



YUNNAN MANGLI HYDROPOWER PROJECT



Document Prepared By LGAI Technological Center, S.A. (Applus+ Certification)

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Summary:

LGAI Technological Center, S.A. (hereafter referred to as “Applus+ Certification”) has been commissioned by Climate Bridge (Shanghai) Ltd. to perform the verification of greenhouse gas emission reductions of the project activity “Yunnan Mangli Hydropower Project” (VCS Ref. No. 928, hereafter referred to as “the project activity”) reported in the monitoring report /1/ during monitoring period 01/05/2018 to 31/07/2021.

The project has been registered as a VCS project which is available at https://www.vcsprojectdatabase.org/#/project_details/928.

The project activity is a grid-connected hydro power project located at Mangshi River, Luxi City of Yunnan Province, P.R.China which is to use hydro resource for electricity generation. The installed capacity of the project activity is 36MW, consisting of 2 sets of hydro turbines with unit capacity of 18MW. The average annual power delivered to the grid by the project is expected to be 143,652 MWh in the first 10 years. The Project can reduce GHG emissions by replacing the electricity generated by fossil fuel fired power plants China Southern Power Grid (CSPG). It's estimated that the project could achieve GHG emission reductions of 113,189 tCO₂e annually in the first crediting period from 25/01/2010 to 24/01/2020 and 51,887tCO₂e annually in the second crediting period from 25/01/2020 to 24/01/2030.

The purpose and scope of this verification is to ensure that reported emission reductions are complete and accurate in accordance with applicable VCS standards and relevant UNFCCC requirements in order to be certified. A desk review and a site visit have been conducted to verify the data submitted in the monitoring report /1/. Applus+ Certification confirms the following has been reviewed:

- Monitoring plan included in the registered VCS PD (version 02 dated 25/10/2012) /3/;
- Approved methodology, ACM0002, (version 12.1.0 and Version 20.0) /9/;
- Registered CDM PDD (version 02 dated 28/12/2010) /4/;
- Validation Report of registered CDM PDD (version 03 dated 05/10/2011) /16/;
- revised CDM PDD approved by CDM EB (version 03 dated 06/08/2012) /17/;

- Validation Opinion on revised CDM PDD approved by CDM EB (version 01 dated 10/09/2012) /18/;
- VCS Validation and Verification Report (version 2.0 dated 16/10/2013) /04/;
- Renewed VCS PD for second crediting period (Version 2.0 dated 07/12/2021) /19/;
- Validation Report of Renewed VCS PD for second crediting period (version 01.0 dated 29/10/2021) /20/;
- VCS Verification Report (version 01 dated 08/11/2012) /15/;
- VCS Verification Report (version 02.0 dated 25/11/2021) /27/;
- VCS standard version 4.1 and VCS Program Guide version 4.0, as well as relevant UNFCCC requirements;
- All information and references relevant to the project activity's resulting in emission reductions.

During this verification, no finding was identified related to the monitoring, implementation or operations of the project activity in relation to relevant VCS standards, guidance and UNFCCC requirements and relevant host party criteria and the applied baseline and monitoring methodology etc.

Applus+ Certification confirms that the project is implemented in accordance with the registered VCS PD /3/ and Renewed VCS PD (for second crediting period) /19/. The monitoring plan complies with the applied methodology ACM0002 /7/ Version 12.1.0 (for first crediting period) and Version 20.0 (for second crediting period) and the monitoring has been carried out in accordance with the monitoring plan in the registered VCS PD /3/ and Renewed VCS PD (for second crediting period) /19/. The monitoring system is in place and the emission reductions are calculated without material misstatements. The level of assurance of the verification is reasonable. Our opinion relates to the projects GHG emissions and the resulting GHG emission reductions reported and related to the valid and registered project baseline and monitoring and its associated documents. Based on the information reviewed and evaluated Applus+ Certification confirms that the implementation of the project has resulted in 201,928 tCO₂e emission reductions during period 01/05/2018 to 31/07/2021.

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1 INTRODUCTION

1.1 Objective

LGAI Technological Center, S.A. (Applus+ Certification) has been commissioned by Climate Bridge (Shanghai) Ltd. to perform the verification of greenhouse gas emission reductions of the project activity “Yunnan Mangli Hydropower Project” (VCS Ref. No. 928) reported in the Monitoring Report /1/ during monitoring period 01/05/2018 to 31/07/2021.

LGAI Technological Center, S.A. (Applus+ Certification) as the verification body of the project activity has been accredited as a DOE by UNFCCC and also meets the competence requirements as set out in ISO 14065:2007.

The objective of verification is to have an independent review and ex post determination by a Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the registration of VCS project. Certification is the written assurance by the DOE that, during a specific time period, a proposed VCS project activity achieved the reductions in anthropogenic emissions by sources of GHGs as verified.

The objective of this verification/certification is to verify and certify emission reductions, reported for the “Yunnan Mangli Hydropower Project” in China for the period 01/05/2018 to 31/07/2021, in which 01/05/2018 to 24/01/2020 is in the first crediting period and 25/01/2020 to 31/07/2021 is in the second crediting period.

1.2 Scope and Criteria

The verification scope is defined as an independent and objective review of the registered VCS PD and renewed VCS PD, the Project’s baseline study and Monitoring Report (MR) and other relevant documents. The information in these documents is reviewed against VCS Version 4.0 requirements, UNFCCC rules and associated interpretations.

The verification is not meant to provide any consulting towards the client. However, stated requests for forward actions and/or corrective actions may provide input for improvement of the Project monitoring towards reductions in the GHG emissions.

1.3 Level of Assurance

The verification report is based on the registered VCS PD and renewed VCS PD, the VCS Monitoring Report (MR), supporting evidences made available to the verifier and information collected through performing interviews and during the on-site assessment.

The verification conclusion is assured a reasonable level of assurance.

1.4 Summary Description of the Project

Project title	Yunnan Mangli Hydropower Project
VCS reference number	928
Project Participants	Datang Mangli Hydropower Development Company Limited (Project Owner, host country, P. R. China)
Location of the project	Mangshi River, Luxi City of Yunnan Province, P.R.China Geographic coordinates: 98.3145° East longitude and 24.3083° North latitude
Project start date	Operation start date: 13/01/2010
Version of VCS PD	version 02 dated 25/10/2012 (the registered VCS PD) Version 2.0 dated 07/12/2021 (the renewed VCS PD for second crediting period)
Monitoring period	01/05/2018 to 31/07/2021
First monitoring report	Version 1.0 dated 29/09/2021
Final monitoring report	Version 2.0 dated 07/12/2021
Applied Methodology/Version	ACM0002, Version 12.1.0 and Version 20.0
Scope/Technical Area	1/1.2

The project activity is a hydro power project located at Mangshi River, Luxi City of Yunnan Province, P.R.China which is to use hydro resource for electricity generation. The installed capacity of the project activity is 36MW, consisting of 2 sets of hydro turbines with unit capacity of 18MW. The average annual power delivered to the grid by the project is expected to be 143,652 MWh. The Project can reduce GHG emissions by replacing the electricity generated by fossil fuel fired power plants China Southern Power Grid (CSPG). It's estimated that the proposed project could achieve GHG emission reductions of 113,189 tCO_{2e} annually in the first crediting period from 25/01/2010 to 24/01/2020 and 51,887 tCO_{2e} annually in the second crediting period from 25/01/2020 to 24/01/2030.

The project has been registered as a VCS project which is available at https://www.vcsprojectdatabase.org/#/project_details/928.

2 VERIFICATION PROCESS

2.1 Method and Criteria

Verification was conducted using Applus+ Certification's procedures in line with the requirements specified in the VCS Standard version 4.1, CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant UNFCCC requirements and applying standard auditing techniques.

Applus+ Certification completed a strategic review and risk assessment of the projects activities and processes in order to gain a full understanding of:

- Activities associated with all the sources contributing to the project emissions and emission reductions, including leakage if relevant;
- Protocols used to estimate or measure GHG emissions from these sources;
- Collection and handling of data;
- Controls on the collection and handling of data;
- Means of verifying reported data; and
- Compilation of the monitoring report.

Applus+ Certification verified the implementation of the monitoring plan and the data presented in the Monitoring Report /1/ for the period in question. This involved a site visit and a desk review of the Monitoring Report. This Verification Report describes the findings of this assessment.

The information of the assessment team is included in below:

Assessment team

According to the sectoral scopes / technical area and experiences in the sectoral or national business environment, Applus+ Certification has composed a project assessment team in accordance with the appointment rules in Applus+ Certification. The composition of assessment team has to be approved by the Applus+ Certification ensuring that the required skills are covered by the team. The four qualification levels for team members that are assigned by formal appointment rules as below:

- Leader Auditor (LA)
- Auditor (A)/ Auditor Trainee (AiT)

- Technical Reviewer (TR)
- Technical Experts (TE)

Name	Qualification	Coverage of scope	Coverage of Technical Area	Host country experience
<i>Doris Dai</i>	<i>LA/TE</i>	<i>Y (1.2)</i>	<i>Y</i>	<i>Y</i>
<i>Simon Shen</i>	<i>TR</i>	<i>Y (1.2)</i>	<i>Y</i>	<i>Y</i>

Doris Dai (Master's Degree in Environmental Sciences, Bachelor's Degree in Environmental Technology) is an Auditor appointed by Applus+ LGAI for the GHG project assessment and auditing. She has more than 6 years of work experience in CDM/VCS project assessment. Before she joined Applus+ LGAI, she has been working for CTI Certification as senior GHG Auditor for 3.5 years. Ms. Doris Dai is based in Beijing, China. Ms. Doris Dai may participate as part of the Audit Team as Lead Auditor and Technical Expert.

Simon Shen (Master's Degree in Thermal Energy Engineering, Bachelor's Degree in Environmental Engineering) is an Auditor appointed by Applus+ LGAI for the GHG project assessment, auditing and technical review. He has more than 6 years of work experience in CDM/GS4GG/VCS project assessment and review with Applus+, apart from the years of experience working as GHG Auditor and ISO 9001/14001 in TUV SUD for 3.5 years before he joined Applus+. Mr. Simon Shen has extensive experience also as former Applus+ Shanghai CDM Technical Manager.

2.2 Document Review

The VCS monitoring report (Version 1.0 dated 29/09/2021) and the VCS monitoring report (Version 2.0 dated 07/12/2021) /1/ and the emission reduction calculations spreadsheet /2/, were assessed as part of the verification. In addition, the registered VCS PD (version 02 dated 25/10/2012) /3/ and renewed VCS PD for second crediting period (Version 2.0 dated 07/12/2021) /19/, in particular the baseline estimations and the monitoring plan, and registered CDM PDD (version 02 dated 28/12/2010) /4/, Validation Report of registered CDM PDD (version 03 dated 05/10/2011) /16/, revised CDM PDD approved by CDM EB (version 03 dated 06/08/2012) /17/, Validation Opinion on revised CDM PDD approved by CDM EB (version 01 dated 10/09/2012) /18/, Validation Report of Renewed VCS PD for second crediting period (version 01.0 dated 29/10/2021) /20/, monitoring report and verification report of previous monitoring periods, as well as relevant documents, were reviewed. A detailed documents reviewed are listed in Annex 1 of the report.

2.3 Interviews

The key personnel interviewed are summarized in the table below:

Interviewed personnel	Role	Organization	Subject
Mr. Ke Youliang	General Manager	Datang Mangli Hydropower Development Company Limited	Operation of the project activity; Implementation of the monitor plan of the project activity; Data collection and data achievement; Calibration of meters and equipment maintenance;
Ms. Li Ling	Director of Security Department	Datang Mangli Hydropower Development Company Limited	
Ms. Zhou Yin	Duty Director	Datang Mangli Hydropower Development Company Limited	
Mr. Xu Mingrui	Director of Administrative Department	Datang Mangli Hydropower Development Company Limited	
Ms. Zhao Qing	Staff	Local Environmental Protection Bureau	The impact of the project activity; The complaint by local stakeholders; The stakeholder consultation during the operation of the project activity.
Mr. Jin Xiaosan	Villager	Local resident	
Mr. Zhang Zixiao	Project Manager	Climate Bridge (Shanghai) Ltd.	Data collection and ER calculation.

2.4 Site Inspections

The assessment team performed the on-site verification (Mangshi River, Luxi City of Yunnan Province, P.R.China) on 26/10/2021 for the monitoring period from 01/01/2019 to 31/07/2021. Online remote assessment was conducted on 06/12/2021 for the extended monitoring period (from 01/05/2018 to 31/12/2018) as requested by the client after on-site verification. The entire monitoring period of this verification is from 01/05/2018 to 31/07/2021..The interviewed personnel and objective are listed in above table.

2.5 Resolution of Findings

As an outcome of the verification process, the team can raise different types of findings.

Where a non-conformance arises the assessment team shall raise a Corrective Action Request (CAR). A CAR is issued, where:

- Non-compliance with the monitoring plan or methodology are found in monitoring and reporting and has not been sufficiently documented by the project participants, or if the evidence provided to prove conformity is insufficient;

- b) Modifications to the implementation, operation and monitoring of the project activity has not been sufficiently documented by the project participants;
- c) Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impact the quantity of emission reductions;
- d) Issues identified in a FAR during validation to be verified during verification or previous verification(s) have not been resolved by the project participants.

The assessment team shall raise a Clarification Request (CL) if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

All CARs and CLs raised during verification shall be resolved prior to submitting a request for issuance.

There is no CARs and CLs raised for this monitoring period for the project.

2.5.1 Forward Action Requests

None FAR was raised during the verification process. Also there are no remaining from former verification and validation.

2.6 Eligibility for Validation Activities

Not applicable as LGAI Technological Center, S.A. holds the accreditation for the validation and verification for projects under scope 1.

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

Through reviewing Registered CDM PDD /4/, Validation Report of registered CDM PDD /16/ and UNFCCC website (<https://cdm.unfccc.int/Projects/DB/DNV-CUK1305694841.24/view>), it was validated that the project has been registered as a CDM project activity with reference No. 4821. Through reviewing the registered VCS PD /3/ and VCS website (<https://registry.verra.org/app/projectDetail/VCS/928>), it was validated that the project has been registered as a VCS project with reference No. 928. Except CDM and VCS scheme, The project does not participate in the other emissions trading program by checking public information on Internet and interviewing with project owner.

During the monitoring period from 01/05/2018 to 31/07/2021 (in which 01/05/2018 to 24/01/2020 is in the first crediting period and 25/01/2020 to 31/07/2021 is in the second crediting period), the project would claim only for VCUs.

Therefore, Applus+ Certification consider the project is eligible to participate under the VCS Program as there is no double counting for the emission reduction during any period.

3.2 Methodology Deviations

Not applicable as not deviation for methodology.

3.3 Project Description Deviations

The project was registered under VCS scheme in 2012. As per the registered VCS PD, the turbine and generator started operation on 13/01/2010, start date of crediting period is chosen as 25/01/2010 (the date when the data have been monitored and collected following the monitoring procedure) and the crediting period is from 25/01/2010 to 06/10/2011. However, in the monitoring report, the 1st VCS crediting period was set as from 25/01/2010 - 24/01/2020. By checking the registered PD, it is confirmed that the project is registered under VCS Version 3.2 and completed validation before 09/03/2020. As per VCS requirement, it remains eligible to apply the crediting period requirements under VCS 3 which shall be a maximum of ten years and may be renewed at most twice. Hence, the first VCS crediting period is updated from 25/01/2010 - 06/10/2011 to 25/01/2010 - 24/01/2020. Meanwhile, by checking UNFCCC website, it is confirmed that the project was registered under CDM scheme on 07/10/2011 with reference number of 4821. According to CDM standard, the first crediting period is 07/10/2011 - 06/10/2018, which could be renewed twice. Therefore, the length of total VCS crediting period of the project activity should not be longer than 21 years and is determined as 25/01/2010 to 24/01/2031 and the project activity is not eligible for VCU issuance beyond 24/01/2031.

In conclusion, the 1st VCS crediting period of the project was determined as 25/01/2010 - 24/01/2020 and the 2nd VCS crediting period of the project was determined as 25/01/2020 to 24/01/2030.

The deviation has no impact for the applicability of the methodology, additionality or the appropriateness of the baseline scenario and meet all appropriate rules and requirements of VCS standard. The same has been described in the monitoring report of previous monitoring period and confirmed in its relevant Verification Report.

The assessment team confirmed that except crediting period related deviations, there were no project description deviations identified by the assessment team to this monitoring period.

3.4 Grouped Project

Not applicable as not a grouped project.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

By means of on-site visit, the assessment team confirms that all physical features of the project activity proposed in the registered VCS PD /3/ and renewed VCS PD /19/ are in place and the PP has operated the project as per registered VCS PD /3/ and renewed VCS PD /19/. The installed capacity of the project activity is 36MW, consisting of 2 sets of hydro turbines with unit capacity of 18MW. The electricity generated is transmitted to Yunnan Power Grid, which was then exported to CSPG. The project activity was expected to supply 143,652 MWh of electricity to the grid annually. The project started operation on 13/01/2010 verified by site visit interview and checking VCS Verification Report (version 01 dated 08/11/2012) /15/. There are no changes on the key equipment and technology since the validation and previous verification of the project. No special event which would affect the monitoring of the project has been observed during the monitoring period. The implementation of project is in line with the description of registered VCS PD /3/ and renewed VCS PD /19/.

The emission reduction resulted from the project during this monitoring period would apply for VCUs. There are no other forms of environmental credits applied or issued for the project activity during this monitoring period. Through interviewing with the project developer during site visit, it is confirmed that, except CDM and VCS scheme, the project has not been participated or been rejected under any other GHG programs since validation or previous verification.

By checking the registered VCS PD and renewed VCS PD, China's National Plan on Implementation of the 2030 Agenda for Sustainable Development and 17 SDGs defined by UNDP, and interviewing with stakeholders during site visit, it is confirmed that the project would contribute to sustainable development in Job creation, Reduction in GHG emissions, Reduction of fossil fuel use and Increase of power supply aspects confirmed during site visit.

The technical parameters have been verified with the nameplates /9 / as below:

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

By comparing the actual ER claimed in this monitoring period with the estimate in the registered VCS PD and the renewed VCS PD, the actual emission reductions (i.e. 201,928 tCO₂e) are lower than that expected (i.e. 275,362 tCO₂e), which surely will not lead to the overestimation of VERs.

The monitoring period is from 01/05/2018 to 31/07/2021 (1188 days), in which 01/05/2018 to 24/01/2020 (634 days) is in the first crediting period and 25/01/2020 to 31/07/2021 (554 days) is in the second crediting period. As per the registered VCS PD and the renewed VCS PD, It's estimated that the project could achieve GHG emission reductions of 113,189tCO₂e annually in the first crediting period from 25/01/2010 to 24/01/2020 and 51,887tCO₂e annually in the second crediting period from 25/01/2020 to 24/01/2030. Therefore, the expected emission reductions for this monitoring period is calculated as: 113,189 tCO₂e/ 365 days × 634 days + 51,887 tCO₂e/ 365 days × 554 days = 275,362 tCO₂e.

The assessment team confirmed that there is no proposed or actual change to the project design during this monitoring period.

All required equipments and procedures are available and implemented in an appropriate manner.

All necessary monitoring instruments are installed. All required instruments including standby and operating procedures for the same have been implemented in an appropriate manner.

The project is completely operational and the same has been confirmed on-site. Neither mistakes nor malfunction on main meters have been observed during this monitoring period.

4.2 Safeguards

4.2.1 No Net Harm

By checking the EIA summary and conclusion provided in the registered VCS PD and renewed VCS PD, it is confirmed that hydro power is green power and the impact caused by hydro power on the surrounding ecosystem and residents, water, and atmosphere etc. is very little, there would be no net harm caused due to the project activity. Also, the EIA of the project are approved by the government.

Furthermore, no potential environment or social economic matter was found during the site visit. The project is renewable energy project and thus no net harm observed in air or water quality on-site.

4.2.2 Local Stakeholder Consultation

As per the registered VCS PD (version 02 dated 25/10/2012), the local stakeholder's consultation was conducted in June 2009 through distributing a questionnaire which was designed to be easily filled in. 100 copies of questionnaire were distributed. The participants filled in the questionnaires included local residents, builders and members of the local authorities. The opinions expressed by the stakeholders were recorded and are available on request.

The stakeholder meeting and the survey showed that the proposed project receives strong support from the local community. They all believe the proposed project will promote local economic development and agree with the project development and construction.

By checking questionnaires, the assessment team confirmed communications with Local stakeholders was being carried out at periodic intervals, ie April 2014, August 2016 and March 2018.during previous monitoring period and May 2019, August 2020 and April 2021 in this monitoring period. There are no negative comments received for the project. Via interviewing with staff from local environmental protection bureau and local residents during the site visit, it is confirmed by the assessment team that during the implementation stage of this monitoring period, local authority has conducted spot checks on the implementation of the project periodically as per the request from the local governments' regulations.

All such conclusion has been verified through site visit and check registered VCS PD and renewed VCS PD.

4.3 AFOLU-Specific Safeguards

Not applicable as non-AFOLU project.

4.4 Accuracy of GHG Emission Reduction and Removal Calculations

The monitoring has been carried out in accordance with the monitoring plan contained in the registered VCS PD /3/ and the renewed VCS PD /19/. All parameters were monitored and determined as per the monitoring plan which is listed in below table:

Data / Parameter:	EG _{export,y}		
Data unit:	MWh		
Description:	Electricity supplied by the project activity to the grid in year y		
Purpose of the data:	Calculation of baseline emissions		
Parameter value:		Year	Value
		01/05/2018~31/12/2018 (1st VCS crediting period)	104,626.720
		01/01/2019~31/12/2019 (1st VCS crediting period)	85,157.600
		01/01/2020~24/01/2020 (1st VCS crediting period)	2,101.781

		25/01/2020~31/12/2020 (2nd VCS crediting period)	104,124.691	
		01/01/2021~31/07/2021 (2nd VCS crediting period)	37,295.280	
		Total	333,306.072	
Source of data used:	Electricity supplied by the project activity to the grid in year y ($EG_{\text{export},y}$) are all sourced from Meter Reading Records (MRRs) /10/ issued by the project owner, Electricity Transaction Notes (ETNs) /11/ issued by power grid company covering monitoring period. The conservative data between MRRs and Electricity Transaction Notes (ETNs) will be used to calculate the emission reductions.			
Information flow:	2 bidirectional electricity meters (meter M1 and meter M2) were measured continuously, recorded monthly and archived electronically. M1 was installed at the substation of Grid Company while meter M2 was installed at the project site. When M1 is not working, the readings from M2 will be used for reference. Meter M1 was used to measure electricity supplied by the project activity to the grid and is the basis of issuing ETNs /11/ by local grid company. By checking the operation log /22/ and interview with project owner during site visit, it is confirmed that during this monitoring period, M1 is working well and has no malfunction. By checking the ETNs /11/ and interviewing with project owner during site visit, it is confirmed that during this monitoring period, the cut-off time was 24:00 hr of last day of each month. At the cut-off time, the staff from project developer and the grid company read the meter reading of meter M1 together. The project owner will afterwards form MRRs /10/ while the grid company transcribes the data into ETNs /11/. $EG_{\text{export},y}$ was sourced from MRRs /10/ issued by the project developer and ETNs /11/ issued by power grid company covering monitoring period. The data for MRRs and ETNs have been sent to the CDM consulting company for reporting of GHG emission reduction. The conservative data between MRRs and ETNs will be used to calculate the emission reductions.			
Monitoring method, frequency and equipments:	The parameter was measured continuously and recorded monthly by 2 bi-direction electricity meters (meter M1 and meter M2). M1 was installed at the substation of Grid Company while meter M2 was installed at the project site. The same has been verified during site visit. By checking Meter Change Records /21/, meter M1 and M2 were replaced on 25/11/2020 during this monitoring period. It is confirmed that the accuracy of replaced electricity meters is in line with monitoring plan contained in the registered VCS PD and renewed VCS PD. See below for the information of 2 bi-direction electricity meters and verified by site visit and checking calibration certificates /12/:			

	Meter		Type	Serial Number	Accuracy
	Before 25/11/2020	Main Meter (M1)	DTS5	02299816	0.2S
		Backup Meter (M2)	DTSD341	20081167020135	0.2S
	From 25/11/2020 onwards	Main Meter (M1)	DTSD718	05131SG0000020015AD701411	0.5S
		Backup Meter (M2)	DTSD5	02299816	0.2S
The type, serial number and accuracy have been confirmed by site visit.					
Calibration:	The calibration information is shown as below /12/:				
	Meter		Calibration date		Valid until
	Main Meter (M1)		04/04/2018		03/04/2019
			24/03/2019		23/03/2020
			19/03/2020		18/03/2021
	Main Meter (M1) (new)		23/11/2020		22/11/2021
	Backup Meter (M2)		03/04/2018		02/04/2019
			24/03/2019		23/03/2020
			19/03/2020		18/03/2021
	Backup Meter (M2) (new)		23/11/2020		22/11/2021
The calibration was conducted by accredited third parties which is Yunnan Power Grid Co., Ltd. Dehong Metrology Center was accredited by Yunnan Provincial Market Supervision Administration valid from 25/12/2014 to 24/12/2019 and from 25/12/2019 to 24/12/2024 /13/.					
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.				
Means of verification:	Data of the parameter was verified by checking MRRs and ETNs. All data is in line with MRRs and ETNs;				
	Information flow was verified by checking MRRs and ETNs and all information are consistent;				
	Monitoring method was verified by site visit, checking calibration certificates, all monitoring method meets the description in the registered VCS PD and renewed VCS PD;				
	Calibration was verified by checking calibration certificate and Accreditation certificate, all calibration of monitoring equipment meets the requirement indicated in the registered VCS PD and renewed VCS PD.				

Data / Parameter:	EG _{import,y}		
Data unit:	MWh		
Description:	Electricity imported by the project activity from the grid in year y		
Purpose of the data:	Calculation of baseline emissions		
Parameter value:	Year		Value
	01/05/2018~31/12/2018 (1st VCS crediting period)		75.680
	01/01/2019~31/12/2019 (1st VCS crediting period)		184.800
	01/01/2020~24/01/2020 (1st VCS crediting period)		23.164
	25/01/2020~31/12/2020 (2nd VCS crediting period)		180.996
	01/01/2021~31/07/2021 (2nd VCS crediting period)		135.520
	Total		600.160
Source of data used:	Electricity imported by the project activity from the grid in year y (EG _{import,y}) are all sourced from Meter Reading Records (MRRs) /10/ issued by the project owner, Electricity Purchase Receipts /28/ issued by power grid company covering monitoring period. The conservative data between MRRs and Electricity Purchase Receipts will be used to calculate the emission reductions.		
Information flow:	2 bidirectional electricity meters (meter M1 and meter M2) were measured continuously, recorded monthly and archived electronically. M1 was installed at the substation of Grid Company while meter M2 was installed at the project site. When M1 is not working, the readings from M2 will be used for reference. Meter M1 was used to measure electricity supplied by the project activity to the grid and is the basis of issuing Electricity Purchase Receipts /28/ by local grid company. By checking the operation log /22/ and interview with project owner during site visit, it is confirmed that during this monitoring period, M1 is working well and has no malfunction. By checking the Electricity Purchase Receipts /28/ and interviewing with project owner during site visit, it is confirmed that during this monitoring period, the cut-off time was 24:00 hr of last day of each month. At the cut-off time, the staff from project developer and the grid company read the meter reading of meter M1 together. The project owner will afterwards form MRRs /10/ while the grid company transcribes the data into Electricity Purchase Receipts /28/. EG_{import,y} was sourced from MRRs /10/ issued by the project developer and Electricity Purchase Receipts /28/ issued by power grid company covering monitoring period. The data for MRRs and Electricity Purchase Receipts have been sent to the CDM consulting company for reporting of GHG emission reduction. The		

	conservative data between MRRs and Electricity Purchase Receipts will be used to calculate the emission reductions.																							
Monitoring method, frequency and equipments:	The parameter was measured continuously and recorded monthly by 2 bi-direction electricity meters (meter M1 and meter M2). M1 was installed at the substation of Grid Company while meter M2 was installed at the project site. The same has been verified during site visit. By checking Meter Change Records /21/, meter M1 and M2 were replaced on 25/11/2020 during this monitoring period. It is confirmed that the accuracy of replaced electricity meters is in line with monitoring plan contained in the registered VCS PD and renewed VCS PD. See below for the information of 2 bi-direction electricity meters and verified by site visit and checking calibration certificates /12/: <table><tr><th colspan="2">Meter</th><th>Type</th><th>Serial Number</th><th>Accuracy</th></tr><tr><td rowspan="2">Before 25/11/2020</td><td>Main Meter (M1)</td><td>DTS5</td><td>02299816</td><td>0.2S</td></tr><tr><td>Backup Meter (M2)</td><td>DTSD341</td><td>20081167020135</td><td>0.2S</td></tr><tr><td rowspan="2">From 25/11/2020 onwards</td><td>Main Meter (M1)</td><td>DTSD718</td><td>05131SG0000020 015AD701411</td><td>0.5S</td></tr><tr><td>Backup Meter (M2)</td><td>DTSD5</td><td>02299816</td><td>0.2S</td></tr></table> The type, serial number and accuracy have been confirmed by site visit.	Meter		Type	Serial Number	Accuracy	Before 25/11/2020	Main Meter (M1)	DTS5	02299816	0.2S	Backup Meter (M2)	DTSD341	20081167020135	0.2S	From 25/11/2020 onwards	Main Meter (M1)	DTSD718	05131SG0000020 015AD701411	0.5S	Backup Meter (M2)	DTSD5	02299816	0.2S
Meter		Type	Serial Number	Accuracy																				
Before 25/11/2020	Main Meter (M1)	DTS5	02299816	0.2S																				
	Backup Meter (M2)	DTSD341	20081167020135	0.2S																				
From 25/11/2020 onwards	Main Meter (M1)	DTSD718	05131SG0000020 015AD701411	0.5S																				
	Backup Meter (M2)	DTSD5	02299816	0.2S																				
Calibration:	The calibration information is shown as below /12/: <table><tr><th>Meter</th><th>Calibration date</th><th>Valid until</th></tr><tr><td rowspan="3">Main Meter (M1)</td><td>04/04/2018</td><td>03/04/2019</td></tr><tr><td>24/03/2019</td><td>23/03/2020</td></tr><tr><td>19/03/2020</td><td>18/03/2021</td></tr><tr><td>Main Meter (M1) (new)</td><td>23/11/2020</td><td>22/11/2021</td></tr><tr><td rowspan="3">Backup Meter (M2)</td><td>03/04/2018</td><td>02/04/2019</td></tr><tr><td>24/03/2019</td><td>23/03/2020</td></tr><tr><td>19/03/2020</td><td>18/03/2021</td></tr><tr><td>Backup Meter (M2) (new)</td><td>23/11/2020</td><td>22/11/2021</td></tr></table> The calibration was conducted by accredited third parties which is Yunnan Power Grid Co., Ltd. Dehong Metrology Center was accredited by Yunnan Provincial Market Supervision Administration valid from 25/12/2014 to 24/12/2019 and from 25/12/2019 to 24/12/2024 /13/.	Meter	Calibration date	Valid until	Main Meter (M1)	04/04/2018	03/04/2019	24/03/2019	23/03/2020	19/03/2020	18/03/2021	Main Meter (M1) (new)	23/11/2020	22/11/2021	Backup Meter (M2)	03/04/2018	02/04/2019	24/03/2019	23/03/2020	19/03/2020	18/03/2021	Backup Meter (M2) (new)	23/11/2020	22/11/2021
Meter	Calibration date	Valid until																						
Main Meter (M1)	04/04/2018	03/04/2019																						
	24/03/2019	23/03/2020																						
	19/03/2020	18/03/2021																						
Main Meter (M1) (new)	23/11/2020	22/11/2021																						
Backup Meter (M2)	03/04/2018	02/04/2019																						
	24/03/2019	23/03/2020																						
	19/03/2020	18/03/2021																						
Backup Meter (M2) (new)	23/11/2020	22/11/2021																						
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.																							
Means of verification:	Data of the parameter was verified by checking MRRs and Electricity Purchase Receipts. All data is in line with MRRs and Electricity Purchase Receipts; Information flow was verified by checking MRRs and Electricity Purchase																							

	Receipts, and all information are consistent; Monitoring method was verified by site visit, checking calibration certificates, all monitoring method meets the description in the registered VCS PD and renewed VCS PD; Calibration was verified by checking calibration certificate and Accreditation certificate, all calibration of monitoring equipment meets the requirement indicated in the registered VCS PD and renewed VCS PD.
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Data / Parameter:	EG _{backup,y}														
Data unit:	MWh														
Description:	Electricity imported through backup line from the grid in year y														
Purpose of the data:	Calculation of baseline emissions														
Parameter value:	0														
Source of data used:	Through interviewing with project owner during site visit and checking operation log /22/, it is confirmed that no electricity imported through backup line from the grid during this monitoring period.														
Information flow:	The parameter was monitored by meter M _{backup} continuously which was installed on the backup line. Through interviewing with project owner during site visit and checking operation log /22/, it is confirmed that no electricity imported through backup line from the grid during this monitoring period.														
Monitoring method, frequency and equipments:	The parameter was measured continuously and recorded monthly by meter M_{backup}, which was installed on the back-up line with accuracy of 1.0. The same has been verified during site visit. By checking Meter Change Records /21/, meter M_{backup} were replaced on 25/11/2020 during this monitoring period. It is confirmed that the accuracy of replaced electricity meter is in line with monitoring plan contained in the registered VCS PD and renewed VCS PD. See below for the information of M_{backup} and verified by site visit and checking calibration certificates /12/: <table><tr><th>Period</th><th>Type</th><th>Serial Number</th><th>Accuracy</th></tr><tr><td>Before 25/11/2020</td><td>HX3000</td><td>060001004134</td><td>1.0</td></tr><tr><td>From 25/11/2020 onwards</td><td>WFET-1000F</td><td>0500131000202052 00008947</td><td>1.0</td></tr></table> The type, serial number and accuracy have been confirmed by site visit.			Period	Type	Serial Number	Accuracy	Before 25/11/2020	HX3000	060001004134	1.0	From 25/11/2020 onwards	WFET-1000F	0500131000202052 00008947	1.0
Period	Type	Serial Number	Accuracy												
Before 25/11/2020	HX3000	060001004134	1.0												
From 25/11/2020 onwards	WFET-1000F	0500131000202052 00008947	1.0												

Calibration:	The calibration information is shown as below /12/:		
	Meter	Calibration date	Valid until
	Main Meter (M _{backup})	26/03/2018	25/03/2019
		24/03/2019	23/03/2019
		19/03/2020	18/03/2021
Main Meter (M _{backup}) (new)	23/11/2020	22/11/2021	
	The calibration was conducted by accredited third parties which is Yunnan Power Grid Co., Ltd. Dehong Metrology Center was accredited by Yunnan Provincial Market Supervision Administration valid from 25/12/2014 to 24/12/2019 and from 25/12/2019 to 24/12/2024 /13/.		
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.		
Means of verification:	Through interviewing with project owner during site visit and checking operation log /22/, it is confirmed that no electricity imported through backup line from the grid during this monitoring period;		
	Monitoring method was verified by site visit, checking calibration certificates, all monitoring method meets the description in the registered VCS PD and renewed VCS PD;		
	Calibration was verified by checking calibration certificate and Accreditation certificate, all calibration of monitoring equipment meets the requirement indicated in the registered VCS PD and renewed VCS PD.		

Data / Parameter:	Cap _{PJ}
Data unit:	MW
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Purpose of the data:	Calculation of project emissions
Parameter value:	36
Source of data used:	Nameplate of hydropower turbine and generator /9/ and the purchase contract of the water-turbine generators equipments /23/
Information flow:	N.A.
Monitoring method, frequency and equipments:	As per the registered VCS PD, the parameter will be checked annually. As per the renewed VCS PD, the parameter will be checked once at the beginning of each crediting period, which is consistent with ACM0002, version

	20.0. The parameter was confirmed through checking nameplate of hydropower turbine and generator /9/ and the purchase contract of the water-turbine generators equipments /23/.
Calibration:	N.A.
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.
Means of verification:	By checking nameplate of hydropower turbine and generator /9/ and the purchase contract of the water-turbine generators equipments signed on 18/08/2008 /23/, it is confirmed by the verification team the installed capacity of project activity is 36MW (36,000,000 W); Monitoring method was verified by site visit, checking nameplate of hydropower turbine and generator /9/ and the purchase contract of the water-turbine generators equipments /23/, all monitoring method meets the description in the registered VCS PD and renewed VCS PD.

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)			
Purpose of the data:	Calculation of project emissions			
Parameter value:		Year	Value	
		2018	2,732,380	
		2019	2,732,305	
		2020	2,732,380	
		2021	2,732,305	
Source of data used:	Survey Report of year 2018-2021, issued by Road Bridge Jiada Surveying Center in Dehong, Yunnan Province /24/			
Information flow:	N.A.			
Monitoring method, frequency and equipments:	As per the registered VCS PD, the parameter will be checked annually. As per the renewed VCS PD, the parameter will be checked once at the beginning of each crediting period, which is consistent with ACM0002, version 20.0.			

	The parameter was confirmed through checking Survey Report of year 2019-2021, issued by Road Bridge Jiada Surveying Center in Dehong, Yunnan Province.
Calibration:	N.A.
QA/QC procedure:	Data record will be archived for a period of 2 years after the crediting period to which the records pertain.
Means of verification:	The parameter is confirmed through checking Survey Report of year 2018-2021, issued by Road Bridge Jiada Surveying Center in Dehong, Yunnan Province; Monitoring method was verified by site visit, checking Survey Report of year 2018-2021, issued by Road Bridge Jiada Surveying Center in Dehong, Yunnan Province, all monitoring method meets the description in the registered VCS PD and renewed VCS PD.

Parameters available at validation stage:

As per the registered VCS PD, the parameters determine $EF_{grid,CM,y}$, including $FC_{i,y}$, $NCV_{i,y}$, $EF_{c,i,y}$, GEN_y , Electricity self-consumption ratio, Electricity imports to CSPG, and $CAP_{j,y}$ are monitored ex-ante. As per the renewed VCS PD, the parameters $EF_{grid,CM,y}$, CAP_{BL} , ABL are monitored ex-ante.

In this monitoring report, parameter $EF_{grid,CM,y}$ is determined ex-ante by China DNA based on these parameters, which is comply with the registered VCS PD and renewed VCS PD. Below data has been verified against the data sources and the registered VCS PD and renewed VCS PD.

Parameter title	Description	Data	Source
$EF_{grid,CM,y}$	The baseline grid emission factor	0.7879	registered VCS PD /3/
		0.3612	renewed VCS PD /19/
CAP_{BL}	Installed capacity of the hydro power plant before the implementation of the project activity	0	Registered VCS PD /3/ and renewed VCS PD /19/, and confirmed through checking FSR /14/
ABL	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.	0	Registered VCS PD /3/ and renewed VCS PD /19/, and confirmed through checking FSR /14/

Based on the values of parameters verified in the above sections, the power density of the project activity is calculated using the following equation: $\text{power density} = (\text{Cap}_{PJ} - \text{Cap}_{BL}) / (\text{A}_{PJ} - \text{A}_{BL})$ and for this monitoring period, the power density of the project activity are listed as follows:

Year	Cap _{PJ} (W)	A _{PJ} (m ²)	Power Density (W/ m ²)
2018	36,000,000	2,732,380	13.175
2019	36,000,000	2,732,305	13.176
2020	36,000,000	2,732,380	13.175
2021	36,000,000	2,732,305	13.176

From the above table, it is concluded that the power density of the whole monitoring period are greater than 10W/m². Therefore, based on ACM0002 (Version 12.1.0 and Version 20.0), the project emission (PE_y) = 0 tCO₂e.

4.5 Quality of Evidence to Determine GHG Emission Reductions and Removals

The monitoring has been carried out in accordance with the monitoring plan contained in the registered VCS PD (version 02 dated 25/10/2012) /3/ and renewed VCS PD for second crediting period (Version 2.0 dated 07/12/2021) /19/.

As a result of verification of the ER calculation process, the assessment team confirmed that all the parameters required for the determination of the emission reductions have been included in the MR Report and ER Calculation Spreadsheet /2/ and are consistent with the applied methodology ACM0002 (Version 12.1.0 and Version 20.0) and the monitoring plan contained in the registered VCS PD and renewed VCS PD. The parameters are complete in this monitoring period. The data used for ER calculation of period 01/01/2020 - 24/01/2020 and 25/01/2020~31/01/2020, which was divided by the first crediting period and the second crediting period) was sourced from Daily Meter Reading Records of January 2020 /29/ and has been confirmed by local power grid company /26/.

After verifying the reported figures with the raw data sources, it's confirmed that the values of the parameters from the raw data sources are consistent with those quoted in the ER Calculation Spreadsheet and the MR Report. The verification process for the same has been clearly described above in section 4.4 of the report.

The reported emission reductions in this monitoring period are 26.67% less than the expected, which is considered in the reasonable variation range. The detailed calculation process has been included in the MR and ER calculation spreadsheet and confirmed by the assessment team to be correct.

4.6 Non-Permanence Risk Analysis

Not applicable as a renewable project.

5 VERIFICATION CONCLUSION

Applus+ Certification has been commissioned by Climate Bridge (Shanghai) Ltd. to perform the verification of greenhouse gas emission reductions of the project activity “Yunnan Mangli Hydropower Project” (VCS Ref. No. 928).

The management of Datang Mangli Hydropower Development Company Limited is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project’s Monitoring Plan in the registered VCS PD (version 02 dated 25/10/2012) /3/ and renewed VCS PD for second crediting period (Version 2.0 dated 07/12/2021) /19/.

Our verification approach was based on the requirements as defined under the applicable VCS standards and relevant UNFCCC requirements. Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. The verification can confirm that:

- the project is implemented and operated as per the registered VCS PD and renewed VCS PD;
- the monitoring plan in registered VCS PD and renewed VCS PD is as per the applied methodology;
- the monitoring complies with the monitoring plan in the registered VCS PD and renewed VCS PD;
- the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable VCS and CDM requirements;
- the installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately;
- the monitoring system is in place and generates GHG emission reductions data;
- the GHG emission reductions are calculated without material misstatements.

In our opinion, the GHG emission reductions for “Yunnan Mangli Hydropower Project” during the monitoring period 01/05/2018 to 31/07/2021 as reported in Monitoring Report, prepared on the basis of the project’s Monitoring Plan are fairly stated. Based on the information we have seen and evaluated, we confirm the following statement:

Verification period: From 01/05/2018 to 31/07/2021 (divided into 4 vintage periods). Verified GHG emission reductions or removals in the above reporting period:

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)
01/05/2018~31/12/2018	82,375	0	0	82,375
01/01/2019~31/12/2019	66,950	0	0	66,950
01/01/2020~24/01/2020	1,637	0	0	1,637
25/01/2020~31/12/2020	37,544	0	0	37,544
01/01/2021~31/07/2021	13,422	0	0	13,422
Total	201,928	0	0	201,928

APPENDIX 1: REFERENCE LIST

- 1 Climate Bridge (Shanghai) Ltd.: Monitoring report, version 1.0 dated 29/09/2021; Version 2.0 dated 07/12/2021
- 2 Climate Bridge (Shanghai) Ltd.: ER calculation spreadsheet, version 1.0 dated 29/09/2021; Version 2.0 dated 07/12/2021
- 3 registered VCS PD, version 02 dated 25/10/2012
- 4 Registered CDM PDD, version 02 dated 25/10/2012
- 5 VCS Standard version 4.1, dated on 19/09/2019
- 6 Datang Mangli Hydropower Development Company Limited: Records of training for on-site staff.
- 7 Approved methodology ACM0002, Version 12.1.0 and Version 20.0, dated 11/05/2012
- 8 Datang Mangli Hydropower Development Company Limited: VER monitoring manual and management procedure.
- 9 Datang Mangli Hydropower Development Company Limited: Nameplate of the equipment
- 10 Datang Mangli Hydropower Development Company Limited: Meter Reading Record (MRRs) for electricity meters
- 11 Datang Mangli Hydropower Development Company Limited: Electricity Transaction Notes (ETNs) covering the monitoring period
- 12 Yunnan Power Grid Co., Ltd. Dehong Metrology Center: Calibration certificates of meters covering the whole monitoring period
- 13 Yunnan Provincial Market Supervision Administration: Accreditation certificates for Yunnan Power Grid Co., Ltd. Dehong Metrology Center covering the whole monitoring period
- 14 Kunming Survey and Design Institute of Water Conservancy and Hydropower: Feasibility Study Report (FSR), compiled in April 2008
- 15 Bureau Veritas Certification Holding SAS: VCS Verification Report, version 01 dated 08/11/2012
- 16 DNV Climate Change and Environmental Services: Validation Report of registered CDM PDD, version 03 dated 05/10/2011
- 17 Revised CDM PDD approved by CDM EB, version 03 dated 06/08/2012

- 18 Bureau Veritas Certification Holding SAS: Validation Opinion on revised CDM PDD approved by CDM EB, version 01 dated 10/09/2012
- 19 Renewed VCS PD for second crediting period, Version 2.0 dated 07/12/2021
- 20 Validation Report of Renewed VCS PD for second crediting period, version 01.0 dated 29/10/2021
- 21 Datang Mangli Hydropower Development Company Limited: Meter Change Records
- 22 Datang Mangli Hydropower Development Company Limited: Operation log, covering the whole monitoring period
- 23 Datang Mangli Hydropower Development Company Limited and Hangzhou Resource Power Equipment Co., Ltd.: The purchase contract of the water-turbine generators equipments, signed on 18/08/2008
- 24 Road Bridge Jiada Surveying Center in Dehong, Yunnan Province: Survey Report of year 2018-2021
- 25 China's National Plan on Implementation of the 2030 Agenda for Sustainable Development
- 26 Local power grid company: Statement about confirmed electricity export and import of the period 01/01/2020 - 24/01/2020 and 25/01/2020~31/01/2020
- 27 Shenzhen CTI International Certification Co., Ltd.: VCS Verification Report (version 02.0 dated 25/11/2021)
- 28 Datang Mangli Hydropower Development Company Limited: Electricity Purchase Receipts covering the monitoring period
- 29 Datang Mangli Hydropower Development Company Limited: Daily Meter Reading Records of January 2020