



YUNNAN MANGLI HYDROPOWER PROJECT



Document Prepared by Climate Bridge (Shanghai) Ltd.

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Yunnan Mangli Hydropower Project (hereinafter referred as “the project”) is located on Mangshi River in Luxi City, Yunnan Province, P. R. China, developed and operated by Datang Mangli Hydropower Development Company Limited. The project has installed two 18MW hydro turbines with a total capacity of 36MW. They generate electricity and supply it to China Southern Power Grid (CSPG), which is expected to supply 143,652 MWh to the grid annually.

The Project started construction on 30-Jun-2008. The first turbine of the Project started commissioning on 13-Jan-2010. And this project was registered as a VCS project (VCS ID 928) on 14-Nov-2012. This project started operation on 13-Jan-2010. In the beginning period of the operation, the monitoring data of the project was not complete. Since 25-Jan-2010, the data have been monitored and collected following the monitoring procedure in Section 4.3. Therefore, starting date of the crediting period is 25-Jan-2010. The project would achieve an amount of 113,189 tCO₂e annual emission reductions in the first crediting period from 25-Jan-2010 to 24-Jan-2020, and 51,887 tCO₂e of annual emission reductions in the second crediting period from 25-Jan-2020 to 24-Jan-2030.

During the monitoring period from 01-Aug-2021 to 31-May-2023, the project has supplied electricity of 175,567.920 MWh and achieved 63,413 tCO₂e emission reductions by replacing electricity generated by fossil fuel fired power plants connected to CSPG.

Audit Type	Period	Program	VVB Name	Number of years
Validation	05-Oct-2011	CDM	DET NORSKE VERITAS	-
Validation (renew of crediting period)	01-Nov-2021	VCS	LGAI Technological Center, S.A. (Applus+ Certification)	-
1 st Verification	25-Jan-2010 to 06-Oct-2011	VCS	Bureau Veritas Certification Holding SAS	1.70 (i.e. 620 days)
2 nd Verification	07-Oct-2011 to 30-Apr-2012	CDM	BUREAU VERITAS CERTIFICATION	0.57 (i.e. 207 days)
3 rd Verification	01-May-2012 to 31-Oct-2013	CDM	CTI Certification Co., Ltd	1.50 (i.e. 549 days)
4 th Verification	01-Nov-2013 to 30-Apr-2018	VCS	CTI Certification Co., Ltd	4.50 (i.e. 1,642 days)

5 th Verification	01-May-2018 to 31-Jul-2021	VCS	LGAI Technological Center, S.A. (Applus+ Certification)	3.25 (i.e. 1,188 days)
6 th Verification	01-Aug-2021 to 31-May-2023	VCS	CTI Certification Co., Ltd	1.83 (i.e. 669 days)
Total	25-Jan-2010 to 31-May-2023	-	-	13.36 (i.e. 4,875 days)

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.

1.3 Project Proponent

Organization name	Datang Mangli Hydropower Development Company Limited
Contact person	Luo Xianjun
Title	Project Manager
Address	Fenghua Road, Mangli City, Dehong District, Yunnan Province
Telephone	+86-21-23019950
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
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1.5 Project Start Date

13-Jan-2010 the date on which the Project started commissioning.

1.6 Project Crediting Period

The first crediting period of the project is from 25-Jan-2010 to 24-Jan-2020 (10 years), and the second crediting period is from 25-Feb-2020 to 24-Feb-2030 (10 years). This monitoring period belongs entirely to the second 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).

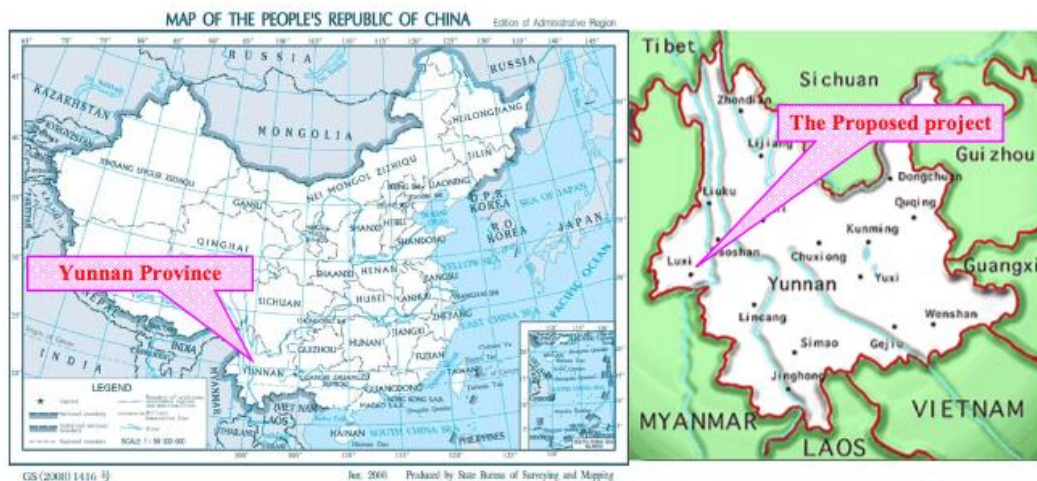


Figure 1 Location of the Project in Provincial Map

1.8 Title and Reference of Methodology

Following approved baseline & monitoring methodology is applied:

Methodology:

ACM0002: "Grid-connected electricity generation from renewable sources" (Version 20.0)

Reference:

<https://cdm.unfccc.int/UserManagement/FileStorage/AG07ZJQ3EXD42LT5YV9HR16M8KINPO>

Tools applied:

"Tool to calculate the emission factor for an electricity system" (version 07.0)

Reference:

<https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v7.0.pdf>

1.9 Participation under other GHG Programs

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

Total GHG emission reductions of 181,832 tCO₂e generated from 07-Oct-2011 to 31-Oct-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 and Supply Chain (Scope 3) Emissions

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 project¹. Thus, 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 list² in public information. Hence, it is confirmed that the emission reductions will not be double counted.

The project does not reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading.

Other Forms of Environmental Credit:

The project has not sought or received another form of GHG-related environmental credit, including renewable energy certificates.

Supply Chain (Scope 3) Emissions:

The Project generated electricity by utilization of renewable hydro sources, replacing the electricity generated by fossil fuel fired power plants of the power grid. For hydro power projects, the GHG emission reductions come from avoiding CO₂ emissions from those fossil fuel-based

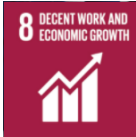
¹ http://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202103/t20210330_826728.html

² <http://mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907682380.pdf>

power plants connected to the grid, which does not happen in a supply chain. Therefore, it is confirmed that the Supply Chain (Scope 3) Emissions are not applicable for the project activity.

1.11 Sustainable Development Contributions

The project is located on Mangshi River in Luxi City, Yunnan Province, P. R. China, generated electricity from hydroelectric sources and feeds it into CSPG, replacing energy that would otherwise be generated by fossil fuels. In this monitoring period the project contributes to the following SDGs:

SDG	SDG indicators	Chinese Sustainable Development Progress	Project activity contribution
	SDG 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	By the end of 2015, China had fully solved the problem of providing electricity to all people without electricity and reached the goal of the Sustainable Development Agenda 15 years ahead of schedule. From 2015 to 2020, the share of non-fossil energy increased from 14.5% to 19.6%, while the share of raw coal decreased from 72.2% to 67.6%.	The project supplied 175,567.920 MWh renewable clean energy to CSPG during this monitoring period, which contributes to achieve China's stated sustainable development priorities "By 2030, the proportion of non-fossil energy consumption will reach about 25%".
	SDG 8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	China has deeply implemented the innovation-driven development strategy. Small, medium and micro enterprises have developed rapidly. Adhering to the policy of giving priority to employment, the unemployment rate has remained at a low level. By coordinating epidemic prevention and control with economic and social development, China has become the only major economy to achieve positive growth in 2020 and has made positive contributions to global	The project provides 26 long-term job opportunities for local people, which has a positive effect on the local economy and contributes to SDG 8. This contributes to one of China's actions for promoting sustainable developing: "by 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with

		economic recovery.	disabilities, and equal pay for work of equal value".
	SDG 13 Take urgent action to combat climate change and its impacts	In 2020, China's energy consumption per unit of GDP was reduced by 24.4% compared with 2012; carbon dioxide emissions per unit of GDP was reduced by 18.8% compared with 2015 and 48.4% compared with 2005, all of which have already fulfilled China's commitment to the international community in 2020 ahead of schedule.	The project achieved 63,413 tCO _{2e} emission reductions <i>which</i> contributes to SDG 13. This contributes to achieve China's stated sustainable development priorities " China's carbon dioxide emissions would strive to peak by 2030 and strive to achieve carbon neutrality by 2060 ".

These contribute to achieve China's stated sustainable development priorities, included strengthening resistance capacity to climate risks, increasing labour force participation rate, increasing the share of clean energy consumption.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.2	Renewable energy supplied to the power grid	Implemented activities to increase	175,567.920 MWh of electricity from clean and renewable sources through making use of hydrogen resources has been supplied to the power grid during this monitoring period, replacing fossil fuel generated electricity.	From 25-Jan-2010 to 31-May-2023, 1,391,456.320 MWh of electricity from clean and renewable sources through making use of hydro resources has been supplied to the power grid.
2)	8.5	Long-term job opportunities provided by implementation of the project	Implemented activities to increase	26 employees have signed long term labor contracts and receive stable payments due to the implementation of the project activity.	Provided 26 employment positions for local villagers in the reporting period.
3)	13.0	Tonnes of greenhouse gas emissions avoided	Implemented activities to increase	The project achieved a GHG emission reduction 63,413 tCO ₂ e during this monitoring period.	From 25-Jan-2010 to 31-May-2023, the project has achieved a GHG emission reduction of 961,197 tCO ₂ e.

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.

100% of the investigated people are supportive to the project construction. Detailed information about the questions and responses in the questionnaire can be found in the CDM PDD.

Local Stakeholder Consultation during the project implementation stage:

Communications with local stakeholders are being carried out at periodic intervals. Key implementation schedules or changes of the project will be communicated to the neighbourhood committee and the local residents, the comments and suggestions from residents will be collected by the project owner and considered during the implementation phase. 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. The relevant grievance redress mechanism is listed as following.

The project staff should conduct friendly contact and discussions with relevant stakeholders to explain the appeal; secondly, for any grievances that are not resolved by amicable negotiations,

the project manager should propose a solution and mediation which is performed by relevant authority based on all collected information; Thirdly, for any grievances that are not resolved through mediation, if necessary, it will be addressed by relevant legal method such as arbitration and courts.

In this monitoring period, the project owner carried out questionnaire survey for the local stakeholder to collect the relevant comments and suggestions in August 2021, June 2022 and April 2023. There are no negative comments received for the project during this monitoring period.

2.3 AFOLU-Specific Safeguards

Not applicable due to the project is not an 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, 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 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
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The power is delivered to the CSPG via 110kV lines to a designated transformer station. The technical process is indicated in the Figure 2.

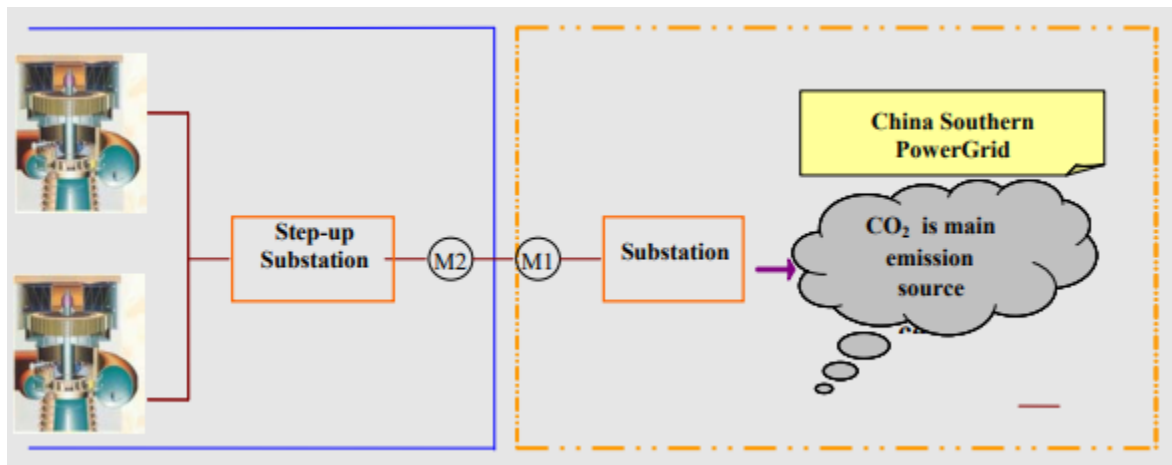


Figure2 The flow diagram of the project

During this monitoring period, the project operated continuously without any project design change, malfunctioning or technical failure. No events that may impact monitoring occurred in this monitoring period. But with much less precipitation than in previous years, emissions were reduced less than expected, as described in section 5.4.

3.2 Deviations

3.2.1 Methodology Deviations

No methodology deviations in this monitoring period.

3.2.2 Project Description Deviations

In previous monitoring reports, there is a deviation for the crediting period. The project is registered under VCS standard Version 3.2 and completed validation before 19-Mar-2020. Thus, it remains eligible to apply the crediting period requirements under VCS Version 3.3 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-Jan-2010 ~ 06-Jan-2011 to 25-Jan-2010 ~ 24-Jan-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-Oct-2011 to 06-Oct-2032. Therefore, the total length of VCS crediting period should be no more than 21 years which is from 25-Jan-2010 to 24-Jan-2031.

No project description deviations in this monitoring period.

However, the change does not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario.

3.3 Grouped Projects

The Project is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

The baseline grid emission factor $EF_{grid,CM,y}$ is obtained directly from the official source Notification on Determining Baseline Emission Factor of China's Grid by China's designated national authority (DNA). Thus, the relevant basis parameters for calculation of $EF_{grid,CM,y}$ are not described in detail here. With consideration of the fact of the Project, data and parameters that are available at validation are summarized in below tables.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO ₂ e/MWh
Description	The baseline grid emission factor
Source of data	2019 Baseline Emission Factors for Regional Power Grids
Value applied	0.3612
Justification of choice of data or description of measurement methods and procedures applied	As per the requirements in "Tool to calculate the emission factor for an electricity system version 07.0"
Purpose of Data	Calculation of baseline emissions
Comments	The value of $EF_{grid,CM,y}$ calculated is determined ex-ante and fixed during the 2 nd 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 20.0 and registered renewed PD
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 2 nd 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 20.0 and registered renewed PD
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 2 nd 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	Monitoring: Electricity meter in control room measured the net quantity of electricity supplied by the project activity plant.					
	Data type: Continuously measured					
	Archiving procedure: Electronic					
	Responsibility: The monitoring team was responsible for monitoring, aggregating and processing original data, crosscheck and archiving of monitoring data, and the maintenance of the measuring equipment.					
Frequency of monitoring/recording	Calibration Frequency: The electricity meter was calibrated by a qualified third party annually					
	Continuously measured, and monthly recorded					
Value monitored	Please refer to the Emission Reductions Calculation Excel.					
	Year			Value		
	01-Aug-2021~31-Dec-2021			51,157.040		
	01-Jan-2022~31-Dec-2022			110,554.400		
	01-Jan-2023~31-May-2023			14,176.800		
	Total			175,888.240		
Monitoring equipment	The meter at the substation of Grid Company (M ₁) has been used to monitor the supplied and imported electricity. When M ₁ is out of order, the metering equipment at the project site (M ₂) will be used to report the data. The bidirectional meters (M ₁ , M ₂) are calibrated annually by the qualified third party.					
	The information of monitoring meters is listed below:					
	No.	Type	Serial number	Accuracy class	Date of calibration	Validity
	M ₁	DTSD718	05131SG000 0020015AD7 01411	0.5S	23-Nov-2020 20-Oct-2021 15-Oct-2022	22-Nov-2021 19-Oct-2022 14-Oct-2023
	M ₂	DTSD5	02299816	0.2S	23-Nov-2020 20-Oct-2021 15-Oct-2022	22-Nov-2021 19-Oct-2022 14-Oct-2023

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	Monitoring: Electricity meter in control room measured the net quantity of electricity supplied by the project activity plant. Data type: Continuously measured. Archiving procedure: Electronic. Responsibility: The monitoring team was responsible for monitoring, aggregating and processing original data, crosscheck and archiving of monitoring data, and the maintenance of the measuring equipment. Calibration Frequency: The electricity meter was calibrated by a qualified third party annually. Calibration Frequency: The electricity meter was calibrated by a qualified third party annually.										
Frequency of monitoring/recording	Continuously measured, and monthly recorded.										
Value monitored	Emission Reductions Calculation Excel. <table border="1"> <thead> <tr> <th>Year</th><th>Value</th></tr> </thead> <tbody> <tr> <td>01-Aug-2021~31-Dec-2021</td><td>50.160</td></tr> <tr> <td>01-Jan-2022~31-Dec-2022</td><td>153.120</td></tr> <tr> <td>01-Jan-2023~31-May-2023</td><td>117.040</td></tr> <tr> <td>Total</td><td>320.320</td></tr> </tbody> </table>	Year	Value	01-Aug-2021~31-Dec-2021	50.160	01-Jan-2022~31-Dec-2022	153.120	01-Jan-2023~31-May-2023	117.040	Total	320.320
Year	Value										
01-Aug-2021~31-Dec-2021	50.160										
01-Jan-2022~31-Dec-2022	153.120										
01-Jan-2023~31-May-2023	117.040										
Total	320.320										

Monitoring equipment	The meter at the substation of Grid Company (M₁) has been used to monitor the supplied and imported electricity. When M₁ is out of order, the metering equipment at the project site (M₂) will be used to report the data. The bidirectional meters (M₁, M₂) are calibrated annually by the qualified third party. The information of monitoring meters is down below: <table><tr><th>No</th><th>Type</th><th>Serial number</th><th>Accuracy class</th><th>Date of calibration</th><th>Validity</th></tr><tr><td>M₁</td><td>DTSD718</td><td>05131SG000 0020015AD7 01411</td><td>0.5S</td><td>23-Nov-2020 20-Oct-2021 15-Oct-2022</td><td>22-Nov-2021 19-Oct-2022 14-Oct-2023</td></tr><tr><td>M₂</td><td>DTSD5</td><td>02299816</td><td>0.2S</td><td>23-Nov-2020 20-Oct-2021 15-Oct-2022</td><td>22-Nov-2021 19-Oct-2022 14-Oct-2023</td></tr></table>	No	Type	Serial number	Accuracy class	Date of calibration	Validity	M ₁	DTSD718	05131SG000 0020015AD7 01411	0.5S	23-Nov-2020 20-Oct-2021 15-Oct-2022	22-Nov-2021 19-Oct-2022 14-Oct-2023	M ₂	DTSD5	02299816	0.2S	23-Nov-2020 20-Oct-2021 15-Oct-2022	22-Nov-2021 19-Oct-2022 14-Oct-2023
No	Type	Serial number	Accuracy class	Date of calibration	Validity														
M ₁	DTSD718	05131SG000 0020015AD7 01411	0.5S	23-Nov-2020 20-Oct-2021 15-Oct-2022	22-Nov-2021 19-Oct-2022 14-Oct-2023														
M ₂	DTSD5	02299816	0.2S	23-Nov-2020 20-Oct-2021 15-Oct-2022	22-Nov-2021 19-Oct-2022 14-Oct-2023														
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	$EG_{backup,y}$
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 procedures to be applied	Monitoring: Electricity meter in control room measured the net quantity of electricity supplied by the project activity plant. Data type: Continuously measured. Archiving procedure: Electronic. Responsibility: The monitoring team was responsible for monitoring, aggregating and processing original data, crosscheck and archiving of monitoring data, and the maintenance of the measuring equipment. Calibration Frequency: The electricity meter was calibrated by a qualified third party annually.

	Calibration Frequency: Annually.					
Frequency of monitoring/recording	Continuous measurement and monthly recording.					
Value monitored	0					
Monitoring equipment	The meter installed on the back-up line (M_{backup}) with measurement accuracy of 1.0 is calibrated annually by the qualified third party.					
	The information of monitoring meters is down below:					
	No.	Type	Serial number	Accuracy class	Date of calibration	Validity
	M_{backup}	WFET-1000 F	050013100 020205200 008947	1.0	23-Nov-2020 20-Oct-2021 15-Oct-2022	22-Nov-2021 19-Oct-2022 14-Oct-2023
	During this monitoring period, backup line has never been used.					
QA/QC procedures to be applied	-					
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	Once at the beginning of each crediting period as per renewed PD for 2 nd crediting period

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
Source of data	Project site
Description of measurement methods and procedures to be applied	Once at the beginning of 2nd crediting period.
Frequency of monitoring/recording	Once at the beginning of each crediting period
Value monitored	2,732,305
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 and VCS requirements. He/she also acts as a liaison with the project manager of the consultancy company on a needy basis.

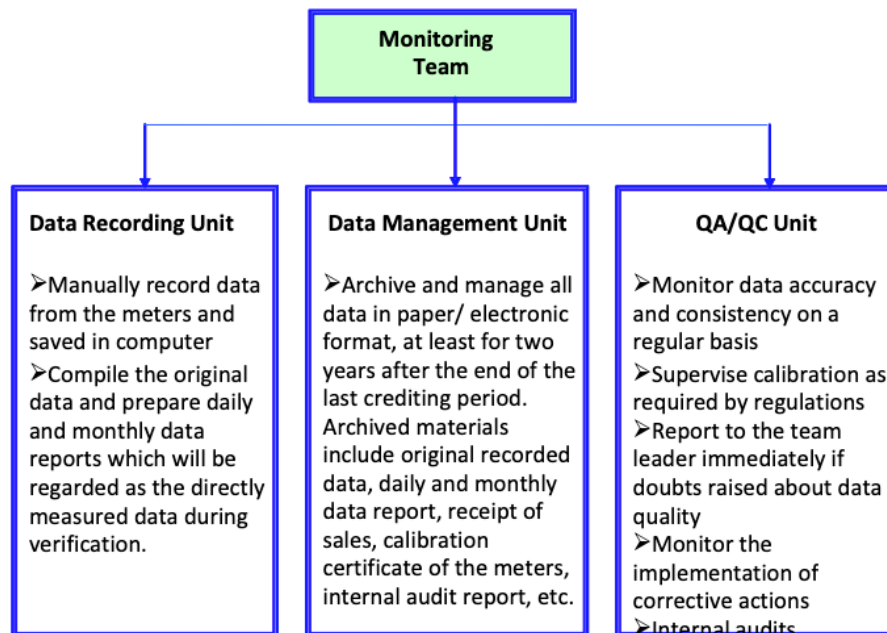


Figure 3 Structure of the monitoring team

2. Monitoring system and data collection

Bidirectional metering equipment installed at the substation of Grid Company and project site. The meter at the substation of Grid Company (M_1) with the rated precision of 0.5s 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) with the rated precision of 0.2s 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.

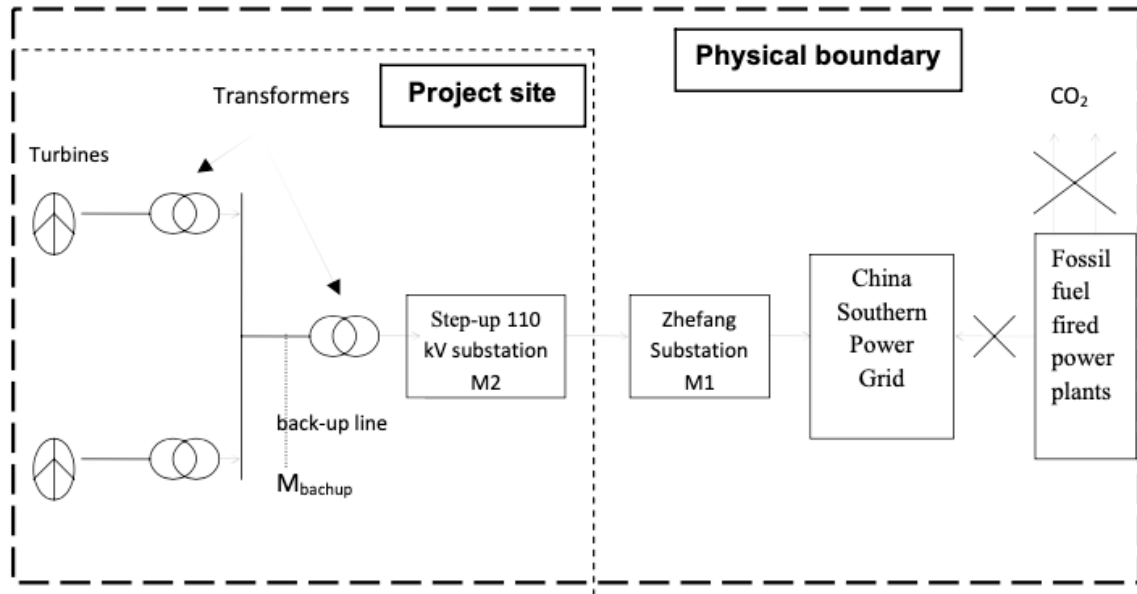


Figure 4 Positioning of monitoring equipment

The installed capacity of the hydro power plant after the implementation of the project activity (Cap_{PI}) is determined once at the beginning of each crediting period 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_{PI}) is measured once at the beginning of each crediting period by professional design institute.

Data recording: In this monitoring period, 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} . Quantity of net electricity generation supplied by the project plant/unit to the grid ($EG_{facility,y}$) can be calculated by $EG_{import,y}$ and $EG_{export,y}$ and $EG_{backup,y}$.

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

The calculation of emission reduction is shown in Section 5.

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.

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.

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) 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.

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

According to the renewed PD, the baseline emission BE_y during the monitoring period is calculated by the equation below:

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

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 (MWh/yr)

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

$EG_{import,y}$ = Electricity imported by 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 in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system”.

During the 2nd crediting period, the $EF_{grid,CM,y}$ is equal to 0.3612 tCO₂e/MWh.

For this monitoring period from 01-Aug-2021 to 31-May-2023,

$$EG_{export,y} = 175,888.240 \text{ MWh},$$

$$EG_{import,y} = 320.320 \text{ MWh},$$

$$EG_{backup,y} = 0 \text{ MWh},$$

$$EF_{grid,CM,y} = 0.3612 \text{ tCO}_2\text{e/MWh},$$

$$\text{So, } BE_y = (175,888.240 \text{ MWh} - 320.320 \text{ MWh}) \times 0.3612 \text{ tCO}_2\text{e/MWh} = \mathbf{63,413 \text{ tCO}_2\text{e}}$$

The values of $EG_{export,y}$ and $EG_{import,y}$ are conservative, by cross-checking the meter reading record with the Electricity Transaction Notes (ETNs), as shown in the following table. During this monitoring period, backup line has never been used.

Period	EG _{export,y} (MWh)			EG _{import,y} (MWh)		
	By Meter Reading	By ETN	The Higher value between ETN and Meter Reading	By Meter Reading	By electricity purchased receipts	The Higher value between electricity purchased receipts and Meter Reading
01-Aug-2021~31-Aug-2021	19,710.240	19,710.240	19,710.240	1.760	1.760	1.760
01-Sep-2021~30-Sep-2021	12,510.960	12,510.960	12,510.960	3.520	3.520	3.520
01-Oct-2021~31-Oct-2021	7,673.600	7,673.600	7,673.600	15.840	15.840	15.840
01-Nov-2021~30-Nov-2021	5,379.440	5,379.440	5,379.440	9.680	9.680	9.680
01-Dec-2021~31-Dec-2021	5,882.800	5,882.800	5,882.800	19.360	19.360	19.360
Subtotal in 2021	51,157.040	51,157.040	51,157.040	50.160	50.160	50.160
01-Jan-2022~31-Jan-2022	1,714.240	1,714.240	1,714.240	33.440	33.440	33.440
01-Feb-2022~28-Feb-2022	2,574.000	2,574.000	2,574.000	24.640	24.640	24.640
01-Mar-2022~31-Mar-2022	2,441.120	2,441.120	2,441.120	25.520	25.520	25.520
01-Apr-2022~30-Apr-2022	3,954.720	3,954.720	3,954.720	17.600	17.600	17.600
01-May-2022~31-May-2022	7,667.440	7,667.440	7,667.440	10.560	10.560	10.560
01-Jun-2022~30-Jun-2022	13,299.440	13,299.440	13,299.440	10.560	10.560	10.560
01-Jul-2022~31-Jul-2022	17,870.160	17,870.160	17,870.160	0.000	0.000	0.000
01-Aug-2022~31-Aug-2022	18,116.560	18,116.560	18,116.560	0.000	0.000	0.000

01-Sep-2022~30-Sep-2022	16,917.120	16,917.120	16,917.120	0.000	0.000	0.000
01-Oct-2022~31-Oct-2022	13,877.600	13,877.600	13,877.600	2.640	2.640	2.640
01-Nov-2022~30-Nov-2022	5,984.000	5,984.000	5,984.000	9.680	9.680	9.680
01-Dec-2022~31-Dec-2022	6,138.000	6,138.000	6,138.000	18.480	18.480	18.480
Subtotal in 2022	110,554.400	110,554.400	110,554.400	153.120	153.120	153.120
01-Jan-2023~31-Jan-2023	2,954.160	2,954.160	2,954.160	29.920	29.920	29.920
01-Feb-2023~28-Feb-2023	2,470.160	2,470.160	2,470.160	14.960	14.960	14.960
01-Mar-2023~31-Mar-2023	2,603.920	2,603.920	2,603.920	26.400	26.400	26.400
01-Apr-2023~30-Apr-2023	1,886.720	1,886.720	1,886.720	29.040	29.040	29.040
01-May-2023~31-May-2023	4,261.840	4,261.840	4,261.840	16.720	16.720	16.720
Subtotal in 2023	14,176.800	14,176.800	14,176.800	117.040	117.040	117.040
Total	-	-	175,888.240	-	-	320.320

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

Period	EG _{export,y} (MWh)	EG _{import,y} (MWh)	EG _{backup,y} (MWh)	EG _{facility,y} (MWh)	EF _{grid,CM,y} (tCO _{2e} /MWh)	Baseline Emissions (tCO _{2e})
01-Aug-2021~31-Dec-2021	51,157.040	50.160	0.000	51,106.880	0.3612	18,459
01-Jan-2022~31-Dec-2022	110,554.400	153.120	0.000	110,401.280	0.3612	39,876
01-Jan-2023~31-May-2023	14,176.800	117.040	0.000	14,059.760	0.3612	5,078
Total	175,888.240	320.320	0.000	175,567.920	/	63,413

In summary, the baseline emissions BE_y during this monitoring period is **63,413** tCO_{2e}.

5.2 Project Emissions

According to the methodology ACM00002 (Version 20.0), for most renewable energy project activities, PE_y = 0.

For hydro power project activities that result in new single or multiple reservoirs, project proponents shall account for CH₄ and CO₂ emissions from the reservoirs. However, If the power density of the project activity is greater than 10 W/m², PE_y = 0.

For the project activity, based on the 2021³ report for the surface area of full reservoir, area of the reservoir measured in the surface of the water of the project is 2,732,305 m². Installed

³The data is measured by professional design institute once at the beginning of 2nd crediting period.

capacity of the project is 36,000,000W, the power density of the project = $(Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL}) = 13.176 \text{ W/m}^2$, hence, $PE_y = 0$.

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,

$$BE_y = 63,413 \text{ tCO}_2\text{e};$$

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

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

$$\text{Therefore, } ER_y = BE_y - PE_y - LE_y = 63,413 \text{ tCO}_2\text{e}$$

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-Aug-2021~31-Dec-2021	18,459	0	0	18,459
01-Jan-2022~31-Dec-2022	39,876	0	0	39,876
01-Jan-2023~31-May-2023	5,078	0	0	5,078
Total	63,413	0	0	63,413

This monitoring period includes the period from 01-Aug-2021 to 31-May-2023, with totally 669 days. Based on the annual estimated emission reductions from renewed VCS PD, the amount of emission reductions for this monitoring period would be $51,887 \text{ tCO}_2\text{e} / 365 \text{ days} \times 669 \text{ days} = 95,102 \text{ tCO}_2\text{e}$. The actual emission reductions in this monitoring period are 63,413 tCO₂e, which is 33.32% less than the estimated value.

<u>Ex-ante emissions reductions</u>	<u>Achieved emissions reductions</u>	<u>Percent difference</u>	<u>Justification for the difference</u>
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95,102 Monitoring Period Total	63,413	-33.32%	the actual power generation was less than expected, mainly due to low rainfall and drought in the project basin. According to the 2021 China Flood and Drought Disaster Prevention Communique released by the Ministry of Water Resources ⁴, rainfall in northwestern Yunnan is 30 to 60 percent less than usual. According to Table 4 in the 2022 National Water Resources Bulletin⁵, although the amount of surface water resources in Yunnan in 2022 has rebounded compared with that in 2021, it has decreased by 18.4% compared with the average level of previous years. In addition, the period covered by this monitoring period of 2023 is more dry periods, from November of the previous year to May of the following year, and therefore less electricity generation than the annual average.
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⁴ http://www.mwr.gov.cn/sj/tjgb/zgshzhgb/202302/t20230222_1646546.html

⁵ http://www.mwr.gov.cn/sj/tjgb/szygb/202306/t20230630_1672556.html

APPENDIX 1: <SUPPORTING EVIDENCE>

Evidence for SDG 7 and 13: From project operation date onwards, the net electricity supplied to the grid and the emission reduction in every monitoring period have been listed in below table. Please refer to following links for details.

<https://registry.verra.org/app/projectDetail/VCS/928>

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

Period		The net electricity delivered to CCPG	Emission Reduction
From	To	MWh	tCO ₂ e
25-Jan-2010	06-Oct-2011	218,303.272	172,001
07-Oct-2011	30-Apr-2012	38907.440	30,655
01-May-2012	31-Oct-2013	191,873.352	151,177
01-Nov-2013	30-Apr-2018	434,098.424	342,023
01-May-2018	31-Jul-2021	332,705.912	201,928
01-Aug-2021	31-May-2023	175,567.920	63,413
Cumulative impacts		1,391,456.320	961,197

Evidence for SDG 8: The payroll of the project staff, including name, gender, wage, insurance and housing fund and other specific information has been submitted to VVB for verification. Thus, the payroll is not included as appendices to this report due to confidentiality requirement of the project proponent.