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YUNNAN MANGLI HYDROPOWER PROJECT

Document Prepared by Climate Bridge(Shanghai) Ltd.

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Project Title	Yunnan Mangli Hydropower Project
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Monitoring Period	01-11-2013 to 30-04-2018 (The first and last days included)
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Yunnan Mangli Hydropower Project (hereafter referred as the project) is located on Mangshi River in Luxi City, Yunnan Province, P. R. China. The project is developed and operated by Datang Mangli Hydropower Development Company Limited.

Totally 2 sets of 18MW hydro turbines has been installed, providing a total capacity of 36MW. It is estimated that the power supplied to the grid would be 143,652MWh annually and achieve an amount of 113,189 tCO₂e emission reductions every year as per revised PD¹. The project is to generate hydro power and deliver it to China Southern Power Grid (CSPG).

The Project started construction on 30/06/2008. The first turbine of the Project started commissioning on 13/01/2010. The project was registered as a CDM project (UNFCCC Ref.4821) on 07/10/2011. And this project was registered as a VCS project (VCS ID 928) on 14/11/2012. In the beginning period of the operation, the monitoring data of the project was not complete. Since 25/01/2010, the data have been monitored and collected following the monitoring procedure in Section 4.3. Therefore, starting date of the VCS crediting period is 25/01/2010. The project is registered under VCS standard Version 3.2 and completed validation before 19/03/2020. Thus, it remains eligible to apply the crediting period requirements under VCS Version 3 which shall be a maximum of ten years and may be renewed at most twice, so the first renewable crediting period of the project should be updated from 25/01/2010 ~ 06/10/2011 to 25/01/2010 ~ 24/01/2020.

During the monitoring period (01/11/2013–30/04/2018), the project has supplied electricity of 434,098.424MWh and achieved 342,023tCO₂e emission reductions by replacing electricity generated by fossil fuel fired power plants connected to CSPG.

1.2 Sectoral Scope and Project Type

Sectoral Scope: 1. Energy (renewable/non-renewable);

Project type: Hydropower generation project;

The project is not a grouped project.

¹ One typo error of the turbine model had been corrected in the revised PDD and approved by EB. The change doesn't affect the monitoring activity.

1.3 Project Proponent

Organization name	Datang Mangli Hydropower Development Company Limited
Contact person	Xianjun Luo
Title	Project Manager
Address	Fenghua Road, Mangli City, Dehong District, Yunnan Province
Telephone	+86-2123019950
Email	3542346576.qq.com

1.4 Other Entities Involved in the Project

Organization name	Climate Bridge (Shanghai) Ltd.
Role in the Project	Consultancy
Contact person	Zhiwen Gao
Title	General Manager
Address	Block B, Level 24, Jiangong Mansion, 33 Fushan Road, Pudong New Area, Shanghai, China 200120
Telephone	+86-2162462036
Email	gao.zhiwen@climatebridge.com ; projects@climatebridge.com

1.5 Project Start Date

13/01/2010 the date on which the Project started commissioning.

1.6 Project Crediting Period

There is a deviation for the crediting period. The project is registered under VCS standard Version 3.2 and completed validation before 19/03/2020. Thus, it remains eligible to apply the crediting period requirements under VCS Version 3 which shall be a maximum of ten years and may be renewed at most twice, so the first renewable crediting period of the project should be updated

from 25/01/2010 ~ 06/10/2011 to 25/01/2010 ~ 24/01/2020. However, as the project is also registered as a CDM project with a seven-year twice renewable project crediting period and the total CDM crediting period is from 07/10/2011 to 06/10/2032. Therefore the total length of VCS crediting period should be no more than 21 years which is from 25/01/2010 to 24/01/2031. This monitoring period belongs to the first VCS crediting period.

1.7 Project Location

The centre of the project site is located on Mangshi River, in Luxi City of Yunnan Province, P.R.China. The exact geographical coordinates of the blocking dam are 98.3145° East longitude and 24.3083° North latitude. The project is 38 km away from Mangshi City (capital of Dehong Prefecture).

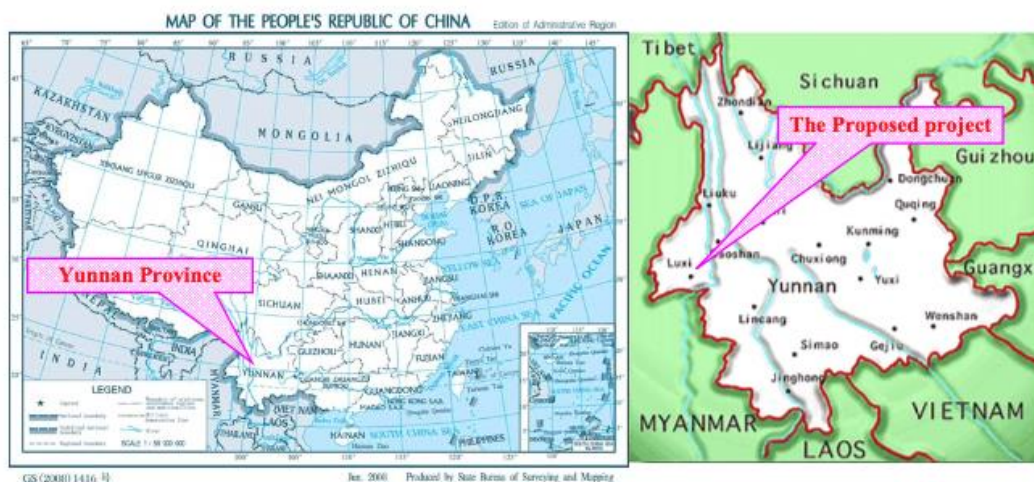


Figure 1 Location of the Project in Provincial Map

1.8 Title and Reference of Methodology

Following approved baseline & monitoring methodology is applied:

Methodology:

The baseline and monitoring methodology ACM0002 is used: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (Version 12.1.0, Sectoral Scope: 01, EB58).

Reference:

<https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG>

Tools applied:

“Tool to calculate the emission factor for an electricity system” (Version 02.1/EB 50/Annex 14)

Reference:

<https://cdm.unfccc.int/methodologies/PAmethodologies/approved>

1.9 Participation under other GHG Programs

The project was registered as a CDM project (UNFCCC Ref.4821) on 07/10/2011, and the starting date of the credit period of CDM project was same as the registration date.

Total GHG emission reductions of 102,673 tCO₂ generated from 07/10/2011 to 31/10/2013 (both first and last days included) by the project has been issued as CER under CDM program.

Please refer to the following link for details:

<https://cdm.unfccc.int/Projects/DB/DNV-CUK1305694841.24/view>.

Except for CDM, the project did not register under any other GHG program.

1.10 Other Forms of Credit

Emission Trading Programs and Other Binding Limits

China has a national emissions trading scheme only cover the high-emission industries, such as thermal power generation, petrochemical, chemical, building materials, iron and steel, non-ferrous, paper, aviation and other key emission industries that emitted at least 26,000 tons of CO₂e/year, not including renewable project². And the project activity is not included the mandatory emission control scheme and there is no emission cap enforced for the project owner according to the enforced company list³ in public information.

Although the project had been registered as a CDM project on 07/10/2011, whose crediting period is from 07/10/2011 to 06/10/2018, it is promised that the emission reduction in the monitoring period from 01/11/2013 to 30/04/2018 (the first and last days included) will request for VCUs and will not be submitted under any other GHG programs or mechanism. Hence, it is confirmed that the emission reductions in this monitoring period will not be double counted.

Other Forms of Environmental Credit

The project has been registered as a CDM project. No other forms of environmental credit have been claimed by the project.

1.11 Sustainable Development

The proposed project would contribute to the sustainable development of the host country and meet the Sustainable Development Goals of UN through the following aspects:

² http://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202103/t20210330_826728.html

³ <http://www.mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907682380.pdf>

- Use local renewable energy to replace local coal-based power plants and thereby reduce CO₂ emissions as well as associated emissions such as PM, SO_x and NO_x, creating local and global air pollutants benefits. Ensure the access to affordable, reliable and sustainable energy for the China southern residents. Thus, the project achieved SDG 7⁴.
- Achieve 342,023 tCO₂e emission reduction in this monitoring period. Thus the project achieved SDG 13⁵.
- Create approximately 103 employment opportunities during the project operation and construction, providing local residents with full and productive employment and decent work. Thus, the project achieved SDG 8⁶.

2 SAFEGUARDS

2.1 No Net Harm

According to the EIA (Environmental Impact Assessment) conducted by a third party, Yunnan University, the environmental impact of the proposed project was reduced to the minimum level. Thus, there are no negative environmental and/or socio-economic impacts due to the project. In fact, the project as a clean renewable energy project can reduce greenhouse gas emissions and the environmental pollution caused by fossil fuels consumption. Meanwhile, the implementation of the project improves local socio-economic development through creating career opportunities and paying taxes.

2.2 Local Stakeholder Consultation

Local Stakeholder Consultation during the project preparation stage:

In order to get the comments and suggestions from local stakeholders, the project owner visited local residents and coherent organizations for stakeholder consultation in June, 2009. 100 questionnaires were sent to the stakeholders by the project developer.

The survey showed that the proposed project receives strong support from local people, which is closely linked to the fact that the majority of local residents have some understandings with hydro power projects. All the respondents believed that the Project would have overall positive impacts on their livelihoods with increase of job opportunities, increase of income and others. The concern about the environmental impacts has been clarified in EIA. All the impacts would be reduced by mitigating measures.

⁴ <https://sdgs.un.org/goals/goal7>

⁵ <https://sdgs.un.org/goals/goal13>

⁶ <https://sdgs.un.org/goals/goal8>

100% of the investigated people are supportive to the project construction.

Local Stakeholder Consultation during the project implementation stage:

Communications with local stakeholders are being carried out at periodic intervals. In this monitoring period, the project owner carried out questionnaire survey for the local stakeholder to collect the relevant comments and suggestions in April 2014, August 2016 and March 2018. And there are no negative comments received for the project. In line with VCS requirements all the processes have been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals.

2.3 AFOLU-Specific Safeguards

There is not applicable due to the project is non-AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project is a hydropower station with the total installed capacity of 36MW. The hydro-junction essentially consists of the water retaining structure (barrage), the sluice works, as well as the water intake and power generation system. The sluice works include free overflow spillway, flood discharging tunnel and desalting tunnel.

Two turbines and two generators have been installed. It is expected that the annual electricity delivered to the grid is 143,652MWh to CSPG and replace the same amount of electricity generated by fossil fuel fired power plants connected to CSPG. The construction of the Project was started on 30/06/2008. The turbine and generator started operation on 13/01/2010. The key events of its implementation are summarized in the Table 1.

Table 1 Key events of the project implementation

Key events	Date
The date on the contract of construction signed	30/06/2008
The date on which the turbines and Generators started operation	13/01/2010
The Project registered under CDM	07/10/2011
1 st monitoring period under CDM	07/10/2011~30/04/2012 (Both days included)

2nd monitoring period under CDM	01/05/2012~31/10/2013 (Both days included)
The Project registered under VCS	14/11/2012
1st monitoring period under VCS	25/01/2010~06/10/2011 (Both days included)
2nd monitoring period under VCS	01/11/2013~30/04/2018 (Both days included)

The project has been registered as a Clean Development Mechanism (CDM) project in UNFCCC on 07/10/2011 (UNFCCC Ref. 4821), with the renewable 3*7 crediting period started from 07/10/2011. 30,655 CERs from 07/10/2011 to 30/04/2012 and 72,018 CERs from 01/05/2012 - 31/10/2013 have been issued under CDM mechanism.

The project also has registered as a VCS project on 14/11/2012 (VCS ID 928), issued 172,001 tCO₂e during the VCS first monitoring period from 25/01/2010 to 06/10/2011.

The electricity for the project is generated by two units of HLA551c-LJ-262 turbines and two units of SF-J18-30/5050 generators. The expected operational lifetime is 25 years. Key technical specifications are listed in Table 2 below.

Table 2 Key technical parameters of the project

Generator		Turbine	
Model	SF-J18-30/5050	Model	HLA551c-LJ-262
Quantity	2	Quantity	2
Rated Power	18 MW	Rated Power	18.66 MW
Rated Voltage	10.5 kV	Rated Water Head	37m
Rated Current	1100 A	Rated Flux	55.42 m ³ /s
Rated Speed	200 r/min	Rated Speed	200 r/min

The power is delivered to the CSPG via 110kV lines to a designated transformer station. The technical process is indicated in the Figure 2⁷.

⁷ During the construction period, there is a back-up line at the project site was used as a power resource and used for emergency. After construction was finished the back-up line has stopped. The back-up line will not be used anymore and no potential emission can be considered.

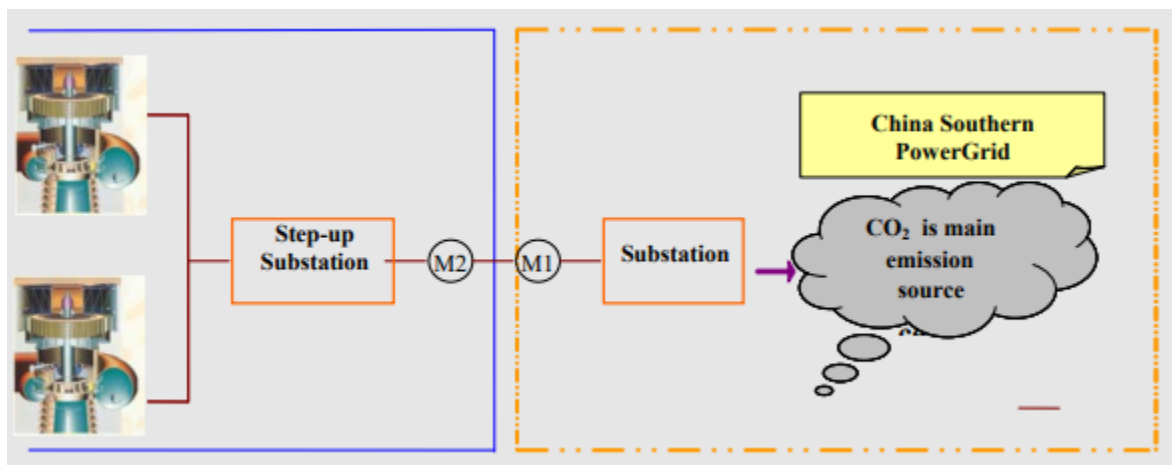


Figure2 The flow diagram of the project

During this monitoring period, the project is normal operation, no special event occurred which may impact the applicability of the methodology, the GHG emission reductions or removals and monitoring. And the project is implemented in accordance with the submitted and revised PD.

3.2 Deviations

3.2.1 Methodology Deviations

There is no deviation applied to this monitoring period.

3.2.2 Project Description Deviations

There is a deviation for the crediting period. The project is registered under VCS standard Version 3.2 and completed validation before 19/03/2020. Thus, it remains eligible to apply the crediting period requirements under VCS Version 3 which shall be a maximum of ten years and may be renewed at most twice, so the first renewable crediting period of the project should be updated from 25/01/2010 ~ 06/10/2011 to 25/01/2010 ~ 24/01/2020. However, as the project is also registered as a CDM project with a seven-year twice renewable project crediting period and the total CDM crediting period is from 07/10/2011 to 06/10/2032. Therefore the total length of VCS crediting period should be no more than 21 years which is from 25/01/2010 to 24/01/2031. This monitoring period belongs to the first VCS crediting period.

3.3 Grouped Projects

The Project is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

The parameter ($FC_{i,y}$, $NCV_{i,y}$, $EF_{c,i,y}$, GEN_y , $CAP_{i,y}$, electricity imports to CSPG, electricity self-consumption ratio) used for calculation of the baseline grid emission factor $EF_{grid,CM,y}$ available at validation in the registered PDD are replaced by the parameter of $EF_{grid,CM,y}$ directly here. With consideration of the fact of the Project, data and parameters that are available at validation are summarized in below table.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO ₂ e/MWh
Description	Emission factor of the Grid
Source of data	Registered CDM PDD
Value applied	0.7879
Justification of choice of data or of description of measurement methods and procedures applied	Published official statistics by Chinese DNA.
Purpose of Data	Calculation of baseline emissions
Comments	The value of $EF_{grid,CM,y}$ calculated is determined ex-ante and is fixed during the first crediting period.

Data / Parameter	CAP_{BL}
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data	ACM0002 version 12.1.0 and registered PDD
Value applied	0

Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of project emissions.
Comments	Determined ex-ante and fixed for the first crediting period

Data / Parameter	A_{BL}
Data unit	m ²
Description	Area of the reservoir measured in 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	ACM0002 version 12.1.0 and registered PDD
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of project emissions or actual net GHG removals by sinks
Comments	Determined ex-ante and fixed for the first crediting period

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{export,y}$
Data unit	MWh

Description	Electricity supplied by the project activity to the grid in year y																					
Source of data	Project site																					
Description of measurement methods and procedures to be applied	Data type: Continuously measured. Archiving procedure: Electronic. Responsibility: The electricity meter was calibrated by a qualified third party regularly. Calibration Frequency: Annually.																					
Frequency of monitoring/recording	Continuously measured, and monthly recorded																					
Value monitored	Please refer to section 5.1 for the monthly data. <table><tr><td>Year</td><td>Value</td></tr><tr><td>01/11/2013-31/12/2013</td><td>11,894.465</td></tr><tr><td>01/01/2014-31/12/2014</td><td>97,312.177</td></tr><tr><td>01/01/2015-31/12/2015⁸</td><td>89,251.190</td></tr><tr><td>01/01/2016-31/12/2016</td><td>107,339.760</td></tr><tr><td>01/01/2017-31/12/2017</td><td>117,568.000</td></tr><tr><td>01/01/2018-30/04/2018</td><td>11,666.160</td></tr><tr><td>Total</td><td>435,031.752</td></tr></table>						Year	Value	01/11/2013-31/12/2013	11,894.465	01/01/2014-31/12/2014	97,312.177	01/01/2015-31/12/2015 ⁸	89,251.190	01/01/2016-31/12/2016	107,339.760	01/01/2017-31/12/2017	117,568.000	01/01/2018-30/04/2018	11,666.160	Total	435,031.752
Year	Value																					
01/11/2013-31/12/2013	11,894.465																					
01/01/2014-31/12/2014	97,312.177																					
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01/01/2017-31/12/2017	117,568.000																					
01/01/2018-30/04/2018	11,666.160																					
Total	435,031.752																					
Monitoring equipment	The bi-directional meters (M ₁ ,M ₂) with measurement accuracy of 0.2s are calibrated annually by the qualified third party. When M ₁ is out of order, the readings from M ₂ will be used for reference. During this monitoring period, M ₂ was never being used. <table><tr><td>No.</td><td>Type</td><td>Serial number</td><td>Accuracy class</td><td>Date of calibration</td><td>Validity</td></tr><tr><td>M₁</td><td>DTS5</td><td>02299816</td><td>0.2S</td><td>25/04/2013 23/04/2014 21/04/2015 16/04/2016 14/04/2017 04/04/2018</td><td>24/04/2014 22/04/2015 20/04/2016 15/04/2017 13/04/2018 03/04/2019</td></tr></table>						No.	Type	Serial number	Accuracy class	Date of calibration	Validity	M ₁	DTS5	02299816	0.2S	25/04/2013 23/04/2014 21/04/2015 16/04/2016 14/04/2017 04/04/2018	24/04/2014 22/04/2015 20/04/2016 15/04/2017 13/04/2018 03/04/2019				
No.	Type	Serial number	Accuracy class	Date of calibration	Validity																	
M ₁	DTS5	02299816	0.2S	25/04/2013 23/04/2014 21/04/2015 16/04/2016 14/04/2017 04/04/2018	24/04/2014 22/04/2015 20/04/2016 15/04/2017 13/04/2018 03/04/2019																	

⁸ From May 2015 onwards, the meter record date is change from 24:00 15th of each month to 24:00 last day.

	M ₂	DTSD3 41	200811 670201 35	0.2S	17/04/2013 15/04/2014 12/04/2015 09/04/2016 07/04/2017 03/04/2018	16/04/2014 14/04/2015 11/04/2016 08/04/2017 06/04/2018 02/04/2019
QA/QC procedures to be applied	The meters are calibrated annually according to the sectoral requirement. Data measured by the meter is cross checked by Electricity Transaction Notes (ETNs), the conservative data between the measured data and data from ETNs are used to calculate VCUs during the verification.					
Purpose of the data	Calculation of baseline emissions					
Calculation method	-					
Comments	-					

Data / Parameter	$EG_{import,y}$	
Data unit	MWh	
Description	Electricity imported by the project activity from the grid in year y	
Source of data	Project site	
Description of measurement methods and procedures to be applied	Data type: Continuously measured. Archiving procedure: Electronic. Responsibility: The electricity meter was calibrated by a qualified third party regularly. Calibration Frequency: Annually.	
Frequency of monitoring/recording	Continuously measured, and monthly recorded.	
Value monitored	Please refer to section 5.1 for the monthly data.	
	Year	Value
	01/11/2013-31/12/2013	27.456
	01/01/2014-31/12/2014	209.792
	01/01/2015-31/12/2015	210.320
	01/01/2016-31/12/2016	205.920
	01/01/2017-31/12/2017	184.800
	01/01/2018-30/04/2018	95.040

	Total		933.328			
Monitoring equipment	The bi-directional meters (M ₁ , M ₂) with measurement accuracy of 0.2s are calibrated annually by the qualified third party. When M ₁ is out of order, the readings from M ₂ will be used for reference. During this monitoring period, M ₂ was never being used.					
	No .	Type	Serial number	Accuracy class	Date of calibration	Validity
	M ₁	DTS5	02299816	0.2S	25/04/2013	24/04/2014
					23/04/2014	22/04/2015
					21/04/2015	20/04/2016
					16/04/2016	15/04/2017
14/04/2017					13/04/2018	
04/04/2018	03/04/2019					
M ₂	DTSD341	20081167020135	0.2S	17/04/2013	16/04/2014	
				15/04/2014	14/04/2015	
				12/04/2015	11/04/2016	
				09/04/2016	08/04/2017	
				07/04/2017	06/04/2018	
03/04/2018	02/04/2019					
QA/QC procedures to be applied	The meters are calibrated annually according to the sectoral requirement. Data measured by the meter is cross checked by purchased receipts, the conservative data between the measured data and data from receipts are used to calculate VCUs during the verification.					
Purpose of the data	Calculation of baseline emissions					
Calculation method	-					
Comments	-					

Data / Parameter	<i>EG_{backup,y}</i>
Data unit	MWh
Description	Electricity imported through backup line from the grid in year y
Source of data	Project site
Description of measurement methods and	Data type: Continuously measured. Archiving procedure: Electronic.

procedures to be applied	Responsibility: The electricity meter was calibrated by a qualified third party regularly. Calibration Frequency: Annually.					
Frequency of monitoring/recording	Continuous measurement and monthly recording.					
Value monitored	0					
Monitoring equipment	The meter (M_{backup}) with measurement accuracy of 1.0 is calibrated annually by the qualified third party. During this monitoring period, backup line has never been used.					
	No.	Type	Serial number	Accuracy class	Date of calibration	Validity
	M_{backup}	HX3 000	060001 004134	1.0	11/04/2013 07/04/2014 03/04/2015 31/03/2016 29/03/2017 26/03/2018	10/04/2014 06/04/2015 02/04/2016 30/03/2017 28/03/2018 25/03/2019
QA/QC procedures to be applied	Metering equipment will be calibrated annually according to the sectoral requirement. Data measured will be cross checked by ETNs.					
Purpose of the data	Calculation of baseline emissions					
Calculation method	-					
Comments	-					

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	Project site
Description of measurement methods and procedures to be applied	Measured. Determine the installed capacity based on recognized standards yearly, i.e. nameplates of the turbines and generators installed at the project site and the equipment purchase contract

Frequency of monitoring/recording	Yearly
Value monitored	36
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	A_{PJ}														
Data unit	m ²														
Description	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m ²)														
Source of data	Project site														
Description of measurement methods and procedures to be applied	The data is measured by professional design institute annually														
Frequency of monitoring/recording	Annually														
Value monitored	<table border="1"> <thead> <tr> <th>Year</th><th>Value</th></tr> </thead> <tbody> <tr> <td>2013</td><td>2,732,305</td></tr> <tr> <td>2014</td><td>2,732,380</td></tr> <tr> <td>2015</td><td>2,732,305</td></tr> <tr> <td>2016</td><td>2,732,355</td></tr> <tr> <td>2017</td><td>2,732,385</td></tr> <tr> <td>2018</td><td>2,732,380</td></tr> </tbody> </table>	Year	Value	2013	2,732,305	2014	2,732,380	2015	2,732,305	2016	2,732,355	2017	2,732,385	2018	2,732,380
Year	Value														
2013	2,732,305														
2014	2,732,380														
2015	2,732,305														
2016	2,732,355														
2017	2,732,385														
2018	2,732,380														

Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	-

4.3 Monitoring Plan

1. Organizational and monitoring structure

A Monitoring Team has been established consisting of three units, which are data recording, data management and QA/QC. The staffs of the team have been selected from different departments of the project company. The Team Leader holds the overall responsibilities to the monitoring of the project. His/her role is to ensure that the data monitored are accurately recorded, properly archived, QA/QC procedure is timely carried out and the entire monitoring process is strictly in line with the CDM requirements. He/she also acts as a liaison with the project manager of the consultancy company on a needy basis.

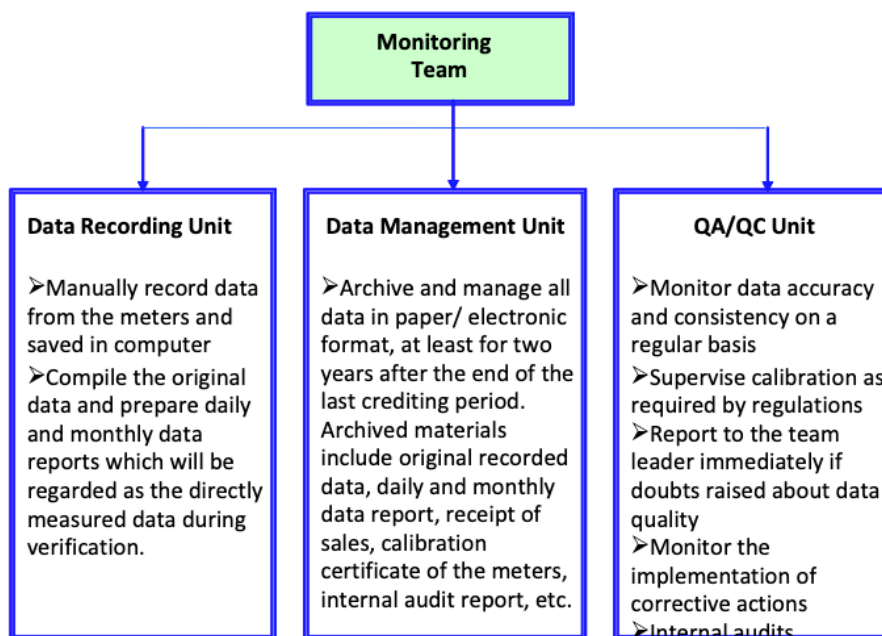


Figure 3 Structure of the monitoring team

2. Monitoring system and data collection

Bidirectional metering equipment with the rated precision of 0.2s installed at the substation of Grid Company and project site. The meter at the substation of Grid Company (M_1) has been used to monitor the supplied and imported electricity. If the metering equipment of the Grid Company failed to monitor the electricity, the metering equipment at the project site (M_2) has been used to report the data. During this monitoring period, the relevant data was from M_1 and M_2 was never being used.

The electricity imported through backup line from the grid could be measured by the meter (M_{Backup}) installed on the back-up line with accuracy of 1.0. Figure 4 illustrates the positioning of monitoring equipment.

The above mentioned monitoring parameters $EG_{export,y}$, $EG_{import,y}$ and EG_{backup} have been measured continuously. The implementation of the monitoring system has been strictly in line with the Power Purchase Agreement signed between the project company and the grid company.

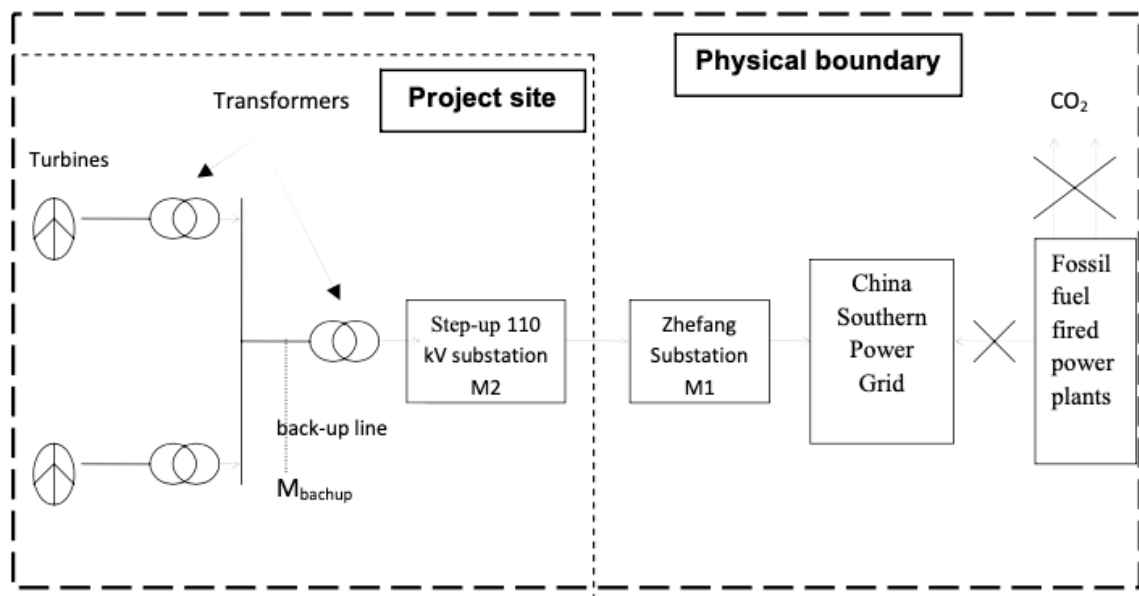


Figure 4 Positioning of monitoring equipment

The installed capacity of the hydro power plant after the implementation of the project activity (Cap_{PJ}) is yearly determined based on recognized standards i.e. by nameplates of the turbines and generators installed at the project site and the equipment purchase contract.

The area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (A_{PJ}) is measured by professional design institute annually.

Data recording: In this monitoring period, before 16/05/2015, the readings of the meters have been normally recorded by the grid company and the plant operation staff together on 24:00 of 15th of each month. From 16/05/2015 onwards, the grid company and the plant operation staff

read and record the meters at 24:00 of the last day of each month. These electricity data is approved by the local grid company. All data including calibration records are kept until 2 years after the end of the total credit time of the VCS project.

Data aggregation: The net electricity supplied to the grid is summed over the monitoring period. Physical document such as paper - based maps, diagrams and environmental assessments have been collected in a central place, together with this monitoring plan. All paper-based information and the electronic records are stored by the technology department of the project owner and will be kept until 2 years after the end of the crediting period of the VCS project.

Calculation: Electricity supplied by the project activity to the grid ($EG_{export,y}$) and electricity imported by the project activity from the grid ($EG_{import,y}$) are monitored by the bi-directional meter (M_1). The electricity imported through backup line ($EG_{backup,y}$) is monitored by M_{backup} . Net electricity supplied by the project activity to the grid ($EG_{facility,y}$) can be calculated by $EG_{import,y}$ and $EG_{export,y}$ and $EG_{backup,y}$.

$$EG_{facility,y} = EG_{export,y} - EG_{import,y} - EG_{backup,y}$$

See section 5 for calculations of emission reductions.

Reporting: The recordings of electricity are collected in an Excel sheet and reported in the VCS - MR. All the events or situations that occurred during the monitoring period, which may impact the accuracy of data, have been detailed recorded by the project owner in the run log and summarized in VCS-MR.

3. Quality Assurance and Quality Control

QA/QC is to ensure the accuracy of data collected through measures including periodic calibration of monitoring meters, corrective actions, and internal audits.

3.1 Data quality monitoring

QA/QC unit is responsible for comparing monthly data reports from Grid company with on - site original data, crosschecking receipts with data reports to ensure data consistency and accuracy before transferring data to the data management unit. If problems occur, QA/QC unit manager will report to the team leader immediately.

3.2 Calibration

Procedure about calibration is consistent with what is stipulated in the Power Purchase Agreement. The metering equipments are calibrated by an accredited calibration agency according to the sectoral requirement. Calibration Certificates and relevant documents are collected by the QA/QC unit and transferred to data management unit for archiving.

3.3 Corrective actions

If the metering equipment of the Grid Company (M_1) failed to monitor the electricity, the metering equipment at the project site (M_2) will be used to report the data and the QA/QC unit manager will initiate and supervise the implementation of corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications.

3.4 Internal audits

Internal audit procedure will be initiated under any of the below circumstances:

- a. modification of the monitoring system
- b. two months prior to verification

Firstly, the monitoring system will be checked on if the system functions properly and if the monitored results are correct. Secondly, spot check of daily/monthly data report will be undertaken. Internal audit report will be submitted upon completion of the procedure.

4. emergency procedures

If problems which can affect the quality of data occur, the QA/QC unit manager will initiate and supervise the implementation of corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. Should the metering equipment (M_1 , M_2) fail, no emission reductions shall be counted.

During this monitoring period, the metering equipment worked very well, and there was no emergency occurred.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline emission BE_y during the monitoring period results from:

$$BE_y = EG_{facility,y} \times EF_{grid,CM,y} = (EG_{export,y} - EG_{import,y} - EG_{backup,y}) \times EF_{grid,CM,y}$$

Where:

BE_y = Baseline emissions in year y (tCO₂e)

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

$EG_{export,y}$ = Electricity supplied by the project activity to the grid in year y

$EG_{import,y}$ = Electricity supplied to the project activity from the Grid in year(y)

$EG_{backup,y}$ = Electricity imported through backup line from the grid in year y

$EF_{grid,CM,y}$ = Combined margin CO₂ emission factor for grid connected power generation

The emission factor $EF_{grid,CM,y}$ is calculated ex ante and fixed for the first crediting period.

The $EF_{grid,CM,y}$ is equal to 0.7879 tCO₂e/MWh.

Please refer to the ER spreadsheet for the monthly monitored data.

The annual baseline emissions are as following:

Period	Electricity supplied by the project activity to the grid (MWh)	Electricity supplied to the project activity from the Grid (MWh)	Electricity imported through backup line from the grid (MWh)	Net electricity delivered to the Grid from the Project Activity (MWh)	EF (tCO ₂ e/MWh)	Baseline Emissions (tCO ₂ e)
01/11/2013-31/12/2013	11,894.465	27.456	0	11,867.009	0.7879	9,350
01/01/2014-31/12/2014	97,312.177	209.792	0	97,102.385	0.7879	76,506
01/01/2015-31/12/2015	89,251.190	210.320	0	89,040.870	0.7879	70,155
01/01/2016-31/12/2016	107,339.760	205.920	0	107,133.840	0.7879	84,410
01/01/2017-31/12/2017	117,568.000	184.800	0	117,383.200	0.7879	92,486
01/01/2018-30/04/2018	11,666.160	95.040	0	11,571.120	0.7879	9,116
Total	435,031.752	933.328	0	434,098.424	0.7879	342,023

*Note: In this monitoring period, before 16/05/2015, the readings of the meters have been normally recorded by the grid company and the plant operation staff together on 24:00 of 15th of each month. From 16/05/2015 onwards, the grid company and the plant operation staff read and record the meters at 24:00 of the last day of each month. As per the statement from local power grid company, the amount of electricity from 01/11/2013 to 15/11/2013, 16/12/2013 to 31/12/2013, 16/12/2014 to 31/12/2014, 01/01/2015 to 15/01/2015 has been confirmed.

In summary, the baseline emissions BE_y during this monitoring period is 342,023 tCO₂e.

5.2 Project Emissions

In April 2013, area of the reservoir measured in the surface of the water of the project is 2,732,305 m², Installed capacity of the project is 36,000,000W, the power density of the project = $(Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL}) = 13.176 \text{ W/ m}^2$, greater than 10W/m².

In April 2014, area of the reservoir measured in the surface of the water of the project is 2,732,380 m², Installed capacity of the project is 36,000,000W, the power density of the project = $(Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL}) = 13.175 \text{ W/ m}^2$, greater than 10W/m².

In April 2015, area of the reservoir measured in the surface of the water of the project is 2,732,305 m², Installed capacity of the project is 36,000,000W, the power density of the project = $(Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL}) = 13.176 \text{ W/ m}^2$, greater than 10W/m².

In April 2016, area of the reservoir measured in the surface of the water of the project is 2,732,355 m², Installed capacity of the project is 36,000,000W, the power density of the project = $(Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL}) = 13.175 \text{ W/ m}^2$, greater than 10W/m².

In April 2017, area of the reservoir measured in the surface of the water of the project is 2,732,385 m², Installed capacity of the project is 36,000,000W, the power density of the project = $(Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL}) = 13.175 \text{ W/ m}^2$, greater than 10W/m².

In April 2018, area of the reservoir measured in the surface of the water of the project is 2,732,380 m², Installed capacity of the project is 36,000,000W, the power density of the project = $(Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL}) = 13.175 \text{ W/ m}^2$, greater than 10W/m².

According to ACM0002, the Power Density of the power plant is greater than 10 W/ m², the project emissions is zero.

5.3 Leakage

According to the ACM0002, Leakage (L_y) is not considered.

5.4 Net GHG Emission Reductions and Removals

According to the Section 5.1, 5.2 and 5.3 above,

$$BE_y = 342,023 \text{ tCO}_2\text{e};$$

$$PE_y = 0 \text{ tCO}_2\text{e};$$

$$LE_y = 0 \text{ tCO}_2\text{e};$$

$$\text{Therefore, } ER_y = BE_y - PE_y - LE_y = 342,023 \text{ tCO}_2\text{e}$$

This monitoring period started from 01/11/2013 to 30/04/2018, with totally 1,642 days. Based on the annual estimated emission reductions from the registered VCS PD, the amount of emission reductions for this monitoring period would be $113,189 \text{ tCO}_2\text{e} / 365 \text{ days} \times 1642 \text{ days} = 509,195 \text{ tCO}_2\text{e}$. The actual emission reductions in this monitoring period (1,642 days) are 342,023 tCO₂e, which is 32.83% less than the estimated value in the revised PDD. It is because the water flow caused by the abundant rainfall for the monitoring period is lower than other seasons in previous year. So, it is reasonable that during this monitoring period, the actual emission reduction is less than the estimated value.

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01/11/2013 - 31/12/2013	9,350	0	0	9,350
2014	76,506	0	0	76,506
2015	70,155	0	0	70,155
2016	84,410	0	0	84,410
2017	92,486	0	0	92,486
01/01/2018 - 30/04/2018	9,116	0	0	9,116
Total	342,023	0	0	342,023