

# YUNNAN SINANJIANG HYDROPOWER PROJECT

Document Prepared By Ms. Cao Changyu

Tel: +86 10 6279 5180 ext 601

Fax: +86 10 6279 5182

Email: [ccy@ittc.com.cn](mailto:ccy@ittc.com.cn)

|                          |                                                                                                                                 |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Title</b>     | Yunnan Sinanjiang Hydropower Project                                                                                            |
| <b>Version</b>           | 02                                                                                                                              |
| <b>Date of Issue</b>     | 04-09-2012                                                                                                                      |
| <b>Project ID</b>        | UNFCC Ref. 2877                                                                                                                 |
| <b>Monitoring Period</b> | 26-04-2008 to 23-02-2010, First and last days included                                                                          |
| <b>Prepared By</b>       | Ms. Cao Changyu, Coway International TechTrans Co.,Ltd.                                                                         |
| <b>Contact</b>           | Physical address: Room 701B and 701D, 7/F, Building B, SP Tower, Tsinghua Science Park, Haidian District, 100084 Beijing, China |

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## 1 PROJECT DETAILS

### 1.1 Summary Description of Project

Yunnan Sinanjiang Hydropower Project (hereafter “the project activity”) is a grid-connected hydro power generation project. The electricity generated by the project activity is delivered to the China Southern Power Grid (CSPG). In doing so, it effectively displaces equal amount of the electricity generated by CSPG which is dominated by fossil fuel power plants, and thus greenhouse gas (GHG) emission reductions could be achieved.

The Project Activity is a low-head pondage hydro-power plant located on the Sinanjiang river with a capacity of 201MW (3×67MW). The designed annual gross electricity output and annual electricity delivered to the grid are 919.6 GWh and 825.6 GWh respectively. The reservoir surface area at full level is 8.168 km<sup>2</sup>, with power density at 24.61 W/m<sup>2</sup>. The key technical parameters of the equipments installed in the project are shown on Table 1 as below:

**Table 1. Technical specifications of the turbines and generators**

| <b>Turbines</b>                    | <b>Generators</b>             |
|------------------------------------|-------------------------------|
| Quantity: 3                        | Quantity: 3                   |
| Model: HL97.1-LJ-225               | Model: SF-J67-12/4420         |
| Rated Output: 69.07MW              | Rated Capacity: 67MW/78.82MVA |
| Rated Revolution: 500r/min         | Rated Revolution: 500r/min    |
| Rated Head: 320m                   | Rated Voltage: 10.5kV         |
| Rated Flow: 23.61m <sup>3</sup> /s | Power Factor: 0.85            |

The Project activity construction started in October 2005 and ended in February 2008. The commissioning of the first generator started at 26th April 2008.

This monitoring report covers the project activity from 26/04/2008 to 23/02/2010 including both days as the monitoring period and the total emission reductions achieved in this monitoring period is 1,544,749 tCO<sub>2</sub>e.

### 1.2 Sectoral Scope and Project Type

Sectoral scope 1: Energy industries (renewable sources)

Project type: Renewable electricity in grid connected application

The project is not grouped project.

### 1.3 Project Proponent

|                        |                                                             |
|------------------------|-------------------------------------------------------------|
| Roles/Responsibilities | Project Owner                                               |
| Project proponent      | Yunnan Dianneng Sinanjiang Hydropower Development Co., Ltd. |

|              |                                                                               |
|--------------|-------------------------------------------------------------------------------|
| Address      | Xinjian Road 2, Mojiang Hanizu Autonomous County, Pu'er City, Yunnan Province |
| Post fix/ZIP | 654800                                                                        |
| Country      | People's Republic of China                                                    |
| Telephone    | 86-879-4642008                                                                |

## 1.4 Other Entities Involved in the Project

No other entities.

## 1.5 Project Start Date

The Project Start Date is 26/04/2008, when the first generator started commissioning.

## 1.6 Project Crediting Period

The Project crediting period is from 26/04/2008 to 23/02/2010 including both days, covering 1 year and 304 days.

## 1.7 Project Location

Project is located near the Sinanjiang village, Mojiang Hanizu Autonomous County, Pu'er City<sup>1</sup>, Yunnan Province, People's Republic of China.

The dam's geographical coordinates (23°05'44"N, 101°52'41"E) and the geographical coordinates of the power plant (23°04'53"N, 101°46'30"E, Spot B) are indicated.

## 1.8 Title and Reference of Methodology

ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 07)

"Tool to calculate the emission factor for an electricity system" (Version 01.1)

"Tool for the demonstration and assessment of additionality" (Version 05.2)

"Guide on the assessment of investment analysis" (Version 02)

# 2 IMPLEMENTATION STATUS

## 2.1 Implementation Status of the Project Activity

Yunnan Sinanjiang Hydropower Project is single phased implemented project. The first set of generators started operation at the 26/04/2008. Please refer to following table for details.

<sup>1</sup> Simao City is renamed Pu'er City according to the approval of the State Council of the P. R. China ([http://www.gov.cn/xxgk/pub/govpublic/mrlm/200803/t20080328\\_32046.html](http://www.gov.cn/xxgk/pub/govpublic/mrlm/200803/t20080328_32046.html)). The new name has been put into service since 08/04/2007([http://news.xinhuanet.com/society/2007-03/04/content\\_5798983.htm](http://news.xinhuanet.com/society/2007-03/04/content_5798983.htm)).

Table 2 timeline of the project implementation status

| Activity                           | Date       |
|------------------------------------|------------|
| Start of construction              | 10/2005    |
| End of construction                | 02/2008    |
| The #1 generator started operation | 26/04/2008 |
| The #2 generator started operation | 30/05/2008 |
| The #3 generator started operation | 07/06/2008 |

This project operation is smooth since operation in 2008, no change on the key equipment and significant events occur.

There has been no event or situation, for example power density or installed capacity changes, that occurring during the monitoring period, which could have a negative impact on the applicability of the methodology.

## 2.2 Deviations from the Monitoring Plan

Not applicable

## 2.3 Grouped Project

Not applicable

## 3 DATA AND PARAMETERS

### 3.1 Data and Parameters Available at Validation

|                        |                                                                                               |
|------------------------|-----------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | EF <sub>grid,CM,y</sub>                                                                       |
| Data unit:             | tCO <sub>2</sub> e/MWh                                                                        |
| Description:           | Combined margin CO <sub>2</sub> emission factor for grid connected power generation in year y |
| Source of data:        | Registered PDD                                                                                |
| Value applied:         | 0.84335                                                                                       |
| Purpose of the data:   | Calculation of baseline emissions                                                             |
| Any comment:           | According to ACM0002 version 07, it is fixed during the first crediting period                |

|                        |                   |
|------------------------|-------------------|
| Data Unit / Parameter: | EF <sub>Res</sub> |
|------------------------|-------------------|

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data unit:           | kgCO <sub>2</sub> e/MWh                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Description:         | Default emission factor for emissions from reservoirs.                                                                                                                                                                                                                                                                                                                                                                                                              |
| Source of data:      | The default value as per EB23                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Value applied:       | 90                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Purpose of the data: | <p>Calculation of project emissions</p> <p>If the power density of power plant is greater than 4W/m<sup>2</sup> and less than or equal to 10W/m<sup>2</sup>, <math>PE_y = ER_{Res} * TEG_y / 1000</math></p> <p>If the power density of power plant is greater than 10W/m<sup>2</sup>, <math>PE_y = 0</math>.</p> <p>Power density of the proposed project activity is 24.61W/m<sup>2</sup>, which is greater than 10W/m<sup>2</sup>. So <math>PE_y = 0</math>.</p> |
| Any comment:         | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|                        |                                                                                                                                              |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | Cap <sub>BL</sub>                                                                                                                            |
| Data unit:             | MW                                                                                                                                           |
| Description:           | Installed capacity of the hydropower plant before the implementation of the project activity. For new hydropower plants, this value is zero. |
| Source of data:        | Methodology ACM0002 (Version 07)                                                                                                             |
| Value applied:         | 0 as the default value                                                                                                                       |
| Purpose of the data:   | <p>Calculation of project emissions</p> <p>The proposed project activity is a new hydropower plant, so Cap<sub>BL</sub>=0</p>                |
| Any comment:           | N/A                                                                                                                                          |

|                        |                                                                                                                                                                                    |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter: | A <sub>BL</sub>                                                                                                                                                                    |
| Data unit:             | m <sup>2</sup>                                                                                                                                                                     |
| Description:           | Area of the reservoir measured as the surface of the water, before the implementation of the project activity, when the reservoir is full. For new reservoirs, this value is zero. |
| Source of data:        | Project site                                                                                                                                                                       |
| Value applied:         | 0                                                                                                                                                                                  |
| Purpose of the data:   | Calculation of project emissions                                                                                                                                                   |
| Any comment:           | N/A                                                                                                                                                                                |

## 3.2 Data and Parameters Monitored

|                                                                  |                                                                                         |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | EG <sub>y, out</sub>                                                                    |
| Data unit:                                                       | MWh                                                                                     |
| Description:                                                     | Electricity output to the grid by the Project Activity during this monitoring period y. |
| Source of data:                                                  | On-site measurement                                                                     |
| Description of measurement methods and procedures to be applied: | Measured by electricity meter                                                           |
| Frequency of monitoring/recording:                               | Hourly measuring and monthly recording                                                  |
| Value monitored:                                                 | 1,832,199.7                                                                             |
| Monitoring equipment:                                            | Electricity meter, please find detail information in table 2 and 3.                     |
| QA/QC procedures to be applied:                                  | Check whether the reading is consistent with sales/purchase receipt                     |
| Calculation method:                                              | N/A                                                                                     |
| Any comment:                                                     | N/A                                                                                     |

|                                                                  |                                                                               |
|------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | EG <sub>y, in</sub>                                                           |
| Data unit:                                                       | MWh                                                                           |
| Description:                                                     | Electricity input for internal use from grid during this monitoring period y. |
| Source of data:                                                  | On-site measurement                                                           |
| Description of measurement methods and procedures to be applied: | Measured by electricity meter                                                 |
| Frequency of monitoring/recording:                               | Hourly measuring and monthly recording                                        |
| Value monitored:                                                 | 516.1                                                                         |
| Monitoring equipment:                                            | Electricity meter, please find detail information in table 2 and 3.           |
| QA/QC procedures to be applied:                                  | Check whether the reading is consistent with sales/purchase receipt           |
| Calculation method:                                              | N/A                                                                           |
| Any comment:                                                     | N/A                                                                           |

|                                        |                                                                                             |
|----------------------------------------|---------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                 | TEG <sub>y</sub>                                                                            |
| Data unit:                             | MWh                                                                                         |
| Description:                           | Total gross electricity produced by the project generation during this monitoring period y. |
| Source of data:                        | On-site measurement                                                                         |
| Description of measurement methods and | Measured by electricity meter                                                               |

|                                    |                                                                     |
|------------------------------------|---------------------------------------------------------------------|
| procedures to be applied:          |                                                                     |
| Frequency of monitoring/recording: | Hourly measuring and monthly recording                              |
| Value monitored:                   | 1,867,215                                                           |
| Monitoring equipment:              | Electricity meter, please find detail information in table 2 and 3. |
| QA/QC procedures to be applied:    | N/A                                                                 |
| Calculation method:                | N/A                                                                 |
| Any comment:                       | N/A                                                                 |

|                                                                  |                                                                                                                            |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | Cap <sub>PJ</sub>                                                                                                          |
| Data unit:                                                       | MW                                                                                                                         |
| Description:                                                     | Installed capacity of the hydro power plant after the implementation of the project activity within this monitoring period |
| Source of data:                                                  | Nameplate of generators                                                                                                    |
| Description of measurement methods and procedures to be applied: | N/A                                                                                                                        |
| Frequency of monitoring/recording:                               | N/A                                                                                                                        |
| Value monitored:                                                 | 201                                                                                                                        |
| Monitoring equipment:                                            | N/A                                                                                                                        |
| QA/QC procedures to be applied:                                  | N/A                                                                                                                        |
| Calculation method:                                              | N/A                                                                                                                        |
| Any comment:                                                     | N/A                                                                                                                        |

|                                                                  |                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data Unit / Parameter:                                           | A <sub>PJ</sub>                                                                                                                                                                                                                                                                  |
| Data unit:                                                       | m <sup>2</sup>                                                                                                                                                                                                                                                                   |
| Description:                                                     | Area of the reservoir measured in the surface of the water after the implementation of the project activity, when reservoir is full.                                                                                                                                             |
| Source of data:                                                  | Project site                                                                                                                                                                                                                                                                     |
| Description of measurement methods and procedures to be applied: | The calculation involves two steps:<br>Input the water level monitored at any time when the reservoir is full and derive the according water surface area with water level- water surface graph depicted by topographical surveys which is carried out by qualified third party. |
| Frequency of monitoring/recording:                               | Yearly                                                                                                                                                                                                                                                                           |
| Value monitored:                                                 | 8,167,700                                                                                                                                                                                                                                                                        |
| Monitoring equipment:                                            | N/A                                                                                                                                                                                                                                                                              |

|                                 |     |
|---------------------------------|-----|
| QA/QC procedures to be applied: | N/A |
| Calculation method:             | N/A |
| Any comment:                    | N/A |

### 3.3 Description of the Monitoring Plan

#### ➤ Summary

The monitoring system of the Project Activity is refer to the relevant sector technical and management standards, the CDM project design document and regional best practise, which includes.

Electricity measurement device technology, DL/448-2000

Standards on electricity remote measurement system, DL/T743-2001

Power Purchase and Sales Agreement and technical annex with Yunnan Power Grid Company

Relevant Yunnan Dianneng Internal Operation and Monitoring Guideline

#### ➤ Organization

The Project Entity employs qualified and experienced personnel for routine operation and recording. To monitor the emissions reduction, a dedicated team is selected from existing staff chosen with reference to their portfolio. They are then trained to meet the CDM requirements.

The administrative team structure is established as:

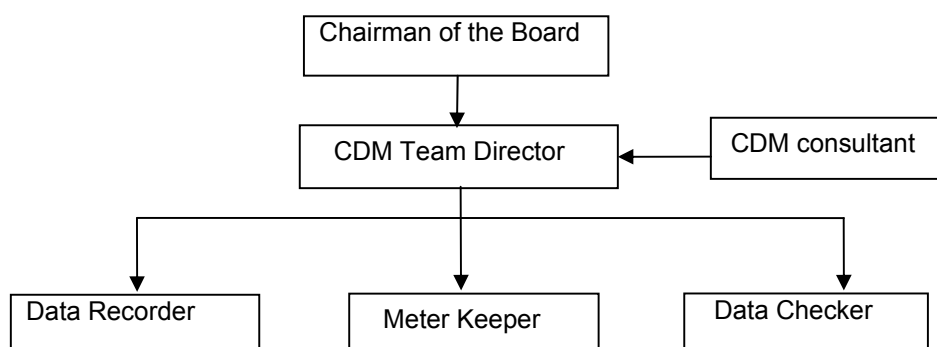


**Figure 1 Monitoring team structure**

**Table 3 Member and function**

| Title             | Function                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CDM team director | <ul style="list-style-type: none"> <li>Manage the whole CDM constituent of Sinanjiang Hydropower Power Plant</li> <li>Guide and supervise data recorder, meter supervisor and data checker to meet relevant requirement</li> <li>Maintain archive system</li> <li>Authorise the monitoring report</li> <li>Focal point for coordination and contact</li> <li>Report to chairman of the board of management directors</li> </ul> |
| CDM consultation  | <ul style="list-style-type: none"> <li>Provide CDM group with training and technical consultancy regarding CDM monitoring plan</li> <li>Pre-review monitoring data and material</li> <li>Draft monitoring report at the end of credit period</li> </ul>                                                                                                                                                                         |

|               |                                                                                                                                                                                                                                                                                                                                                                  |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | <ul style="list-style-type: none"> <li>Assist project owner to facilitate the Verification and Certification procedure</li> </ul>                                                                                                                                                                                                                                |
| Data recorder | <ul style="list-style-type: none"> <li>Record and collect electricity, measuring data every month for each credit period according to monitoring system</li> <li>Preliminarily check for consistency and clerical error</li> <li>Report to meter keeper promptly if abnormal situation occur</li> </ul>                                                          |
| Data checker  | <ul style="list-style-type: none"> <li>Cross check the collected data for consistency</li> <li>Aggregate and report to Yunnan Power Grid for confirmation</li> <li>Resolve the dispute about data internally and externally</li> <li>When the abnormal situation found report to CDM team director</li> </ul>                                                    |
| Meter keeper  | <ul style="list-style-type: none"> <li>Check and maintain electricity meter routinely according to relevant regulation, and report to CDM group director promptly if any abnormal situation might cause obvious impact</li> <li>Assist the professional institute on calibration and maintenance of the electricity meter, keep the relevant records;</li> </ul> |

### ➤ Monitoring device

As a redundant line, the emergency backup connection (M1' & M3') isn't built, but it doesn't impact the level of monitoring accuracy and completeness. All the required data could be well monitored and cross checked by the existing monitoring system. Emergency and dispute resolution could also be resolved by existing meters without meters in backup outlet line. So backup connection (M1' & M3') isn't built has no impact on the level of monitoring accuracy and completeness and further has no impact on emission reduction.

The power connection with relevant component and electricity meter points is illustrated below:

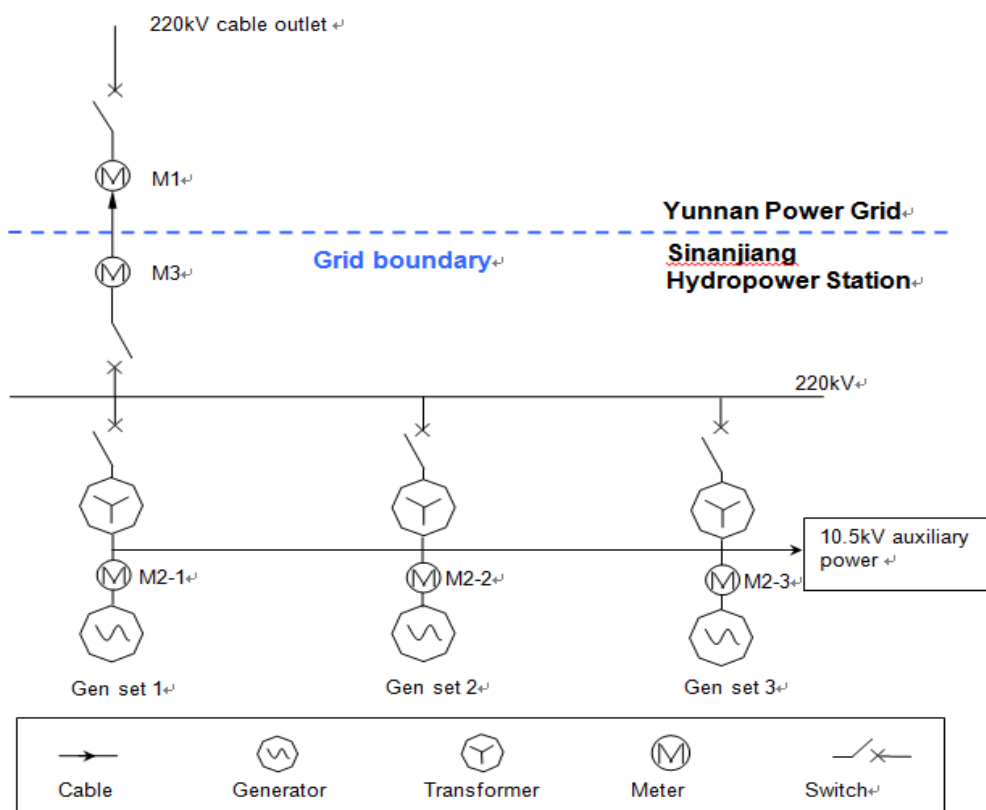


Figure 2 Power connection schematic

The electricity meter is the key monitoring device for electric power measurement. Gateway electricity meter (M1) is installed at the inlet of the power grid as the main meter to measure electricity generated by the Project Activity to the grid as well as electricity supplied to the Project Activity from the grid. Checking electricity meter (M3) is installed at the outlet of the transformer of the hydropower station (namely outlet of hydropower station) serving as backup for the Gateway Meter. Meters (M2-1, M2-2, M2-3, Generator meters) are installed to measure the electricity output of each generator (TEG<sub>y</sub>).

**Table 4 Specification of electricity meter**

| Electricity meter                                  | Location                                            | S/N ID.                             | Manufactory /Type/ feature                                      | Function                                                                                                     | monitor frequency                     | Related parameter                           |
|----------------------------------------------------|-----------------------------------------------------|-------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------|
| M1<br>(Gateway electricity meter)                  | Inlet of Yunnan Power Grid                          | 206659835                           | Redphase-Australia/MK6E/ bi-directional, accuracy class 0.2s    | Amount of electricity imported/exported by Mojiang 500kV Transformer Substation from/to the proposed project | Hourly measurement and monthly record | EG <sub>y, out</sub><br>EG <sub>y, in</sub> |
| M2-1<br>M2-2<br>M2-3<br>(Output electricity meter) | Outlet of each generator                            | 206584459<br>206584461<br>206584462 | Redphase-Australia/ GENIUS /unidirectional, accuracy class 0.5s | Amount of electricity output of each generator set.                                                          | Hourly measurement and monthly record | TEG <sub>y</sub>                            |
| M3<br>(Checking meter)                             | Outlet of the transformer of the hydropower station | 206659836                           | Redphase-Australia/MK6E/ bi-directional, accuracy class 0.2s    | Amount of electricity imported/exported by the proposed project from/to Mojiang 500kV Transformer Substation | Hourly measurement and monthly record | EG <sub>y, out</sub><br>EG <sub>y, in</sub> |

*\*These five electricity meters are referred to hereafter as M1, M2-1, M2-2, M2-3, M3 respectively.*

For monitoring the area of reservoir surface of the water when the reservoir full(A<sub>PJ</sub>), a contour map and elevation-area curve diagram drawn by topographical survey are employed.

#### ➤ Recording and Reporting

Data related to electricity transmission with Yunnan Power Grid Company (referred to hereafter as Grid Company) is measured hourly and recorded on a monthly basis. The data recorder takes note of the M1, M3 and M2-1, M2-2, M2-3 readings at 24:00 every day which includes electricity export and import by the project and output of each generator unit. These types of electricity meters indicate accumulative readings; electricity for a given duration can be derived by subtracting readings. These data is cross-checked with previous recorded one with each other and consequently adopted for baseline emission calculation.

Before the account day these data or predicted data derived and relevant calculations are summarized, formally submitted by project owner and then cross-checked by Grid Company referring to their remote reading. Once confirmed by Grid Company, these data is adopted for accounts and payment settling. This procedure is parallel and independent to the monitoring activity. Its result is employed for quality control.

$A_{PJ}$  is obtained with an Elevation/Area curve diagram, contour and reservoir area at full level for any time of year. Then the derived  $A_{PJ}$  is employed for project emission calculation. Other inertia data such as installed capacity  $Cap_{PJ}$ , any changes have to be reported and adopted for the emission reduction calculation, otherwise treated constant during the whole crediting period.

➤ **Emergency and Dispute resolution**

Should a fault on M1 electricity meter occur, the amount of the electricity imported and exported should be determined by M3 as backup electricity meter with identical functions and properties, otherwise internal electricity transmission data of Grid is employed. The discrepancy on any further measurement validity is arbitrated by the Yunnan Electrical Power Experiment and Research Institute Group, which is authorized appointed in Yunnan province region. These alternative methods should be verifiable, conservative and thus appropriate and valid for emission reduction calculation.

➤ **Archive management**

- CDM team should digitally archive monitored data and calculation spreadsheet at the end of the month. Documents related to electricity transmission data and sales/purchase should be photocopied. Electronic documents should be stored onto compact disc(s) at every end of each year.
- Document such as geographic map, EIA report, project design etc. used for monitoring plan, should be archived. The original source of copy should be documented.
- Archiving should be systematic and easy to search.
- All data should be kept for 2 years after the crediting period.

➤ **Calibration and Maintenance**

The gateway and checking electricity meter test and calibration is conducted by a professional entity under supervision of both Project Entity and Grid Company at least twice a year. M2-1, M2-2 and M2-3 are conducted by a professional entity under supervision of Project Entity at least once a year. Detailed calibration information has been summarized in table 5. As calibrated by Yunnan Electric Power Test & Research Institute Group CO., LTD. Electric Power Research Institute, it is concluded that the electricity meters are qualified.

**Table 5 Calibration information of electricity meters**

| Items | Date of Calibration | validity              | Calibration Organization                                                                                   |
|-------|---------------------|-----------------------|------------------------------------------------------------------------------------------------------------|
| M1    | 03/04/2008          | 03/04/2008~02/10/2008 | Yunnan Electric Power<br>Test & Research Institute<br>Group CO., LTD. Electric<br>Power Research Institute |
|       | 07/07/2008          | 07/07/2008~06/01/2009 |                                                                                                            |
|       | 07/01/2009          | 07/01/2009~06/07/2009 |                                                                                                            |
|       | 07/07/2009          | 07/07/2009~06/01/2010 |                                                                                                            |
|       | 07/01/2010          | 07/01/2010~06/07/2010 |                                                                                                            |
| M3    | 03/04/2008          | 03/04/2008~02/10/2008 |                                                                                                            |
|       | 07/07/2008          | 07/07/2008~06/01/2009 |                                                                                                            |
|       | 07/01/2009          | 07/01/2009~06/07/2009 |                                                                                                            |
|       | 07/07/2009          | 07/07/2009~06/01/2010 |                                                                                                            |
|       | 07/01/2010          | 07/01/2010~06/07/2010 |                                                                                                            |
| M2-1  | 03/04/2008          | 03/04/2008-02/04/2009 |                                                                                                            |

|      |            |                       |  |
|------|------------|-----------------------|--|
|      | 07/01/2009 | 07/01/2009-06/01/2010 |  |
|      | 07/01/2010 | 07/01/2010~06/01/2011 |  |
| M2-2 | 03/04/2008 | 03/04/2008-02/04/2009 |  |
|      | 07/01/2009 | 07/01/2009-06/01/2010 |  |
|      | 07/01/2010 | 07/01/2010~06/01/2011 |  |
| M2-3 | 03/04/2008 | 03/04/2008-02/04/2009 |  |
|      | 07/01/2009 | 07/01/2009-06/01/2010 |  |
|      | 07/01/2010 | 07/01/2010~06/01/2011 |  |

After inspection and on-site check, electricity meters must be sealed; neither party can remove the seal or modify the electricity meter. The routine electricity meter inspection and on-site check is implemented by the meter keeper according to national technical code and regulations. The elevation-area curve diagram and reservoir full level would be calibrated and confirmed by professional hydrology and hydropower design institute on a yearly basis.

The monitoring system is maintained under the inspection of CDM Team Director and consultant. When external conditions (for instance, reporting procedure with Grid Company, power connection etc.) change, monitoring system should adapt accordingly. While verification the suggestion and correction raised by DOE should be considered and corrected for future monitoring activity.

## 4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

### 4.1 Baseline Emissions

According to the registered PDD, baseline emissions of the project should be calculated according to the following formula:

$$BE_y = (EG_y - EG_{\text{baseline}}) \times EF_{\text{grid,CM,y}}$$

$$EG_y = EG_{y,\text{out}} - EG_{y,\text{in}}$$

Where,

|                         |                                                                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| $BE_y$                  | Baseline emissions during this monitoring period $y$ (tCO <sub>2</sub> e)                                                                 |
| $EG_y$                  | Net electricity supplied to the grid by the project activity during this monitoring period $y$ (MWh)                                      |
| $EG_{\text{baseline}}$  | The electricity supplied to the grid before the Project Activity (MWh). For new project as Sinanjiang Hydropower Power the value is zero. |
| $EF_{\text{grid,CM,y}}$ | Combined margin CO <sub>2</sub> emission factor for grid connected power generation in monitoring period $y$ . (tCO <sub>2</sub> e/MWh)   |
| $EG_{y,\text{out}}$     | Electricity output to grid by the proposed project activity during the monitoring period $y$ (MWh)                                        |
| $EG_{y,\text{in}}$      | Electricity input from grid by the proposed project activity during the monitoring period                                                 |

y (MWh)

Concerning data vintage selection, determination of  $EF_{grid,CM,y}$  consists of OM and BM parts. For OM, once for each crediting period (7 years) using the most recent three historical years, for which data is available at the time of submission of the PDD to the DOE for validation; To determine BM once ex-ante for the first crediting period. For the second and third crediting period, only once ex-ante required at the start of the second crediting period. Thus the value acquired in project design  $0.84335tCO_2e/MWh$  is valid and adopted.

This monitoring period starts on 26/04/2008 and ends on 23/02/2010. Table 6 indicates the results of the measurement and calculation result of baseline emission during the monitoring period. Please find excel sheet for detail emission reduction calculation.

**Table 6 Calculation of baseline emission**

| Period                | $EG_{y,out}$       | $EG_{y,in}$  | $EG_y$             | $BE_y$            |
|-----------------------|--------------------|--------------|--------------------|-------------------|
|                       | MWh                | MWh          | MWh                | tCOe <sub>2</sub> |
|                       | A                  | B            | C = A-B            | D = C*0.84335     |
| 26/04/2008-31/05/2008 | 27,527.8           | 8.8          | 27,519.0           | 23,208.1          |
| 01/06/2008-30/06/2008 | 122,595.1          | 0.5          | 122,594.6          | 103,390.1         |
| 01/07/2008-31/07/2008 | 136,339.8          | 0.0          | 136,339.8          | 114,982.2         |
| 01/08/2008-31/08/2008 | 141,715.4          | 0.0          | 141,715.4          | 119,515.7         |
| 01/09/2008-30/09/2008 | 106,666.2          | 0.0          | 106,666.2          | 89,956.9          |
| 01/10/2008-31/10/2008 | 103,018.6          | 0.9          | 103,017.7          | 86,880.0          |
| 01/11/2008-30/11/2008 | 100,966.4          | 1.1          | 100,965.3          | 85,149.1          |
| 01/12/2008-31/12/2008 | 68,041.1           | 22.9         | 68,018.2           | 57,363.1          |
| <b>Subtotal</b>       | <b>806,870.3</b>   | <b>34.2</b>  | <b>806,836.1</b>   | <b>680,445</b>    |
| 01/01/2009-31/01/2009 | 77,474.8           | 8.8          | 77,466.0           | 65,331.0          |
| 01/02/2009-28/02/2009 | 22,023.4           | 1.1          | 22,022.3           | 18,572.5          |
| 01/03/2009-31/03/2009 | 44,088.2           | 60.0         | 44,028.2           | 37,131.1          |
| 01/04/2009-30/04/2009 | 58,965.5           | 34.0         | 58,931.5           | 49,699.8          |
| 01/05/2009-31/05/2009 | 41,468.2           | 106.0        | 41,362.2           | 34,882.8          |
| 01/06/2009-30/06/2009 | 127,404.1          | 0.0          | 127,404.1          | 107,446.2         |
| 01/07/2009-31/07/2009 | 146,429.9          | 2.0          | 146,427.9          | 123,490.0         |
| 01/08/2009-31/08/2009 | 152,682.8          | 0.0          | 152,682.8          | 119,488.4         |
| 01/09/2009-30/09/2009 | 149,381.6          | 0.0          | 149,381.6          | 116,704.4         |
| 01/10/2009-31/10/2009 | 65,974.3           | 53.0         | 65,921.3           | 74,148.0          |
| 01/11/2009-30/11/2009 | 39,893.0           | 63.0         | 39,830.0           | 33,590.6          |
| 01/12/2009-31/12/2009 | 40,525.1           | 66.0         | 40,459.1           | 34,121.1          |
| <b>Subtotal</b>       | <b>966,310.8</b>   | <b>393.9</b> | <b>965,916.8</b>   | <b>814,605</b>    |
| 01/01/2010-31/01/2010 | 43,081.3           | 36.0         | 43,045.3           | 36,302.2          |
| 01/02/2010-23/02/2010 | 15,937.3           | 52.0         | 15,885.3           | 13,396.9          |
| <b>Subtotal</b>       | <b>59,018.6</b>    | <b>88.0</b>  | <b>58,930.6</b>    | <b>49,699</b>     |
| <b>Total</b>          | <b>1,832,199.7</b> | <b>516.1</b> | <b>1,831,683.5</b> | <b>1,544,749</b>  |

## 4.2 Project Emissions

As per the methodology in advance of project mission calculation, project emission should be determined by power density PD, with the given formula:

$$PD_y = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

$PD_y$  power density in the monitoring period y ( $W/m^2$ );

$Cap_{PJ}$  Install capacity after the implementation of Project Activity (W);

$Cap_{BL}$  Installed capacity before the implementation of Project Activity (W), for new project the value is zero.

$A_{PJ}$  Area of the reservoir measured in the surface of the water, after the implementation of the Project Activity, when the reservoir is full ( $m^2$ );

$A_{BL}$  Area of the reservoir measured in the surface of the water, before the implementation of the Project Activity, when the reservoir is full ( $m^2$ ). For new project the value is zero.

$Cap_{BL}$  and  $A_{BL}$  are zero for the Project Activity is a newly built project. As specified in the FSR the installed capacity is 201MW and the surface area of the reservoir is  $8.168 \text{ km}^2$  when the nominal water level is reached. Thus the power density is  $24.61 W/m^2$ , which is greater than  $10 W/m^2$ .

After the project implementation and during this monitoring period,  $Cap_{BL}$  remains 201 MW. As measured and calculated by professional hydrology and hydropower design institute, the water surface area by normal full water level (900 m) is  $8,167,700 \text{ m}^2$  in the year 2008, 2009 and 2010 according to the elevation-area curve diagram. Then  $PD_y$  for this monitoring period is  $24.61 W/m^2$  which is still greater than  $10 W/m^2$ .

The project emission therefore does not include emissions by inundation in the monitoring period and the  $PE_y = 0$ .

## 4.3 Leakage

According to ACM0002 (version 07) and registered PDD, as a new grid connected hydropower electricity project leakage is not considered in the proposed project.  $LE_y = 0$ .

## 4.4 Summary of GHG Emission Reductions and Removals

According to baseline and monitoring methodology (ACM0002, Version 07), the emission reduction  $ER_y$  by the Project Activity during a given year y is:

$$ER_y = BE_y - PE_y - LE_y$$

Where,

$ER_y$       emission reduction in year  $y$ ;  
 $PE_y$       project emissions in year  $y$ ;  
 $LE_y$       emissions due to leakage in year  $y$ ;  
 $BE_y$       baseline emissions in year  $y$

The emission reductions of the project activity during the monitoring period (26/04/2008 – 23/02/2010) are summarized in the following table.

**Table 7 summary of emission reductions**

| Period                | Baseline emissions   | Project emissions    | Leakage emissions    | Emission reductions  |
|-----------------------|----------------------|----------------------|----------------------|----------------------|
|                       | (tCO <sub>2</sub> e) | (tCO <sub>2</sub> e) | (tCO <sub>2</sub> e) | (tCO <sub>2</sub> e) |
| 26/04/2008-31/05/2008 | 23,208.1             | 0                    | 0                    | 23,208.1             |
| 01/06/2008-30/06/2008 | 103,390.1            | 0                    | 0                    | 103,390.1            |
| 01/07/2008-31/07/2008 | 114,982.2            | 0                    | 0                    | 114,982.2            |
| 01/08/2008-31/08/2008 | 119,515.7            | 0                    | 0                    | 119,515.7            |
| 01/09/2008-30/09/2008 | 89,956.9             | 0                    | 0                    | 89,956.9             |
| 01/10/2008-31/10/2008 | 86,880.0             | 0                    | 0                    | 86,880.0             |
| 01/11/2008-30/11/2008 | 85,149.1             | 0                    | 0                    | 85,149.1             |
| 01/12/2008-31/12/2008 | 57,363.1             | 0                    | 0                    | 57,363.1             |
| <b>Subtotal</b>       | <b>680,445</b>       | <b>0</b>             | <b>0</b>             | <b>680,445</b>       |
| 01/01/2009-31/01/2009 | 65,331.0             | 0                    | 0                    | 65,331.0             |
| 01/02/2009-28/02/2009 | 18,572.5             | 0                    | 0                    | 18,572.5             |
| 01/03/2009-31/03/2009 | 37,131.1             | 0                    | 0                    | 37,131.1             |
| 01/04/2009-30/04/2009 | 49,699.8             | 0                    | 0                    | 49,699.8             |
| 01/05/2009-31/05/2009 | 34,882.8             | 0                    | 0                    | 34,882.8             |
| 01/06/2009-30/06/2009 | 107,446.2            | 0                    | 0                    | 107,446.2            |
| 01/07/2009-31/07/2009 | 123,490.0            | 0                    | 0                    | 123,490.0            |
| 01/08/2009-31/08/2009 | 119,488.4            | 0                    | 0                    | 119,488.4            |
| 01/09/2009-30/09/2009 | 116,704.4            | 0                    | 0                    | 116,704.4            |
| 01/10/2009-31/10/2009 | 74,148.0             | 0                    | 0                    | 74,148.0             |
| 01/11/2009-30/11/2009 | 33,590.6             | 0                    | 0                    | 33,590.6             |
| 01/12/2009-31/12/2009 | 34,121.1             | 0                    | 0                    | 34,121.1             |
| <b>Subtotal</b>       | <b>814,605</b>       | <b>0</b>             | <b>0</b>             | <b>814,605</b>       |
| 01/01/2010-31/01/2010 | 36,302.2             | 0                    | 0                    | 36,302.2             |
| 01/02/2010-23/02/2010 | 13,396.9             | 0                    | 0                    | 13,396.9             |
| <b>Subtotal</b>       | <b>49,699</b>        | <b>0</b>             | <b>0</b>             | <b>49,699</b>        |
| <b>Total</b>          | <b>1,544,749</b>     | <b>0</b>             | <b>0</b>             | <b>1,544,749</b>     |

## 5 ADDITIONAL INFORMATION

**Comparison of actual emission reductions with estimates in registered PDD**

Annual emissions reduction of the project in the registered PDD is 696,245tCO<sub>2</sub>e, which referred to annual net electricity delivered to CSPG (825.6 GWh) estimated in FSR on a yearly basis. This monitoring period totally cover 669 days in year 2008 to 2010. So expected emission reduction achieved in this monitoring period is estimated as  $696,245 \times 669 / 365 = 1,276,131 \text{tCO}_2\text{e}$ . Emission reduction during the current monitoring period is 1,544,749 tCO<sub>2</sub>e, which is 21.05% more than estimated value.

**Table 8 comparison of emission reduction**

| Year                                     | Values estimated in ex-ante calculation of registered PDD (tCO <sub>2</sub> e) | Actual values achieved during this monitoring period (tCO <sub>2</sub> e) |
|------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Emission reductions (tCO <sub>2</sub> e) | 1,276,131                                                                      | 1,544,749                                                                 |

**Analysis on difference from estimated value in the PDD**

According to FSR, mean monthly runoff of Sinanjiang hydropower station is listed in table 9. So average designed water runoff is 42.29m<sup>3</sup>/s (= (15.4+11.5+8.82+8.70+17.6+51.50+107+107+70.7+50.1+36.9+22.3)/12).

**Table 9 Mean monthly runoff of Sinanjiang hydropower station (m<sup>3</sup>/s)**

| Month  | 1    | 2    | 3    | 4    | 5    | 6     | 7   | 8   | 9    | 10   | 11   | 12   |
|--------|------|------|------|------|------|-------|-----|-----|------|------|------|------|
| Runoff | 15.4 | 11.5 | 8.82 | 8.70 | 17.6 | 51.50 | 107 | 107 | 70.7 | 50.1 | 36.9 | 22.3 |

Date source: FSR

In the project water monitoring system is installed and operates to monitor water parameters such as water runoff at the dam and reservoir water level etc. As statistical data of water inflow at the dam listed in the table 10, the average actual water runoff during the current monitoring period is 56.65m<sup>3</sup>/s, which is 33.95% more than the average designed water runoff (42.29m<sup>3</sup>/s).

**Table 10 2008-2010 monthly runoff of Sinanjiang hydropower station (m<sup>3</sup>/s)**

| Year | 1     | 2     | 3    | 4     | 5     | 6     | 7      | 8      | 9     | 10    | 11     | 12    |
|------|-------|-------|------|-------|-------|-------|--------|--------|-------|-------|--------|-------|
| 2008 |       |       |      |       | 24.90 | 57.37 | 150.22 | 148.25 | 95.72 | 54.49 | 102.92 | 30.66 |
| 2009 | 19.17 | 10.19 | 8.46 | 17.26 | 25.23 | 63.57 | 118.82 | 161.26 | 77.64 | 32.02 | 19.29  | 13.49 |
| 2010 | 9.19  | 6.17  |      |       |       |       |        |        |       |       |        |       |

Based on the above analysis, it can be concluded that much water runoff resulted in extra electricity output to grid and more emission reduction.