



MADUSHAN HYDROPOWER PROJECT ON HONGHE RIVER IN YUNNAN PROVINCE, CHINA

Document Prepared by Goldchina Consultancy International Co., Ltd.

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Prepared By	Dr. Zhaoning Zheng Goldchina Consultancy International Co., Ltd.
Contact	Address: Room 230, Unit B, Building 2, Tangning One, No. 16 of Zhongguancun East Road, Haidian District, Beijing, China 100083 Telephone: (86)18010121386 Fax: (8610) 62682682 Email: zzn@gcci-carbon.com

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1.PROJECT DETAILS

1.1. Summary Description of the Project

Madushan Hydropower Project on Honghe River in Yunnan Province, China (hereafter referred to as “the project” or “the proposed project”) is located on Honghe River in Honghe Hani and Yi Autonomous State, Yunnan Province, P. R. of China. The proposed project is a newly built hydro power project with type of diversion.

The purpose of the project is to generate renewable hydro power and deliver it to South China Power Grid (hereafter referred to as “SCPG”). According to the following analysis in section 3.4, in the absence of the proposed project, the most viable baseline scenario is “the same annual power generation provided by SCPG, which is dominated by fossil fuel-fired power plants. So, the baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity.

The project involves the installation of 3 sets of water turbine and generator, each of which has a rated capacity of 96MW, providing a total capacity of 288MW. After the implementation of the proposed project, when all the 3 sets of water turbine and generator were put into operation, the annual grid-connected electricity supplied to SCPG is 1,217,569MWh. Therefore, the project substituted a part of the electricity of SCPG, resulting in reducing the CO₂ emission of SCPG. The annual average emission reductions of the proposed project were estimated to be 439,755tCO₂e in the second renewal 10 years crediting period from 28/02/2021 to 27/02/2031.

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 Eligibility

The project is a hydro power generation project and registered as VCS project (VCS 883), which is eligible under the scope of the VCS program.

1.4. Project Design

The project has been designed to include a single location or installation only,

Eligibility Criteria

Not applicable.

1.5. 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

1.6. 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, China 100083
Telephone	(86) 18010121386
Email	zzn@gcci-carbon.com

1.7. Ownership

Ownership of the plant, equipment and electricity generation licence belongs to Honghe Guangyuan Madushan Hydro Power Development Co., Ltd. and all emission reductions are granted to the company. The production license and the operating certification of the company given by the Chamber of Commerce are provided to the validating DOE as proof of the Title.

1.8. Project Start Date

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

1.9. Project Crediting Period

10 years *3 renewable crediting period is adopted by the project activity. The total crediting period under VCS would have been from 28/02/2011-27/02/2041 (30 years).

However, the project was registered under CDM on 07/06/2011 (CDM ref no.: 4476). And the total crediting period under CDM is from 07/06/2011 to 06/06/2032 (21 years).

The first 10 years VCS project crediting period started on 28/02/2011 and expired on 27/02/2021 (the start and end dates included).

The second 10 years VCS project crediting period started on 28/02/2021 and will be expired on 27/02/2031 (the start and end dates included).

The VCS project crediting period will be ended once the third CDM project crediting period expired, i.e. the third VCS crediting period of the project will be ended on 27/02/2032.

1.10. Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	√

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
28/02/2021-31/12/2021	407,225
01/01/2022-31/12/2022	439,755
01/01/2023-31/12/2023	439,755
01/01/2024-31/12/2024	439,755
01/01/2025-31/12/2025	439,755
01/01/2026-31/12/2026	439,755
01/01/2027-31/12/2027	439,755
01/01/2028-31/12/2028	439,755
01/01/2029-31/12/2029	439,755

01/01/2030-31/12/2030	439,755
01/01/2031-27/02/2031	32,530
Total estimated ERs	4,397,550
Total number of crediting years	10
Average annual ERs	439,755

1.11. Description of the Project Activity

The proposed project is a newly-built hydro power station with type of diversion. There is no equipment and system in operation prior to the start of the implementation of the proposed project at the project site.

The scenario existing prior to the start of the implementation of the proposed project is the same as the baseline scenario. According to the following analysis in section 3.4, in the absence of the proposed project, the most viable baseline scenario is that power supplied by SCPG, which is dominated by fossil fuel-fired power plants. The baseline emission source is CO₂ emission by SCPG. Furthermore, the power density of the proposed project is 15W/m² (288MW/19,180,000m²), larger than 10W/m², so there is no emission source from the project activity.

The project involves the installation of 3 sets of water turbine and generator, each of which has a rated capacity of 96MW, providing a total capacity of 288MW. The main constructions include dam, reservoir, water diversion structures, power house, and switch station. The maximum height of the dam is 107.5 meters, and the surface area of the reservoir is 19,180,000 m² when the reservoir is full. The annual power generation of the proposed project is 1,314,380MWh, the annual operation hour is 4,564 hours¹ with the PLF of 52.10%, and the annual grid-connected electricity of 1,217,569MWh was supplied to Yunnan Power Grid and then to SCPG through one 220kV circuit.

The major parameters of the equipment are as follows:

Table1.1 The parameters of equipment used in the proposed project²

	Number & Model	Manufacturer	Major Parameters
Water Turbine	Three sets of HL210a-LJ- 430	Tianjin City Tianfa Hydropower Equipment Manufacture Co.,	Rated Capacity: 96MW Rated Speed: 142.9 r/min Rated Water Head: 67.0m Rated Flow: 168.67 m ³ /s

¹ Data source: Attach table 1 of chapter 1 in approved FSR.

² Data source: Turbines and Generators Purchase Agreement and Transformer Purchase Agreement

		Ltd	Operation year: 50 years in ideal condition
Generator	Three sets of SF96-42/10000	Tianjin City Tianfa Hydropower Equipment Manufacture Co., Ltd	Capacity per set: 96 MW Power Factor: 0.85; Rated Speed: 142.9r/min Rated Voltage: 13.8 kV Operation year: 50 years in ideal condition
Transformer	Three sets of SFP10-120000/230	Jiangxi Transformer Technology Co., Ltd	Rated Capacity: 120000kVA Rated frequency: 50HZ Operation year: >30 years in ideal condition

The monitoring equipment is the bidirectional electric energy meter and the accuracy of the meter should be 0.5s or 0.2s in accordance with Technical Administrative Code of Electric Energy Metering (DL/T448-2016). The monitoring equipment was installed at the grid interface point of the proposed project. For more information about monitoring equipment, see section 3.3 and 5.3.

1.12. Project Location

The proposed project is located on Honghe River in Honghe Hani and Yi Autonomous State, Yunnan Province. It is about 75km away from Gejiu City, about 59km away from Yuanyang County, and about 86km away from Mengzi County. The geographical coordinates of the dam are 103°16'58.5"E , 23°02'43.9"N, and the geographical coordinates of the power house are 103°17'15" E, 23°02'39" N. The detailed project location is shown in Figure 1.1.

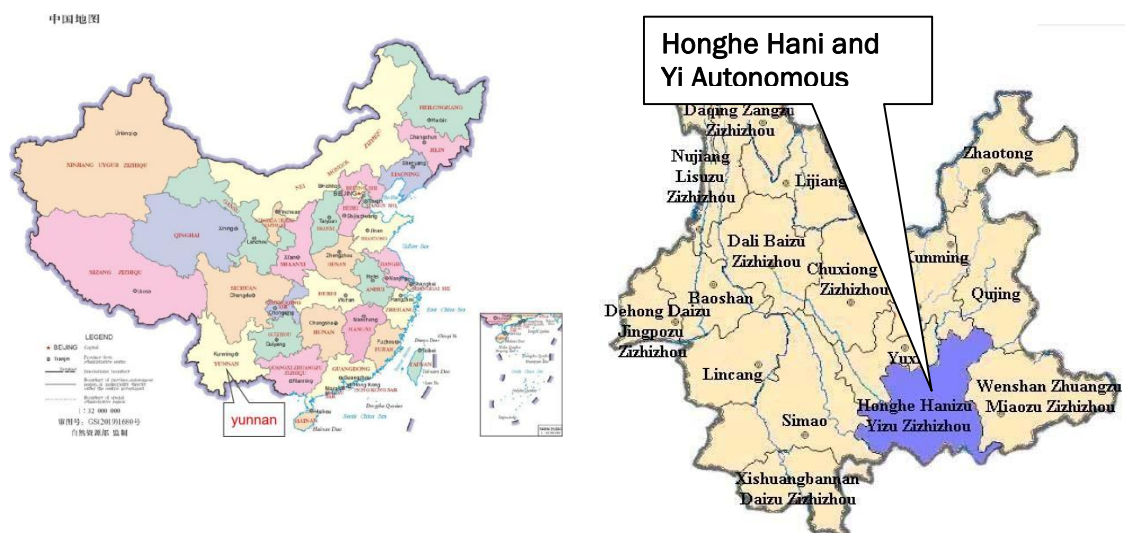




Figure 1.1. Geographical location of the proposed project

1.13. Conditions Prior to Project Initiation

The project is a renewable energy project. Prior to the project initiation, there was no other hydro electric power plant installation at the project site. The scenario existing prior to the start of the implementation of the project activity is SCPG providing the same electricity service as the Project. So, the baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

For more information about prior the project, see section 3.4.

1.14. Compliance with Laws, Statutes and Other Regulatory Frameworks

The Environmental Impact Assessment (EIA) report was approved by Ministry of Environmental Protection of People's Republic of China on 27/09/2007, and the Feasibility Study Report of the project was approved by National Development and Reform Commission on 31/12/2008. The project has got LOA from China DNA on 10/12/2009. These approvals demonstrate that the project meets the requirement of national laws and regulations, including Renewable Energy Law of the People's Republic of China and Regulations on the Administration of Environmental Protection of Construction Projects, etc.

Addition of a new power generation capacity to the grid is regulated by Energy Market Regulatory Authority (EMRA) who issues the licenses for electricity generation and is responsible for ensuring that new capacity applies with its rules and regulations.

1.15. Participation under Other GHG Programs

1.15.1. Projects Registered (or seeking registration) under Other GHG Program(s)

The project was registered as CDM project (CDM ref no.: 4476). 3*7 years renewable crediting period is adopted by the project activity. 3*7 years renewable crediting of the project under CDM covers 07/06/2011 to 06/06/2032. The VCS crediting period started from 28/02/2011, So, the VCS crediting period will be expired after 27/02/2032.

1.15.2. Projects Rejected by Other GHG Programs

Not applicable.

1.16. Other Forms of Credit

1.16.1. Emissions Trading Programs and Other Binding Limits

The project has been registered as a CDM project with registration number 4476 and VCS project (project ID: 883), for which a renewable crediting period of 3*7 years will be used under the CDM GHG Program. As per CCER rule, the registered CDM project which have CER issuance since the start date of crediting periods are ineligible to participate the China's ETS.

The project has not been counted or used under GS project or under any other voluntary carbon crediting scheme. In the future, the emission reductions that apply for issuance under VCS will not be issued under CDM or GS project or under any other voluntary carbon crediting scheme. The project does not involved in China's ETS or other binding limits.

1.16.2. Other Forms of Environmental Credit

CERs were claimed for 07/06/2011 to 30/11/2011 and 01/12/2011 to 31/07/2012 [<https://cdm.unfccc.int/Projects/DB/ERM-CVS1297254096.28/view>]. The period issue CERs was not issued any other environment credit to avoid possible double issuance, and the period issue VCUs will not be issue any other environment credit to avoid possible double issuance.

The project has not been registered in any other renewable certificate systems such as I-REC or Tigrs.

1.17. 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 55 long-term job opportunities could be offered during the operation period.

(3) By displace coal fired electricity in SCPG, the project will reduce 439,755tCO₂e/year in the second renewal 10 years crediting period from 28/02/2021 to 27/02/2031.

The project is expected to contribute 3 SDGs which are SDG 7, 8 and 13. It will be included in the monitoring report.

SDG 7 Energy: The project contributes SDG Target 7.2 “By 2030, increase substantially the share of renewable energy in the global energy mix” by the utilization of hydro power as a renewable energy source.

SDG 8 Economic Growth: The project creates direct and indirect employment opportunities during construction and operation phases. Therefore, the project contributes to SDG Target 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”.

SDG 13 Climate Change: The project produces clean renewable energy by diminishing CO₂ emissions. Therefore, it contributes SDG Target 13.3 “Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning”.

1.18. Additional Information Relevant to the Project

Leakage Management

Not applicable. As per ACM0002 (Version 20.0), no leakage emissions are considered in this project.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Further Information

No further information to be added.

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 approval comments of the EIA Report by the State Environmental Protection Administration, the environmental impacts likely to be caused by the project are considered insignificant and conforming to the laws and regulations; therefore, there is no net harm.

2.2. Local Stakeholder Consultation

Local stakeholder consultation before the Project construction

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 during August to October of 2006. 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 follows³:

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?

³ Chapter 11 in EIA of the proposed project

- 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.

Local stakeholder consultation during the project operation

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

2.3. Environmental Impact

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 27/09/2007. 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 industrial, workers' and power station's wastewater. 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.

2.4. Public Comments

The project did not receive any public comments.

2.5. AFOLU-Specific Safeguards

The project is not an AFOLU project.

3. APPLICATION OF METHODOLOGY

3.1. Title and Reference of Methodology

- 1) Version 20.0 of ACM0002 Grid-connected electricity generation from renewable sources⁴;
- 2) Version 07.0 of the tool to calculate the emission factor for an electricity system⁵;
- 3) Version 03.0.1 of the Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (EB66)⁶.

⁴ <https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG>.

⁵ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v7.0.pdf>

⁶ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-11-v3.0.1.pdf>

3.2. Applicability of Methodology

The proposed project activity is within the scope of the methodology ACM0002 (Version 20.0). In addition, the project also meets with the conditions included in the tools referred above. Applicability criteria and how the project meets these criteria are given in below:

Applicability Criteria	Status of the Project Activity
This methodology is applicable to grid-connected renewable energy power generation project activities that: • Install a Greenfield power plant; • Involve a capacity addition to (an) existing plant(s); • Involve a retrofit of (an) existing operating plants/units; • Involve a rehabilitation of (an) existing plant(s)/unit(s); or • Involve a replacement of (an) existing plant(s)/unit(s)	The proposed project is a newly-built hydro power station with installed capacity of 288MW. The electricity generated will be connected to SCPG. So it is a grid-connected renewable power generation project activity. Hence, the methodology is applicable.
The methodology is applicable under the following conditions: • The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit	The project activity involves an installation of a hydro power plant. Hence, the methodology is applicable.
In case of hydro power plants, one of the following conditions shall apply: (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m².	According to the approved FSR of the proposed project, the surface area of the reservoir resulted by the proposed project is 19,180,000m², and the power density of the proposed project is calculated to be 15W/m² ⁽⁷⁾, which is greater than 4W/m²; So, the methodology is applicable.
In the case of integrated hydro power projects, project proponent shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the	The project activity does not involve integrated hydro power project. Hence, the methodology is applicable.

⁷ Refer to section 4.1

generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum of five years prior to the implementation of the CDM project activity.	
The methodology is not applicable to: (a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (b) Biomass fired power plants/units	According to the approved FSR of the proposed project, the proposed project doesn't involve switching from fossil fuels to renewable energy sources at the site of the project activity; Hence, the methodology is applicable.
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	The project activity does not involve capacity additions, retrofits, replacement, or rehabilitations. Hence, the methodology is applicable.

For the applicability of "Tool to calculate the emission factor for an electricity system, version 07.0", following conditions are met:

Applicability Criteria of tool	Status of the Project Activity
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand- side energy efficiency projects).	The project is a hydro power plant providing clean energy to the grid.

Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, two sub-options under the step 2 of the tool are available to the project participants, i.e. option IIa and option IIb. If option IIa is chosen, the conditions specified in “Appendix 1: Procedures related to off-grid power generation” should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	The project is a grid connected power plant.
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For the applicability of “Tool for the demonstration and assessment of additionality, Version 07”, following conditions are met:

Applicability Criteria of tool	Status of the Project Activity
Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity.	Since this tools application is required in the approved methodology, it is used in this project

For the applicability of “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period, Version 03.0.1”, following conditions are met:

Applicability Criteria of tool	Status of the Project Activity
This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 49 (a) of the modalities and procedures of the clean development mechanism.	Since this tools application is required in the approved methodology, it is used in this project

3.3. Project Boundary

The electricity generated by the proposed project will be supplied to Yunnan Power Grid which is a part of SCPG. According to the delineation of grid boundaries published by China's DNA on 29/12/2020⁸, the project electricity system of the proposed project is SCPG, so the boundary of the proposed project includes the proposed project and all power plants connected physically to SCPG which is composed of Guangdong Power Grid, Guangxi Power Grid, Guizhou Power Grid, Hainan Power Grid and Yunnan Power Grid.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in Table 3.1.

Table 3.1 Summary of greenhouse gases and sources included in and excluded from the project boundary

Source		Gas	Included?	Justification/Explanation
Baseline	Electricity generation of SCPG	CO ₂	Yes	Main emission source
		CH ₄	No	Minor emission source
		N ₂ O	No	Minor emission source
		Other	/	
Project	Emissions of CH ₄ from the reservoir	CO ₂	No	Minor emission source
		CH ₄	No	Minor emission source. The power density is 15W/ m ² , which is greater than 10W/m ² . The Cap _{PJ} and A _{PJ} will be monitored throughout the crediting period.
		N ₂ O	No	Minor emission source
		Other	/	

The flowchart of the proposed project is as following:

⁸ https://www.mee.gov.cn/ywgz/xdqhbh/wsqtz/202012/t20201229_815386.shtml

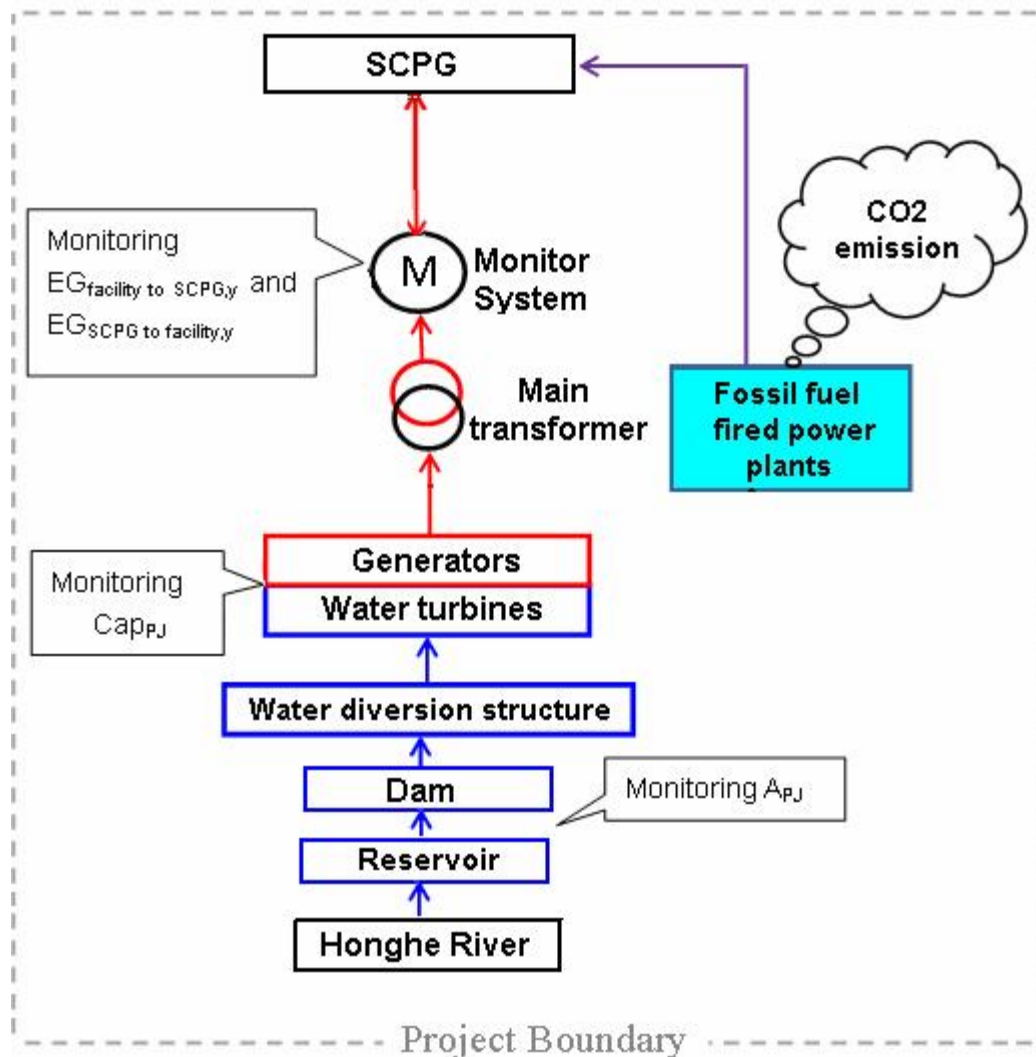


Figure 3.1 The Diagram of Project Boundary

3.4. Baseline Scenario

According to the last version of “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (EB66, version 03.0.1)”, the baseline of the project is assessed as below:

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

If the current baseline complies with all relevant mandatory national and/or sectoral policies which have come into effect after the submission of the project activity for validation or the

submission of the previous request for renewal of the crediting period and are applicable at the time of requesting renewal of the crediting period, go to Step 1.2.

- There are no new national and/or sectoral policies that could affect the baseline scenario at the time of requesting renewal of the crediting period. The current baseline complies with all relevant mandatory national and/or sectoral policies. Hence in the absence of the project activity the electricity would still have been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

Step 1.2: Assess the impact of circumstances

Assess the impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions, without reassessing the baseline scenario.

In the situation where the baseline scenario identified at the validation of the project activity was the continuation of the current practice without any investment, an assessment of the changes in market characteristics is required for the renewal of the crediting period.

- The baseline scenario identified at the validation of the project activity was the continuation of the current practice without any investment. In the most recent 5 years (2014-2018), the average proportions of low-cost/must run resources in the total electricity output in South China Power Grid during 2013-2017 is 46.91%, less than 50%. Therefore, market characteristics do not have impact on the baseline emissions.

Evaluate whether the conditions used to determine the baseline emissions in the previous crediting period are still valid. Assess the availability of new fuels or raw materials and the impact of electricity or fuel prices in the identification of the current practice for the baseline emissions.

- The conditions used to determine the baseline emissions in the previous crediting period are still valid. The availability of new fuels or raw materials or the level of fuel prices has no impact on the identification of the current practice for the baseline emissions. Presently the SCPG is dominated by the fossil fuel power plants. The availability of new fuels or raw materials or the level of fuel prices has no impact on the baseline emissions.

If the new circumstances make a continued validity of the current baseline not plausible, then the current baseline needs to be updated for the subsequent crediting period.

- As there are no new circumstances that make a continued validity of the current baseline not plausible, the current baseline does not need to be updated for the third crediting period.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested

This sub-step should only be applied if the baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology.

Assess whether the remaining technical lifetime of the equipment that would have continued to be used in the absence of the project activity, as determined in the VCS-PD, exceeds the crediting period for which renewal is requested.

Take into consideration the market penetration of different technologies. Evaluate the penetration rate of different technologies that are available in the market and evaluate how they could affect the baseline.

If the baseline scenario of the project activity is the continuation of use of the current equipment(s) without any investment and the projects proponents or third party(ies) will undertake an investment later, but before the end of a crediting period, then the current baseline needs to be updated for that crediting period or the crediting of emission reductions should be limited to the period before the baseline equipment would cease its operation.

- As determined in the VCS-PD, the baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources in Central China Power Grid, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system". The projects proponents or third party (or parties) would not undertake an investment later. The combined margin calculation automatically takes account of any issues regarding remaining technical lifetime or market penetration. Therefore, the current baseline does not need to be updated for the third crediting period.

Step 1.4: Assessment of the validity of the data and parameters

Assess whether data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are still valid or whether they should be updated. Updates should be undertaken in the following cases:

- Where IPCC default values are used, the values should be updated if any new default values have been adopted and published by the IPCC, for example, in guidelines for national GHG inventories, IPCC assessment report or special reports by the IPCC;
- Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the VCS project activity.

If the application of Steps 1.1, 1.2, 1.3 and 1.4 confirmed that the current baseline as well as data and parameters are still valid for the subsequent crediting period, then this baseline, data and parameters can be used for the renewed crediting period. Otherwise, proceed to Step 2.

- The original baseline scenario needs to be updated to incorporate the latest grid emission factor in accordance with the methodology.

Step 2: Update the current baseline and the data and parameters

This step is only applicable if any of the Steps 1.1, 1.2, 1.3 and/or 1.4 showed that the current baseline needs to be updated.

Step 2.1: Update the current baseline

Update the current baseline emissions for the subsequent crediting period, without reassessing the baseline scenario, based on the latest approved version of the methodology applicable to the project activity. The procedure should be applied in the context of the sectoral policies and circumstances that are applicable at the time of request for renewal of the crediting period.

- As shown in step 1.1 above, in accordance with the procedures for renewal of the crediting period of a registered VCS project activity, the original baseline, as updated, remains valid taking new relevant national and/or sectoral policies and circumstances into account.

Step 2.2: Update the data and parameters

If the application of Step 1.4 showed that the data and/or parameter(s) that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, project participants should update all applicable data and parameters, following the guidance in Step 1.4.

- As discussed above in step 1.4, the grid emission factor and all the values in its calculation are updated in section 4.

Conclusion regarding the assessment of the validity of the original baseline scenario

In accordance with the procedures for renewal of the crediting period of a registered CDM project activity, the original baseline, as updated in accordance with step 2.2 in section 4.1, remains valid taking new relevant national and/or sectoral policies and circumstances into account.

According to the Identification of the baseline scenario in “Consolidated baseline methodology for grid- connected electricity generation from renewable sources”ACM0002 (Version 20.0), because the proposed project is a new grid-connected hydropower plant, the baseline scenario is the following: in the absence of the VCS project activity, electricity delivered to the SCPG by

the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

3.5. Additionality

According to VCS standard 4.3, a full reassessment of additionality is not required.

The validity of the original baseline scenario is demonstrated in Section 3.4, and it was concluded that the current baseline is still valid for the next crediting period. Only EF related parameters should be updated for the second crediting period.

Project has no change compared with the original status. Therefore, the project description is the same as in the first crediting period.

The demonstration of regulatory surplus is provided below.

The project activity is in compliance with current laws and regulations in China, such as Renewable Energy Law of the People's Republic of China and Environmental Protection Regulation for Hydro Power Project, etc. The law and regulations are described in section 1.14. There is no other regulatory requirement for the implementation of a hydropower technology.

3.6. Methodology Deviations

No any deviation from methodology.

4. QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1. Baseline Emissions

According to the latest version of ACM0002 (Version 20.0) and the tool to calculate the emission factor for electricity system, since the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions in year y (t CO ₂ /yr).
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EF_{grid,CM,y}$ = Combined margin CO₂ emission factor for grid connected power generation in year y calculated using the latest version of “TOOL07: Tool to calculate the emission factor for an electricity system” (t CO₂/MWh)

The detailed processes are as follows:

Step 1 Identify the relevant electric power system

As the demonstration in section 3.3, according to the delineation of grid boundaries published by China’s DNA on 29/12/2020, the project electricity system of the proposed project is SCPG, so the boundary of the proposed project includes the proposed project and all power plants connected physically to SCPG which is composed of Guangdong Power Grid, Guangxi Power Grid, Guizhou Power Grid, Hainan Power Grid and Yunnan Power Grid. The power from SCPG has been also considered as the net grid-in electricity.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional).

The proposed project chooses the “Option I: only grid power plants are included in the calculation”.

Step 3. Select a method to determine the operating margin (OM)

According to the “Tool to calculate the emission factor for an electricity system”, four methods could be used to calculate the OM and any of the four methods can be used:

- a) Simple OM,
- b) Simple adjusted OM, or
- c) Dispatch Data Analysis OM, or
- d) Average OM.

The simple OM method is applicable if low-cost/must run resources⁹ constitute less than 50% of total grid generation in average of the five most recent years. In the most recent 5 years (2014-2018), the average proportions of low-cost/must run resources in the total electricity output in South China Power Grid during 2013-2017 is 46.91%, less than 50%. So the simple OM method is applicable to the proposed project.

According to this tool, the emissions factor can be calculated using either of the two following data vintages:

⁹ Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

- Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the VCS-PD to the DOE for validation.
- Ex post option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

The proposed project chooses the “Ex ante option”. The simple OM is calculated ex-ante using a 3-year generation-weighted average, based on the most recent data available at the time of submission of the VCS-PD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the first crediting period.

Step 4 Calculate the operating margin emission factor according to the selected method

As for the chosen simple OM, there is two methods to calculate simple emission factor in this tool:

- Option A: Based on the net electricity generation and a CO₂ emission factor of each power unit;¹⁰ or
- Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For data of each power station and power unit is not public available in China, it can't adopt option A. Meanwhile, only nuclear and renewable power generation are considered as low-cost / must-run power sources and the quantity of electricity supplied to the grid by these sources is known from “China Electric Power Yearbook” and “China Energy Statistical Yearbook” and off-grid power plants are not included in the calculation. Therefore, option B could be used to calculate OM emission factor.

According to the selected method above, the calculation formula of OM emission factor is as below:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y} \quad \text{Equation(2)}$$

Where:

- $EF_{grid,OMsimple,y}$ = Simple operating margin CO₂ emission factor in year y (tCO₂/MWh);
- $FC_{i,y}$ = Amount of fuel type i consumed in the electricity system in year y

¹⁰ Power units should be considered if some of the power units at the site of the power plant are low- cost/must-run units and some are not. Power plants can be considered if all power units at the site of the power plant belong to the group of low-cost/must-run units or if all power units at the site of the power plant do not belong to the group of low-cost/must-run units.

(mass or volume unit);

$NCV_{i,y}$ = Net calorific value (energy content) of fuel type i in year y (GJ/mass or volume unit);

$EF_{CO_2,i,y}$ = CO₂ emission factor of fuel type i in year y (tCO₂/GJ);

EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-must-run power plants/units, in year y (MWh).

i = all fuel types combusted in power sources in the project electricity system in year y ;

y = the relevant year as per the data vintage chosen in Step 3.

SCPG also imports electricity from Central China Power Grid (CCPG), the imported electricity from CCPG should be treated as generation from one power plant. Because it's impossible to identify the specific power plants which exporting electricity to SCPG, the simple operating margin emission factor of CCPG which exporting electricity was chosen as the CO₂ emission factor for net electricity imports ($EF_{grid,OM,simple,y}$) from CCPG.

The proposed project adopts the latest data of OM emission factor in SCPG which is issued by China DNA on 29/12/2020.

Step 5 Identify the cohort of power units to be included in the build margin

The sample group of power unit m used to calculate the build margin consists of either:

The set of five power units that have been built most recently, or

The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently;

Due to the data availability in China, it is impossible to adopt either one of the two options mentioned above for BM calculation. The deviation method to calculate BM for the situation of China which can be approved by CDM EB is elaborated in Step 6.

“Tool to calculate the emission factor for an electricity system” provided two methods to calculate BM:

Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of VCS-PD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the

second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, ex- post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 was adopted by the proposed project.

Step 6 Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{BL,m,y}}{\sum_m EG_{m,y}} \quad \text{Equation (3)}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO ₂ emission factor in year <i>y</i> (tCO ₂ e/MWh);
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit <i>m</i> in year <i>y</i> (MWh);
$EF_{BL,m,y}$	=	CO ₂ emission factor of power unit <i>m</i> in year <i>y</i> (tCO ₂ e/MWh).
<i>m</i>	=	Power units included in the build margin;
<i>y</i>	=	Most recent historical year for which power generation data is available;

The proposed project adopts the latest data of BM emission factor in SCPG which is issued by China DNA on 29/12/2020.

For the second crediting period, the weights w_{OM} and w_{BM} are 25% and 75% respectively, so:

$$EF_{grid,CM,y} = 0.25 \times 0.8042 + 0.75 \times 0.2135 = 0.361175 \text{ tCO}_2/\text{MWh}$$

Calculation of $EG_{PJ,y}$

The proposed project is a newly-built project, according to ACM0002 (Version20.0), then:

$$EG_{PJ,y} = EG_{facility,y} \quad \text{Equation (4)}$$

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 (MWh/yr).

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

The project is likely to import the electricity from the SCPG in case of equipment shutdown or overhaul. Then the net quantity of electricity supplied will be calculated as follows:

$$EG_{PJ,y} = EG_{facility,y} - EG_{facility\ to\ SCPG,y} + EG_{SCPG\ to\ facility,y} \quad \text{Equation (5)}$$

Where:

$EG_{facility\ to\ SCPG,y}$ = Quantity of exported electricity from the proposed project to SCPG in year y;

$EG_{SCPG\ to\ facility,y}$ = Quantity of imported electricity from SCPG to the proposed project in year y.

According to ACM0002 (Version 20.0), in base of calculation of $EF_{grid,CM,y}$ and $EG_{PJ,y}$ above, calculation method of the proposed project baseline emission is as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} = EG_{facility,y} \times EF_{grid,CM,y} - (EG_{facility\ to\ SCPG,y} - EG_{SCPG\ to\ facility,y}) \times EF_{grid,CM,y} \quad \text{Equation (6)}$$

4.2. Project Emissions

According to ACM0002 (version 20.0), the project emissions shall be accounted by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \text{Equation (7)}$$

Where:

PE_y = Project emissions in year y (tCO₂e/yr);

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO₂e/yr);

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO₂e/yr);

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO₂e/yr).

The proposed project is a hydro power project. According to ACM0002 (version 20.0), only the CH₄ emissions from the reservoir shall be accounted for. So:

$$PE_y = PE_{HP,y} \quad \text{Equation (8)}$$

Emissions from water reservoirs of hydropower plants ($PE_{HP,y}$)

In order to decide the project emissions for hydro power plants, firstly the power density must be calculated according to ACM0002 (version 20.0):

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \quad \text{Equation (9)}$$

Where

- PD = Power density of the project activity, in W/m².
- Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).
- Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero. The proposed project is a new hydro plant, so Cap_{BL} is zero.
- A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m²).
- A_{BL} = Area of the reservoir measured in the surface of the water before the implementation of the project activity, when the reservoir is full (m²). For new hydro power plants, this value is zero.

The installed capacity of the proposed project (Cap_{PJ}) is 288 MW, the area of the new reservoir (A_{PJ}) is 19,180,000m², so the power density is calculated to be 15W/m², much higher than 10 W/m². According to ACM0002 (version 20.0), the project proponents shall not account for project emissions, so:

$$PE_y = PE_{HP,y} = 0 \quad \text{Equation (10)}$$

4.3. Leakage

According to ACM0002 (Version 20.0), no leakage emissions are considered.

4.4. Net GHG Emission Reductions and Removals

According to ACM0002 (Version 20.0), in base of calculation of BE_y and PE_y above, so:

$$ER_y = BE_y - PE_y = BE_y \quad \text{Equation(11)}$$

Where

- ER_y = Emission reductions in year y.
- BE_y = Baseline emissions in year y (t CO₂/yr).

Year	Estimated baseline emissions or removals (tCO ₂ e)	Estimated project emissions or removals (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated net GHG emission reductions or removals (tCO ₂ e)
28/02/2021-31/12/2021	407,225	0	0	407,225
01/01/2022-31/12/2022	439,755	0	0	439,755
01/01/2023-31/12/2023	439,755	0	0	439,755
01/01/2024-31/12/2024	439,755	0	0	439,755
01/01/2025-31/12/2025	439,755	0	0	439,755
01/01/2026-31/12/2026	439,755	0	0	439,755
01/01/2027-31/12/2027	439,755	0	0	439,755
01/01/2028-31/12/2028	439,755	0	0	439,755
01/01/2029-31/12/2029	439,755	0	0	439,755
01/01/2030-31/12/2030	439,755	0	0	439,755
01/01/2031-27/02/2031	32,530	0	0	32,530
Total	4,397,550	0	0	4,397,550

5. MONITORING

5.1. Data and Parameters Available at Validation

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 (For new hydro power plants, this value is zero)
Justification of choice of data or description of measurement methods and procedures applied	Determine the installed capacity based on recognized standards.

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 (For the proposed project with a new reservoir, this value is zero.)
Justification of choice of data or description of measurement methods and procedures applied	Measured from topographical surveys, maps, satellite pictures, etc.
Purpose of Data	Calculation of project emissions
Comments	/

Data / Parameter	EF _{grid,OM,y}
Data unit	tCO ₂ e/MWh
Description	OM emission factor of SCPG.
Source of data	China's DNA: Report of 2019 Baseline Emission Factors for Regional Power Grids in China issued on 29/12/2020
Value applied	0.8042
Justification of choice of data or description of measurement methods and procedures applied	Specific national value
Purpose of Data	Calculation of baseline emissions
Comments	/

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO ₂ e/MWh
Description	BM emission factor of SCPG
Source of data	China's DNA: Report of 2019 Baseline Emission Factors for Regional Power Grids in China issued on 29/12/2020
Value applied	0.2135
Justification of choice of data or description of measurement methods and procedures applied	Specific national value.
Purpose of Data	Calculation of baseline emissions
Comments	/

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO ₂ e/MWh
Description	CM emission factor of SCPG
Source of data	China's DNA: Report of 2019 Baseline Emission Factors for Regional Power Grids in China issued on 29/12/2020
Value applied	0.361175
Justification of choice of data or description of measurement methods and procedures applied	Specific national value.
Purpose of Data	Calculation of baseline emissions
Comments	/

5.2. Data and Parameters Monitored

Data / Parameter	$EG_{facility\ to\ SCPG,y}$
Data unit	MWh/yr

Description	Quantity of electricity supplied by the proposed project to the grid in year y		
Source of data	Measured by meter		
Description of measurement methods and procedures to be applied	Measured continuously by electricity meter(bi-directional) installed at the project site. All data will be monitored and archived electronically. Double check by receipt of electricity sales.		
Frequency of monitoring/recording	Continuous measurement and at least monthly recording.		
Value applied	1,217,569		
Monitoring equipment	Electricity meter of the project activity. the information of the installed meters is follow:		
	Meter	M1 (Main meter)	M2 (Backup meter)
	SN	213139169	213139150
	Location	Manhao Switching Station	
	Type	MK6E, 3×57.7V, 3×1(6)A	
	Accuracy class	0.2S	
	Calibration frequency	At least once a year	
	The meters may be replaced by local grid company. The serial number and type will be change based on the new meters.		
	QA/QC procedures to be applied	Measurement results should be cross-checked by electricity sales receipts.	
Purpose of data	Calculation of baseline emissions		
Calculation method	Direct Continuous Measurement		
Comments	/		

Data / Parameter	EG _{SCPG to facility,y}
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Data unit	MWh/yr																		
Description	Quantity of electricity imported from the grid in year y																		
Source of data	Measured by meter																		
Description of measurement methods and procedures to be applied	Continuous measurement and at least monthly recording																		
Frequency of monitoring/recording	Continuous measurement and at least monthly recording																		
Value applied	0																		
Monitoring equipment	Electricity meter of the project activity. the information of the installed meters is follow: <table><tr><td>Meter</td><td>M1 (Main meter)</td><td>M2 (Backup meter)</td></tr><tr><td>SN</td><td>213139169</td><td>213139150</td></tr><tr><td>Location</td><td colspan="2">Manhao Switching Station</td></tr><tr><td>Type</td><td colspan="2">MK6E, 3×57.7V, 3×1(6)A</td></tr><tr><td>Accuracy class</td><td colspan="2">0.2S</td></tr><tr><td>Calibration frequency</td><td colspan="2">At least once a year</td></tr></table> The meters may be replaced by local grid company.The serial number and type will be change based on the new meters.	Meter	M1 (Main meter)	M2 (Backup meter)	SN	213139169	213139150	Location	Manhao Switching Station		Type	MK6E, 3×57.7V, 3×1(6)A		Accuracy class	0.2S		Calibration frequency	At least once a year	
Meter	M1 (Main meter)	M2 (Backup meter)																	
SN	213139169	213139150																	
Location	Manhao Switching Station																		
Type	MK6E, 3×57.7V, 3×1(6)A																		
Accuracy class	0.2S																		
Calibration frequency	At least once a year																		
QA/QC procedures to be applied	Measurement results should be cross-checked by electricity sales receipts.																		
Purpose of data	Calculation of baseline emissions																		
Calculation method	Direct Continuous Measurement																		
Comments	/																		

Data / Parameter	$EG_{\text{facility},y}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project

	plant/unit to the grid in year y
Source of data	Project activity site
Description of measurement methods and procedures to be applied	Apply the data of $EG_{\text{facility to SCPG},y}$ and $EG_{\text{SCPG to facility},y}$ to calculate . All data will be monitored and archived electronically. Double check by receipt of electricity sales.
Frequency of monitoring/recording	Continuous measurement and at least monthly recording
Value applied	1,217,569
Monitoring equipment	N/A
QA/QC procedures to be applied	Cross check measurement results with records for sold electricity
Purpose of data	Calculation of baseline emissions
Calculation method	This parameter is calculated based on $EG_{\text{facility to SCPG},y}$ subtract to $EG_{\text{SCPG to facility},y}$
Comments	/

Data / Parameter	Cap_{PJ}
Data unit	W
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	Verified by the nameplate of water turbine generators.
Frequency of monitoring/recording	The measured frequency is once a year.
Value applied	288,000,000
Monitoring equipment	N/A
QA/QC procedures to be applied	Can be confirmed also by the parameter readings on the design plates of each turbine and by summing the two units.

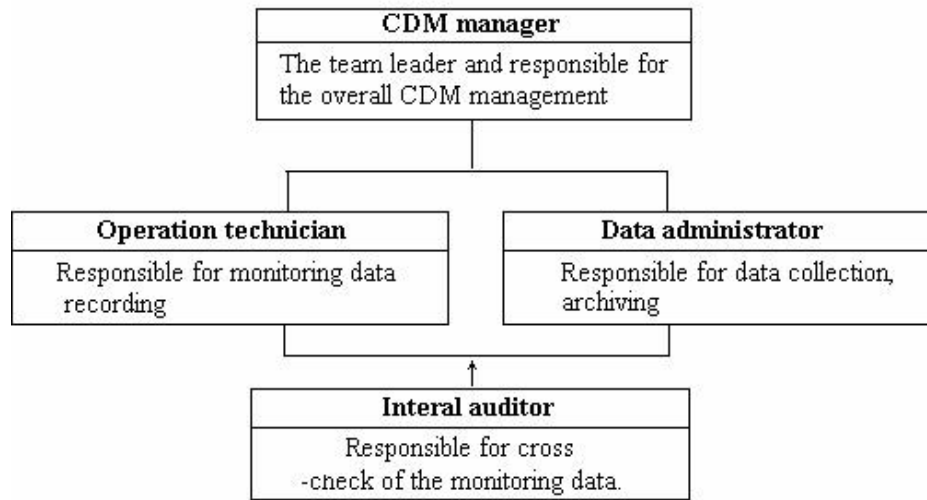
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	Cross check against the project documentation.

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	Measured by the qualified design institute.
Frequency of monitoring/recording	The measured frequency is once a year
Value applied	19,180,000
Monitoring equipment	-
QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions
Calculation method	N/A
Comments	/

5.3. Monitoring Plan

5.3.1. Monitoring team

Monitoring will be carried out by the monitoring team, and the detailed responsibility of each team member is as below:



- a) VCS manager is the team leader and responsible for the overall VCS management;
- b) Operation technician is responsible for monitoring data recording;
- c) Data administrator is responsible for data collection and archiving;
- d) Internal auditor is responsible for cross-check of the monitoring data.

5.3.2. Monitoring system

The electricity exported to the grid in the positive direction ($EG_{\text{facility to SCPG},y}$) and the electricity imported from the grid in the reverse direction ($EG_{\text{SCPG to facility},y}$) will be directly measured through the bidirectional energy meter. The $EG_{\text{facility},y}$ is calculated based on $EG_{\text{facility to SCPG},y}$ subtract to $EG_{\text{SCPG to facility},y}$. The meters will be installed at the grid interface point of the proposed project according to the Power Purchase Agreement signed between the project owner and the grid company. The following Figure 5.1 is the monitoring system diagram of the project.

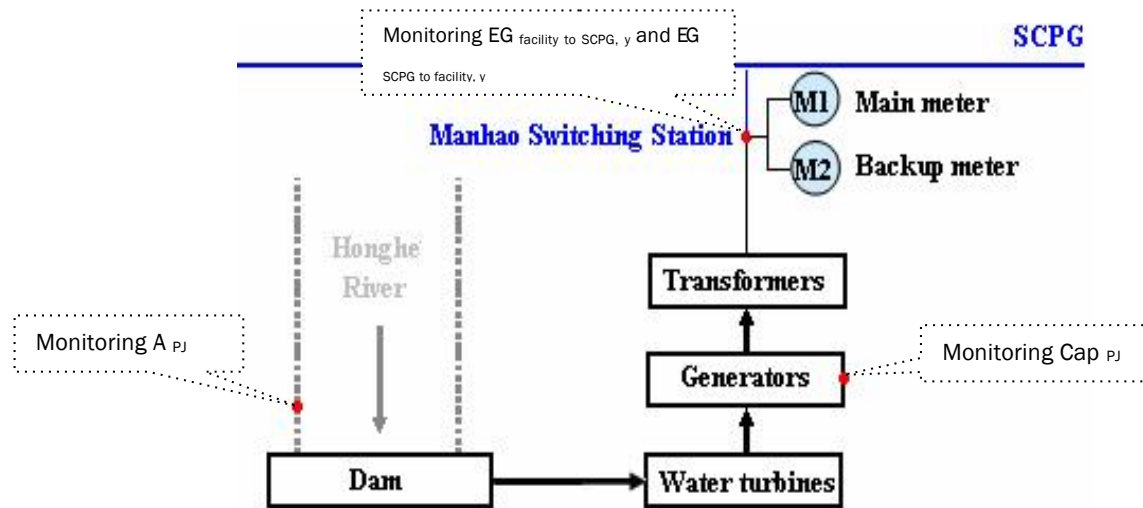


Figure 5. 1 Monitoring system diagram

The accuracy class of the energy meters should be no less than 0.5s which meets the requirement of Technical Administrative Code of Electric Energy Metering (DL/T448-2016). Power Purchase Agreement, DL/T448-2016 and the technical parameters of the meters should be archived for verification.

5.3.3. Monitoring frequency

$EG_{\text{facility to SCPG},y}$ and $EG_{\text{SCPG to facility},y}$ will be continuously measured and monthly recorded by the grid company and the project owner.

5.3.4. Calibration

The meters installed at the grid interface point will be calibrated at least once a year in accordance with Technical Administrative Code of Electric Energy Metering (DL/T448-2016) by the qualified calibration entity.

5.3.5. 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.

5.3.6. Training

The team members of the monitoring team were trained by the CDM consulting company before the operation of the project.

5.3.7. Data management

All of the data records relevant to monitoring such as Power Purchase Agreement, 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 CERs, 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 CERs, whichever occurs later; 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 CERs, whichever occurs later.

5.3.8. Monitoring and management manual

Monitoring and management manual of the proposed project has been compiled. The monitoring system diagram, monitoring frequency, calibration, data collection procedures and organizational structure are clearly described in the manual. It will be also updated according to the upgrade of DL/T448-2016.

5.3.9. Emergency Plan

In normal condition, meter records from the main meters are used for CER calculation. In the case of main meter malfunction, the meter records from the backup meters will be used for CER calculation, and the electricity transaction receipts will be kept for cross check. Problem occurred in monitoring and measurement process will be recorded and reported to project manager or CDM manager.