



**Verified Carbon
Standard**

MADUSHAN HYDROPOWER PROJECT ON HONGHE RIVER IN YUNNAN PROVINCE, CHINA

Document Prepared by Goldchina Consultancy International Co., Ltd.

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Madushan Hydropower Project on Honghe River in Yunnan Province, China (hereafter referred to as “the project”) is a newly-built hydropower project. The total installed capacity of the project is 288MW, consisting of three sets of 96 MW hydro turbine and generator units. The electricity generated by the project is supplied to South China Power Grid (SCPG). According to the registered PDD, the estimated annual net grid-connected electricity is 1,164,249MWh for the first three operational years and 1,217,569MWh for the remaining years. The emission reductions are achieved by displacing part of the electricity of SCPG, which is dominated by coal-fired power plants. The estimated annual emission reductions for the first three operational years are 917,369tCO₂e, and 959,382 tCO₂e for the remaining years in the registered PDD.

Relevant dates for the project are as follows:

The construction of the project started on 25/01/2009. The first set of water turbine and generator unit was commissioned on 28/02/2011¹, the second on 29/06/2011, and the third on 27/07/2011.

The project was registered as a VCS project (VCS883). The first 10-year renewable crediting period started on 28/02/2011 and expired on 27/02/2021.

During the monitoring period (01/01/2018 to 27/02/2021), the emission reduction achieved by the project are 3,020,882tCO₂e. The emission reductions in the monitoring period will be verified and issued under VCS rules.

Audit Type	Period	Program	VVB Name	Number of years
Validation	06/06/2011	CDM	ERM Certification and Verification Services	N/A
Validation (RCP)	17/10/2022	VCS	APPLUS+ TECHNOLOGICAL LGAI CENTER S.A.	N/A
Verification	28/02/2011-06/06/2011	VCS	RINA Services S.p.A. (RINA)	0.27 (=99 days/365)

¹ The first generator was tested on 28/02/2011 and put into formal operation on 04/03/2011. Some electricity was generated since 28/02/2011. So, 28/02/2011 was selected as the start date to include the electricity generated in the testing operation period (28/02/2011-04/03/2011) in 1st VCS monitoring period. The crediting period start date of CDM project is 07/06/2011.

Verification	07/06/2011-30/11/2011	CDM	China Environmental United Certification Co., Ltd	0.48 (=177 days/365)
Verification	01/12/2011-31/07/2012	CDM	China Environmental United Certification Center Co., Ltd	0.67 (=244 days/365)
Verification	01/08/2012 - 31/12/2017	VCS	APPLUS+ TECHNOLOGICAL LGAI CENTER S.A.	5.42 (=1,979 days/365)
Verification	01/01/2018-27/02/2021 (this monitoring period)	VCS	CTI Certification Co., Ltd	3.16 (=1,154 days/365)
Total	/	/	/	10

1.2 Sectoral Scope and Project Type

This category would fall within sectoral scope 1: energy industries (renewable/non-renewable).

Project type: Renewable energy projects.

The project is not a grouped project.

1.3 Project Proponent

Organization name	Honghe Guangyuan Madushan HydroPower Development Co., Ltd.
Contact person	Zhang Jing
Title	Director of Investment
Address	780 Building Hongzhuyuan Mengzi County, Yunnan Province, China.
Telephone	+86-873-3743179
Email	hhgyhydropower@sina.com

1.4 Other Entities Involved in the Project

Organization name	Goldchina Consultancy International Co., Ltd.
Role in the Project	Consultancy
Contact person	Dr. Zheng Zhaoning

Title	Technical director
Address	Address: Room 230, Unit B, Building 2, Tangning One, No. 16 of Zhongguancun East Road, Haidian District, Beijing, 100083
Telephone	(+86) 18010121386
Email	zzn@gcci-carbon.com

1.5 Project Start Date

The operation starting date for the project was 28/02/2011.

1.6 Project Crediting Period

The project was registered as CDM project (CDM ref no.:4476). 3*7 years renewable crediting period is adopted by the project activity.

The first 10 years renewable crediting period started on 28/02/2011 and expired on 27/02/2021.

1.7 Project Location

The project is located in Gejiu City and Jinping County/ Honghe Hani & Yi Autonomous State/ Yunnan Province/ China. GPS coordinates: 103°16'58.5" E, 23°02'43.9" N (Dam); 103°17'15" E, 23°02'39" N (Power house). The detailed project location is shown in Figure 1.1.

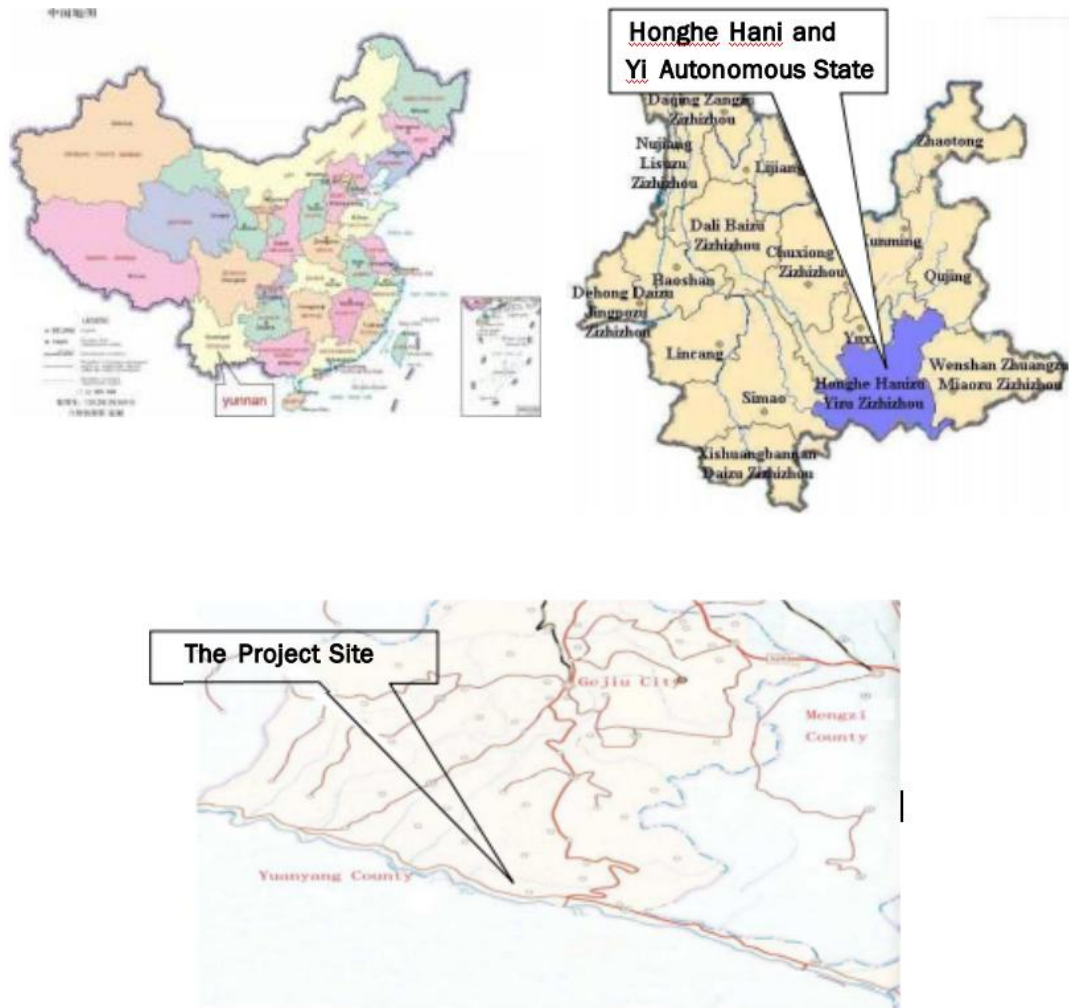


Figure 1.1. Geographical location of the proposed project

1.8 Title and Reference of Methodology

ACM0002 ver.11 - Consolidated methodology for grid-connected electricity generation from renewable sources.

Version 2 of the tool to calculate the emission factor for an electricity system²;

Version 05.2 of the tool for the demonstration and assessment of additionality³.

² <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf>

³ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf>

1.9 Participation under other GHG Programs

The project has been registered as a CDM project with registration number 4476 and VCS project (project ID: 883). CER was only issued during 07/06/2011-31/07/2012 and no VCU issued during 07/06/2011-31/07/2012.

1.10 Other Forms of Credit and Supply Chain (Scope 3) Emissions

The project has not created any other form of environmental credit during this monitoring period, which will be verified by VVB.

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. And the project activity is not included the mandatory emission control scheme and there is no emission cap enforced for the project owner according to the enforced company list in public information. Hence, it is confirmed that the emission reductions will not be double counted. The project will not seek to generate or has received any form of environmental credits, and the GHG emission removals generated by the project will not be used for compliance under such programs or mechanisms.

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

The project does not involve specific goods procurement supply chain emissions, so supply Chain (Scope 3) Emissions section is not applicable.

1.11 Sustainable Development Contributions

The project contributes to the sustainable development to both local, global and the host country in a number of ways:

(1) The construction and operation of the proposed project will mitigate shortage of electricity supply in local area, increase electricity quality in the power grid, ensure industrial and agricultural production, and satisfy local people with sufficient electricity in daily life;

(2) The construction and operation of the proposed project will create more job opportunities for local people. Rural labors could be arranged for on-site construction during the construction period, and long-term job opportunities could be offered during the operation period.

(3) By displace coal fired electricity in SCPG, the project reduced more than 3 million CO₂ emission in the monitoring period.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.0	Ensure access to affordable, reliable, sustainable and modern energy for all	Implemented activities to increase	Provide 3,833,852.55 MWh clean electricity in this monitoring period	An accumulated 10,954,347.80 MWh of net electricity from renewable sources has been supplied to the power grid by end of the reporting period.
2)	8.0	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Implemented activities to increase	No further changes this monitoring period	Create new job opportunities for the local people: thousands temporary job opportunities were available during the construction period and 55 permanent jobs during the operation time.
3)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	By displacing fuel fired electricity, reduce 3,020,882 tonnes of CO ₂ emission.	Reduce total 8,673,690tCO ₂ e over the first crediting period.

2 SAFEGUARDS

2.1 No Net Harm

There is no net harm.

The Environment Impact Assessment (EIA) report for the proposed project was made by Pearl River Water Resource Conservation Science Institute. The EIA report for the proposed project was approved by State Environmental Protection Administration on 27th Sep 2007. According to the EIA report, the environmental impacts likely to be caused by the proposed project, protective actions adopted by the project owner and effect analysis are analyzed as follows:

Construction Period

Wastewater

The wastewater produced by the proposed project will be that of industrial, workers' and power station. Production wastewater treatment facilities will be built to gather the wastewater, after the treatments of sand setting, precipitation, adding neutralizer etc., then the production wastewater will be discharged. Domestic wastewater will also be dealt before being discharged.

Both production wastewater and domestic wastewater will meet the Level-two standard of Integrated Wastewater Discharge Standard (GB8978-1996).

Waste Air

Waste air during the construction period will be mainly from blasts, crushed sand processing, dust and the pollutant discharged by construction equipment etc. Wet techniques and protect measures will be adopted; dust collecting equipment is installed.

These measures will ensure that the discharge of air pollutants will meet the standard of the Integrated Emission Standard of Air Pollutants (GB16297-1996).

Noise

Noise during the construction period will be mainly from blasts, drilling, crushed sand processing, mixing of concrete and traffic. Low-noise processing equipments will be used. Meanwhile the construction time will be strictly controlled. If the condition allows, greenbelt will be built to decrease the effect of noise. These measures will ensure that the construction site will meet the Standard of Noise at Boundary of Industrial Enterprises (GB 12523-90).

Waste Residue

Waste residue consists of engineering refuse and domestic waste produced by constructors. The construction waste and domestic waste will be piled up in corresponding abandoned dredge site respectively. All the abandoned dredge sites will be reinforced, and slag dam will be built along rivers and roads. Domestic waste will be put together, and delivered to landfill sites to be dealt at set intervals.

Ecological impacts

There is little impact to terricolous plant. The large lizard and tortoise will be affected by the construction of the proposed project. It must take measures to protect them. Five species of fish will be affected by the construction of the proposed project, as there is no influence to fishes in other branch of river, so the influences to fishes in Honghe river will be very small either. There are two terminalia myriocarpa trees (a Class II nationally protected species) in the Project affected area, they will be relocated. They won't be affected by the construction of the proposed project. The Mayutian village relocation is near the protection area, it will be taken measures to protect.

Operation Period

- The production wastewater is mainly little oil pollution during the operation phase, there is base sumps and corresponding treatment equipments, there are also integrative domestic wastewater treatment. These measures will ensure that the operation of station will not contaminate the water of the reservoir.
- The project owner will shoulder the obligation of the effects of construction and operation on the fishes, the construction of remedial measures and the corresponding cost.
- The operation and management of this project will be optimized, which will ensure that the minimum flow is no less than 30.2m³/second, and satisfy the demand of water environment of lower and aquatic biological environment.
- Adopting water and soil conservation engineering and vegetation measures to control soil loss, the main places are slag dumps, material yards, temporary area for construction, roads for construction, affected zones and the occupied areas of key building.

Because of reservoir inundation and project permanent land occupation, there are people need to resettle. Resettlement can't occupy ecological protection wetland. The prevention of water and soil loss, meanwhile the measures of water environment protection, waste disposal etc. in the resettlement area should be reinforced. Environmental protection measures should be implemented during relocation and reconstruction.

2.2 Local Stakeholder Consultation

In order to know the attitudes and views of the public on the project's construction, Pearl River Water Resource Conservation Science Institute, made a sampling survey when compiling EIA Report. A total of 125 questionnaires had been handed out and 100 questionnaires were returned, so the return rate was 80%. The information of stakeholders is as follows:

Age situation of the stakeholders							
Age	19~29		30~40		41~45	46~66	
Number(people)	28		34		21	17	
Proportion(%)	28		34		21	17	
Occupation situation of the stakeholders							
Occupation	Cadre	Worker	Teacher	Technician	Farmer	Student	Others
Number(people)	20	15	5	28	15	5	12
Proportion(%)	20	15	5	28	15	5	12

Education situation of the stakeholders				
Education	Junior college	Technical secondary school	Senior high school	Junior high school
Number(people)	30	25	20	25
Proportion(%)	30	25	20	25

The contents of investigation are as follows:

- Do you know the proposed project?
- What's your attitude toward the construction of the project?
- What are the impacts of the proposed project after its construction?
- What are the effects of this hydropower station on local environment?
- Will the reservoir worsen the water pollution?
- What are the effects of this hydropower station on landscape? If there are effects on landscape, what are the effects?
- If you need to resettle, do you agree the resettlement?
- Where do you think the immigrants to move?
- What are the influence to the immigrants?
- If there are immigrants move to your living place, do you accept?

The analysis of 100 questionnaires is as follows:

Item	Survey result	Proportion
1. Do you know the proposed project?	Know and somehow know	85%
	Don't know	15%
2. What's your attitude toward the construction of the project?	Agree	88%
	Indifferent	12%
	Oppose	0
3. What are the impacts of the proposed project after its construction?	Great affects to the local development	65%
	Accelerate the economic development	70%
	Improve environment in downstream area and country water supply	63%
	Improve water environment in downstream area	65%
	Improve the local peoples' life	56%
	Improve traffic situation in	30%
4. What are the effects of this hydropower station on local environment?	Is benefit to improve the environment	75%
	Some influence, must take measurement to control	15%
	No influence	10%
5. Will the reservoir worsen the water pollution?	No pollution	84%
	Little pollution	16%
6. What are the effects of this hydropower station on landscape?	No influence	100%
	Little influence	0
7. If you need to resettle, do you agree the resettlement?	Would like to immigrate	92%
	Obey the arrangement	8%

8. Where do you think the immigrants to move?	Would like to backwards	60%
	Would like to move to other place	8%
	Obey the arrangement	24%
	Don't know	8%
9. What are the influences to the immigrants?	Increase the incomes	58%
	No changes of the incomes	21%
	Don't know	21%
10. If there are immigrants move to your living place, do you accept?	Accept	50%
	Indifferent	20%
	Obey the arrangement	30%

The investigation shows that the majority of common people have the supportive attitude towards the construction of this project, only few people think there are a few questions, which focus on the ecology and environment after the implementation of this project, immigration and compensation. As for the above 3 questions, the project owner will solve them by the following ways:

- As for the ecology and environmental protection, a big investment will be used during the construction phase, which will ensure that the environment and water protection, it will minimize the damage to ecological environment.
- The resettlement areas consist of Yuanyang County, Gejiu City, Mengzi County and Jinping County, which will ensure the resettlement of immigrants.
- The compensation for the land and crops is constituted according to the relevant policies of the State and Yunnan Province. Based on the local price level, that will satisfy the need of immigration and reproduction.

In conclusion, the problems of this project brought forward by the public can be solved effectively, and there would be no negative effects.

During project implementation phase, there is a public comments collection and feedback book for the project. The local stakeholders can leave their opinions, comments and concerns on the project and contact information in the public comments collection and feedback book in the reception room at any time⁴. The project owner will contact the local stakeholder to give feedback within two weeks. So far, no public comments about potential negative impacts during project implementation have been received by the project owner.

⁴ See the APPENDIX II.

2.3 AFOLU-Specific Safeguards

The project is not AFOLU projects.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project involves the installation of three sets of 96MW water turbine and generator units. The main structures include the dam, reservoir, water diversion structures, power house, and switch station. The main parameters of the installed equipments are as follows:

Table 1 The main parameters of the installed equipments

Water turbine	Model:	HL210a-LJ-430
	Number:	3
	Rated capacity:	96 MW
	Rated water head:	67.0m
	Rated flow:	168.67m ³ /s
	Rated speed:	142.9 r/min
	Operation year	50 years in ideal condition
Generator	Model:	SF96-42/10000
	Number:	3
	Capacity per set:	96MW
	Power factor:	0.85
	Rated speed:	142.9 r/min
	Rated voltage:	13.8kV
	Operation year	50 years in ideal condition
Transformer	Model:	SFP10-120000/230
	Number:	3
	Rated capacity	120000kVA
	Rated frequency:	50HZ
	Operation year	>30 years in ideal condition

The construction of the project started on 25/01/2009. The first set of water turbine and generator unit was commissioned on 28/02/2011, the second on 29/06/2011, and the third on 27/07/2011. All facilities and equipments have been installed as described in the registered PDD.

Over this monitoring period, the water turbine and generator units and the monitoring meters operated normally, no malfunction or replacement of the equipments took place. Moreover, no events or situations have occurred during this monitoring period that could have impacted the applicability of the applied methodology.

3.2 Deviations

2.1.1 Methodology Deviations

There is no deviation applied to this monitoring period.

2.1.2 Project Description Deviations

The project was registered under VCS version 3 and completed validation before 19/03/2020. thus, it remains eligible to apply the crediting period requirements under VCS Standard Version 3.4 which shall be a maximum of ten years and may be renewed at most twice as the project started operation which is also the start date of the project was 28/02/2011, therefore the first crediting period for project under VCS should be updated from 28/02/2011 to 06/06/2011 to 28/02/2011 to 27/02/2021. The deviation on the crediting period deviation 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

Parameters $NCV_{i,y}$, $EF_{CO2,i,y}$, $FC_{i,y}$, EG_y , $CAP_{y,j}$, $GENE_{best,coal}$ and $GENE_{best,oil/gas}$ were the parameters used to calculate $EF_{grid,CM,y}$ which have been confirmed during the validation stage, thus, they are not listed in detail here.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO ₂ e/MWh
Description	CM emission factor of SCPG
Source of data	The registered PDD
Value applied	0.78795
Justification of choice of data or description of measurement methods and procedures applied	The data is ex ante determined in the registered PDD and fixed for the first crediting period.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	Cap _{BL}
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data	Project site
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	For new hydropower plant, this value is 0
Purpose of Data	Calculation of project emissions
Comments	-

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 (m ²).
Source of data	Project site
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	For new hydropower plant, this value is 0
Purpose of Data	Calculation of project emissions
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	EG _{facility to SCPG, y}
Data unit	MWh
Description	Quantity of electricity supplied by the project to the grid in year y
Source of data	Meter records
Description of measurement methods and procedures to be	Measured

applied			
Frequency of monitoring/recording	Continuous measurement and at least monthly recorded		
Value monitored	3,837,351.10		
Monitoring equipment	Meter	M1 (Main meter)	M2 (Backup meter)
	SN	213139169	213139150
	Location	Manhao Switching Station	
	Type	Mk6E	
	Accuracy class	0.2S	
	Calibration date	17/03/2017 16/03/2018 15/03/2019 13/03/2020	
	Validity period	17/03/2017-16/03/2018 16/03/2018-15/03/2019 15/03/2019-14/03/2020 13/03/2020-12/03/2021	
	Calibration frequency	At least once a year	
	Calibration entity	Electric Power Research Institute of Yunnan Electric Power Test & Research Institute (Group) Co., Ltd	
QA/QC procedures to be applied	Measurement results should be cross-checked by electricity sales receipts.		
Purpose of the data	Calculation of baseline emissions		
Calculation method	-		
Comments	-		

Data / Parameter	EG SCPG to facility, y
Data unit	MWh
Description	Quantity of electricity imported from the grid in year y
Source of data	Meter records
Description of measurement methods and procedures to be applied	Measured
Frequency of monitoring/recording	Continuous measurement and at least monthly recorded
Value monitored	3,498.55

Monitoring equipment	Meter	M1 (Main meter)	M2 (Backup meter)
	SN	213139169	213139150
	Location	Manhao Switching Station	
	Type	Mk6E	
	Accuracy class	0.2S	
	Calibration date	17/03/2017 16/03/2018 15/03/2019 13/03/2020	
	Validity period	17/03/2017-16/03/2018 16/03/2018-15/03/2019 15/03/2019-14/03/2020 13/03/2020-12/03/2021	
	Calibration frequency	At least once a year	
	Calibration entity	Electric Power Research Institute of Yunnan Electric Power Test & Research Institute (Group) Co., Ltd	
	QA/QC procedures to be applied	Measurement results should be cross-checked by electricity sales receipts.	
Purpose of the data	Calculation of baseline emissions		
Calculation method	-		
Comments	-		

Data / Parameter	EG _{facility, y}
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Meter records
Description of measurement methods and procedures to be applied	Calculated
Frequency of monitoring/recording	-
Value monitored	3833852.55
Monitoring equipment	Refer to EG _{facility to SCPG, y} and EG _{SCPG to facility, y} for details.
QA/QC procedures to be applied	Refer to EG _{facility to SCPG, y} and EG _{SCPG to facility, y} for details.

Purpose of the data	Calculation of baseline emissions
Calculation method	$EG_{\text{facility, y}} = EG_{\text{facility to SCPG, y}} - EG_{\text{SCPG to facility, y}}$
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	Read directly from the nameplates of three generators of the project.
Frequency of monitoring/recording	Measured once at the start of the operation of the project.
Value monitored	288
Monitoring equipment	-
QA/QC procedures to be applied	Cross check against the project documentation.
Purpose of the data	Calculation of project 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	A _{PJ} has been measured through an engineering survey by Pearl River Water Resources Scientific Research Institute of Pearl River Water Resources Commission.
Frequency of	Yearly measured

monitoring/recording													
Value monitored	<table><tr><td>Year</td><td>Measured value</td><td>Measurement date</td></tr><tr><td>2018</td><td>19,180,000</td><td>15/09/2018</td></tr><tr><td>2019</td><td>19,180,000</td><td>15/07/2019</td></tr><tr><td>2020</td><td>19,180,000</td><td>15/10/2020</td></tr></table>	Year	Measured value	Measurement date	2018	19,180,000	15/09/2018	2019	19,180,000	15/07/2019	2020	19,180,000	15/10/2020
Year	Measured value	Measurement date											
2018	19,180,000	15/09/2018											
2019	19,180,000	15/07/2019											
2020	19,180,000	15/10/2020											
Monitoring equipment	-												
QA/QC procedures to be applied	The measured frequency is once a year. Pearl River Water Resources Scientific Research Institute of Pearl River Water Resources Commission is a qualified design institute with Class B of Certificate Surveying and Mapping Qualification (Certificate No.Yicezizi 44101043).												
Purpose of the data	Calculation of project emissions												
Calculation method	-												
Comments	-												

4.3 Monitoring Plan

1. Monitoring system

The electricity exported to the grid ($EG_{\text{facility to SCPG, y}}$) and imported from the grid ($EG_{\text{SCPG to facility, y}}$) by the project is monitored through two bidirectional electric energy meters (M1 and M2) installed in Manhao Switching Station. M1 is the main meter; M2 is the backup meter in case of emergency use. Figure 1 is the monitoring system diagram of the project.

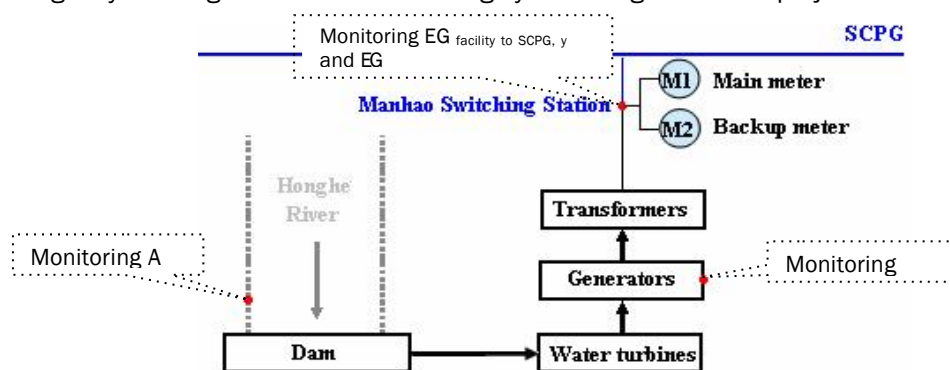


Figure 1 Monitoring system diagram

2. Data collection procedures

$EG_{\text{facility to SCPG, y}}$ and $EG_{\text{SCPG to facility, y}}$ is continuously measured and automatically accumulated by the electric energy meters. The designated personnel from the grid company and the project

owner record the meter readings at 24:00 on the last day of each month in Monthly Readings Records (MRRs). Then the grid company issues Electricity Transaction Notes (ETNs) to the project owner. MRRs were served as the basis for ERs calculation; ETNs were served as the electricity sales and purchase receipts for cross-check.

$EG_{\text{facility}, y}$ is net electricity generation supplied by the project to the grid. It is calculated as $EG_{\text{facility to SCPG}, y}$ minus $EG_{\text{SCPG to facility}, y}$.

Cap_{PJ} is monitored yearly by the VCS management team. No replacement of hydro turbines and generators has taken place during this monitoring period. Cap_{PJ} of the project could be verified by the nameplates of water turbine and generator units.

A_{PJ} is measured yearly by Pearl River Water Resources Scientific Research Institute of Pearl River Water Resources Commission, which is a qualified institute. The measurement result of A_{PJ} of the full reservoir has not been changed and has been provided by Pearl River Water Resources Scientific Research Institute of Pearl River Water Resources Commission.

3. The Organizational structure and responsibilities

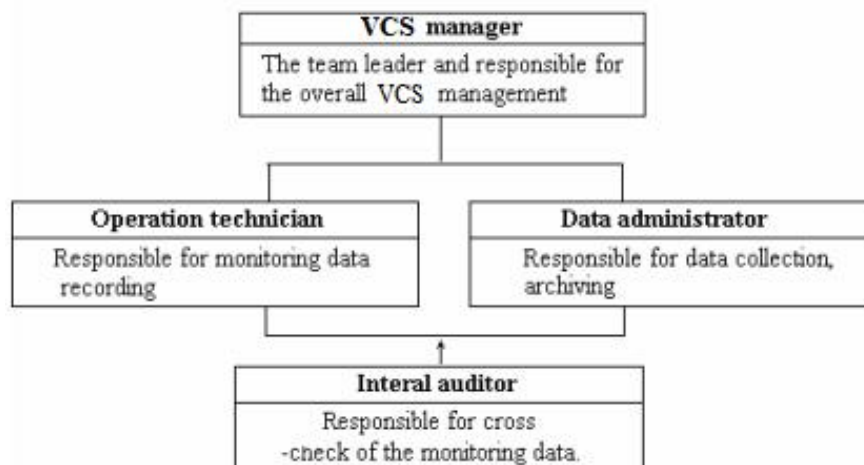


Figure 2 Organizational structure and responsibility

4. Emergency procedures

In normal condition, meter records from the main meter are used for ER calculation. If the malfunction happened to the main meter, the meter records from the backup meter will be used for ER calculation, and the electricity sales and purchase receipts will be kept for cross check. Problem occurred in monitoring and measurement process will be recorded and reported to project manager.

During this monitoring period, the meters operated normally, and no emergency occurred.

5. Internal audit

All the monitoring data are forwarded to the internal auditor monthly for the cross-check. The $EG_{\text{facility to SCPG, } y}$ and $EG_{\text{SCPG to facility, } y}$ from meter records will be cross-checked against the electricity sales receipts issued by the grid company.

6. Training

The team members of the monitoring team was trained by the VCS consulting company before the operation of the project. Relevant training material was provided to VVB

7. Data management

All of the data records relevant to monitoring such as Power Purchase Agreement, DL/T448-2000 and DL/T448-2016, technical parameters of the energy meters, monthly meter records, electricity transaction receipts, calibration records, training records and so on will be archived electronically and kept at least for 2 years after the end of the last crediting period. Thereinto, monthly meter records, electricity transaction receipts will be preserved monthly and kept at least for 2 years after the end of the last crediting period or the last issuance of VCUs, whichever occurs later; the Power Purchase Agreement, calibration records will be preserved yearly and kept at least for 2 years after the end of the last crediting period or the last issuance of VCUs, whichever occurs later; DL/T448-2000 and DL/T448-2016, technical parameters of the energy meters and training records will be preserved and kept at least for 2 years after the end of the last crediting period or the last issuance of VCUs, whichever occurs later.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

According to the registered PDD, the baseline emissions (BE_y) is calculated as follows:

$$BE_y = EG_{PJ, y} \times EF_{\text{grid, CM, } y} = EG_{\text{facility, } y} \times EF_{\text{grid, CM, } y} = (EG_{\text{facility to SCPG, } y} - EG_{\text{SCPG to facility, } y}) \times EF_{\text{grid, CM, } y}$$

Where:

$EG_{PJ, y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the VCS project activity in year y .

The detailed calculation procedure is described below:

Table 2 $EG_{\text{facility to SCPG, } y}$ and $EG_{\text{SCPG to facility, } y}$ in the monitoring period

Period	$EG_{\text{facility to SCPG, } y}$			$EG_{\text{SCPG to facility, } y}$		
	MRRs	Sales receipts	ER calculation	MRRs	Purchase receipts	ER calculation
	MWh	MWh	MWh	MWh	MWh	MWh
	A	B	C=MIN(A,B)	D	E	F=MAX(D,E)

01/01/2018-31/12/2018	1,422,803.25	1,422,803.25	1,422,803.25	291.50	291.50	291.50
01/01/2019-31/12/2019	1,301,256.55	1,301,256.55	1,301,256.55	1,245.20	1,245.20	1,245.20
01/01/2020-31/12/2020	1,036,233.55	1,036,233.55	1,036,233.55	1,516.90	1,516.90	1,516.90
01/01/2021-27/02/2021	77,057.75	77,057.75	77,057.75	444.95	444.95	444.95
Total	3,837,351.10	3,837,351.10	3,837,351.10	3,498.55	3,498.55	3498.55

Table 2 Baseline emission in the monitoring period

Period	EG _{facility to SCPG,y} (MWh)	EG _{SCPG to facility,y} (MWh)	EG _{facility,y} (MWh)	EF _{grid,CM,y} (tCO ₂ e/MWh)	BE _y (tCO ₂ e)
01/01/2018-31/12/2018	1,422,803.25	291.50	1,422,511.75	0.78795	1,120,868
01/01/2019-31/12/2019	1,301,256.55	1,245.20	1,300,011.35	0.78795	1,024,343
01/01/2020-31/12/2020	1,036,233.55	1,516.90	1,034,716.65	0.78795	815,304
01/01/2021-27/02/2021	77,057.75	444.95	76,612.80	0.78795	60,367
Total	3,837,351.10	3,498.55	3,833,852.55	0.78795	3,020,882

5.2 Project Emissions

Since there is no project emissions from fossil fuel consumption and the operation of dry, flash steam or binary geothermal power plants.

$$PE_y = PE_{HP,y}$$

For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH₄ and CO₂ emissions from the reservoir. The project is a newly-built hydropower project, the value of Cap_{BL} and the A_{BL} are zero. As per the nameplates of water turbine and generator units, the value of Cap_{PJ} is 288MW. According to the measurement results issued by Pearl River Water Resources Scientific Research Institute of Pearl River Water Resources Commission on 28 May of each year, the actual measured value of A_{PJ} is 19,180,000 m², thus the power density of the project is calculated to be 15W/m² (15W/m²=(288 × 10⁶W-0)/(19,180,000m²-0)), which is greater than 10W/m², so PE_{HP,y} = 0. Therefore, the project emission (PE_y) is 0.

5.3 Leakage

As per the methodology ACM0002 ver. 11, no leakage emissions need to be considered.

5.4 Net GHG Emission Reductions and Removals

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)
01/01/2018-31/12/2018	1,120,868	0	0	1,120,868

01/01/2019-31/12/2019	1,024,343	0	0	1,024,343
01/01/2020-31/12/2020	815,304	0	0	815,304
01/01/2021-27/02/2021	60,367	0	0	60,367
Total	3,020,882	0	0	3,020,882

Ex-ante emissions reductions/removals	Achieved emissions reductions/removals	Percent difference	Justification for the difference
3,030,596 tCO₂e	<u>3,020,882tCO₂e</u>	-0.32%	The difference is in the normal range of fluctuation.

During this monitoring period from 01/01/2018 to 27/02/2021 (total 3 years and 58 days). The actual emission reductions are 3,020,882tCO₂e. According to the registered PDD, the estimated emission reductions for this monitoring period should be 3,030,596tCO₂e (959382*3+959382*58/365). In comparison, the actual emission reductions are 0.32% lower than the estimated emission reductions in the registered PDD.

APPENDIX I: THE EMPLOYEE ROSTER

马堵山公司人员名单			
序号	岗位名称	人数	姓名
1	董事长		张雄云
2	总经理		周占文
3	副总经理	2	吴云煜、曹鸿晋
4	总工程师	1	艾永俊
5	发电部部长	1	王治全
6	发电部副部长	1	杨玉江
7	值长	3	彭林峰、董国外、刘加祥
8	副值长	2	韦照艳、李州燕
9	见习值长	1	刘航
10	值班员	6	李春、杨宇辰、张竣奕、张婷、尚家宇、赵人龙
11	运行学员	2	邹瑞、白春旺
12	安全技术部部长	1	王德勇
13	电气一级专责	1	宋广冉
14	机械班长	1	蒋红辉
15	电气班长	1	谢建红
16	水工专责	1	党令宜
17	安全专责 安全员	2	叶细红、孔繁伟
18	机械二级专责	1	赵善荣
19	机械三级专责	2	李锐根、沈绍辉
20	电气三级专责	1	卢坤
21	环保办公室副主任	1	陈白超
22	环保办公室技术员	1	杨金花
23	环保办公室职员	2	李云、黄杰
24	综合管理部主管	1	曹海
25	综合管理部部长	1	王玲
26	档案及合同管理	1	陆文旭
27	仓管员	1	李海金
28	文员	1	徐桂华
29	会计	1	王旭
30	出纳	1	王刚
31	驾驶员	3	杨国成、罗世山、宗洲
32	厨师	2	李建英、吴斗芬
33	保洁员	3	侯艳兰、吴灯收、李季
34	保安员	4	刀永成、白春林、陶文兵、李国光
	总人数	55	

APPENDIX II: THE PICTURE OF RECEPTION ROOM

