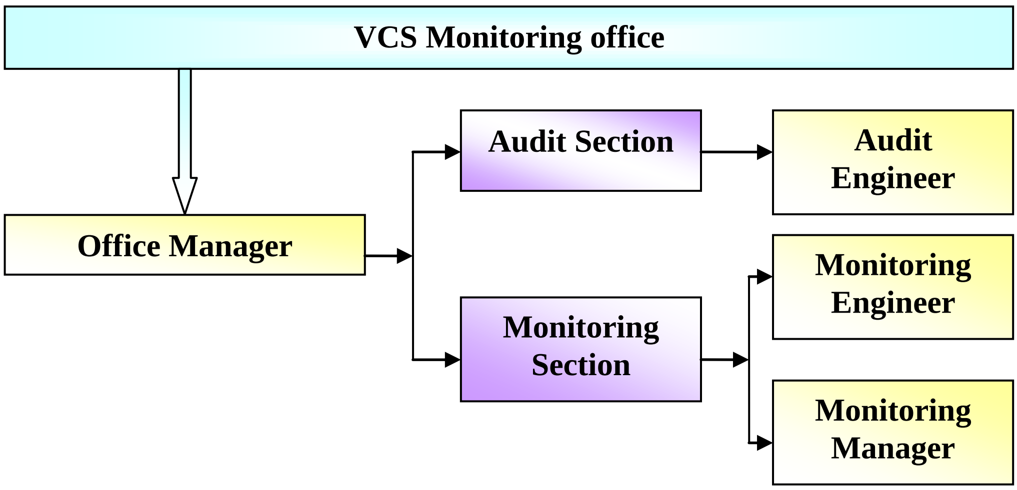


Figure 3 The organization of the monitoring group

The respective responsibilities are as follows:

- Office Manager: Receive reports from Monitoring Manager, manage the VCS project jointly with VCUs buyer, submit the monitoring reports to the DOE and deliver them to the VCUs. He will have the overall responsibility for the monitoring system on this project.
- Monitoring Manager: Prepare monitoring reports, and in charge of all relevant matters with the monitoring activity.
- Monitoring Engineer: Record Electricity Exports and Electricity Imports, is in charge of daily operation and maintenance.
- Auditing Engineer: Audit the work of Monitoring Section and execute the QC/QA procedures according to the Monitoring Plan.

（2） Training of Operation and Maintenance

As to the preparation of manual for operation and maintenance, all of personnel in the monitoring department should have accepted training which is set up to meet requirement of job. They can’t undertake such work until they pass the exams and master the knowledge and skills. The project entity is responsible for the relevant training of monitoring plan. In the course of training, each situation of equipment, how to read, how to operate, how to manage data and so on are taught to personnel in this apartment to meet the requirements of the monitoring methodology. Through the training of personnel, the workers are competent for the daily operation and maintenance. At the same time, manual for operation and maintenance will be prepared as a rule for daily work to enhance the standard of monitoring. In the manual for operation and maintenance, emergency preparedness for cases where emergencies can cause unintended emissions, procedures identified for review of reported results/data and corrective actions are included in order to provide for more accurate future monitoring and reporting.

（3） Monitoring equipments and installation

The positions of the meters are illustrated in the figure below, and more detailed electric schematics of the project are available to the verifier.

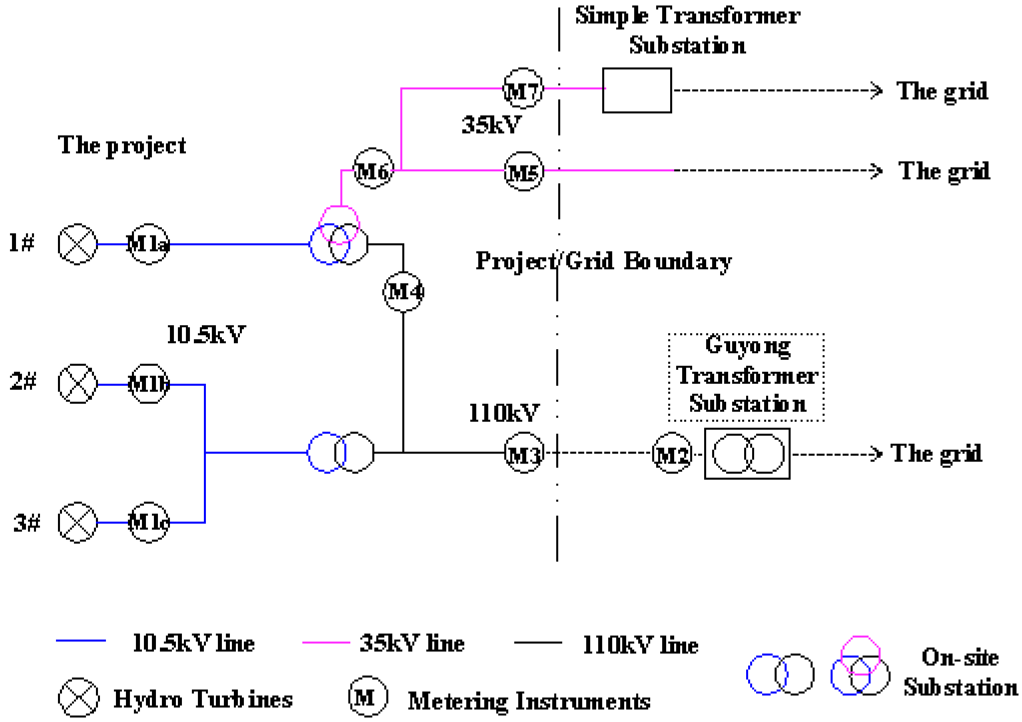


Figure 4 Simplified electric grid connection diagram

According to the meter installation figure, the project is connected to the grid through the first on-site substation which increases the voltage of the generated electricity to 110kV monitored by meter M3, then transferred to the Guyong transformer substation owned to the grid company. Otherwise, through the second on-site substation, the project is connected to the grid which increases to two 35kV power lines, thereinto one 35kV power line is connected to the simple transformer substation owned to the grid company measured by meter M7, the other 35kV power line is connected to the grid monitored by meter M5.

Main meters M2, M3, M5 and M7 are grid-connected meters, only meter M2 is installed and recorded by the grid company in Guyong substation which used as cross check meter, other meters is installed in the Houqiao Hydropower Station used to measure the amount of power sales.

The other cross check meters M1a, b, c, M4 and M6 would be installed, operated and maintained by the project owner, according to the relevant Chinese standard (Verification equipment for AC electrical energy meters JJG597-2005) to enable the use of the data as a cross check or back up in the case of a failure of the main meter M3, M5, M7. The cross-check meter data is used in VCS calculation only where accurate main meter data is unavailable.

The detailed illustrations of each meter are listed as follows table:

Table 9 Detailed illustrations of meters

Metering	Function	Recorded by	Calibrated	Recording

Location			by	
M3 (grid-connected meter)	Monitoring the electricity supplied to the grid and the electricity use of the project get from the grid.	Grid Company & Project Entity	Grid Company	Monthly
M5 (grid-connected meter)	Measuring the electricity supplied to the grid from 1# generator.	Grid Company & Project Entity	Grid Company	Monthly
M7 (grid-connected meter)	Measuring the electricity supplied to the grid from 1# generator.	Grid Company & Project Entity	Grid Company	Monthly
M2 (cross-check meter)	Monitoring the electricity supplied to the grid and the electricity use of the project get from the grid.	Grid Company	Grid Company	Monthly
M4 (cross-check meter)	Measuring the electricity supplied to the grid from 1# generator.	Project Entity	Project Entity	Monthly
M6 (cross-check meter)	Measuring the electricity supplied to the grid from 1# generator.	Project Entity	Project Entity	Monthly
M1a (cross-check meter)	Measuring the electricity which 1# generator produces.	Project Entity	Project Entity	Monthly
M1b (cross-check meter)	Measuring the electricity which 2# generator produces.	Project Entity	Project Entity	Monthly
M1c (cross-check meter)	Measuring the electricity which 3# generator produces.	Project Entity	Project Entity	Monthly

Grid-connected meter M3 and M2 are bidirectional meters which can monitor both electricity output generated from the proposed project and electricity input provided by the grid at the substation. Other meters aren't bidirectional. The accuracy of all the meters is 0.2s. At the same time, the data can be monitored and recorded at the on-site control centre using a computer system.

In addition, power measuring equipment installation shall be collocated and should be checked and accepted by the project owner and power grid company before it operating based on "Technical administrative code of electric energy metering" (DL/T448-2000, issued by State Economic and Trade Commission on Nov. 3, 2000 and implemented on Jan.1, 2001). In order to ensure the equipments work properly, they will be checked by the project owner and the grid company before the project is in operation.

（4） Monitoring data and calculation

Because the baseline emission factor is ex-ante calculated, the monitored data only refers to net electricity connected to grid by the project (EG_y in section 3.2). EG_y is calculated on a monthly as:

$EG_y = EG_{ex} - EG_{im}$

where:
EG_{ex}, the amount of electricity proposed project supplied to grid;
EG_{im}, the amount of electricity get from the grid.

So the amount of electricity not only the proposed project supply to the grid but also the electricity import from the grid would be monitored.

The project entity not only supplies the power to the grid but also gets from the grid monitored by meter M3 in 110kV line. But there wouldn't get the power from the grid through 35kV line, only supply the power to the grid measured by meters M5 and M7. So the net amount of electricity would be calculated as follows:

$EG_y = EG_{ex}$ (M3+M5+M7) $- EG_{im}$ (M3)

（5） Data collection and recording

The steps of monitoring electric power proposed project delivered to power grid and it get from the grid and consumed by the project are as follows:

- The project owner and power grid company should read and check data from routine measurement meter on 25th every month, including three main revenue ammeters M3, M5, M7 and the backup meters M1a,b,c, M4, M6 and M2;
- The power grid company should offer actual M3, M5, M7 value of electric power delivered to grid to the project owner. In case there are no significant discrepancies compared with the value of backup meters, the steps described below will be followed.
- The project owner provides electricity sale invoices to the Grid Company. Copies of the invoices are stored by the project owner.
- Meanwhile if there is electricity input from the grid, the project owner would store electricity purchase invoices provided by the grid company.
- The project owner should record the net electric power delivered to power grid which will be calculated as the electricity supplied to the power grid subtract the amount consumed by the project;
- The project owner should offer reading record of routine measurement ammeter and invoice copy piece to verifying people of DOE.

Once the reading beyond the precision allowed error range at any month or ammeter function is not abnormal, our competent work will find the events in no time, because of daily work on it. The amount of electricity connected to grid should be confirmed according to the following:

- Firstly, if the grid-connected ammeter M3 is inaccurate, the readings of M2 plus the transformation line losses will be used, if one of the meters M5 and M7 is found to be faulty, data from the cross-check ammeters M6 will be used to calculate the sum of power of the meter M5 and M7, if the meter M6 and M2 is inaccurate, the sum readings of M1a, b, c will be used, and data of the meter M1a will be used as the backup of the sum power of the meter M4 and M6, unless any side thinks that the check ammeter is not precise in reading;

- Secondly, if the cross check ammeters have no acceptable precision or standard operation, the project owner and power grid company should jointly design a reasonable conservative method to estimate readings, and explain that it’s reasonable and conservative in DOE’s verification.
- Thirdly, if the project owner and power grid company cannot reach an agreement on the conservative method to estimate readings, arbitration should be conducted according to conventional procedure to confirm the consistency of estimating method.

（6） Calibration and Maintenance

In order to ensure measurement precision, the project owner should sign an agreement with the power grid company to stipulate quality control process of measurement and calibration before the plan of monitoring will be implemented. Periodical ammeter inspection and calibration shall be implemented according to standards and regulations of the state electric power industry (See the Verification equipment for AC electrical energy meters, published by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China in 2005, doc number [JJG597-2005]). After inspection and calibration, ammeters must be sealed. The project owner and power grid company should inspect and seal together, and no one of the two can remove the seal or modify the ammeter when the other (or its deputy representative) is absent.

All installed ammeters should be tested by measuring inspection institution entrusted by both the project owner and the power grid company, within 10 days after either of the followings occurs:

- The error of grid-connected ammeter or the cross check ammeter exceeds the accepted range specified in the national standard[JJG597-2005];
- Ammeter is repaired or replaced for component malfunction.

（7） Data management

To keep safely the record of the data collected during monitoring safely, this project will set up a complete data management system. The data management procedure is illustrated as follows:

- The monitoring data should be kept in the form of paper document and filed electronically by the VCS group appointed at 25th of each month;
- Electronic documents should be copied by CD and printed to be paper backup;
- Electricity sale/purchase invoice and paper documents should be kept by the project owner such as maps, drawings, EIA reports and FSR etc. They should be used with monitoring plan to verify the authenticity of data;
- The index of the project document and monitoring report should be offered by the project owner to make it easy for the verifiers to obtain the documents and information related to the emission reduction of the project;.
- All the data and information in the form of paper document will be kept in archives by VCS group, with at least one copy backup for each datum;

- All the data shall be kept until two years after the end of crediting period.

（8）Monitoring Report

Based on monitoring GHG emissions, the VCS monitoring office manager will take charge of writing the annual monitoring report before verification. The report should cover the monitoring of grid-connected power generation, check report, report on calculation of the emission reductions and records of monitoring instrument repair and calibration, etc. The emissions of the project will be monitored monthly and calculated in Ton CO_2e according newly renewed methodology ACM0002. The proposed project owner plans to elaborate internal monitoring reports every six months and submit at the end of every year for the verification of DOE.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

According to the approved methodology ACM0002 (Ver.10): consolidated baseline methodology for grid-connected electricity generation from renewable resources, the emission reduction (ER_y) of the project activity during a given year y is the difference between the baseline emission (BE_y) and the project emission (PE_y) and emission from the leakage (LE_y). The emission reduction ER_y during a given year y is calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \qquad (1)$$

Where,

ER_y refers to emission reductions of the project activity during the year ‘y’ (tCO_2e);

BE_y refers to the baseline emissions due to displacement of fossil fuel-based electricity during the year ‘y’ (tCO_2e);

PE_y refers to the project emissions during the year ‘y’ (tCO_2e);

LE_y refers to the leakage.

The steps to calculate PE_y, LE_y and BE_y to confirm ER_y are detailed in the following:

Project Emission (PE_y):

According to the consolidated baseline methodology ACM0002, for the uncertainty in science, electric power density (W/m^2, electric power density = installed capacity/area of the reservoir) is required to decide whether the hydropower project is in line with the requirement of the VCS project.

According to the feasibility study report of the proposed project, the surface area at normal reservoir level is 0.17 km^2, the power density is 282.4 W/m^2 which is greater than $10W/m^2$. Based on ACM0002, the emission by the proposed project could be omitted, i.e. PE_y=0.

Leakage (IE_y):

According to ACM0002, there is no leakage in the newly-built hydropower station, i.e. $LE_y = 0$

Baseline emissions (*BE_y*):

The baseline emissions of the proposed project (*BE_y*) could be calculated by the following formula:

$$BE_y = EG_y \times EF_{grid,CM,y} \quad (2)$$

Where,

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

EG_y = *Electricity supplied by the project activity to the grid (MWh).*

$EF_{grid,CM,y}$ = *Combined margin CO_2 emission factor for grid connected power generation in year y, which is calculated by the latest version of the Tool to calculate the emission factor for an electricity system.*

$$EG_y = EG_{ex,y} - EG_{im,y} \quad (3)$$

Where,

EG_y = Net electricity supplied by the project activity to the grid (MWh).

$EG_{ex,y}$ = Electricity supplied by the project activity to the grid (MWh).

$EG_{im,y}$ = Electricity supplied by the grid to project activity (MWh).

The "*Tool to calculate the emission factor for an electricity system"* provides for a step-wise approach to calculate the *$EF_{grid,CM,y}$*. These steps include:

Step 1 Identify the relevant electric power system

As described in section 2.3, the spatial extent of the project boundary includes the proposed project and all power plants connected physically into CSPG. CSPG is the relevant project electricity system.
For CSPG, there are electricity imports from Central China Power Grid (CCPG), therefore CCPG is the connected electricity system.

Step 2 Select an operating margin (OM) method

Calculate the operating margin emission factor(s) (*$EF_{grid,OM,y}$*) based on one of the four following methods:

(a) Simple OM;

(b) Simple adjusted OM;

(c) Dispatch Data Analysis OM;

(d) Average OM.

We use method (a) to calculate the OM emission factor of CSPG and the *ex-ante* option is adopted with using the data vintage as a 3-year generation-weighted average based on the most recent data.

Simple OM can only be used where low operating cost/ must-run resources constitute less than 50% of total grid generation. In recent 5 years, electricity generated by the hydropower of CSPG and other renewable energy is less than 50% of the total power generation, which meets the requirement that a low operating cost/must-run plant's electricity generation constitute less than 50% of total grid electricity generation.

Step 3 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:

- Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system(Option C).

In China, all power grids and power plants keep their specific net electricity generation and the fuel consumption data as business secrets, so they would not publicly release these data, thus only option (c) is feasible.

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y} \qquad (4)$$

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).
$EF_{CO_2,i,y}$	= 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 three most recent years.

According to the calculation of DNA of China, adopting *ex-ante* calculation, the operating margin emission factor of CSPG is 1.0608 tCO_2e /MWh.

Step 4 Identify the cohort 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.

In the current circumstance in China the data of sampling power units group are not available. Therefore, CDM EB approves the following methodology deviation[19]:

(1) Use of capacity additions during last 1 - 3 years for estimating the build margin emission factor for grid electricity.

(2) Use of weights estimated using installed capacity in place of annual electricity generation and use of the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

Methodology AM0005 has been replaced by the consolidated methodology ACM0002, thus the deviation above is also applicable to the consolidated methodology ACM0002.

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 VSC-PD 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.

Step 5 Calculate the build margin emission factor

Because the generation capacities of coal, oil and gas fueled power cannot be separated from the current statistic data, the following steps are adopted in the calculation: firstly the PD make use of the latest energy balance data to calculate all sorts of emission scale in total emission from coal, oil and gas fueled power; then based on the emission factor under the level of best commercialized technical efficiency, calculate the fuelled power emission factor of the grid; last multiply the fuelled power emission factor and fuelled power proportion of the total power, then comes the resulting BM of the grid.

The detailed procedure and formula are as follows:

1) Calculate the specific proportions of CO_2 emission induced by solid, liquid and gaseous fuels in local grid with the following formulas:

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (5)$$

[19] EB guidance for “Request for guidance: Application of AM0005 and AMS-ID in China，2005.10.7”: Request for clarification on use of approved methodology AM0005 for several projects in China. http://cdm.unfccc.int/Projects/Deviations/index.html?p=4.

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \tag{6}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \tag{7}$$

Where,

$F_{i,j,y}$ = The amount of fuel *i* consumed by province *j* in year(s) *y;*

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)

$EF_{CO2,i,j,y}$ = CO_2 emission factor of fossil fuel type i in j province in year y (tCO_2/GJ)

Coal, Oil and Gas refer to the solid, liquid and gaseous fuel.

2) Calculated the emission factor of fossil fuel plants

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \tag{8}$$

Where,

$EF_{Coal,Adv,y}$、$EF_{Oil,Adv,y}$ and $EF_{Gas,Adv,y}$ refer to the emission factor of the efficiency level of the best technology commercially by utilizing coal, oil and gas to generate electricity.

3) Calculate the $EF_{grid,BM,y}$ of the grid

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \tag{9}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

CAP_{Total} = The total installed capacity addition (MW)

$CAP_{Thermal}$ = The installed capacity addition of fossil fuel (MW)

According to the calculation of DNA of China, adopting *ex-ante* calculation, the build margin emission factor of CSPG is 0.6816 tCO_2e /MWh.

Step 6 Calculate the combined emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \tag{10}$$

Where:

$EF_{grid,OM,y}$ = *Operating margin CO_2 emission factor in year y (tCO_2/MWh).*

$EF_{grid,BM,y}$ = *Build 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 (%).*

The weighting w_{OM} and the weighting w_{BM} are both taken 0.5 as default for the first crediting period. For the second and third crediting period, w_{OM} = 0.25 and w_{BM} = 0.75.

For first crediting period, the weightings w_{OM} and w_{BM} are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), according to the formula, the baseline emission factor of CSPG is obtained as:

$EF_y = 0.5 \times 1.0608 + 0.5 \times 0.6816 = 0.8712$ tCO_2/MWh

4.2 Quantifying GHG emissions and/or removals for the baseline scenario:

Baseline emissions are calculated with combined baseline emission factor and the net electricity delivered to the grid by the project.

According to the FSR of the project, the average annual net Electricity Export is estimated to be 211,080 MW h while the actual measured Electricity Export in 2006, 2007 and 2008 were 149,514, 219,545, 187,980 MWh. Hence the actual annual and estimated baseline emission of the project in the first crediting period are calculated as below.

From Apr. 1, 2006 to Dec.31, 2006
$BE_y = EG_y \times EF_y = 149{,}514 \times 0.8712 \times 275/365 = 98{,}139$ t CO_2e

From Jan 1, 2007 to Dec.31, 2007
$BE_y = EG_y \times EF_y = 219{,}545 \times 0.8712 = 191{,}267$ t CO_2e

From Jan 1, 2008 to Dec.31, 2008
$BE_y = EG_y \times EF_y = 187{,}980 \times 0.8712 = 163{,}768$ t CO_2e

From 2009 to 2015 annually
$BE_y = EG_y \times EF_y = 211{,}080 \times 0.8712 = 183{,}893$ t CO_2e

From Jan.1, 2016 to Mar.31, 2016
$BE_y = EG_y \times EF_y = 211{,}080 \times 0.8712 \times 91/366 = 45{,}722$ t CO_2e

4.3 Quantifying GHG emissions and/or removals for the project:

The power density of Houqiao Hydropower Station is 282.4 W/m^2, which is greater than 10 W/m^2. The Project activity emissions $PE_y = 0$.
The Houqiao Hydropower Station is a gird-connected renewable project, referring to the description in methodology ACM0002, there no leakage, then $LE_y = 0$.

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project:

The average annual emission reductions of the project in the first crediting period were estimated to be 178,615 tCO_2e. The annual emission reductions of the project were estimated as follows:

From Apr. 1, 2006 to Dec.31, 2006
$ER_y = BE_y - PE_y - LE_y$ = 98,139－0 －0 = 98,139 tCO_2e

From Jan 1, 2007 to Dec.31, 2007
$ER_y = BE_y - PE_y - LE_y$ = 191,267－0 － 0 = 191,267 tCO_2e

From Jan 1, 2008 to Dec.31, 2008
$ER_y = BE_y - PE_y - LE_y$ = 163,768－0－0 = 163,768 tCO_2e

From 2009 to 2015 annually
$ER_y = BE_y - PE_y - LE_y$ = 183,893－0－0 = 183,893 tCO_2e

From Jan.1, 2016 to Mar.31, 2016
$ER_y = BE_y - PE_y - LE_y$ = 45,722－0－0 = 45,722 tCO_2e

5 Environmental Impact:

According to Environmental Protection Law of the People's Republic of China, the assessment of environmental impacts of the project activities must be completed before the exploiting and using of natural resources. The Houqiao Hydropower Project has been approved by Yunnan Environmental Protection Bureau on August 25th, 2004, in the form of official document (approved file No.[2004] 599), that shows the proposed project is in accordance with the claim to environmental protection by the host party. The basic conclusions on environmental impacts assessment of the proposed project are as follows:

Main benefits

(1) The Huoqiao hydropower station will become the strong guarantee in power supply for exploiting the local resources and promoting the local economic development, with the average capacity of 235 million kWh over years.
(2) The power plant generates electricity with renewable energy source (hydro-energy resources). Compare with the same scale thermal power plant, it can save 77, 600 t standard coal per year. This is advantageous to the protection of non-renewable resources.
(3) The massive input of manpower and investment during the construction period will create the employment opportunities for the locality and promote the local economic development. In the operational period, the hydropower station will not only bring the locality considerable profits and taxes, moreover lead the development of the related industries.

Disadvantageous impacts

Construction Phase

Three main wastes (wastewater, exhaust gas, rubbish) and noise will be produced during the construction period. The vegetation will be destroyed and the soil erosion will be brought forth with the excavating, the abandoned dregs and the land occupying in the construction. All of these will negatively influence the regional environment to a certain extent.

- **Ecological effect**

The main vegetation type influenced by the construction and submerged by the reservoir will be the deciduous broadleaved forest, which is the secondary vegetation formed from the destroyed prophyta. Due to the small scale of this vegetation, the regional vegetation will not be impacted significantly. The construction of the power plant will not substantially influence the species resources of plants, no significant foreseeable influence to the terrestrial vertebrate will come forth.

- **Environmental pollution**

The concentration of pollutants in the construction plant effluent and the domestic sewage during the construction period of the Huoqiao Hydropower Station exceeds the limitation of the national discharge standard, and this will impact the water environment of the construction area adversely in certain extent. Therefore, wastewater treatment facilities are required to prevent the water of Binglang River from pollution.
Dust and noise produced from construction machine working, rock excavating, blast, construction material processing, and transporting on site, which will be destructive mentally and physically to the construction worker and resident nearby, should be eliminated by adopting proper steps.
There are seven locations planed to stack waste residue excavated during construction, where measures for water and soil conservation should be taken to avoid new damage of soil erosion caused by erosion and collapse of the dregs. In addition, domestic waste in construction area should be managed well to prevent the spread of disease among the workers.

- **Soil erosion**

It is predicted that a surface area of 65 hm^2 will be disturbed and 54.99 hm^2 area including paddy field, garden plot and woodland will be destroyed, accompanying $44.8 \times 10^4 m^3$ waste residue produced. Without proper conservation methods, soil erosion amounting to 12.35×10^4 t will be added with the construction and the intensity of soil erosion will achieve to be fierce.

- **Impact on people health**

It will increase the risk of outbreaks of malaria, phthisis, and water-borne infection during construction period that massive constructors garrison the construction site. The incidence of water-borne diseases will increase, on condition that the sanitation and epidemic prevention have not been enhanced.

Operation Phase

Although there won't produce pollutant during operation phase, some woodland will be submerged by reservoir filling, and the primary ecosystem of the river will be changed with the obstructing of the dam, which will finally influence the fish as impediment. The river will be intercepted by the dam built, and the habitat for the fishes will be artificially divided into two regions, resulting in the failure of gene exchange between fishes of upstream and downstream and consequently the reduction of species vitality. Although the quantity of torrenticole will decrease, no species will be lost at the construction area.

6 Stakeholders' comments:

To confirm the impacts of the proposed project on the relevant stakeholders, a survey using a questionnaire was conducted by the project owner and Yunnan Sun Valley Energy Conservation Development Co. Ltd in May 2009. A brief summary of the project was introduced to the respondents prior to asking the questions and filling in the questionnaire forms. The invited stakeholders included institution and enterprise, government worker, peasant, students, etc., nearly 90% of which are aged 18 to 54, and more than 72% have attended junior middle school.
As to the written questionnaire survey carried out for the community groups and local people, a total of 68 questionnaires were issued which all 68 valid responses were obtained. The completed questionnaires are available for DOE.

The questionnaire involved the following aspects:

(1) What is the most serious impact of the project for you?

(Air pollution; Water pollution; Noise pollution; Others; No concern)

(2) What do you think about the proposed project's function on local area's environmental quality?

(Prominent; Adverse; Not sure)

(3) Can you accept the adverse impact to environment of the project if its construction and production are carried out in strict accordance with national standards, and reduce the environment impact to its lowest level?

(Yes; No; Not sure)

(4) What do you think about the proposed project's function on local area's economic development?

(Prominent; Adverse; Not sure)

(5) Do you think the construction of the power plant will increase your employment opportunities?

(Yes; No; Not sure)

(6) Do you think the proposed project is feasible after taking all factors brought by its construction into consideration?

(Yes; No; Not Sure)

Comments of informants on the proposed project are summarized as follows:

Only 16% people worried about the environmental pollution of the project, including air pollution, water pollution and so on, while more than 88% people considered the project will improve local environmental condition. 67 of the 68 informants could accept the adverse impact to environment of the project. All the informants considered the project will promote economic development and increase job opportunity. Except only one people had no response to the question, others thought that the proposed project is feasible. So the local stakeholders had an adequate opportunity to the project.

7 Schedule:

Main event	Year	Date
Construction start	2003	Jul. 28
Main Equipment Purchasing Contract of turbines and generators	2003	Nov. 4
EIA approved	2004	Aug. 25
FSR approved	2004	Nov. 22
Consideration of CDM	2004	Nov.
Power Purchase Agreement	2005	Jul. 25
Construction closure	2005	Dec.
The first generator was put into operation (Starting date of reducing GHG emissions)	2005	Sep. 23
The second generator was put into operation	2005	Oct. 14
The third generators was put into operation	2005	Dec. 22
Starting date of the first Crediting Period	2006	Apr. 1
Ending date of the first Crediting Period	2016	Mar. 31
Starting date of the second Crediting Period	2016	Apr. 1
Ending date of the second Crediting Period	2026	Mar. 31
Starting date of the third Crediting Period	2026	Apr. 1
Ending date of the three Crediting Periods	2036	Mar. 31
Date of terminating operation of the Houqiao Hydropower Station(estimated based on FSR)	2036	Dec. 31

Discussion on VCS with Sun Valley	2008	May 6
Begin project design documents for VCS	2009	Apr.
Frequency of monitoring and calculating the emissions of the project	Yearly	Monthly
Frequency of submitting monitoring reports	Yearly	

8 Ownership:

8.1 Proof of Title:

The evidence of proof of title includes the following, see detailed in Annex 2.

- Enterprise Business License.
- The land use certificate.

8.2 Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):

Not applicable

Annex 1 Baseline information

BASELINE INFORMATION

Please refer to annex 1 of the “*Bulletin on the Baseline Emission Factors of the China’s Regional Grids”* reviewed by Director Office of National Climate Change Coordination of National Development and Reform Commission (NDRC) of China (DNA of China) on Jul. 18th, 2008.

Table A1. Proportion of the electricity generation from low operating cost/must-run power plants among the total electricity generations of the China Southern Power Grid

	Fuel-fired （10^8kWh）	Hydropower （10^8kWh）	Nuclear （10^8kWh）	Others （10^8kWh）	Total of all the power plants （10^8kWh）	Total of low operating cost/must-run power plants（10^8kWh）	Percentage of the electricity generation from low operating cost/must-run power plants
2002	1837.33	639.31	208.77	1.35	2686.76	849.43	31.62%
2003	2227.79	810.64	289.30	23.65	3351.3	1123.59	33.53%
2004	2195.41	809.66	284.81	32.55	3322.43	1127.02	33.92%
2005	2871.86	916.26	304.76	34.33	4127.21	1255.35	30.42%
2006	3322.26	1045.16	312.13	35.86	4715.41	1393.15	29.54%

Remark:

1、 Low cost and must run resources in this case include hydro, nuclear and others.

2、Data resource：2003-2007 China electric power yearbook

According to the data above, we can use the simple OM method to calculate operation margin emission factor.

Table A2 Power generation from fuel-fired power of CSPG in 2004

	Power generation （10^8kWh)	**Power generation （MWh)**	**Internal consumption rater (%)**	**Power supply to grid （MWh)**
GuangDong	1693.89	169389000	5.42	160,208,116
GuangXi	201.43	20143000	8.33	18,465,088
GuiZhou	497.2	49720000	7.06	46,209,768
YunNan	243.22	24322000	7.56	22,483,257
Total				**247,366,229**

Data resource：2005 China electric power yearbook

Table A3. Simple OM calculation sheet of CSPG in 2004

Fuel sort	unit	Guangdong	Guangxi	Guizhou	Yunnan	subtotal	Emission factor (tc/TJ)	Oxidation rate (%)	Average caloric value ($MJ/t,km^3$)	Emission of CO_2 I=G*H*F*E*44/
		A	B	C	D	E=A+B+C+D	F	G	H	I=G*H*F*E*44/
Raw coal		6017.7	1305	2643.9	1751.28	11717.88	25.8	100	20908	231,
Wash extractive coal	10^4 ton	0.21				0.21	25.8	100	26344	5
Other wash coal						0	25.8	100	8363	
Coke						0	25.8	100	28435	
Coke oven gas	10^8 m^3					0	12.1	100	16726	
Other coal gas		2.58				2.58	12.1	100	5227	5
Crude oil		16.89				16.89	20	100	41816	51
Gasoline						0	18.9	100	43070	
Diesel oil	10^4 ton	48.88			1.83	50.71	20.2	100	42652	16
Fuel oil		957.71				957.71	21.1	100	41816	30,
LPG						0	17.2	100	50179	
Refine dry gas		2.86				2.86	15.7	100	46055	7
Nature gas	10^8 m^3	0.48				0.48	15.3	100	38931	10
Other oil production	10^4 ton	1.66				1.66	20	100	38369	4
Other coke production						0	25.8	100	28435	
Other energy	10^4 tce	79.42				79.42	0	100	0	
						Total				265,
Net import electricity from CCPG							10,951,240			
Average emission rate of CCPG in 2004							0.82732			
Total emission of CO_2 from CSPG in 2004							265,163,407+10,951,240*0.82732=274,223,576			
Electricity delivered to grid generated by **fuel-fired Power** ,2004 CSGP							10,951,240+247,366,229=258,317,469			
2004 Emission factor of CSPG							**1.06158**			

Data source: *2005 China Energy Statistics Yearbook*

Table A4. Power generation from fuel-fired power of CSPG in 2005

	Power generation （10^8kWh)	Power generation （MWh)	Internal consumption rate (%)	Power supply to grid （MWh)
GuangDong	1764.53	176,453,000	5.58	166,606,923
GuangXi	250.23	25,023,000	7.95	23,033,672
GuiZhou	584.3	58,430,000	6.94	54,141,238
YunNan	272.81	27,281,000	7.34	25,387,699
Total				**269,169,531**

Data resource：2006 China electric power yearbook

Table A5. Simple OM calculation sheet of CSPG in 2005

Fuel sort	**unit**	**Guangdong**	**Guangxi**	**Guizhou**	**Yunnan**	**subtotal**	**Emission factor (tc/TJ)**	**Oxidation rate (%)**	**Average caloric value (MJ/t,km^3)**	**Emission of CO_2 (t** **I=G*H*F*E*44/12/10000**
		A	**B**	**C**	**D**	**E=A+B+C+D**	**F**	**G**	**H**	**I=G*H*F*E*44/12/100**
Raw coal		6696.47	1435	3212.31	1975.55	13319.33	25.8	100	20908	263,442,602
Wash extractive coal	10^4 ton				0.15	0.15	25.8	100	26344	3,738
Other wash coal				10.39	33.88	44.27	25.8	100	8363	350,238
Coke		4.79			8.05	12.84	29.2	100	28435	390,906
Coke oven gas	10^8 m^3				0.79	0.79	12.1	100	16726	58,624
Other coal gas		1.87			15.96	17.83	12.1	100	5227	413,486
Crude oil		10.91				10.91	20	100	41816	334,556
Gasoline		0.68				0.68	18.9	100	43070	20296
Diesel oil	10^4 ton	31.96	2.02		1.81	35.79	20.2	100	42652	1,130,639
Fuel oil		887.21				887.21	21.1	100	41816	28,702,703
LPG						0	17.2	100	50179	0.00
Refine dry gas		4.92				4.92	15.7	100	46055	130,441
Nature gas	10^8 m^3	0.93				0.93	15.3	100	38931	203,115
Other oil production	10^4 ton	1.7				1.7	20	100	38369	47,833
Other coke production						0	25.8	100	28435	0.00
Other energy	10^4 tce	104.66	133.15		59.72	297.53	0	100	0	0.00
Total										295,229,177
Net import electricity from CCPG								20,264,000		
CM of CCPG in 2005								0.77216		
Total emission of CO_2 from CSPG in 2005								0.77216*96,363,000+295,229,177=310,876,215		
Electricity delivered to grid generated by **fuel-fired Power** ,2005 CSGP								20,264,000+269,169,531=289,433,531		
2005 Emission factor of CSPG								**1.07409**		

Data source: *2006 China Energy Statistics Yearbook*

Table A6. Power generation from fuel-fired power of CSPG in 2006

	Power generation （10^8kWh)	Power generation （MWh)	Internal consumption rate (%)	Power supply to grid （MWh)
GuangDong	1884.29	188,429,000	5.27	178,498,792
GuangXi	279.67	27,967,000	4.45	26,722,469
GuiZhou	760.39	76,039,000	6.06	71,431,037
YunNan	397.91	39,791,000	4.12	38,151,611
Total				**314,803,908**

Data resource：2007 China electric power yearbook

Table A7. Simple OM calculation sheet of CSPG in 2006

Fuel sort	unit	Guangdong	Guangxi	Guizhou	Yunnan	subtotal	Emission factor (tc/TJ)	Oxidation rate (%)	Average caloric value ($MJ/t,km^3$)	Emission of CO_2 (tC I=G*H*F*E*44/12/10000
		A	**B**	**C**	**D**	**E=A+B+C+D**	**F**	**G**	**H**	**I=G*H*F*E*44/12/1000**
Raw coal		7303.19	1490.01	4001.54	2735.88	15530.62	25.8	100	20908	307,179,636
Wash extractive coal						0	25.8	100	26344	0
Other wash coal	10^4 ton			19.53	45.8	65.33	25.8	100	8363	516,852
Briquette coal		133.75				133.75	26.6	100	20908	2,727,466
Coke					1.31	1.31	29.2	100	28435	39,882
Coke oven gas	10^8 m^3		0.84		2.06	2.9	12.1	100	16726	215,202
Other coal gas		0.89			19.15	20.04	12.1	100	5227	464,737
Crude oil		0.87				0.87	20	100	41816	26,679
Gasoline						0	18.9	100	43070	0
Diesel oil	10^4 ton	29.92	1.26		3	34.18	20.2	100	42652	1,079,777
Fuel oil		685.85	0.09			685.94	21.1	100	41816	22,191,288
LPG						0	17.2	100	50179	0
Refine dry gas						0	15.7	100	46055	0
Nature gas	10^8 m^3	7.92				7.92	15.3	100	38931	1,729,751
Other oil production	10^4 ton	0.67				0.67	20	100	38369	18,852
Other coke production						0	25.8	100	28435	0
Other energy	10^4 tce	93.54	189.68		20.29	303.51	0	100	0	0.00
Total										336,190,122
Net import electricity from CCPG								21,730,840		
CM of CCPG in 2006								0.77134		
Total emission of CO_2 from CSPG in 2006								0.77134*21,730,840+336,190,122=352,951,910		
Electricity delivered to grid generated by **fuel-fired Power** ,2006 CSGP								21,730,840+314,803,908=336,534,748		
2006 Emission factor of CSPG								**1.04878**		

Data source: *2007 China Energy Statistics Yearbook*

Table A8. Weighted average OM emission factor of CSPG in the past 3 years

		2004	2005	2006	Remark
1	Total generation(MWh)	258,317,469	289,433,531	336,534,748	884,285,748(2004-2006)
2	Total emissions (tCO_2e)	274,223,576	310,876,215	352,951,910	938,051,701(2004-2006)
	Weighted average emission factor	Total emissions of 2004-2006/Total generation of 2004-2006			**1.06080**

Calculation for BM：

Table A9. sheet for λ_{Coal}, λ_{Oil}, $\lambda_{Gas\ calculation}$, 2006 CSPG

Fuel sort	unit	Guangdong A	Guangxi B	Guizhou C	Yunnan D	subtotal E=A+B+C+D	Emission factor (tc/TJ) F	Oxidation rate (%) G	Average caloric value (MJ/t,km^3) H	Emission of CO_2 (tCO_2e) I=G*H*F*E*44/12/10000(quality) I=G*H*F*E*44/12/1000 (volume)
Raw coal		7303.19	1490.01	4001.54	2735.88	15530.62	25.8	100	20908	307,179,636
Refined coal		0	0	0	0	0	25.8	100	26344	0
Other washed coal	10^4 ton			19.53	45.8	65.33	25.8	100	8363	516,852
Briquette coal		133.75	0	0	0	133.75	26.6	100	20908	2,727,466
Coke		0	0	0	1.31	1.31	29.2	100	28435	39,882
Sort total										310,463,836
Crude oil		0.87	0	0	0	0.87	20	100	41816	26,679
Gasoline		0	0	0	0	0	18.9	100	43070	0
kerosene		0	0	0	0	0	19.6	100	43070	0
Diesel oil	10^4	29.92	1.26	0	3	34.18	20.2	100	42652	1,079,777
Fuel oil	ton	685.85	0.09	0	0	685.94	21.1	100	41816	22,191,288
Other petroleum products		0.67	0	0	0	0.67	20	100	38369	18,852
Other coke products		0	0	0	0	0	25.8	100	28435	0
Sort total										23,316,596
Natural gas		79.2	0	0	0	79.2	15.3	100	38931	1,729,751
Coke oven gas	10^8 m^3	0	8.4	0	20.6	29	12.1	100	16726	215,202
Other coal gas		8.9	0	0	191.5	200.4	12.1	100	5227	464,737
LPG	10^4	0	0	0	0	0	17.2	100	50179	0
Refine dry gas	ton	0	0	0	0	0	15.7	100	46055	0
Sort total										2,409,690
Total										336,190,122

Data source: *2007 China Energy Statistics Yearbook*

According to the table above：$\lambda_{Coal,y}$ = 92.35%, $\lambda_{Oil,y}$ = 6.94%, $\lambda_{Gas,y}$ = 0.71%

Table A10. Eefficiency Level of the Best Power Generation Technology Commercially

	Variable	Consumption rate (gce/kWh)	Efficiency of Power Supply	Emission Factor of Fuel（tc/TJ）	Oxidation Factor	Emission Factor（tCO_2e /MWh）
			A	B	C	D=3.6/A/1000*B*C*44/12
Coal	$EF_{Coal,Adv}$	329.94	37.28%	25.8	1	0.9135
Gas	$EF_{Gas,Adv}$	252	48.81%	15.3	1	0.4138
Oil	$EF_{Oil,Adv}$	252	48.81%	21.1	1	0.5706

Data source: DNA publication of 18 Jul. 2008

Table A11. Percentage of the CO_2 emission from different type of fossil fuel among total CO_2 emission

	Coal	Oil	Gas	Emission factor of fuel-fired power (tCO_2e/MWh) (λ_{Coal}*$EF_{coal,Adv}$+λ_{Oil}*$EF_{oil,Adv}$+λ_{Gas}*$EF_{gas,Adv}$)
λ	92.35%	6.94%	0.71%	**0.8862**
EF_{Adv}	0.9135	0.5706	0.4138	

Table A12. BM calculation of CSPG

	Installed Capacity in 2004	**Installed Capacity in 2005**	**Installed Capacity in 2006**	**New Added Installed Capacity in 2004~2006**	**% of New Added Installed Capacity**
	A	B	C	D=C-A	
Fuel-fired Power（MW）	46659.7	54507	68963	22303.3	76.91%
Hydro Power（MW）	27580.1	30347.1	34176	6595.9	22.75%
Nuclear Power（MW）	3780	3780	3780	0	0.00%
Wind Power（MW）	83.4	83.4	183	99.6	0.34%
Total（MW）	78103.3	88717.5	107102	28998.7	100.00%
% of Installed Capacity in 2006	72.92%	82.84%	100%		

$$\mathbf{EF_{BM,y}=0.8862\times76.91\%=0.6816\ tCO_2e/MWh}$$

Calculation of CM:

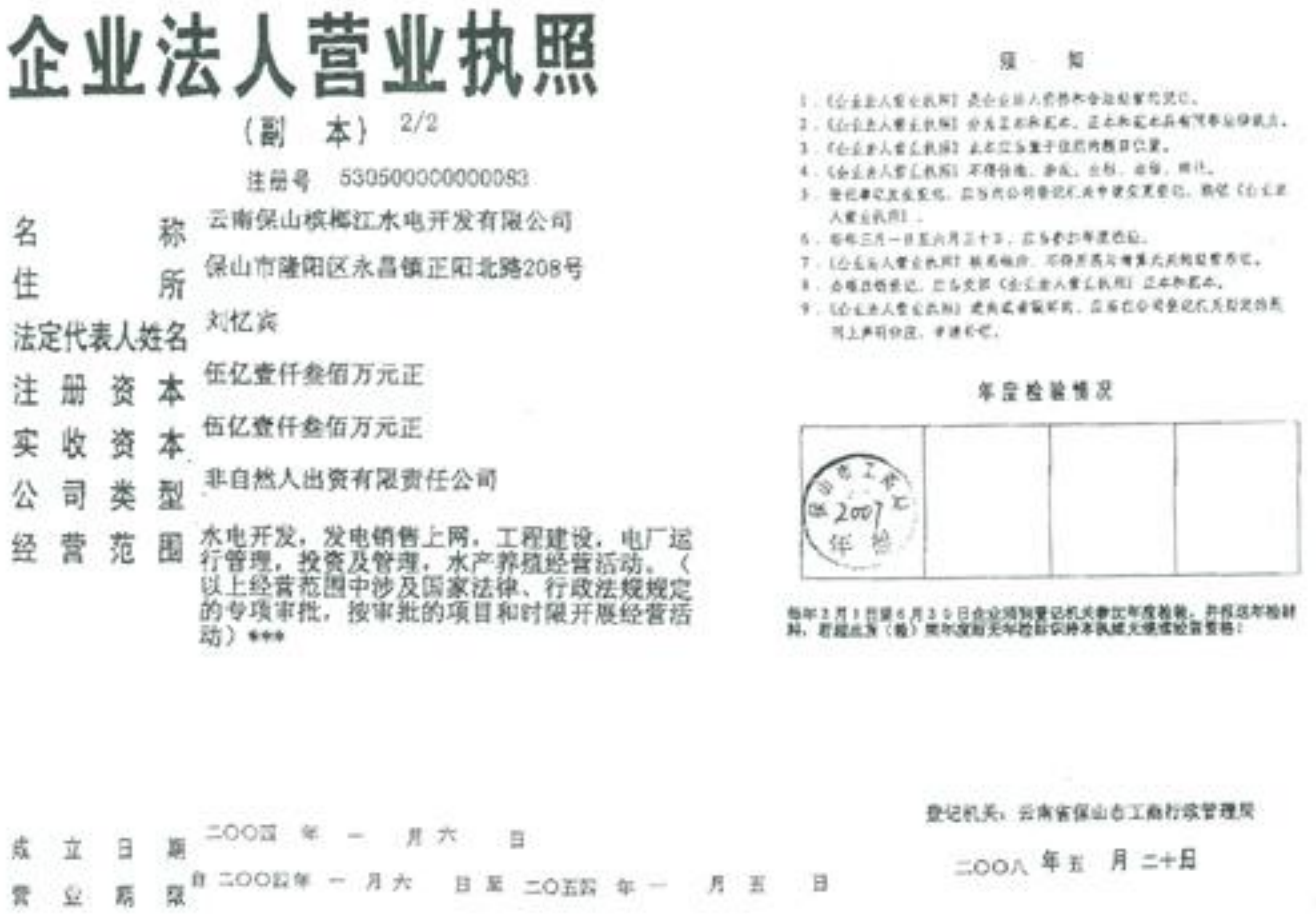
Table A13. Calculation Sheet of CM Emission Factor of CSPG

	OM Emission Factor (tCO_2e/MWh)	BM Emission Factor (tCO_2e/MWh)	CM Emission Factor =(OM+BM)/2 (tCO_2e/MWh)
CSPG	1.0608	0.6816	0.8712

Formula: CM Emission Factor = (BM + Simple OM) /2 (Weights ω_{OM} and ω_{BM}, by default, are 0.5.)

Annex 2 The evidence of proof of title

- **Enterprise Business License**



企业法人营业执照

（副 本） 2/2

注册号 530500000000093

名 称 云南保山槟榔江水电开发有限公司

住 所 保山市隆阳区永昌镇正阳北路208号

法定代表人姓名 刘忆滨

注 册 资 本 伍亿壹仟叁佰万元正

实 收 资 本 伍亿壹仟叁佰万元正

公 司 类 型 非自然人出资有限责任公司

经 营 范 围 水电开发，发电销售上网，工程建设，电厂运行管理，投资及管理，水产养殖经营活动。（以上经营范围中涉及国家法律、行政法规规定的专项审批，按审批的项目和时限开展经营活动）***

成 立 日 期 二〇〇四 年 一 月 六 日

营 业 期 限 自 二〇〇四年 一 月 六 日 至 二〇五四 年 一 月 五 日

须 知

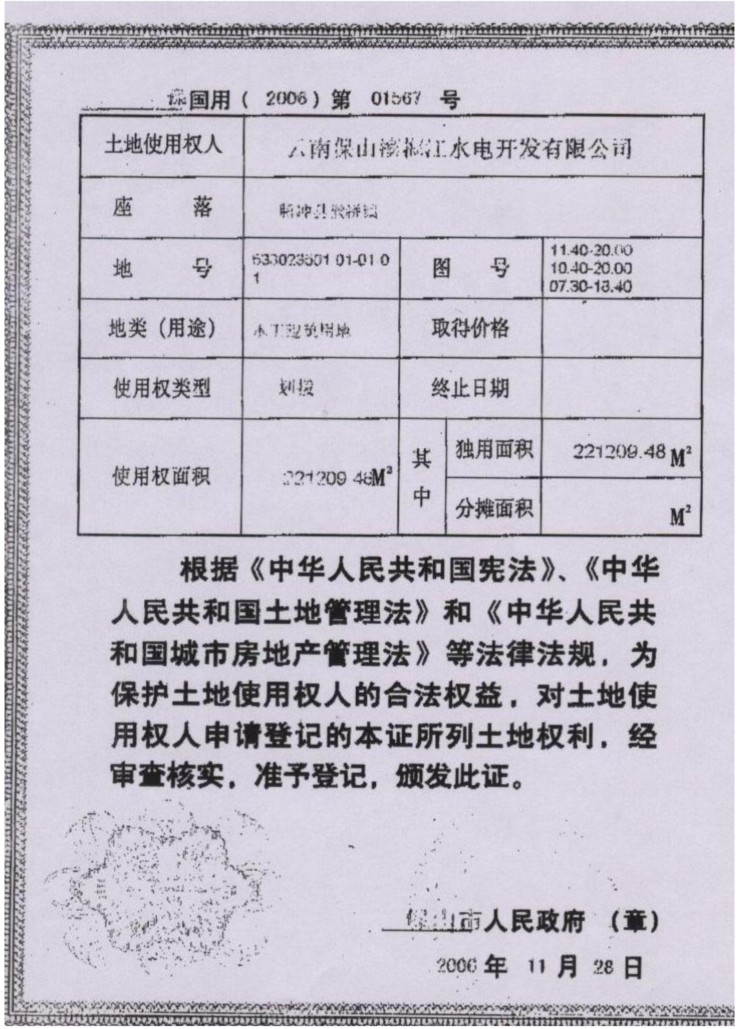
年度检验情况

2007

登记机关：云南省保山市工商行政管理局

二〇〇八 年 五 月 二十日

- **The land use certificate**



保国用（ 2006 ）第 01567 号

土地使用权人	云南保山槟榔江水电开发有限公司		
座落	[illegible]		
地号	533023501 01-01 0 1	图号	11.40-20.00 10.40-20.00 07.30-13.40
地类（用途）	水工建筑用地	取得价格	
使用权类型	划拨	终止日期	
使用权面积	221209.48M²	其中 独用面积	221209.48 M²
		其中 分摊面积	M²

根据《中华人民共和国宪法》、《中华人民共和国土地管理法》和《中华人民共和国城市房地产管理法》等法律法规，为保护土地使用权人的合法权益，对土地使用权人申请登记的本证所列土地权利，经审查核实，准予登记，颁发此证。

保山市人民政府（章）

2006 年 11 月 28 日