Voluntary Carbon Standard 2007
Project Description Template

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***[Table of Contents]***

Contents....1

# 1 Description of Project:

## 1.1 Project title

4×50 MW Dayingjiang-3 Hydropower Project Phases 1&2

## 1.2 Type/Category of the project

According to the categorization system of CDM, 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.

The project is a grouped project. It consists of one dam, one reservoir, and two sets of power plants (one set for phase 1 and another for phase 2). In addition, it has two feasibility study reports (FSR) and two approval letters on the FSRs from local government, and one set is for phase 1 and another is for phase 2. Therefore, the project is considered as a grouped project, because of its integral constructions and individual approval letters, based on the tradition of one approval letter for one project.

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

The estimated emission reductions are 569,379 $tCO_2e$ per year through out the 10 years crediting period, for a total of 5,693,788 $tCO_2e$.

Table 1 Emission reductions of the project

| Year | Annual estimation of emission reductions in tonnes of $CO_2e$ |
|---|---|
| 2006/04/01-2006/12/31 | 232,960[1] |
| 2007 | 269,110[1] |
| 2008 | 609,999[1] |
| 2009 | 632,021 |
| 2010 | 632,021 |
| 2011 | 632,021 |
| 2012 | 632,021 |
| 2013 | 632,021 |
| 2014 | 632,021 |
| 2015 | 632,021 |
| 2016/01/01-2016/03/31 | 157,572 |
| Total estimated reductions (tonnes of $CO_2e$) | 5,693,788 |
| Total number of years in the first | 10 |

[1] As the project has already started operation, these values are not estimated but measured ones.

| | |
|---|---|
| crediting period<br>Annual average over the crediting period of estimated reductions (tonnes of $CO_2e$) | 569,379 |

**The first crediting period of 10 years is selected for the project activity.*

### 1.4 A brief description of the project:

The Dayingjiang-3 Hydropower Project Phases 1&2 has total installed capacity of 200 MW. The objective of the proposed project is to utilize water resources of the Daying River for electricity generation through the installation and operation of four 50 MW hydro generation units at Yingjiang County, Dehong Prefecture, Yunnan Province, P. R. China. The reservoir surface area is 0.108 $km^2$, and the power density is calculated to be 1851.9 $W/m^2$. The proposed project is a grid-connected renewable energy project, from which the electricity generated will be sold to the Dehong Power Grid and then be fed to Yunnan Power Grid, an integral part of the China Southern Power Grid (CSPG). The proposed project activity will achieve obvious GHG emission reductions by avoiding $CO_2$ emissions, as grid-connected fossil fuel-fired power plants are dominated in the CSPG. The annual average estimated emission reductions over the first crediting period are 569,379 tonnes of $CO_2e$.

Yunnan, locating in the southwest of China, is one of the most slowly developing provinces throughout the country. The newly installed capacity will directly benefit the local region by creating job and investment opportunities, stimulating economic development, raising the quality of the local power supply and contributing to local government with more tax revenues. Meanwhile, the project will bring online additional power capacity to meet the strong local electricity demand, and originate this power from a renewable energy resource. Economic growth, social benefits and environmental improvement will be achieved in the region by conducting the project. Furthermore, the proposed project is consistent with China's national energy policy and the Western Development Strategy.

### 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 site, Dayingjiang-3 Hydropower station, is located between the No.38 China-Myanma boundary marker and Hutiaoshi view spot, and at the lower reach of the Daying River, in the Yingjiang County, Dehong Prefecture, Yunnan Province, P. R. China (Fig. 1).

The Dayingjiang station is 48 km far from the capital of Yingjiang County, and 786 km far from Kunming, the capital of Yunnan Province by road. The Yingjiang-Longchuan road, which belongs to S233 (a provincial road) goes by the Dayingjiang-3 station, and the distance between the station and No.131 marker stone of S233 is about 5 km.

The GPS coordinates of the project site are 24° 28′ 13.50″ N and 97° 43′ 00.00″ E.

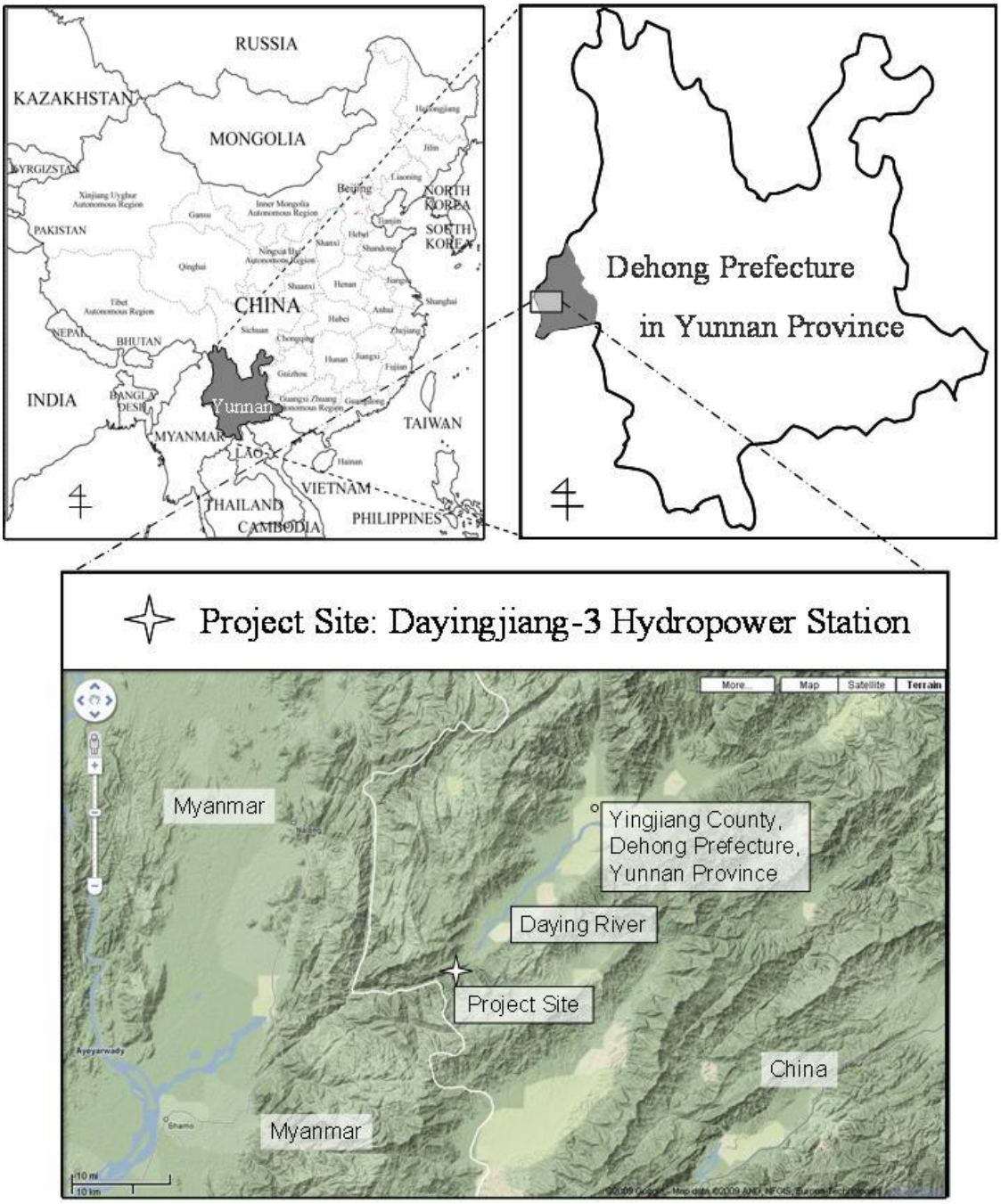



Fig. 1 Geographical location of the proposed project

### 1.6 Duration of the project activity/crediting period:

According to "Policy Announcement from the VCS Association"[2] publish on 10 September 2008, the 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", we determined the project start date as 18 March 2006.

[2] Refer to

http://www.v-c-s.org/docs/Policy%20Announcement%20-%20Validation%20Date%20Deadline.pdf

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 Project Description.

### 1.7 Conditions prior to project initiation:

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

Yunnan is one of China's relatively undeveloped provinces with more poverty-stricken counties than the other provinces. In 1994, about 7 million people lived below the poverty line of less than an annual average income of 300 Yuan per capita. They were distributed in the province's 73 counties mainly and financially supported by the central government. Yunnan's nominal GDP in 2004 was 295.9 billion Yuan, with an annual growth rate of 8.3%, and the GDP per capita was 6,733 Yuan. The share of primary, secondary, and tertiary industries in GDP were 20.4%, 44.4%, and 35.2%, respectively. Yunnan's four pillar industries include tobacco, agriculture, mining, and tourism. The main manufacturing industries are iron and steel production and copper-smelting, commercial vehicles, chemicals, fertilizers, textiles, and optical instruments. The electricity industry is another important economic pillar of Yunnan, which plays a key role in the "West-East Electricity Transmission Project". The electricity produced in Yunnan is mainly transported to Guangdong Province.

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

Yunnan Power Grid (YNPG) is an important component of the CSPG. YNPG covers most of areas in the Yunnan province and its annual energy supply constitutes approximately 79.78% of that for the whole province. YNPG possesses total power transformation capacity of 24,147 MW and total length of transmission line of 14,235 km. Among them, there are six 500kV substations with total transformation capacity of 6,500 MW and 500 kV power transmission lines of 1,569 km, thirty-seven 220kV substations with total transformation capacity of 9,540 MW 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.

3) The climate and hydrological condition before the project[5]

Yunnan has sufficient rainfall and many rivers and lakes. The annual water flow originating in the province is about 200 cubic kilo-meters, which is three times that of

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

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

[5] Refer to feasibility study report of the Dayingjiang-3 hydropower project.

the Yellow River. The rivers 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 the country. The rich water resources offer abundant hydro-energy. The project site is in the area with subtropical climate, and high precipitation. The annual precipitation was about 2100 mm, and annual average temperature was 19.3 ℃ according to last ten years records.

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

The purpose of the proposed project is to generate clean electricity by using water resource of Daying River to mitigate electricity shortage in Yunnan Province. By using zero emission renewable resource, the project will contribute to the reduction of GHG emission by displacing part of the electricity from the fossil fuel fired power plants of the CSPG, and the expected annual GHG emission reductions over the first crediting period are 569,379 $tCO_2e$, which will potentially contribute to slower global warming.

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

The Dayingjiang-3 Hydropower Project Phases 1&2 has total installed capacity of 200 MW, consists of four 50 MW turbine-generator sets. There is a small reservoir with the surface area of 0.108 $km^2$ and storage of 1.53 million $m^3$. The generated electricity is distributed to the Dehong Power Grid and finally integrated by the CSPG.

Construction of the proposed project includes the following components: civil works, powerhouse, and power distribution system. Each of the components is detailed below.

**1) Civil works**

**Dam**

It is a reinforced concrete slab dam, with the height of 39.5 m, width of 5.0 m and length of 150.0 m for dam crest. The dam consists of three floodgates (each in 12.0 m height and 12.0 m width) and two sand sluicing gates (each in 12.0 m height and 12.0 m width), with a total flood sluicing capacity of 4349 $m^3$/sec.

**Intake**

The water intake is located at the upper-stream in front of the sand sluicing gates, which consists of two trash racks (each in 14.0 m height and 6.0 m width) and an emergency gate (6.0 m high and 6.0 m wide). The intake is connected with water-tunnel.

**Water-tunnel**

The water-tunnel is 3535 m in length and 7.0 m in diameter (inner), which carries water downhill from the intake to surge tank.

**Surge tank**

The surge tank is a cylindrical chamber with the height of 54.4 m and inner-diameter of 18.0 m. Water from tunnel is passed through the surge tank to adjust the water pressure for electricity generation in powerhouse.

**Penstock**

The penstock is 272.4 m in length and carries water downhill from the surge tank to the powerhouse. The penstock pipe has an inner-diameter of 5.5 m and outer-diameter of 6.1 m, in order to handle the increasing water pressure and carry the design flow of 6.0-7.0 m/sec. The penstock is finally divided to two sub ones to carry water to turbines located in powerhouse.

**2) Powerhouse**

There are two powerhouses. One was built in length of 63.5 m, width of 21.6 m, and height of 47.5 m for generation use, and the other one was built in length of 63.5 m, width of 12.0 m, and height of 23.0 m for gas insulated switchgear (GIS) control and power distribution use.

**Turbine and generator**

The power plant consists of four 50 MW turbines and four 50 MW generators, which are the most practical type in China and other nations. The detailed technical parameters of the turbine and generator are shown in Table 2.

Table 2 Technical specifications of the turbines and generators.

| Turbine | Generator |
|---|---|
| Quantity: 4 | Quantity: 4 |
| Model: HLA722c-LJ-290 | Model: SF50-24 / 6000 |
| Rated Power: 51.5 MW | Rated Power: 58.82 MW |
| Rated Speed: 250 r/min | Rated Voltage: 10.5 kV |
| Design Head: 84 m | Rated Current: 3234.4 A |
| Design Discharge: 66.8 $m^3/s$ | Rated Power Factor: 0.85 |

*Refer to the actual data indicated on nameplate of turbine and generator.

**3) Power distribution**

The generated electricity is distributed by a 220 kV line to Yingjiang transformer substation, which is connected to the Dehong Power Grid and finally integrated to the CSPG.

The proposed project meets the basic requirements of ISO 14064: 2006 and all the principles of VCS 2007.1. In addition, it is expected to operate safely and maximum the use of generators.

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

The Dehong Kairui Hydropower Development Co., Ltd. must maintain the permits of land use for the land use of Dayingjiang-3 station approved by Yunnan National Land and Resources Management Bureau according to the Law of People's Republic of China on Land Management. The approved land transfer letter (yunguotuzifu [2005] 347) by Yunnan National Land and Resources Management Bureau can show the project compliance with local law on land use.

The Dehong Kairui Hydropower Development Co., Ltd. must also maintain the permits of environmental impact from Yunnan Environmental Protection Bureau according to the following law and regulations. The approved Environmental Impact Assessment (EIA) letter (yunhuanshen [2004] 393) by Yunnan Environmental Protection Bureau can show the project compliance with local law on environmental protection.

- Environmental Protection Law of the People's Republic of China;
- Environmental Impact Assessment Law of the People's Republic of China;
- Law of the People's Republic of China on Water;
- Law of the People's Republic of China on Water and Soil Conservation;
- Law of the People's Republic of China on Forest;
- Law of the People's Republic of China on the Protection of Wild Animal;
- Law of the People's Republic of China on the Prevention and Control of Water Pollution;
- Law of the People's Republic of China on the Prevention and Control of Air Pollution;
- Law of the People's Republic of China on the Prevention and Control of Ambient Noise Pollution;
- Law of the People's Republic of China on Land Management;
- Interim Regulation on Management of Scenic area;
- Regulation on Management of Environmental Protection of Construction Project;
- Regulation of the People's Republic of China on the Protection of Farmland, based on the Law of Agriculture;
- Regulation of the Yunnan Province on Land Management;
- Regulation of the People's Republic of China on the Protection of Wild Plant;
- Surface Water Environment Quality Standard (GB3838-2002);
- Ambient Air Quality Standard (GB3095-1996);
- Ambient Noise Standard for Urban Area(GB3096-1993);
- Integrated Wastewater Discharge Standard (GB8978-1996);
- Integrated Air Pollution Emission Standard (GB16297-1996);
- Noise Limits for Construction Site (GB 12523-1990).

Yunnan Development and Reform Commission approved the FSR of Dayingjiang-3 Hydropower project. The financial and economic analyses were drafted in accordance with following laws and regulations:

- Budget ration for hydraulic and hydropower engineering design, Yunnan Province;
- Regulation for fire protection design of hydraulic and hydropower project, SDJ278-90;
- Budget estimation of hydraulic and hydropower project, Yunnan Province;
- Regulation on Compensation of Land Requisition and Immigrant Settlement for Construction of Large and Medium Sized Hydraulic and Hydropower Project, the Land Administration Law of the People's Republic of China;
- Detailed Implementation Rules of Water Resource Industrial Policy;
- Electricity Law of People's Republic of China;
- The Law of Corporations of People's Republic of China;
- Financial Assessment Stipulation for Hydropower Project Development[6];
- Economic Assessment and Parameters for Developing Project (Ver. 2)[7];
- Regulation on Economic Assessment for Small Hydropower Development[8].

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

(1) Nature disasters

Nature disasters may potentially damage or affect the dam and/or power plants. Repairing of the dam and/or power plants may take several months, during which the electricity can not be generated, consequently, the GHG emission reductions will be affect. The following disasters may substantially affect the project's GHG emission.

(a) Storm, Flood

The potential risk caused by storm may be debris flow and/or slope instability landslides;

Risk caused by flood may be flood over controlling and/or deformation of river channel.

(b) Earthquake

Earthquake may cause changes in rock masses around the project area, and landslides. The stored water in the reservoir may change the rock mass and potentially trigger an earthquake

(c) Thunderstorms

Thunderstorms occasionally occurred in summer may take danger to staff and/or equipment.

(2) Accident

Fire caused by smoking and any other operation mistake, malfunction of power supply and electrical equipment could also be risks that affect GHG emission reductions.

[6] Ministry of water resource

[7] National Statistic Department, National Construction Department

[8] Water regulation institute

### 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, in order to cope with the increasing demand of electricity, the government has promoted development of hydropower stations, Dayingjiang-3 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 (such as 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. This is a newly developed project.

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

Contact information of project proponent, project owner and operator:

| | |
|---|---|
| Organization: | Dehong Kairui Dayingjiang Hydropower Development Co., Ltd. |
| Street/P.O.Box: | Mengla Road, Pingyuan Town |
| City: | Yingjiang County, Dehong Prefecture |
| State/Region: | Yunnan Province |
| Postfix/ZIP: | 679300 |
| Country: | The People's Republic of China |
| Tel: | + 86 692 8187758 |
| Represented by: | Yinggui Yi |
| Title: | Mr. |
| Last Name: | Yi |
| First Name: | Yinggui |
| Mobile: | + 86 13578371896 |
| Tel: | + 86 692 8187758 |
| Personal E-Mail: | Yiyinggui59@126.com |

Contact information of project proponent, purchaser of the credits:

| | |
|---|---|
| Organization: | Tepia Corporation Japan, Co., Ltd. |
| Street/P.O.Box: | 1-7-4, Minamihorie, Nishi-ku |
| City: | Osaka |
| Postfix/ZIP: | 5500015 |
| Country: | Japan |
| Tel: | + 81 6 6533 8018 |
| E-Mail: | info@tepia.co.jp |
| URL: | http://www.tepia.co.jp |
| Represented by: | Xuefeng Wen |
| Title: | General manager |
| Salutation: | Mr. |
| Last Name: | Wen |
| First Name: | Xuefeng |
| Department: | Tokyo Branch |
| FAX: | +81 3 5857 4863 |
| Tel: | +81 3 5857 4862 |
| Personal E-Mail: | wenxf@tepia.co.jp |

Contact information of developer of the PD:

**Department**: Beijing Tepia Technology Co., Ltd.
**Division**: Research Institute
**Developer of the PD**: Dr. Pengcheng Zhang
**Phone:** +86 10 6878 1998
**E-mail**: zhangpc@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):

First, the list below is the name of approval letters of the project to show its eligibility.

The approval of EIA for phase1 project, No. yunhuanshen [2004] 393, by Yunnan Environmental Protection Bureau on June 28, 2004;
The approval of FSR for phase1 project, No. yunfagainengyuan [2004] 511, by Yunnan Development and Reform Commission on July 12, 2004.

The approval of EIA for phase 2 project, No. yunhuanshen [2009] 38, by Dehong Environmental Protection Bureau on March 16, 2009;
The approval of FSR for phase2 project, No. yunfagainengyuan [2005] 1273, by Yunnan Development and Reform Commission on December 27, 2005.

The project will not only generate renewable electricity to the grid, but also contribute to sustainable development of the local community by means of:

- To contribute to local economic development by providing electricity to regions where electricity is short of;
- To reduce GHG emissions and to mitigate the emissions of other pollutants from local coal-fired power plants by displacing fossil fuel-fired power plants with such hydropower plants;
- To be in accordance with the development priority in China's energy industry, and to help diversify energy mix of CSPG by increasing the share of renewable energy;
- To create short-term employment opportunities during project's construction and long-term jobs opportunities for local people during project operation period.

### 1.17 List of commercially sensitive information (if applicable):

Not applicable.

## 2 VCS Methodology:

### 2.1 Title and reference of the VCS methodology 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".
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)

For more information regarding the methodology please refer to 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:

1) The proposed project is new hydroelectric power with reservoirs having power density of 1851.9 W/m$^2$, which is greater than 4 W/m$^2$;
2) The proposed project does not involve switching from fossil fuels to renewable energy at the site;
3) The geographic and system boundaries of CSPG where the proposed project will be connected can be clearly identified and information on the characteristics of the gird is available.

On the basis of the above reasons, the proposed project meets applicable conditions of ACM0002, 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 of China (the Designated National Authority for CDM in China[9]).

The proposed power plant is connected to Yunnan Power Grid, finally gathered to the CSPG. The CSPG also covers other provincial power grids such as Guangdong, Yunnan, and Guizhou Power Grid. Furthermore, the project boundary also includes China Central Power Gird 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 China Central Power Grid. China Central power grid is a regional power grid in China, including Henan, Hubei, Hunan, Jiangxi, Sichuan province and Chongqing city. The GHG emission sources included in or excluded from the project boundary are as shown in Table 3.

Table 3 Emission sources included or excluded from the project boundary.

| | Source of Emission | Gas | Included? Yes/No | Instruction |
|---|---|---|---|---|
| Baseline | Power Generation by CSPG | $CO_2$ | 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 | The power density of the project is greater than 4 W/m$^2$ |
| | | $N_2O$ | No | There is no $N_2O$ emission |

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

## 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 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 Financial Inter Return Rate (FIRR) of the project is less than the benchmark FIRR (8.0%)[10]. 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 200 MW. However, according to the <Adjustment Catalogue of Industrial Structure in China>, coal-fired thermal power unit which is lower than 300MW is constrained to construct, except for small grid such as Xinjiang and Hainan Province[11]. Therefore, coal-fired thermal power plant is not consistent with China's laws and regulations. In addition, the project site is lack of oil and natural gas, and the cost is expensive[12], it is impossible to build an oil-fired or natural gas fired power plant. Therefore, Alternative II is omitted for further consideration.

For Alternative III, according to the FSR of the project, there is no economically exploitable wind resource to build a wind power plant with equivalent amount of annual electricity generation of the project. Furthermore, the project site can not provide 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 now. Therefore, Alternative III is not the plausible baseline scenario for the project.

[10] Refer to Chinese hydropower industry benchmark; also see the section 2.5 and Table 4 for detailed analysis.

[11] National Development and Reform Committee of China, document No. 40 in 2005.

[12] http://www.m188.com/newsinfo/2006413/2006413-8561948.html

For Alternative IV, the installed capacity of the CSPG for both existing power plants and the power plants to build in a near 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):

Two once in a half century debris flows occurred on July 5 and July 20, 2004 in Dehong prefecture almost destroyed the construction of Daying Hydropower Station. The debris flows directly caused a four-month construction delay and about two million Yuan financial losses as calculated later. At that time, the directorate of Dehong Kairui Dayingjiang Hydropower Development Co., Ltd. faced to decide whether or not to continue the construction of Dayingjiang-3 Hydropower Station because of the fatal flood disaster. They hold a directorate conference (the fifth conference of the first directorate on March 2, 2005 at Pingyuan Town, Yingjiang County, Yunnan Province) and de novo had to make an economic assessment of the project. They finally demonstrated that the project was not economically continuable without additional support from a CDM and other kind of carbon revenues, since they had heard that some of the hydropower projects also facing the financial difficulty in China were preparing to apply for CDM registration. The project entity then explored whether the economic returns of the project could be improved through CDM and started discussions with CDM advisors in later 2005. The decision to go forward with the project was subsequently taken by Dehong Kairui Dayingjiang Hydropower Development Co., Ltd. from 2006 by engaging CDM consultants to start the application of the project under CDM. However, because the project had put into operation since March 18, 2006, the application for CDM was stopped and the project owner turned to find a consultant for starting VCS application. After communication with a number of interested parties from 2006 to 2008, the project owner finally focused on a local VCS consulting corporation, named Yunnan Sun Valley Conservation Industry Development Co., Ltd. The project owner then held a meeting with Sun Valley Corporation on April 17, 2008 and preliminary decided to develop VCS for this project. In addition, through the recommendation of Sun Valley Corporation, the project owner identified the final buyer (Tepia Corporation Japan, Co., Ltd.)

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

According to VCS 2007.1, the project proponent shall demonstrate that the project is additional using one of the following tests:

Test 1 – The project test

Test 2 – Performance test

Test 3 – Technology test

The project test is chosen in this Project Description, as the other two tests are not currently available.

**Step 1 Regulatory Surplus**

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

**Step 2 Implementation Barries**

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 constrains 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, 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 is applicable for the project, for the impacts of other two barriers are limited.

**Sub-step 2a Determine appropriate analysis method for identifying Investment Barrier**

**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 whether alternative IV can be the baseline for the proposed project.

Since the proposed project will obtain the revenues not only from the electricity sales but also from VCUs, the simple cost analysis method (option I) is not appropriate. Investment comparison analysis method (option II) is applicable to those 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 CSPG other than new investment projects. Therefore, the option II is not an appropriate method for the decision-making context. For the proposed project, we will use benchmark analysis method as below, because we can get the benchmark FIRR on total investment and on equity capital of the power sector in China. From the result of evaluation, we can know it is lower than benchmark FIRR that is national financial requirement of construction. Thus, 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 8.00% of the project FIRR. 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

| Item | FSR | Actual |
|---|---|---|
| ***Installed capacity*** | 196 MW | 200 MW |
| ***Annual grid-electricity*** | 725,460 MWh | For 2006, 2007, and 2008 was 354,914, 308,896, and 700,183 MWh, respectively. From 2009 is estimated to be 725,460 MWh, based on the FSR. |
| ***Project lifetime span for FIRR*** | 35 years (5 years construction, and 30 years operation) | 35 years |
| ***Static investment*** | RMB 795.67 million Yuan | RMB 808.27 million Yuan |
| ***Liquid capital*** | RMB 1.96 million Yuan | RMB 2.00 million Yuan |
| ***Annual O&M cost*** | RMB 24.65 million Yuan | RMB 30.72 million Yuan |
| ***Tax*** | 17%, value added tax rate; 8%, additional tax rate (based on value added tax); and 33%, income tax rate | 17%, value added tax rate; 8%, additional tax rate (based on value added tax); and 33%, income tax rate |
| ***Electricity tariff*** | RMB 0.1493 Yuan/kWh (without VAT) | RMB 0.1556 Yuan/kWh (without VAT) |
| ***Crediting period*** | 10 ×3 years (renewable) | 10 ×3 years (renewable) |
| ***Expected VCUs price*** | 3.0 EUR / $tCO_2e$ (exchange rate: 1: 10) | 3.0 EUR / $tCO_2e$ (exchange rate: 1: 10) |

Since the project has started operating from 2006, the data used for calculating FIRR are partly different from FSR, for example, the investment, O&M cost, grid power supply, and tariff as shown in the table above)..

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

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

FIRRs of the project, with and without VCUs revenue, are shown in Table 4. When without VCUs revenue, the FIRR of the project is 6.96% (after tax), which is lower than the benchmark 8.00%. The proposed project without VCU would be considered as financially unattractive to investors. It is infeasible in business.

When with VCUs revenue, the IRR after tax of the project is calculated to be 8.77%, which apparently exceed the benchmark 8.00%. Therefore, the project with VCUs revenue can be considered as financially attractive to investors with relatively high profits.

Table 4 Comparison between FIRR with and without VCUs revenue.

| Scenario | FIRR (total investment) |
|---|---|
| Without VCUs | 6.96% |
| With VCUs | 8.77% |

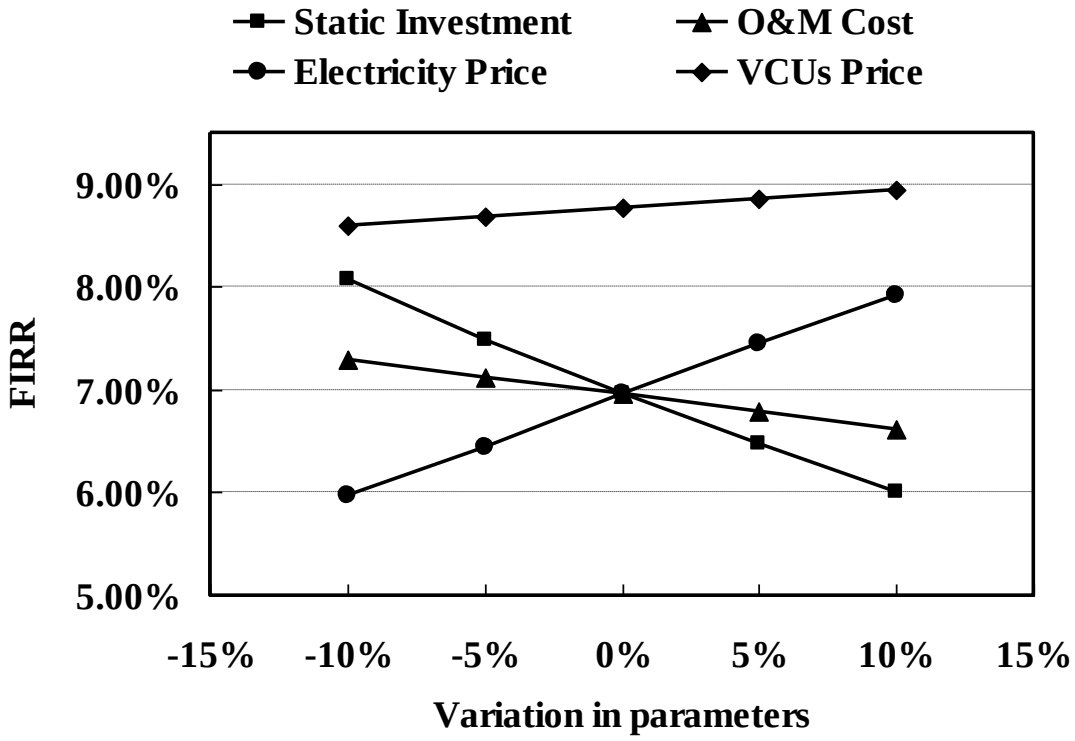



Fig. 2 Sensitivity analysis of the proposed project

*Static investment*

Due to the long construction period, the equipment and relevant materials price has already increased substantially since the FSR was completed, and the on-site geological and construction conditions are very complicated. These factors seems only can led an increase in total static investment. A decrease of 10% in total static investment may cause an increase of FIRR over 8% (Fig.2). However, as shown in excel sheet of FIRR calculation, the total static investment has increased according to the additional investment on 5 July 2004, 13 August 2007 accidents and water supply

reform project.

*Annual O&M cost*

According to the FSR of this project, the annual O&M cost consisted of Materials, Salary and Welfare, Facilities Maintenance, Reservoir Maintenance, Water Resource, Insurance and Other Fees. According to the relevant state regulations, all the parameters were selected according to a certain scale based on best practice guidelines. Furthermore, the salary and relevant material costs have been rising. Given inflationary pressures, the annual O&M cost are not likely to decrease and indeed are expected to increase significantly.

*Electricity tariff*

The tariff applied is according to the official notification on the tariff issued by Yunnan Development and Reform Commission. Furthermore, the government is responsible for setting of the tariff, and the possibility for variation over 10% is extremely small. Actually, according to the notice of local government, the electricity tariff has decreased 0.033 Yuan/kWh since November 2008.

In conclusion, when the key parameters fluctuate within a reasonable range, the Project Activity without VCUs will never be economically attractive.

**Step 3 Common practice analyses**

**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 between 50 MW and 300MW), and the operational time (after 2002). The common practice analysis is limited to the provincial level as the investment environment for each province differs (e.g. tax, loan policy and electricity price). 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]. According to the mentioned reasons, the Dayingjiang-1 and Malutang hydropower projects are selected for common practice analysis.

| Name of Hydropower Station | Installed capacity (MW) | Operation start year | Investment cost (Yuan/kWh) | Remark |
|---|---|---|---|---|
| Dayingjiang-3 | 200 | 2006 | 0.83 | The proposed project |
| Dayingjiang-1[14] | 99 | 2007 | 0.69 | |

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

[14] Metal Structure Design of Dayingjiang-1 Hydropower Station in Dehong, Yunnan, 2007. Journal of Northwest Hydroelectric Power, Vol. 23 (4): 115-117.

| | | | | |
|---|---|---|---|---|
| Malutang [15,16] | 100 | 2004 | 0.64 | |

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

The investment cost of 0.83 Yuan/kWh (calculated as $85765.92\times10^4$ Yuan / 1039500 MWh) is 20% higher than Dayingjiang-1 (0.69 Yuan/kWh), and 30% higher than Malutang (0.64 Yuan/kWh) Hydropower Station. The higher investment cost of the proposed projects may due to its tough construction and transportation conditions, consequently, higher investment cost. The reason is that the proposed project is located nearby the national boundary of China and Myanmar, where the geologic and topographic conditions are not favorable for civil works and the transportation distances from major cities to the stations are much farther than common cases.

In conclusion, the proposed project matches all criteria addressed in the *Tool for the Demonstration and Assessment of Additionality*. It is economically unfeasible and need VCUs revenue 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, ACM0002 (Ver.10) – "Consolidated methodology for grid-connected electricity generation from renewable sources" is chosen for 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 and quantity of consumed diesel can be used to confirm the baseline emission, leakage and emission reduction.

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

[15] Almanac of China Water Resource, p561, 2007

[16] A Summary of Design of Malutang Phase-1 Hydropower Project, 2005. Yunnan Water Power, Vol. 21(5): 7-10.

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. 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 determined by power density.

- **Origin of the data**

Electricity Exports and Electricity Imports can be obtained from the readings of the gateway meters. The gateway meter records the data automatically every month. The value of reservoir area applied is derived from FSR, and the reservoir area is 0.108 $km^2$.

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

According to the monitored data, annual net electricity export of 2006, 2007, and 2008 was 354,914, 308,896, and 700,183 MWh, respectively. The annual electricity export to the CSPG from 2009 was estimated to be 725,460 MWh, based on the FSR of the proposed project.

- **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 automatically 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 ream consists of a Monitoring Section and an Audit Section. The respective responsibilities are as follows:

VCS Project Manager: Receive reports from Monitoring Manager, manage the VCS project jointly with VCUs buyer, submit the monitoring report to the DOE and deliver the VCUs.

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.

- **Managing data quality**

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 electricity meter at hydropower station. |
| Value of data applied for the purpose of calculating expected emission reductions in section 2.5 | 725,460 |
| 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 electricity meter. 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:** | $EG_{im}$ |
|---|---|

| | |
|---|---|
| Data unit: | MWh |
| Description: | Electricity supplied by the grid to project activity |
| Source of data to be used: | Directly measured by electricity meter at hydropower 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 electricity meter. 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 hydro power 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 | 200 |
| 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 | 0.108 |
| Description of measurement methods and procedures to be applied: | The data will be measured yearly by professional design institute. |
| QA/QC procedures to be applied: | - |
| Any comment: | - |

### 3.4 Description of the monitoring plan

This monitoring plan outlines the principles which shall be followed in the monitoring of the parameters listed in section 3.3. A monitoring manual with detailed procedures will be prepared on the basis of the principles outlined below.

The proposed project activity is connected to the Yunnan Power Grid through one or more on-site transformer stations. The project is connected by a 220 kV line to the Yingjiang 220kV Switching Station which is connected to the Yunnan Power Grid. The project will furthermore be connected through a 110 kV power line with the 110kV Dayingjiang-2 Hydropower Station to supply power from Dayingjiang-2 Hydropower Station to the power grid. An indicative grid connection diagram is provided in Fig. 3.

The grid connection diagram indicates the principles for positioning of metering instruments that will be used in the monitoring of emission reductions. The project entity will ensure that the actual implementation of grid connection will not deviate from the procedures outlined in this section.

The project entity will meter electric power according to the following principles:

Power supplied to the grid through main power line:

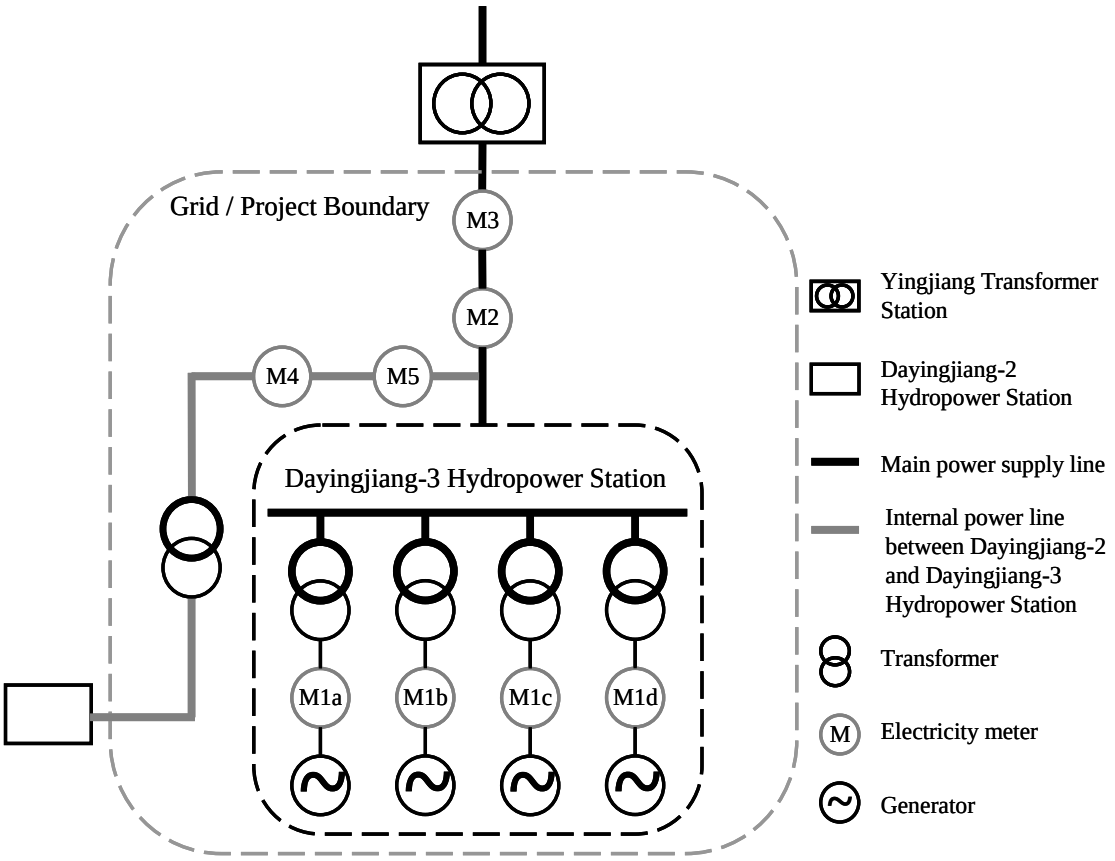



Fig.3 Scheme of grid connection of Dayingjiang-3 Phases 1&2 Hydropower Project

As indicated in Fig.3, the project is connected by one main power supply line (black bold) which will totally deliver the power generated by the proposed project and that from Dayingjiang-2 Hydropower Station to the grid. The total power supplied to grid is metered as below:

Project entity: The power supplied to the grid is metered by M2. Therefore, no further transformer losses occur before the project is connected to the grid. M2 is a standard electricity meter in accordance with national regulations. The metering instruments records the net supply as the main power supply line can transfer power in both directions. The metering instruments can record either a net figure of power delivered to the grid or two readings; i.e. power delivered to the grid ($M2_{ex}$) and power received from the grid ($M2_{im}$).

Grid company: The grid company meters the power supply with its own electricity meter M3. The metering instruments can record either a net figure of power delivered to the grid or two readings; i.e. power delivered to the grid ($M3_{ex}$) and power received from the grid ($M3_{im}$). The regulations of the grid company require annual calibrations of both metering instruments.

Calibration: Calibrations are carried out by the grid company or by a certified company appointed by the grid company. If there are any substantial discrepancies between the readings of the metering instruments throughout the year, both instruments will be recalibrated.

Power supplied from Dayingjiang-2 Hydropower Station to the grid through back-up power line:

As indicated in Fig.3 the project is connected by one back-up emergency power line (gray bold) which delivers power from the Dayingjiang-2 Hydropower Station to

power grid. Power supplied from Dayingjiang-2 Hydropower Station to the grid is metered as below:
Project entity: The power supplied from Dayingjiang-2 Hydropower Station to the grid is metered with a standard electricity meters M4 in accordance with national regulations. The metering instruments can record either a net figure of power delivered to the grid or two readings; i.e. power delivered to the grid ($M4_{ex}$) and power received from the grid ($M4_{im}$).
Grid company: The power supplied from Dayingjiang-2 Hydropower Station to the grid is metered with a standard electricity meters M5 in accordance with national regulations. The metering instruments can record either a net figure of power delivered to the grid or two readings; i.e. power delivered to the grid ($M5_{ex}$) and power received from the grid ($M5_{im}$). The regulations of the grid company require annual calibrations of both metering instruments.
Calibration: Calibrations are carried out by the grid company or by a certified company appointed by the grid company. If there are any substantial discrepancies between the readings of the metering instruments throughout the year, both instruments will be recalibrated.

Determination of net power supply:

Net electricity supplied to the grid by the project ($EG_y$ in section 3.2) is calculated on monthly as:

$$EG_y = EG_{ex} - EG_{im} = (M3_{ex} - M3_{im}) - (M5_{ex} - M5_{im})$$

where:
$EG_{ex}$, electricity supplied by the project through the main power line(s) (in MWh) metered by the grid company (evidenced by monthly sales receipts) and cross-checked against the readings of metering instruments of the project entity.
$EG_{im}$, electricity delivered to the project through back-up power line(s) metered by the grid company (evidenced by monthly billing receipts) and cross-checked against the readings of metering instruments of the project entity.
$M3_{ex}$, electricity supplied by the proposed project and Dayingjiang-2 Hydropower Project through the main power line (in MWh) metered by the grid company (evidenced by monthly sales receipts) and cross-checked against the readings of metering instruments of the project entity.
$M3_{im}$, electricity delivered to the proposed project and Dayingjiang-2 Hydropower Project through the main power line (in MWh) metered by the grid company (evidenced by monthly sales receipts) and cross-checked against the readings of metering instruments of the project entity.
$M5_{ex}$, electricity supplied by Dayingjiang-2 Hydropower Project through the main power line (in MWh) metered by the grid company (evidenced by monthly sales receipts) and cross-checked against the readings of metering instruments of the project entity.
$M5_{im}$, electricity delivered to Dayingjiang-2 Hydropower Project through the main power line (in MWh) metered by the grid company (evidenced by monthly sales receipts) and cross-checked against the readings of metering instruments of the project entity
In addition, if M3 and M5 do not work, the backup electricity meters M2 and M4 will be used to determine the net electricity supplied to the grid by the proposed project.

The calculation is basically the same as that by using gateway meters M3 and M5, which is shown as bleow.

$EG_y = EG_{ex} – EG_{im} = (M2_{ex}–M2_{im}) – (M4_{ex}–M4_{im})$.

# 4 GHG Emission Reductions:

## 4.1 Explanation of methodological choice:

According to the approved methodology ACM0002 (Ver.10), 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:

$$ER_y = BE_y – PE_y – LE_y \quad (1)$$

Where,

$ER_y$ refers to emission reductions;

$BE_y$ refers to the baseline emissions;

$PE_y$ refers to the project emissions;

$LE_y$ refers to the leakage.

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

**Project Emission ($PE_y$):**

According to the feasibility study report of the proposed project, the surface area at normal reservoir level is 0.108 $km^2$, the power density is 1851.9 $W/m^2$ which is greater than $4W/m^2$. Based on ACM0002, the $CH_4$ emission by the proposed project could be omitted, i.e. $PE_y = 0$.

**Leakage:**

According to ACM0002, there is no leakage in a 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 ($tCO_2/yr$).*

$EG_y$ = *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.
There are electricity imports from China Central Power Grid for CSPG; therefore, CCPG is the connected electricity system.

**Step 2 Select an operating margin (OM) method**

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

(a) Simple OM;

(b) Simple adjusted OM;

(c) Dispatch Data Analysis OM;

(d) Average OM.

We used 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.

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

(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).

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

$EG_y$ = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year *y* (MWh).

*i* = All fossil fuel types combusted in power sources in the project electricity system in year *y*.

*y* = The most recent three 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[17]:

(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

[17] 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

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:

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

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

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

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

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

Where,

$EF_{Coal,Adv,y}$, $EF_{Oil,Adv,y}$, and $EF_{Gas,Adv,y}$ refers 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

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

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:

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

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 weights $w_{OM}$ 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:

According to the monitored data, the annual Electricity Export of 2006, 2007, and 2008 was 354,914, 308,896, and 700,183 MWh, respectively. The annual electricity export to the CSPG from 2009 is estimated to be 725,460 MWh (refer to FSR). The actual annual and estimated baseline emission of the project in the first crediting period are calculated as below.

From April 1, 2006 to Dec.31, 2006
$BE_y = EG_y \times EF_y$ = 354,914 ×0.8712 × 275/365 = 232,960 t $CO_2e$

From Jan 1, 2007 to Dec.31, 2007
$BE_y = EG_y \times EF_y$ = 308,896 ×0.8712 = 269,110 t $CO_2e$

From Jan 1, 2008 to Dec.31, 2008
$BE_y = EG_y \times EF_y$ = 700,183 ×0.8712 = 609,999 t $CO_2e$

From 2009 to 2015, annually
$BE_y = EG_y \times EF_y$ = 725,460 ×0.8712 = 632,021 t $CO_2e$

From Jan.1, 2016 to Mar.31, 2016
$BE_y = EG_y \times EF_y$ = 725,460 × 0.8712 × 91/365 = 157,572 t $CO_2e$

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

The power density of Dayingjiang-3 Hydropower Station is 1851.9 W/$m^2$, which is greater than 4 W/$m^2$, hence, $PE_y$ = 0.

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

The annual emission reductions of the project were estimated as follows:

From April 1, 2006 to Dec.31, 2006
$ER_y = BE_y - PE_y - L_y$ = 354,914 × 0.8712 × 275/365－0－0 = 232,960 t $CO_2e$

From Jan 1, 2007 to Dec.31, 2007
$ER_y = BE_y - PE_y - L_y$ = 308,896 × 0.8712－0－0 = 269,110 t $CO_2e$

From Jan 1, 2008 to Dec.31, 2008
$ER_y = BE_y - PE_y - L_y$ = 700,183 × 0.8712－0－0 = 609,999 t $CO_2e$

From 2009 to 2015, annually

$ER_y = BE_y - PE_y - L_y$ = 725,460 × 0.8712－0－0 = 632,021 t $CO_2e$

From Jan.1, 2016 to Mar.31, 2016
$ER_y = BE_y - PE_y - L_y$ = 725,460 × 0.8712 × 91/365 －0－0 = 157,572 t $CO_2e$

# 5 Environmental Impact:

According to the EIA, which was drawn up by Kunming Hydroelectric Investigation, Design and Research Institute, and approved by Yunnan Development and Reform Commission, the environmental impacts of the proposed project are summarized as follows.

**1) Impacts on water environment**

A forecasted major impact during the project construction period is that the wastewater will cause an increase of suspended solid, and make the river turbid.
However, by passing the liquid waste through a common sewage treatment process, the said impact on water environment can be avoided.
There will be no significant impact on water environment during the project operation period, because the reservoir capacity is small (about 0.0015 $km^3$) and the reserved water can be refreshed daily by the river itself.

**2) Ecological Impacts**

Construction and operation of the proposed project need no migration, therefore, the impact on normal life of local residents is little.
The reservoir will submerge 18.8 ha semi-evergreen monsoon forest, and construction of the reservoir will damage 12.3 ha of that in the project area. Fortunately, there is no endangered species located in this area, and the damage on wild life caused by reservoir construction can be retrieved by reforesting.

**3) Air pollution**

Air pollutants are mainly from the emissions from various kinds of dust, coal burning and oil burning. All sorts of appliances and machines should be equipped with dust-proof facilities, and watering cart should be used in construction area for regular watering and reducing dust everyday. Exhaust emission from diesel machines used during the construction period should be in line with relative technical regulations of the state. Exhaust purifier should be equipped if the exhaust emission does not reach the standard.

**4) Noise pollution**

The noises during the construction phase mainly come from various construction activities. Constructing workers should be protected when working, equipped with sound-blocking earplugs and crash helmets. Low-noise facilities should be employed as possibly; sound-blocking chambers should be established where there is a fixed source of biggish noise, and sound-absorbing equipments should be used for source of relatively minor noise.

**5) Solid waste**

Project construction will induce some wasted soil and dross. The wasted soil and dross should be piled in appointed plot, and are prohibited to be placed on a slope or the sides of bank top along which the flood of mountain torrents goes down into

reservoirs and rivers. In addition, corresponding work should be managed for soil and water conservation. The wasted soil caused by temporary land occupation should be piled at some fixed place, and backfill measure should be taken after the construction is completed.

In conclusion, the original environmental condition in the project area is comparatively good; conducting the project will caused some negative impacts on local ecosystem, especially, the forest. However, such impacts can be recovered by careful operation and corresponding protection measures. Totally, the environmental impacts arising from the proposed project are considered as insignificant. Construction of the proposed project is considered as feasible from environmental point of view.

## 6 Stakeholders' comments:

Stakeholders of the project include local residents of student, farmer, employee of corporation, and employee of government.

The questionnaire includes the following contents:

1) Basic information of the informants

2) Brief introduction of the proposed project (site location, installed capacity, total investment)

3) Questions on:

a) What do you think the active impact of the project has been and/or will be on your living (multiple options)?
b) What do you think the negative impact of the project has been and/or will be on your living (multiple options)?
c) Do you support the local existed hydropower stations?
d) If you are the resident whose domain was appropriated and life in the lower stream of proposed project was impacted, what would you like to be compensated from the project?

4) Signature and date

Results of the questionnaire:

| Item and question | | Respondents | % |
|---|---|---|---|
| Age | Under 18 | 1 | 1.75% |
| | 18-34 | 24 | 42.11% |
| | 35-54 | 32 | 56.14% |
| | Over 55 | 0 | 0 |
| Educational level | Elementary | 8 | 14.00% |
| | Junior | 15 | 26.32% |
| | Senior | 15 | 26.32% |
| | Academic | 19 | 33.33% |
| Career | Student | 0 | 0 |
| | Farmer | 18 | 31.57% |
| | Employee of corporation | 30 | 52.63% |
| | Employee of government | 9 | 15.79% |
| | Others | 0 | 0 |
| What do you think the active impact of the project has been and/or will be on your living (multiple options)? | Capable of using and/or increase in electricity | 38 | 66.67% |
| | Decrease in electricity price | 19 | 33.33% |
| | Increase in income | 47 | 82.46% |
| | Increase in job opportunities | 48 | 84.21% |
| | Increase in standard of living | 53 | 92.98% |
| | Others | 14 | 24.56% |
| What do you think the negative impact of the project has been and/or will be on your living (multiple options)? | Noise | 6 | 10.53% |
| | Eminent domain | 16 | 28.07% |
| | Decrease in water resource | 0 | 0 |
| | Destroying the local natural environment | 0 | 0 |
| | Decrease in fishing harvest | 3 | 5.26% |
| | Decrease in agricultural harvest | 1 | 1.75% |
| | Others | 6 | 10.53% |
| Do you support the local existed hydropower stations? | Support | 57 | 100% |
| | Not support | 0 | 0 |
| | No opinion | 0 | 0 |
| If you are the resident whose domain was appropriated and life in the lower stream of proposed project was impacted, what would you like to be compensated from the project? | According to national standard | 10 | 17.54% |
| | According to contract | 15 | 26.32% |
| | No opinion | 32 | 56.14% |
| Note) Face to face interview method, 57 questionnaires were distributed and all were collected as valid returns. | | | |

Summary of the comments received:

All surveyed residents know the proposed hydropower station and they all support that. They commented that the project would promote the development of local hydropower industry, and local environmental quality. In addition, the construction of this hydropower station will facilitate with the optimization of local grid structure, as well as promoting economic and culture development in the area nearby. It brings employment opportunities to local inhabitants and mitigates the current situation of weak fundamental facility construction, traffic condition and poor education level. It has potential political and economic impacts on building local society, which aims at well living quality.

Furthermore, hydropower project, as a renewable project, is conducive to improving the environment and reducing pollution of the area. The construction and operation of the project can accelerate the development of transportation, construction material and construction-related industries in the area.

## 7 Schedule:

| Year | Date | Main event | Evidences/Remarks |
|---|---|---|---|
| 2003 | 11 March | Approval of project implementation | Hydropower Development Contract with Dehong Prefecture government |
| 2003 | July | Contract with Construction Company | "Construction Contract" between Project Owner and Construction Company, Phase1 |
| 2003 | 28 July | Main Equipment Procurement Contract | "Procurement Agreement" between the PP and Equipment Manufacturing Co., Phase1 |
| 2003 | July | Completion of FS Report | "FSR" prepared by [HydroChina Kunming Engineering Corporation], Phase1 |
| 2003 | 26 August | Construction Start | Phase1 |
| 2004 | June | Completion of EIA Report | "EIA Report" prepared by [Yunnan University], Phase1 |
| 2004 | 28 June | Approval of EIA Report | "Approval Letter" of Yunnan Environmental Protection Bureau, Phase1 |
| 2004 | 12 July | Approval of FS Report | "Approval Letter" of Yunnan DRC, Phase1 |
| 2005 | 2 March | Serious Consideration of CDM Application | Board decision, Phase1&2<br>But it failed to be implemented |
| 2005 | September | Completion of FS Report | "FSR" prepared by [HydroChina Kunming Engineering Corporation], Phase2 |
| 2005 | 27 December | Approval of FS Report | "Approval Letter" of Yunnan DRC, Phase2 |
| 2006 | 7 March | Power Purchase Agreement | "Power Purchase Agreement" between Project Owner and Grid Company, Phase1 |
| 2006 | 18 March | Commissioning Start | Phase1; Project starting date of the entire project |
| 2006 | 26 March | Main Equipment Procurement Contract | Phase2 |
| 2006 | 26 March | Contract with Construction Company | Phase2 |
| 2006 | 1 April | Starting date of the first crediting period | Starting date of the first crediting period for the entire project |
| 2006 | 1 May | Construction Start | Phase2 |
| 2006 | 31 July | Completion of the Plant | Phase1 |

| | | | |
|---|---|---|---|
| 2006 | August | Stakeholders' Comment Invitation | Face to face interview, Phase1&2 |
| 2008 | 8 April | (Power Purchase Agreement) | Phase2 |
| 2008 | 17 April | Serious Consideration of VCS Development | VCS Proposal from Sun Valley Consultant |
| 2008 | 4 May | Commissioning Start | Phase2 |
| 2008 | 13 May | Completion of the Plant | Phase2 |
| 2008 | November | Completion of EIA Report | "EIA Report" prepared by [Yunnan University], Phase2 |
| 2008 | November | MOU with VCS Author and Credit Buyer | MOU between project owner and Tepia |
| 2009 | 16 March | Approval of EIA Report | "Approval Letter" of Dehong Environmental Protection Bureau, Phase2 |
| 2016 | 31 March | Closing date of the first crediting period | Closing date of the first crediting period Entire project |

# 8 Ownership:

## 8.1 Proof of Title:

According to VCS2007.1, evidence of proof of title shall be provided through one of the following:

⇒a legislative right;
⇒a right under local common law;
⇒Ownership of the plant, equipment and/or process generating the reduction/removal;
⇒a construction arrangement with the owner of the plant, equipment or process that grants all reduction/removals to the proponent

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

- Enterprise Business License.

Besides, the purchasing contract for turbine generator set and ERPA for the project between project participants are to proof the ownership of the main equipment and process penetrating the reductions, respectively. The all documents shall be provided to Validator/Verifier and Registry Operator whenever necessary.

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

Not applicable

Annex 1 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 of China (the DNA for CDM in China) on July 18, 2008.

Table A1.1 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 ($10^8$kWh) | Hydropower ($10^8$kWh) | Nuclear ($10^8$kWh) | Others ($10^8$kWh) | Total of all the power plants ($10^8$kWh) | Total of low operating cost/must-run power plants ($10^8$kWh) | 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 | 3377.15 | 1045.16 | 312.13 | 35.86 | 4766.3 | 1393.15 | 29.23% |

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 A1.2 Power generation from fuel-fired power of CSPG in 2004

| | Power generation ($10^8$kWh) | 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 A1.3 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 $CO_2$ ($tCO_2e$) I=G*H*F*E*44/12/10000 (quality) I=G*H*F*E*44/12/1000 (volume) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E=A+B+C+D | F | G | H | |
| Raw coal | | 6017.7 | 1305 | 2643.9 | 1751.28 | 11717.88 | 25.8 | 100 | 20908 | 231,767,574 |
| Wash extractive coal | $10^4$ ton | 0.21 | | | | 0.21 | 25.8 | 100 | 26344 | 5,233 |
| Other wash coal | | | | | | 0 | 25.8 | 100 | 8363 | 0.00 |
| Coke | | | | | | 0 | 25.8 | 100 | 28435 | 0.00 |
| Coke oven gas | $10^8$ $m^3$ | | | | | 0 | 12.1 | 100 | 16726 | 0.00 |
| Other coal gas | | 2.58 | | | | 2.58 | 12.1 | 100 | 5227 | 59,831 |
| Crude oil | | 16.89 | | | | 16.89 | 20 | 100 | 41816 | 517,933 |
| Gasoline | | | | | | 0 | 18.9 | 100 | 43070 | 0.00 |
| Diesel oil | $10^4$ ton | 48.88 | | | 1.83 | 50.71 | 20.2 | 100 | 42652 | 1601975 |
| Fuel oil | | 957.71 | | | | 957.71 | 21.1 | 100 | 41816 | 30,983,494 |
| LPG | | | | | | 0 | 17.2 | 100 | 50179 | 0.00 |
| Refine dry gas | | 2.86 | | | | 2.86 | 15.7 | 100 | 46055 | 75,825 |
| Nature gas | $10^8$ $m^3$ | 0.48 | | | | 0.48 | 15.3 | 100 | 38931 | 104,833 |
| Other oil production | $10^4$ ton | 1.66 | | | | 1.66 | 20 | 100 | 38369 | 46,708 |
| Other coke production | | | | | | 0 | 25.8 | 100 | 28435 | 0.00 |
| Other energy | $10^4$ tce | 79.42 | | | | 79.42 | 0 | 100 | 0 | 0.00 |
| Total | | | | | | | | | | 265,163,407 |
| 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 | | | |
| 10,951,240+247,366,229=258,317,469 | | | | | | | | | | |
| 2004 Emission factor of CSPG | | | | | | | 1.06158 | | | |

Data source: *2005 China Energy Statistics Yearbook*

Table A1.4 Power generation from fuel-fired power of CSPG in 2005

| | Power generation ($10^8$kWh) | Power generation (MWh) | Internal consumption rater (%) | Power supply to grid (MWh) |
|---|---|---|---|---|
| GuangDong | 1764.53 | 176453000 | 5.58 | 166,606,923 |
| GuangXi | 250.23 | 25023000 | 7.95 | 23,033,672 |
| GuiZhou | 584.3 | 58430000 | 7.34 | 54,141,238 |
| YunNan | 272.81 | 27281000 | 6.94 | 25,387,699 |
| Total | | | | 269,169,531 |

Data resource：2006 China electric power yearbook

Table A1.5 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 $CO_2$ ($tCO_2e$) I=G*H*F*E*44/12/10000 (quality) I=G*H*F*E*44/12/1000 (volume) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E=A+B+C+D | F | G | H | |
| Raw coal | $10^4$ ton | 6696.47 | 1435 | 3212.31 | 1975.55 | 13319.33 | 25.8 | 100 | 20908 | 263,442,602 |
| Wash extractive coal | | | | | 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 | $10^4$ ton | 10.91 | | | | 10.91 | 20 | 100 | 41816 | 334,556 |
| Gasoline | | 0.68 | | | | 0.68 | 18.9 | 100 | 43070 | 20296 |
| Diesel oil | | 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 | $10^8$ m$^3$ | 4.92 | | | | 4.92 | 15.7 | 100 | 46055 | 130,441 |
| Nature gas | | 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 A1.6 Power generation from fuel-fired power of CSPG in 2006

| | Power generation ($10^8$kWh) | Power generation (MWh) | Internal consumption rater (%) | Power supply to grid (MWh) |
|---|---|---|---|---|
| GuangDong | 1884.29 | 188429000 | 5.27 | 178,498,792 |
| GuangXi | 279.67 | 27967000 | 4.45 | 26,722,469 |
| GuiZhou | 760.39 | 76039000 | 6.06 | 71,431,037 |
| YunNan | 397.91 | 39791000 | 4.12 | 38,151,611 |
| Total | | | | 314,803,908 |

Data resource：2007 China electric power yearbook

Table A1.7 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 $CO_2$ ($tCO_2e$) I=G*H*F*E*44/12/10000 (quality) I=G*H*F*E*44/12/1000 (volume) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E=A+B+C+D | F | G | H | |
| 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 | | | | | | 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 A1.8 Weighted average 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 generation of 2004-2006/Total emissions of 2004-2006 | | | 1.06080 |

Calculation for BM： Table A1.9 Sheet for $\lambda_{Coal}$, $\lambda_{Oil}$, $\lambda_{Gas\ calculation}$, 2006 CSPG

| Fuel sort | unit | Guangdong | Guangxi | Guizhou | Yunnan | subtotal | Emission factor (tc/TJ) | Oxidation rate (%) | Average caloric value (MJ/t,km$^3$) | Emission of $CO_2$ ($tCO_2e$) I=G*H*F*E*44/12/10000(quality) I=G*H*F*E*44/12/1000 (volume) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E=A+B+C+D | F | G | H | |
| Raw coal | $10^4$ ton | 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 | | | | 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 | $10^4$ ton | 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 | | 29.92 | 1.26 | 0 | 3 | 34.18 | 20.2 | 100 | 42652 | 1,079,777 |
| Fuel oil | | 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 | $10^8$ $m^3$ | 79.2 | 0 | 0 | 0 | 79.2 | 15.3 | 100 | 38931 | 1,729,751 |
| Coke oven gas | | 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 | $10^4$ ton | 0 | 0 | 0 | 0 | 0 | 17.2 | 100 | 50179 | 0 |
| Refine dry gas | | 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 A1.10 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 A1.11 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) ($\lambda_{Coal}$*$EF_{coal,Adv}$+$\lambda_{Oil}$*$EF_{oil,Adv}$+$\lambda_{Gas}$*$EF_{gas,Adv}$) |
|---|---|---|---|---|
| λ | 92.35% | 6.94% | 0.71% | 0.8862 |
| $EF_{Adv}$ | 0.9135 | 0.5706 | 0.4138 | |

Table A1.12 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% | | |

$EF_{BM,y}$=0.8862×76.91%=0.6816 $tCO_2e/MWh$

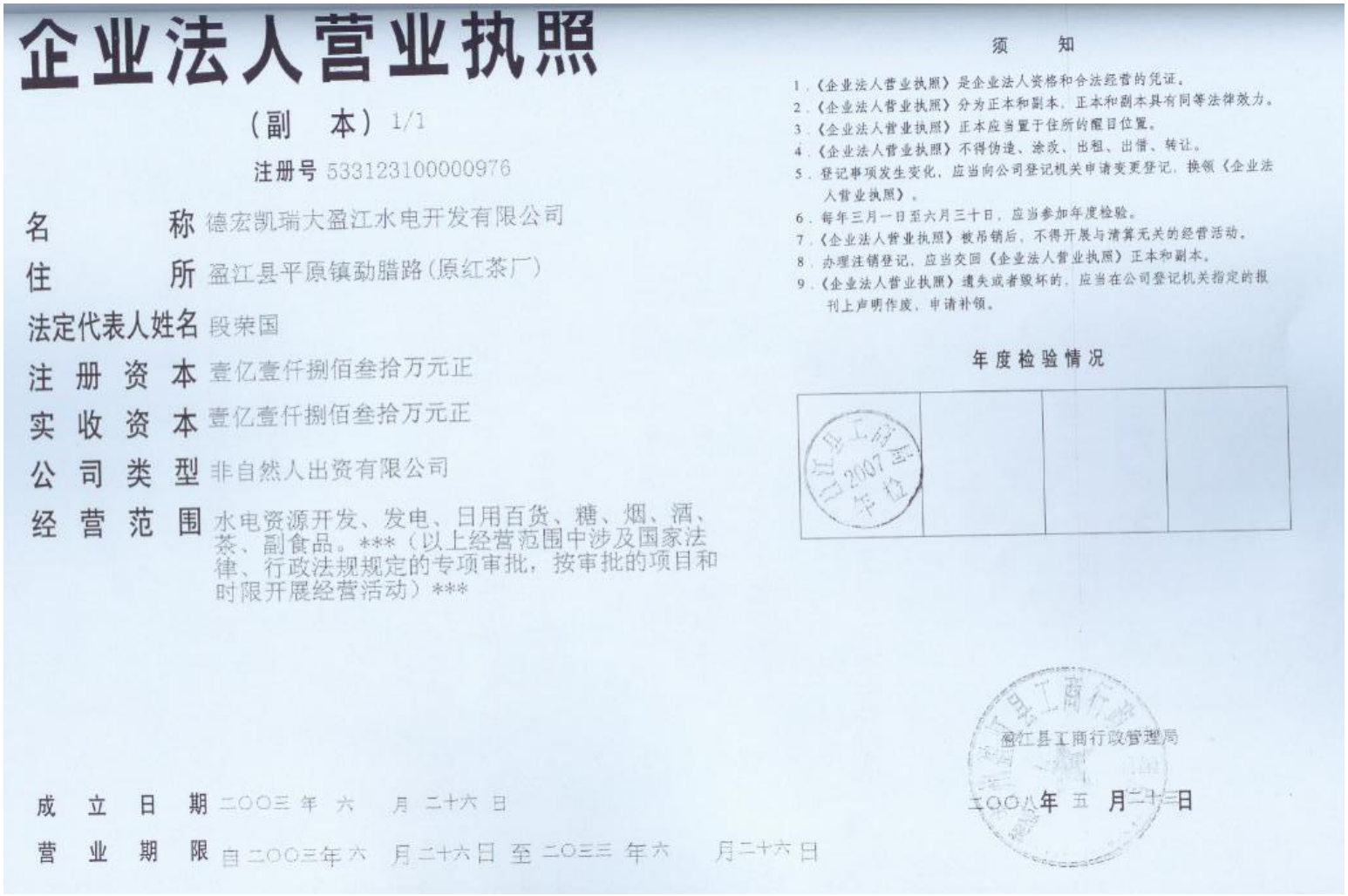
Calculation of CM:

Table A1.13 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 $\omega_{OM}$ and $\omega_{BM}$, by default, are 0.5)

Annex 2 Proof of Title:



# 企业法人营业执照

（副　本）1/1

注册号 533123100000976

名　　称 德宏凯瑞大盈江水电开发有限公司

住　　所 盈江县平原镇勐腊路（原红茶厂）

法定代表人姓名 段荣国

注 册 资 本 壹亿壹仟捌佰叁拾万元正

实 收 资 本 壹亿壹仟捌佰叁拾万元正

公 司 类 型 非自然人出资有限公司

经 营 范 围 水电资源开发、发电、日用百货、糖、烟、酒、茶、副食品。***（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 二〇〇三 年 六 月 二十六 日

营 业 期 限 自二〇〇三年六 月二十六日 至 二〇三三 年六 月二十六 日

须　　知

1．《企业法人营业执照》是企业法人资格和合法经营的凭证。
2．《企业法人营业执照》分为正本和副本，正本和副本具有同等法律效力。
3．《企业法人营业执照》正本应当置于住所的醒目位置。
4．《企业法人营业执照》不得伪造、涂改、出租、出借、转让。
5．登记事项发生变化，应当向公司登记机关申请变更登记，换领《企业法人营业执照》。
6．每年三月一日至六月三十日，应当参加年度检验。
7．《企业法人营业执照》被吊销后，不得开展与清算无关的经营活动。
8．办理注销登记，应当交回《企业法人营业执照》正本和副本。
9．《企业法人营业执照》遗失或者毁坏的，应当在公司登记机关指定的报刊上声明作废，申请补领。

年度检验情况

盈江县工商行政管理局

二〇〇八年 五 月二十三日

Business License for Enterprise's Legal Person

(Duplicate copy)

**Registration No.**: 533123100000976

**Enterprise Name**: Dehong Kairui Dayingjiang Hydropower Development Co., Ltd.

**Residence**: Mengla Road, Pingyuan Town, Yingjiang City

**Legal Representative**: Duan Rongguo

**Registered Capital**: RMB 118.30 Million Yuan

**Paid-in Capital**: RMB 118.30 Million Yuan

**Type of Enterprise**: Un-natural Person Contributive Company of limited liability

**Date of Establishment**: June 26, 2003

**Term of Business**: From June 26, 2003 to November June 26, 2033

Fig. A2.1 Business License of Dehong Kairui Dayingjiang Hydropower Development Co., Ltd. and its translation.