



**Verified Carbon
Standard**

YUNNAN MANGLI HYDROPOWER PROJECT

Document Prepared by Climate Bridge(Shanghai) Ltd.

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Project Title	Yunnan Mangli Hydropower Project
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1 PROJECT DETAILS

1.1 Summary Description of the Project

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

The proposed project involves the installation of 2 turbines, each of which has a rated output of 18MW, providing a total capacity of 36MW. The annual grid-connected output of the proposed project is estimated to be 143,652MWh¹. The electricity to be generated will be sold to the China Southern Power Grid (CSPG). The Project started construction on 30/06/2008. The first turbine of the Project started commissioning on 13/01/2010.

The implementation of the proposed project will achieve CO₂ emission reduction by replacing electricity generated by fossil fuel fired power plants. The purpose of the proposed project is to generate hydro power and deliver it to CSPG.

For the proposed project, the scenario existing prior to the start of the implementation of the project activity is the CSPG providing the same electricity service as the proposed project.

The project will help reduce GHG emissions generated from the high-growth, coal-dominated power generation. The estimated annual GHG emission reductions are 51,887tCO₂e in the second crediting period.

1.2 Sectoral Scope and Project Type

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

Project type: Hydropower generation project;

The project is not a grouped project.

1.3 Project Eligibility

The scope of the VCS Program includes:

1) The six Kyoto Protocol greenhouse gases

¹ According to the registered Project Description, the electricity consumption for internal use and transmission loss is estimated to be 1.5%, therefore, the annual grid-connected output of the proposed project is estimated as 145,840 MWh *(1-1.5%) = 143,652MWh.

The emissions reduction of the project sources from CO₂ emissions from the production of the equivalent amount of electricity replaced by the project that would otherwise have been purchased from the fossil fuel fired power plants of CSPG. Thus, the project applicable to this scope.

2) Ozone-depleting substances

NA.

3) Project activities supported by a methodology approved under the VCS Program through the methodology approval process

NA.

4) Project activities supported by a methodology approved under a VCS approved GHG program, unless explicitly excluded under the terms of Verra approval

The approved methodology ACM0002 (Version 20.0) of the project utilized is a methodology approved under CDM Program, that is a VCS approved GHG program.

5) Jurisdictional REDD+ programs and nested REDD+ projects as set out in the VCS Program document Jurisdictional and Nested REDD+ (JNR) Requirements

NA.

And the project was registered on 14/11/2012 under VCS Standard v3.2. Thus, the project is eligible under the scope of VCS program.

1.4 Project Design

The project has been designed to be a single installation of an activity, not a grouped project.

1.5 Project Proponent

Organization name	Datang Mangli Hydropower Development Company Limited
Contact person	Luo Xianjun
Title	Project Manager
Address	Fenghua Road, Mangli City, Dehong District, Yunnan Province
Telephone	+86-21-23019950
Email	3542346576.qq.com

1.6 Other Entities Involved in the Project

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

1.7 Ownership

The project proponent is Datang Mangli Hydropower Development Company Limited, who has the full ownership of the project. Business license of the project company and PPA from the Grid company, approval of the project from Development and Reform Commission (DRC) of Yunnan Province and Letter of Approval for the project as a CDM project by Chinese NDRC are evidence for legislative right. Besides, the equipment purchasing contract and the purchasing power agreement are the evidence for the ownership of the plant, equipment and power generating.

1.8 Project Start Date

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

1.9 Project Crediting Period

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

period of the project should be updated from 25/01/2010² ~ 06/10/2011 to 25/01/2010 ~ 24/01/2020. And this is the second crediting period from 25/01/2020 to 24/01/2030.

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)
25/01/2020~24/01/2021	51,887
25/01/2021~24/01/2022	51,887
25/01/2022~24/01/2023	51,887
25/01/2023~24/01/2024	51,887
25/01/2024~24/01/2025	51,887
25/01/2025~24/01/2026	51,887
25/01/2026~24/01/2027	51,887
25/01/2027~24/01/2028	51,887
25/01/2028~24/01/2029	51,887
25/01/2029~24/01/2030	51,887
Total estimated ERs	518,870
Total number of crediting years	10
Average annual ERs	51,887

1.11 Description of the Project Activity

The proposed Yunnan Mangli Hydropower Project is located on Mangshi River in Luxi City, Yunnan Province, P. R. China. The proposed project is developed and operated by Datang Mangli

² According to the registered PD, in the beginning period of the operation, the monitoring data of the project was not complete. Since 25/01/2010, the data have been monitored and collected following the monitoring procedure in the VCS-PD. Therefore, starting date of the crediting period is 25/01/2010.

Hydropower Development Company Limited. The purpose of the project is to utilize the hydro resource to generate electricity.

The project scenario is the implementation of the proposed project which is a hydropower station with the total installed capacity of 36MW. The hydro-junction essentially consists of the water retaining structure (barrage), the sluice works, as well as the water intake and power generation system. The sluice works include free overflow spillway, flood discharging tunnel and desalting tunnel. Two turbines and two generators have been installed. It is expected that the annual electricity delivered to the grid is 143,652MWh to CSPG and replace the same amount of electricity generated by fossil fuel fired power plants connected to CSPG, the lifetime of the project is 28 years which include 3 years for construction and 25 years for operation.

For the proposed project, the scenario existing prior to the start of the implementation of the project activity is the CSPG providing the same electricity service as the proposed project. The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

The main parameters of the turbine and generator units are listed in the Table 1.

Table 1 Technical information of the turbine and generator units

Parameters		Value
Turbine	Amount	2
	Designation	HLA551c-LJ-262
	Rated Power	18.66 MW
	Rated Water Head	37 m
	Rated Flow Rate	55.42 m ³ /s
	Rated Rotational Speed	200 r/min
Generator	Amount	2
	Designation	SF-J18-30/5050
	Rated Capacity	18 MW
	Rated Voltage	10.5kV
	Rated Rotational Speed	200 r/min

*The model and the main parameters of the turbine and generator units have been updated to the actual ones based on the actual situation.

All the technology of project activity doesn't involve technology transfer.

The main equipment, such as the turbines and other equipment are made in China. The Chinese domestic manufacturers have the ability to produce the turbines and relevant facilities.

The annual electricity generation would be 145,840 MWh which made the annual operation hour of the project would be 4051 hours ($145,840\text{MWh}/36\text{MW}$), and the PLF is $0.462(4051/8760)$ determined by FSR.

The project connected to the on-site 110kV step-up substation. The power in the 110kV step-up substation is transmitted to the Zhefang substation. Then the electricity generated is transmitted to the CSPG. Therefore, the proposed project can replace electricity generated from fossil fuel fired power plant connected to the Grid and reduce GHG emissions. As a result, 51,887 tCO₂ emission reductions will be generated annually.

The project facility could be monitored and controlled by onsite central control room and the net electricity delivered to the grid is measured by electronic meters with accuracy of 0.2S (M₁), 0.2S (M₂) and 1.0 (M_{backup}).

1.12 Project Location

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



Figure 1 Location of the Project in Provincial Map

1.13 Conditions Prior to Project Initiation

The baseline scenario of the project activity is that annual electricity delivered to the grid is 143,652MWh to CSPG and replace the same amount of electricity generated by fossil fuel fired power plants connected to CSPG. The scenario existing prior to the start of the implementation

of the project activity is the same as the baseline scenario. (Detail refer to Section 3.4 Of this report).

The project scenario is the implementation of the proposed project which is a hydropower station with the total installed capacity of 36MW. The hydro-junction essentially consists of the water retaining structure (barrage), the sluice works, as well as the water intake and power generation system. The sluice works include free overflow spillway, flood discharging tunnel and desalting tunnel. Two turbines and two generators have been installed. It is expected that the annual electricity delivered to the grid is 143,652MWh to CSPG and replace the same amount of electricity generated by fossil fuel fired power plants connected to CSPG, the lifetime of the project is 28 years which include 3 years for construction and 25 years for operation.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project is hydropower generation project and meets the relevant provisions of the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution. The generation of power supplied to CSPG will meet the requirement of national laws and regulations, also financially viable.

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

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

Please refer to the following link for details:

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

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

1.15.2 Projects Rejected by Other GHG Programs

N.A.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

China has a national emissions trading scheme only cover the high-emission industries, such as thermal power generation, petrochemical, chemical, building materials, iron and steel, non-

ferrous, paper, aviation and other key emission industries that emitted at least 26,000 tons of CO₂e/year, not including renewable project³. 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 list⁴ in public information. Hence, it is confirmed that the emission reductions will not be double counted.

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

1.16.2 Other Forms of Environmental Credit

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

1.17 Additional Information Relevant to the Project

Leakage Management

According to the CDM baseline methodology ACM0002(version 20.0), the leakage of the project is not considered for this project.

Commercially Sensitive Information

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

Sustainable Development

The proposed project will contribute to the sustainable development in the following ways:



143,652 MWh/yr of electricity from renewable sources will be supplied to the power grid. Use local renewable energy to replace local coal-based power plants and thereby reduce CO₂ emissions as well as associated emissions such as PM, SO_x and NO_x, creating local and global air pollutants benefits. Thus, the project will achieve SDG 7 Affordable and Clean Energy⁵.

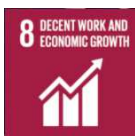
³ http://www.mee.gov.cn/xgk/xxgk/xxgk05/202103/t20210330_826728.html

⁴ <http://mee.gov.cn/xgk/xxgk/xxgk03/202012/W020201230736907682380.pdf>

⁵ <https://sdgs.un.org/goals/goal7>



The project will achieve 51,887 tCO₂e/yr emission reduction during the second crediting period. Thus, the project achieved SDG 13 Climate Action⁶.



Create employment opportunities during the project operation and construction, providing local residents with full and productive employment and decent work. Thus, the project achieved SDG 8 Decent Work and Economic Growth⁷.

Further Information

N.A.

2 SAFEGUARDS

2.1 No Net Harm

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

2.2 Local Stakeholder Consultation

Local Stakeholder Consultation during the project design stage:

⁶ <https://sdgs.un.org/goals/goal13>

⁷ <https://sdgs.un.org/goals/goal8>

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

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

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

The mechanism for on-going communication with local stakeholders

Communications with Local stakeholders will be carried out at periodic intervals. The project owner will carry out questionnaire survey for the local stakeholder to collect the relevant comments and suggestions. In line with VCS requirements all the processes have been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals.

2.3 Environmental Impact

The project owner entrusted a third party, Yunnan University, to conduct the environmental impact assessment (EIA) on the proposed project, which was completed in July 2005 and offered the approval (Yunhuanxuzhun [2005] 182) from Yunnan Provincial Environmental Protection Bureau (YNEPB) on 27/10/2005. The analysis and measures to be taken to mitigate the impacts during the constructing and operating stages are demonstrated in the following texts:

Wastewater and sewage: The sewage is mainly composed with the water produced by flushing and maintaining the construction machinery, and daily life waste generated by the operation staff. By collecting and processing through septic tank, the wastewater and sewage could be processed for irrigating the farmland before discharging.

Dust and Air Quality: The air impact during the construction period mainly comes from flying dust produced by excavating land and transportation vehicles, and some exhaust discharge from using and moving construction machinery. By using enclosed or semi-enclosed transportation vehicles with strictly managed schedule and route, strengthening the construction control, and regularly spraying the work area, the influences could be reduced under the construction standards set by governments and environmental protection departments.

Noise: The noise pollution mainly comes from the instantaneous demolition noise, manual drills, cement mixers, and transportation vehicles during construction period. By choosing equipment with low noise, setting sound insulation workshop, and banning construction activity in the evenings, the noise could be controlled at a satisfactory level.

Soil Erosion: Considering the soil erosion problem and disturbance of grassland, the waste soil will be used for backfilling, while solid wastes are collected regularly and transported into the designated

dumping sites. After the project completion, the land in the project management site and temporary construction site will be restored and rehabilitated with trees and vegetation.

In conclusion, by all the measures taken by the project owner, the environmental impact of the proposed project was reduced to the minimum level.

2.4 Public Comments

In order to get the comments and suggestions from local stakeholders, the project owner visited local residents and coherent organizations for stakeholder consultation in June, 2009. 100 questionnaires were sent to the stakeholders by the project developer. The survey showed that the proposed project receives strong support from local people, which is closely linked to the fact that the majority of local residents have some understandings with hydro power projects. 100% of the investigated people are supportive to the project construction. The project owner carried out questionnaire survey for the local stakeholder to collect the relevant comments and suggestions. And there are no negative comments received for the project.

And in the public comment period from 03/08/2010 to 01/09/2010 under CDM program, there is no comments received.

2.5 AFOLU-Specific Safeguards

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

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Following approved baseline & monitoring methodology is applied:

Methodology:

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

Reference:

<https://cdm.unfccc.int/UserManagement/FileStorage/AG07ZJ03EXD42LT5YV9HR16M8KINPO>

The tool applied:

“Tool to Calculate the Emission Factor for an Electricity System” (version 07.0)

Reference:

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

“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)

Reference:

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

3.2 Applicability of Methodology

The approved methodology ACM0002 (version 20.0) is applicable to the project activity and the project meets the applicability of the applied methodology as follows:

Clauses	Requirements of the ACM0002 (version 20.0)	Scenario of the project	Conclusion
1	This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield plant; (b) Involve a capacity addition in (an) existing plant(s); (c) Involve a retrofit of (an) existing plant(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s).	The project is a greenfield CSPG-connected renewable power generation project.	Applicable
2	The methodology is applicable under the following conditions: (a) 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; (b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects) the existing	This project is a hydro power plant using the local hydrological resource to generate electricity. And there's no retrofits, rehabilitations or replacements of this project capacity.	Applicable

Clauses	Requirements of the ACM0002 (version 20.0)	Scenario of the project	Conclusion
	plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.		
3	In case of hydro power plants, one of the following conditions shall apply: (a)The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b)The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density, calculated using equation (7)⁸, is greater than 4 W/m²; or (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; or (d)The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m², all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per	Based on the 2019 report for the surface area of full reservoir, area of the reservoir measured in the surface of the water of the project is 2,732,305 m ² . Installed capacity of the project is 36,000,000W, the power density of the project is 13.176 W/m ² , hence.	Applicable

⁸ equation (7): $PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$

Clauses	Requirements of the ACM0002 (version 20.0)	Scenario of the project	Conclusion
	equation (8)⁹, is greater than 4 W/m²; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m² shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.		
4	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 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	Not applicable, the project is not an integrated hydro power project.	N.A.

⁹ Equation (8): $PD = \frac{\sum Cap_{PJ,i}}{\sum APJ,j}$

Clauses	Requirements of the ACM0002 (version 20.0)	Scenario of the project	Conclusion
	implementation of the CDM project activity.		
5	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.	The proposed project does not involve switching from fossil fuels to renewable energy at the site of the project activity. Also, the proposed project doesn't involve biomass fired power plants/units.	Applicable
6	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".	Not applicable, the proposed project doesn't involve retrofits, rehabilitations, replacements, or capacity additions.	N.A.

In addition, the project meets the applicability conditions of the applied tools: Calculate the Emission Factor for an Electricity System (version 07.0) and 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) applied in the PDD as follows:

Tool/Criteria	Applicability	Conclusion
Calculate the Emission Factor for an Electricity System (version 07.0)		
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 the installation of a hydropower plant supplying electricity to the Grid.	Applicable

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 the installation of a hydropower plant supplying electricity to the CSPG.	Applicable
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project electricity system located in a non-Annex I country.	Applicable
Under this tool, the value applied to the CO ₂ emission factor of biofuels is zero.	Not applicable, the project is a hydropower project, which not involves biofuels consumption.	NA
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)		
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.	The tool is used to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period. As per section 3.4 of this VCS PD, the current baseline does not need to be updated.	Applicable

3.3 Project Boundary

According to methodology ACM00002 (Version 20.0), the spatial extent of the Project boundary includes the Project Power Plant and all the power plants connected physically and geographically to CSPG that the Project is connected to.

Electricity generated by the Project was delivered to CSPG. According to *2019 Baseline Emission Factors for Regional Power Grids* in China issued by China's DNA which provides the delineation of grid boundaries, CSPG is the grid boundary of the Project. CSPG is composed of includes Guangdong Power Grid, Guangxi Power Grid, Guizhou Power Grid and Yunnan Power Grid.

The greenhouse gases and emission sources included in or excluded from the above-identified project boundary are shown as below:

Source		Gas	Included?	Justification/Explanation
Baseline	CO ₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO ₂	Yes	Main emission source
		CH ₄	No	Minor emission source
		N ₂ O	No	Minor emission source
Project Activity	For hydro power plants, emissions of CH ₄ from the reservoir	CO ₂	No	Minor emission source
		CH ₄	No	According to ACM0002, if the power density of the project activity is greater than 10 W/m ² , project emission is 0. The power density of the project is 13.176 W/m ² . Hence, None CH ₄ emissions emitted.
		N ₂ O	No	Minor emission source

Figure 2 presents a flow diagram within the project boundary including all the equipment, systems and flows of mass and energy. The below flow diagram physically delineates the project activity and its relevant information. Establishment and description of baseline scenario.

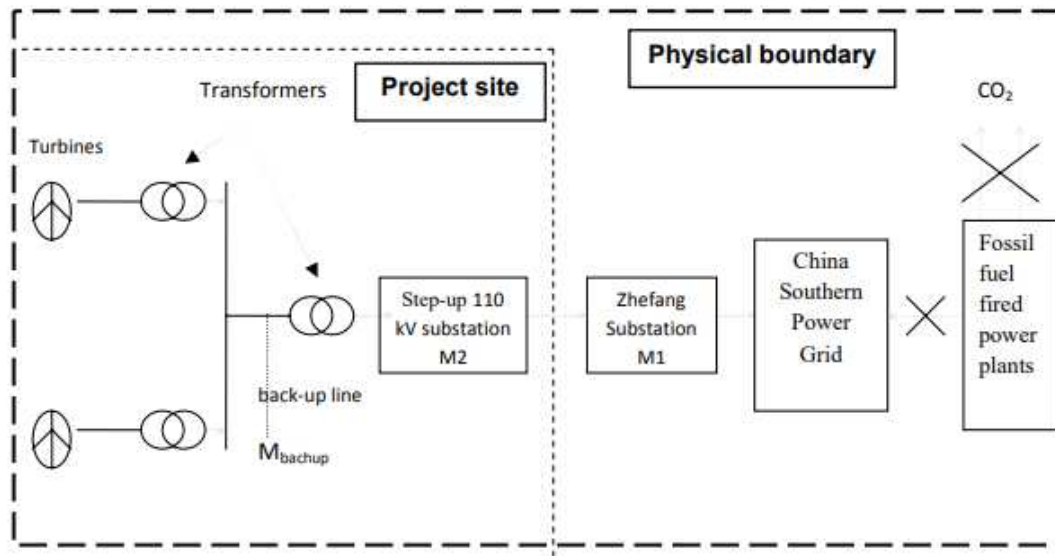


Figure 2 The flow diagram of the project

As illustrated in the above diagram, meter M₂ installed at the exit of the project station is employed to measure output electricity, and the main meter M₁ measures the power supplied to the grid at the input of the substation of the Grid Company (interconnection facility connecting the facility to the grid). The M_{backup} installed at the project site is employed to measure the input electricity. The main meter and the backup meter are used to monitor the annual total electricity supplied to the grid and the annual total electricity imported from the grid by the project.

3.4 Baseline Scenario

According to the description in the approved baseline methodology ACM00002 (version 20.0), for Greenfield power plant, 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 into the grid.

In accordance with “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), the validity of the current baseline is assessed using the following sub-steps:

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

There are no new national and/or sectoral policies that could affect the baseline scenario during the renewal of the crediting period. Although national policies favour the development of renewable energy sources, CSPG is still dominated by the thermal power plants. For total electricity generation produced by fossil fuel power plants, the average share of the five most

recent years is more than 50% of total electricity generation in CSPG¹⁰. Hence in the absence of the project activity, electricity would still have been generated in the existing grid-connected power plants or by the addition of new generation sources from CSPG. The current baseline still complies with all relevant mandatory national and sectoral policies which have come into effect after the submission of the project activity for validation and are applicable at the time of requesting renewal of the crediting period. Go to step 1.2.

Step 1.2: Assess the impact of circumstances

The baseline scenario identified at the validation of the project activity was the provision of an equivalent amount of annual electricity generation by CSPG. The investment environment or market characteristics especially the feed-in tariff, the policy in terms of market access permit, these circumstances continue during the second crediting period and therefore, do not have an impact on the current baseline emissions. Hence the current baseline does not need to be updated. Go to step 1.3.

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. The project is a Greenfield project with a lifetime of 20 operation years, with no baseline equipment(s) or an investment for the crediting period for which renewal is requested, this step is not applicable. Go to step 1.4.

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 prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity.

If any of the data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, the current baseline needs to be updated for the subsequent crediting period.

¹⁰ China Electric Power Yearbook

In accordance with the methodology, the grid emission factor and all the values in its calculation are updated in section 4.1.

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

Step 2.1: Update the current baseline

As per the analysis in step 1 above, the current baseline does not need to be updated.

Step 2.2: Update the data and parameters

The updated baseline emission factor for the project ($EF_{grid,CM,y}$) is calculated in line with the “Tool to calculate the emission factor for an electricity system (version 07.0)”, $EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$, and in the second crediting period, $w_{OM} = 0.25$ and $w_{BM} = 0.75$, baseline emission factor for the project ($EF_{grid,CM,y}$) is calculated as 0.3612 tCO₂e/MWh, please refer to section 4.1 for details.

3.5 Additionality

The project has demonstrated its additionality in the first crediting period and no changes affect the additionality of the project since its registration. According to the relevant applicable laws and regulations at the time of renewal of crediting period, i.e. Renewable Energy Law of the People's Republic of China which came into effect on 01/01/2006, Agenda for China's 14th Five-Year Plan (2021-2025), there are no new national and/or sectoral policies that could affect the baseline scenario during the renewal of the crediting period. Of course, no regulatory surplus required comparing with the first validation at time of renewal of crediting period.

3.6 Methodology Deviations

As plant specific fuel consumption and electricity generation data are not publicly available in China, the Guidance caused by DNV's request for deviation of Chinese project activities for the CDM baseline methodology AM0005 has been applied for calculating the build margin (BM) emission factor of this project activity. Please refer to section 4.1 of this report for details.

The deviation has no impact on conservativeness of the quantification of GHG emission reductions or removals.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions include only CO₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. 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 (tCO ₂ e)
$EG_{PJ,y}$	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
$EF_{grid,CM,y}$	Combined margin CO ₂ emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (tCO ₂ e/MWh)

The project activity is a Greenfield wind power plant, then:

$$EG_{PJ,y} = EG_{facility,y} = EG_{export,y} - EG_{import,y} - EG_{backup} \quad \text{Equation (2)}$$

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 CDM project activity in year y
$EG_{facility,y}$	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)
$EG_{export,y}$	Electricity supplied by the project activity to the grid in year y
$EG_{import,y}$	Electricity imported by the project activity from the grid in year y
EG_{backup}	Electricity imported through backup line from the grid in year y

According to registered PD, the designed power generation is 145,840MWh, and the annual supplied electricity to CSPG is 143,652MWh, for this second crediting period,

$$EG_{facility,y} = EG_{export,y} - EG_{import,y} - EG_{backup} = 1,436,520 \text{ MWh.}$$

And the baseline emission factor $EF_{grid,CM,y}$ is calculated as per the latest version of “Tool to calculate the emission factor for an electricity system” (version 07.0). The $EF_{grid,CM,y}$ is calculated ex ante and fixed for the second crediting period. Detailed as follows:

Step 1. Identify the relevant electricity system

For determining the electricity emission factors, identify the relevant project electricity system. Similarly, identify any connected electricity system. If a connected electricity system is located partially or totally in Annex-I countries, then the emission factor of that connected electricity system should be considered zero. If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used.

The Chinese DNA has published a delineation of the project electricity system and connected electricity systems; this delineation is used. Following the DNA delineation, the project electricity system is the South China Power Grid, which consists of Guangdong, Guangxi, Yunnan, Guizhou and Hainan Province Power Grids. Therefore, South China Power Grid is chosen as the relevant electric power system.

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

Based on China's real situation, only grid power plants are included in the calculation.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on the following methods:

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

Detailed information to carry out a dispatch data analysis is not publicly available; therefore, method (b) and method (c) are not suitable for the project.

According to tool, the Simple OM method is applicable to the project if the low-cost resources constitute less than 50% of total grid generation on average in the five most recent years or based on long-term normal for hydroelectric production.

According to the data from China Electric Power Yearbook 2014-2018, from year 2013 to year 2017, the share of low-cost/must-run generation in China South Power Grid is 37.73% in 2013, 45.53% in 2014, 49.44% in 2015, 50.92% in 2016 and 50.91% in 2017. And the average share of the five most recent years is 46.90%, which is less than 50%. The Simple OM method, therefore, is selected to calculate the Operating Margin emission factor of the project.

The Simple OM can be calculated using either of the two following data vintages for years(s) y:

(a) (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 CDM-PDD to the DOE for validation.

(b) (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 emission factor to be updated annually during monitoring.

Here ex-ante vintage is chosen, and the $EF_{grid,OM,y}$ is fixed during the second crediting period.

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

The Simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units. The simple OM may be calculated:

(a) **Option A:** Based on the net electricity generation and a CO₂ emission factor of each power unit, or

(b) **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 the project activity, the required data for the exercise of Option A is not available and those of Option B can be obtained from official sources, and off-grid power plants are not included in the calculation, therefore, Option B is chosen to calculate the operating margin emission factor:

For Option B, the Simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_m EG_y} \quad \text{Equation (3)}$$

Where:

$EF_{grid,OMsimple,y}$	Simple operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)
$FC_{i,y}$	Amount of fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fuel type i in year y (GJ/mass or volume unit)
$EF_{CO_2,i,y}$	CO ₂ emission factor of fuel type i in year y (tCO ₂ /GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/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

Regarding parameter selection, local values of $NCV_{i,y}$ and $EF_{CO_2,i,y}$ should be used where available. If no such values are available, IPCC world-wide default values are preferable. In this PD, the Net Calorific Value ($NCV_{i,y}$) of each type of fossil fuel used in the calculation comes from China Energy Statistic Yearbook 2014-2016. Emission factors ($EF_{CO_2,i,y}$) of each type of fossil fuel come from IPCC 2006 default values.

The Simple OM Emission Factor ($EF_{grid,OM,simple,y}$) of the project is calculated on the basis of the fuel consumption data for electricity generation of the South China Grid, not including those of low-operating cost and must-run power plants, such as wind power, hydropower and nuclear etc. These data are obtained from the China Electric Power Yearbook (2016~2018, published annually) and China Energy Statistical Yearbook (2016~2018). Based on these data, the Simple OM Emission Factor ($EF_{grid,OM,simple,y}$) of the CSPG is calculated as 0.8042 tCO₂e/MWh.

For the project, the renewable crediting period, i.e., 10×3 years, is adopted.

Step 5. Calculate the build margin (BM) emission factor

In terms of vintages of data, project participants can choose between one of the following two options:

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 CDM-PDD 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 second crediting period should be used. 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 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.

The PD chooses **Option 1**, which requires the project participant to calculate the Build Margin Emission Factor $EF_{grid,BM,y}$, ex-ante based on the most recent information available on units already built for sample group m at the time of PD submission.

The sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5-units}$) and determine their annual electricity generation ($AEG_{SET-5-units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total} , in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20 percent of AEG_{total} (if 20 percent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20 \text{ percent}}$) and determine their annual electricity generation ($AEG_{SET-\geq 20 \text{ percent}}$, in MWh);

(c) From $SET_{5-units}$ and $SET_{\geq 20 \text{ percent}}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Otherwise:

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20 percent of the annual electricity generation of the project electricity system (if 20 percent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample-CDM}$) the annual electricity generation ($AEG_{SET-sample-CDM}$, in MWh);

If the annual electricity generation of that set is comprising at least 20 percent of the annual electricity generation of the project electricity system (i.e. $AEG_{SET-sample-CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample-CDM}$ to calculate the build margin. Ignore steps (e) and (f).

(e) Include in the sample group $SET_{sample-CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20 percent of the annual electricity generation of the project electricity system (if 20 percent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

(f) The sample group of power units m used to calculate the build margin is the resulting set ($SET_{sample-CDM->10yrs}$).

Under the current circumstances in China, the power plants consider the Build Margin data as important business data and will not have them published. Therefore, it is difficult to obtain the data of five power plants that have been put into operation most recently or the newly installed power plant capacity additions in the electricity system that comprise 20% of the system generation.

According to the instructions of China DNA, for the determination of the set of samples, a sample merging processing in some degree has been adopted due to that the power generation data, energy consumption data or thermal efficiency data of each plant cannot be consulted in the public statistical data. In this calculation, the newly installed power units in the past years are classified by year, province and power generation technology, and the same type of newly installed power units in the same province and in the same year are bundled as a "newly-installed power units".

The power generation of each "newly-installed power units" in the most recent year y is estimated based on its installed capacity and the number of power generation utilization hours in year y . The formula is as follows:

$$EG_{m,y} = CAP_m \times H_{m,y} \quad \text{Equation (4)}$$

Where:

$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
CAP_m	Installed capacity of electricity generated and delivered to the grid by power unit m in year y (MW)
$H_{m,y}$	The number of power utilization hours (h) of electricity generated and delivered to the grid by power unit m in year y . And it selects the average utilization hours of similar units in the province in which it is located in year y ;
y	Most recent year for which data is available.
m	The sample group of power units.

The power unit m is selected from the "newly-installed power plants" in the most recent year y (For the calculation of the grid BM in 2019, the y is equal to 2017) to the "newly-installed power plants" in the earlier year, until the cumulative power generation reaches 20% of the total power generation in the year y ($y=2017$).

Since the newly installed power units of the same type (k) in the same province (A) and the same year (t) are bundled into the "newly-installed power units", the CAP_m is equal to the statistical data of recent installed capacity of a given unit type(k) in a given year(t) in a given province (A).

$$CAP_m = CAP_m |_{m=(A,t,k)} = CAP_{A,t,k} \quad \text{Equation (5)}$$

Where:

CAP_m	Installed capacity of electricity generated and delivered to the grid by power unit m in year y (MW), and m is equivalent to an established combination of (A , t , k);
---------	---

$CAP_{A,t,k}$	Capacity of newly installed power units of a given province (A), given year (t), and given unit type (k) (MW)
A	It is the various provincial regions covered by the regional power grid It is the sampling year of the "newly-installed power units".
t	For the calculation of the grid BM in 2019, t is equal to 2017, 2016, ..., until the units that comprise at least 20 percent of the system generation in 2017. It is the power generation technology classification of "newly-installed power units", which is divided into: hydro-power, coal-thermal power, gas-thermal power, oil-thermal power, Waste-thermal power plant, other thermal power ¹¹ , nuclear power, wind power, solar power, and others ¹² .
k	

As per tool, the CO₂ emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the tool in Step 4 section 6.4.1 for the simple OM, using Options A1, A2 or A3, using for y the most recent historical year for which electricity generation data is available, and using from the power units included in the build margin.

Because current statistics data cannot separate each power plant, for a power unit m, only data on electricity generation and the fuel types used is available. So, the option A2 is selected, the emission factor should be determined based on the CO₂ emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \quad \text{Equation (6)}$$

Where:

$EF_{EL,m,y}$	CO ₂ emission factor of power unit <i>m</i> in year <i>y</i> (tCO ₂ /MWh)
$EF_{CO2,m,i,y}$	Average CO ₂ emission factor of fuel type <i>i</i> used in power unit <i>m</i> in year <i>y</i> (tCO ₂ /GJ)
$\eta_{m,y}$	Average net energy conversion efficiency of power unit <i>m</i> in year <i>y</i> (ratio)
3.6	Conversion coefficient of thermal work equivalent of electricity (GJ/MWh)

According to formula (10), the unit electricity emission factor of the hydro-power, nuclear power, wind power, solar power, other thermal power¹³, and others power generation technology¹⁴ in the "newly-installed power units" samples are is zero. The emission factor per unit of electricity for power generation from coal, gas, oil and and waste power is calculated based on equation (6).

¹¹ refers to waste heat and pressure, straw, bagasse, forest wood power generation.

¹² refers to power generation such as geothermal energy and ocean energy.

¹³ Other thermal power mainly refers to waste heat and pressure, straw, bagasse and forest power generation.

¹⁴ Others power generation technology mainly refers to geothermal energy, ocean energy and other power generation.

Since the average net energy conversion efficiency of each sample ($\eta_{m,y}$) cannot be obtained, the power supply thermal efficiency of the best commercialized technology of coal, gas, oil and waste power ($\eta_{Best,m,y}$) is better than $\eta_{m,y}$. It is conservative to use $\eta_{Best,m,y}$ for the calculation of $EF_{EL,m,y}$.

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:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \text{Equation (7)}$$

Where,

$EF_{grid,BM,y}$	Build Margin CO ₂ emission factor in year y (tCO ₂ /MWh)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y
$EF_{EL,m,y}$	CO ₂ emission factor of power unit m in year y (tCO ₂ /MWh)
m	Power units included in the Build Margin
y	The most recent year for which data is available

Outcome of STEP5:

Based on the calculation in appendix 4, the Build Margin Emission Factor ($EF_{grid,BM,y}$) of the SCPG could be obtained to be 0.2135 tCO₂/MWh.

Step 6. Calculate the combined margin emission factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

- (a) Weighted average CM; or
- (b) Simplified CM.

The weighted average CM method (**option A**) should be used as the preferred option. And the PD choose option A.

The combined margin emissions factor ($EF_{grid,CM,y}$) is calculated as follows:

$$EF_{grid,CM,y} = \omega_{OM} \times EF_{grid,OM,y} + \omega_{BM} \times EF_{grid,BM,y} \quad \text{Equation (8)}$$

Where:

$EF_{grid,BM,y}$	Build margin CO ₂ emission for the project electricity system factor in year y (tCO ₂ e /MWh)
$EF_{grid,OM,y}$	Operating margin CO ₂ emission factor for the project electricity system in year y (tCO ₂ e /MWh)
ω_{OM}	Weighting of operating margin emissions factor (%)
ω_{BM}	Weighting of build margin emissions factor (%)

The Combined Margin emissions factor $EF_{grid,CM,y}$ should be calculated as the weighted average of the Operating Margin emission factor $EF_{grid,OM,y}$ and the Build Margin emission factor $EF_{grid,BM,y}$, where $\omega_{OM} = 0.25$ and $\omega_{BM} = 0.75$ for all other project excluded wind and solar project for the second and third crediting period. The $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ are calculated as described in Step 4 and 5.

Therefore,

$$EF_{grid,CM,y} = 0.8042 \text{ tCO}_2\text{e/MWh} * 0.25 + 0.2135 \text{ tCO}_2\text{e/MWh} * 0.75 = 0.3612 \text{ (tCO}_2\text{e/MWh)}$$

$$BE_y = 143,652 \text{ MWh} * 0.3612 \text{ tCO}_2\text{e/MWh} = 51,887 \text{ tCO}_2\text{e}$$

4.2 Project Emissions

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

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

For the project activity, based on the 2019¹⁵ report for the surface area of full reservoir, area of the reservoir measured in the surface of the water of the project is 2,732,305 m². Installed capacity of the project is 36,000,000W, the power density of the project = $(Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL}) = 13.176 \text{ W/m}^2$, hence, $PE_y = 0$.

4.3 Leakage

According to the methodology ACM00002 (Version 20.0), no leakage is considered, so $LE_y = 0$.

¹⁵ 2019 is the last year when the surface of the water of the project got measured before the start date of this crediting period.

4.4 Net GHG Emission Reductions and Removals

The annual emission reductions ER_y for the project activity are calculated as the baseline emissions minus the project emissions and minus the leakage emissions. Being the project of a zero-emission activity, the final GHG emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation(9)}$$

Where:

ER_y Emission reductions in year y (tCO_2)

BE_y Baseline Emissions in year y (tCO_2)

PE_y Project emissions in year y (tCO_2)

LE_y Leakage emissions in year y (tCO_2)

The summary of ex ante estimates of emission reductions is shown as follows

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
25/01/2020~24/01/2021	51,887	0	0	51,887
25/01/2021~24/01/2022	51,887	0	0	51,887
25/01/2022~24/01/2023	51,887	0	0	51,887
25/01/2023~24/01/2024	51,887	0	0	51,887
25/01/2024~24/01/2025	51,887	0	0	51,887
25/01/2025~24/01/2026	51,887	0	0	51,887
25/01/2026~24/01/2027	51,887	0	0	51,887
25/01/2027~24/01/2028	51,887	0	0	51,887
25/01/2029~24/01/2030	51,887	0	0	51,887
Total	518,870	0	0	518,870

5 MONITORING

5.1 Data and Parameters Available at Validation

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

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO ₂ e/MWh
Description	The baseline grid emission factor
Source of data	-
Value applied	0.3612
Justification of choice of data or description of measurement methods and procedures applied	As per the requirements in "Tool to calculate the emission factor for an electricity system version 07.0"
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	CAP _{BL}
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data	ACM0002 version 20.0 and registered PDD
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of project emissions

Comments	Determined ex-ante and fixed for the second crediting period
Data / Parameter	A _{BL}
Data unit	m ²
Description	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full. For new reservoirs, this value is zero.
Source of data	ACM0002 version 20.0 and registered PDD
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of project emissions
Comments	Determined ex-ante and fixed for the second crediting period

5.2 Data and Parameters Monitored

Data / Parameter	EG _{export,y}
Data unit	MWh
Description	Electricity supplied by the project activity to the grid in year y
Source of data	Project site
Description of measurement methods and procedures to be applied	Data type: Continuously measured. Archiving procedure: Electronic. Responsibility: The electricity meter was calibrated by a qualified third party regularly. Calibration Frequency: Annually.

Frequency of monitoring/recording	Continuously measured, and monthly recorded
Value applied	Estimation of annual net electricity generation delivered to grid: 143,652MWh
Monitoring equipment	The bi-directional meters (M ₁ , M ₂) with measurement accuracy of 0.2S are calibrated annually by the qualified third party. When M ₁ is out of order, the readings from M ₂ will be used for reference.
QA/QC procedures to be applied	The meters are calibrated annually according to the sectoral requirement. Data measured by the meter is cross checked by Electricity Transaction Notes (ETNs).
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	EG _{import,y}
Data unit	MWh
Description	Electricity imported by the project activity from the grid in year y
Source of data	Project site
Description of measurement methods and procedures to be applied	Data type: Continuously measured. Archiving procedure: Electronic. Responsibility: The electricity meter was calibrated by a qualified third party regularly. Calibration Frequency: Annually.
Frequency of monitoring/recording	Continuously measured, and monthly recorded
Value applied	0
Monitoring equipment	The bi-directional meters (M ₁ ,M ₂) with measurement accuracy of 0.2s are calibrated annually by the qualified third party. When M ₁ is out of order, the readings from M ₂ will be used for reference.

QA/QC procedures to be applied	The meters are calibrated annually according to the sectoral requirement. Data measured by the meter is cross checked by electricity purchased receipts.
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	EG _{backup}
Data unit	MWh
Description	Electricity imported through backup line from the grid in year y
Source of data	Project site
Description of measurement methods and procedures to be applied	Data type: Continuously measured. Archiving procedure: Electronic. Responsibility: The electricity meter was calibrated by a qualified third party regularly. Calibration Frequency: Annually.
Frequency of monitoring/recording	Continuously measured, and monthly recorded
Value applied	-
Monitoring equipment	The meter (M _{backup}) with measurement accuracy of 1.0 is calibrated annually by the qualified third party.
QA/QC procedures to be applied	Metering equipment will be calibrated annually according to the sectoral requirement. Data measured will be cross checked by ETNs.
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	Cap _{PI}
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Data unit	MW
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site
Description of measurement methods and procedures to be applied	Measured. Determine the installed capacity based on recognized standards yearly, i.e., nameplates of the turbines and generators installed at the project site and the equipment purchase contract.
Frequency of monitoring/recording	Once at the beginning of each crediting period.
Value applied	36
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of baseline emissions
Calculation method	-
Comments	-

Data / Parameter	APJ
Data unit	m ²
Description	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data	Project site
Description of measurement methods and procedures to be applied	Once at the beginning of each crediting period.
Frequency of monitoring/recording	Once at the beginning of each crediting period.
Value applied	2,732,305
Monitoring equipment	-

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

5.3 Monitoring Plan

1. Organizational and monitoring structure

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

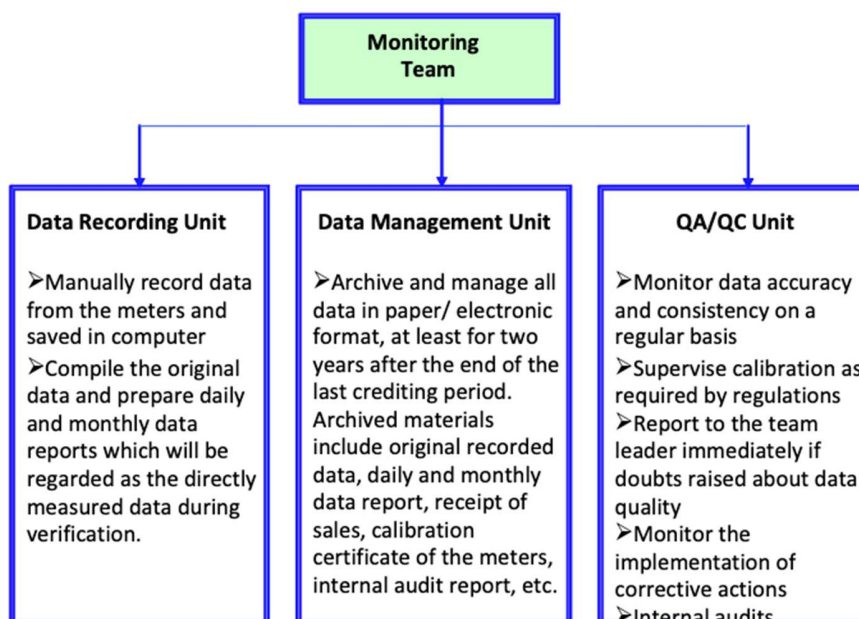


Figure 3 Structure of the monitoring team

2. Monitoring system and data collection

Bidirectional metering equipment with the rated precision of 0.2s installed at the substation of Grid Company and project site. The meter at the substation of Grid Company (M₁) has been used to monitor the supplied and imported electricity. If the metering equipment of the Grid Company

failed to monitor the electricity, the metering equipment at the project site (M_2) has been used to report the data.

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

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

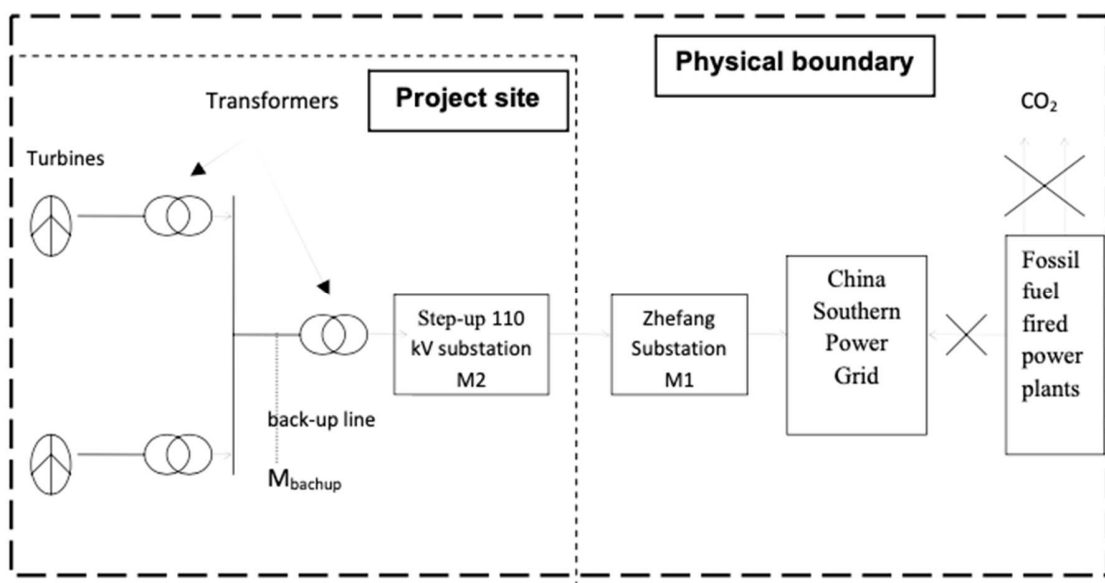


Figure 4 Positioning of monitoring equipment

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

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

Data recording: In the second crediting period, the grid company and the plant operation staff read and record the meters at 24:00 of the last day of each month and saved in computer. These electricity data is approved by the local grid company. Compile the original data and prepare daily and monthly data reports which will be regarded as the directly measured data during verification.

Data aggregation: Physical document such as paper-based maps, diagrams and environmental assessments have been collected in a central place, together with this monitoring plan. All paper-

based information and the electronic records are stored by the technology department of the project owner and will be kept until 2 years after the end of the crediting period of the VCS project.

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

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

See section 4 for calculations of emission reductions.

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

3. Quality Assurance and Quality Control

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

3.1 Data quality monitoring

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

3.2 Calibration

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

3.3 Corrective actions

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

3.4 Internal audits

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

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

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

4. emergency procedures

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