



**Verified Carbon
Standard**

86 MW HYDRO PROJECT IN HIMACHAL PRADESH



Document Prepared by EKI Energy Services Limited

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The project activity is 86 MW hydro power project located at Jari village in Malana town of Kullu district, Himachal Pradesh, India. Project activity is based on the Run-of-the River (ROR) scheme and has been developed by Malana Power Company Limited having registered office at Noida, India (herein after referred as MPCL). MPCL is a private organization, established with an objective of developing new hydro projects across the country. Electricity generated from the project activity is being transmitted to Bajaura substation. From Bajaura substation, generated electricity is exported to Unified Indian Grid.

The project activity is estimated to generate 321,159 MWh of electricity annually; thus reducing GHGs to the tune of 284,869 tCO₂e/ annum for the entire crediting period of 10 years.

The relevant implementation dates are:

The project plant has 2 units (2 x 43 MW) and Unit-1 was commissioned on 09-July-2001 & Unit-2 was commissioned on 05-July-2001 and run satisfactorily.

The total estimated GHG emission reductions achieved in the third crediting period i.e. from 05-July-2021 to 04-July-2031 (first and last days included) is 2848,690 tCO₂e with annual average emission reduction of 284,869 tCO₂e.

The second crediting period was from 05-July-2011 to 04-July-2021 (first and last days included) and the estimated annual emission reduction was 275,532 tCO₂e.

1.2 Sectoral Scope and Project Type

Project Type: I – Renewable Energy Projects

Sectoral Scope: 1 Energy industries (renewable/ non-renewable sources)

Project Category: ACM0002 “Grid-connected electricity generation from renewable sources” Version 20.0¹, 28th November 2019, EB 105.

Project is not grouped project activity as per VCS guidelines.

1.3 Project Eligibility

The project activity involves installation and generation of electricity using hydro power i.e. by using the renewable sources replacing electricity supply from a fossil-fuel dominated electricity, thus leads to reductions of anthropogenic GHG emissions from atmosphere. Hence the project activity is eligible Sectoral scope 1 i.e. Energy industries (renewable/ non-renewable sources) under the scope of the VCS Program.

¹ <https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG>

1.4 Project Design

The project design entails single installation of two turbine of capacity 43 MW each along with other auxiliary devices implemented at village Jari, Kullu District, Himachal Pradesh.

Eligibility Criteria

Not applicable to this project activity as this is not a grouped project.

1.5 Project Proponent

Organization name	M/s. Malana Power Company Limited
Contact person	Mr. O.P. Ajmera
Title	Vice President Finance
Address	Bhilwara Towers, -12, Sector 1, Noida -201301, Uttar Pradesh, India
Telephone	91-120-2541810, 91-120-2531648
Email	opajmera@lnjbhilwara.com

1.6 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the project	Project Consultant
Contact person	Mr. Ankit Sethiya
Title	Executive – Operations
Address	EnKing Embassy, Office No. 201, Plot 48, Scheme 78, Part 2, Vijay Nagar, Indore- 452010 Madhya Pradesh, India
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1.7 Ownership

For the ownership details of the 86 MW Hydro Project in Himachal Pradesh following may be referred:

1. PCB clearance
2. Commissioning certificates
3. Letter of Intent dated 26-April-1999

1.8 Project Start Date

The start date of the project is 05-July-2001, which is the commissioning date of the project activity.

1.9 Project Crediting Period

Project Crediting Period Start date: 05-July-2021

Project Crediting Period End date: 04-July-2031

Total Crediting Period: 10 Years

This is the third crediting period of this project activity. The first & second crediting period of this project activity was given below-

- 1st Crediting Period start date: 05-July-2001 – 04-July-2011
- 2nd Crediting Period start date: 05-July- 2011 – 04-July-2021

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

Estimated average annual GHG emission reductions from the project activity for third crediting period are 284,869 tCO₂e per year, which is less than 300,000 tCO₂e per year. Hence the project scale of the project activity will become “Projects” as shown below:

Project Scale	
Project	√
Large project	

Year	Estimated GHG emission reductions or removals (tCO ₂ e)
2021-2022	284,869
2022-2023	284,869

2023-2024	284,869
2024-2025	284,869
2025-2026	284,869
2026-2027	284,869
2027-2028	284,869
2028-2029	284,869
2029-2030	284,869
2030-2031	284,869
Total estimated ERs	2,848,690
Total number of crediting years	10
Average annual ERs	284,869

1.11 Description of the Project Activity

The electricity generation facility is installed on Malana Nallah, a tributary of Parbati River. The project activity entails installation of two turbine of capacity 43 MW each along with other auxiliary devices implemented at village Jari, Kullu District, Himachal Pradesh. The project activity has the capacity to generate about 370 million KWh per annum and this estimation is based on 95% power plant availability for a 90% dependable year based on the hydrological data for the last 24 years provided by the Government of Himachal Pradesh. And average power generation based on actual data of last 10 year is about 320 million KWh per annum. The generated power, after meeting the auxiliary power requirements, the net billable power will be injected to Bajaura Substation which is the part of Unified Indian Grid.

The purpose of the project activity is to generate electricity by using the renewable energy sources (water) for a grid system in the state of Himachal Pradesh, India. In the absence of the project activity, equivalent power would have been generated based on the fossil fuel intensive grid. The project activity displaces electricity and greenhouse gases (GHG) emissions currently produced by thermal fossil fuel-burning facilities from the Unified Indian Grid.

This whole process will support climate change mitigation as it would lead to an emission reduction of 2,848,690 tonnes of CO_{2e} over the chosen crediting period of ten years for third

crediting period. As the commissioning date of this project activity is 05-July-2001, this is considered as the start date of project activity.

Lifetime of the project activity is expected to be 40 years.

1.12 Project Location

The project is located at Jari village in district Kullu of Himachal Pradesh around 25 Km from Bhunter. The Project activity is uniquely identified as Malana Hydro Project in the region. The nearest railway station from the project site is Kiratpur Sahib, about 198 Km from Bhunter. Bhunter has airport and is well connected to Delhi.

Coordinates of the Barrage:

Latitude: $32^{\circ} 2' 24''$ N ; Longitude - $77^{\circ} 15' 4''$ E

Coordinates of Power House:

Latitude - $32^{\circ} 0' 12''$ N ; Longitude - $77^{\circ} 14' 30''$ E

For the project activity the project boundary is from the diversion site to the point of power supply to nearest substation where the project proponent has full control.

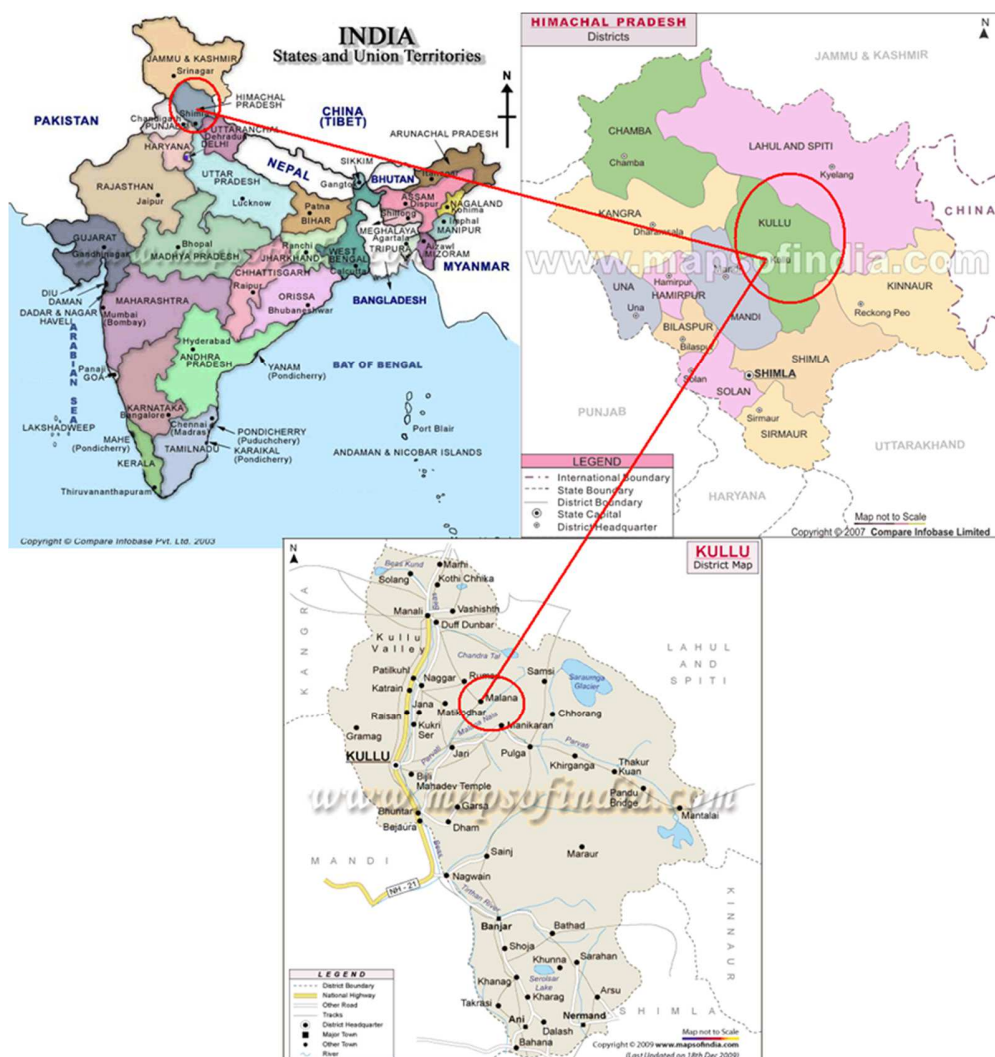


Figure 1: Location of project activity

1.13 Conditions Prior to Project Initiation

The project is a renewable energy project which generates electricity. In the absence of the project activity the electricity delivered to the Unified Indian Grid would have been generated by the operation of grid-connected power plants which are mainly thermal based power stations. Hence, it would have led to increased GHG emissions thereby, further accelerating climate change.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project activity is not mandated by any local or national laws. The project proponent has obtained all required approvals as given below.

Approval Name	Approval date	Law under which it is applicable
Renewable consent to Operate	11-March-2011	Water (Prevention & Control of Pollution) Act, 1974 & Air (Prevention & Control of Pollution) Act, 1981
Implementation agreement	13-March-1997	Government of Himachal Pradesh Agreement with Project Developer

1.15 Participation under Other GHG Programs

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

The project activity has been registered under I-REC mechanism. The PP has claimed I-REC from the project “Malana Hydro and the registration date is 01-March-2015 on I-REC²”. The details for the period, during which I-REC has been claimed/issued, is provided in the table below.

Duration	Volume claimed/ issued
01-January-2016 to 31-December-2016	315,567
01-January-2017 to 30-June-2017	119,495
01-October-2017 to 30-November-2017	32,618
01-January-2018 to 31-May-2018	49,287
01-January-2019 to 24-June-2019	116,601

1.15.2 Projects Rejected by Other GHG Programs

Project has not been rejected under any GHG programs. Undertaking for the same is provided from PP.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The net GHG emission reductions or removals generated by the project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions.

1.16.2 Other Forms of Environmental Credit

PP is not getting any other form of environmental credit and undertaking for the same is provided from PP end.

² <https://evident.services/device-register/MALANAHY>

1.17 Additional Information Relevant to the Project

Leakage Management

No leakage emissions are considered for the proposed project activity since no energy generating equipment is transferred from another activity and/or the existing equipment is transferred to another activity.

Commercially Sensitive Information

There is no such information which is deemed as commercially sensitive.

Sustainable Development

Contribution to sustainable development:

Ministry of Environment, Forest and Climate Change (MoEFCC), has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. The project contributes to sustainable development using the following ways.

Social well-being: The project helped in generating employment opportunities during the construction and operation phases. The project activity also lead to development in infrastructure in the region like development of roads and also may promote business with improved power generation.

Economic well-being: The project is a clean technology investment in the region, which would not have been taken place in the absence of the VCS benefits. The project activity also help to reduce the demand supply gap in the state.

Technological well-being: The successful operation of project activity lead to promotion of hydro based power generation and would encourage other entrepreneurs to participate in similar projects.

Environmental well-being: Hydro being a renewable source of energy, it reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. Since the project activity is a hydro power project, it also helps in avoiding significant amount of GHG emissions and specific pollutants like SO_x, NO_x, and SPM associated with the conventional thermal power generation facilities.

Further Information

Not applicable

2 SAFEGUARDS

2.1 No Net Harm

Not applicable

2.2 Local Stakeholder Consultation

As per VCS Guidelines, this section is not mandatory as the project is already registered and DOE Contract for validation was prior to 19-April-2017. There were no other major comments or protest raised by the stakeholders and they were totally in support for setting up of these kinds of projects in the region.

As a part of continuous feedback from stakeholders, the PP also placed a grievance register onsite where-in, the stakeholders can put down their complain and the same if found genuine are addressed immediately.

2.3 Environmental Impact

For a hydroelectric power project the major concern is at the point of project implementation in regard to social, economic and environmental issues. Under the regulatory frame work, Environment Impact Assessment (EIA) study is mandatory for the project activity as clarified by the Host party namely Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India. In this regard MPCL has addressed and resolve the key issues which are necessary part of Environment Impact Assessment. The environmental impacts associated with the project activity are as follows:

Impact on Flora and Fauna

Project activity doesn't involve storage of large amount of river water hence there is no issue regards to the submergence of the forests, fertile land or of the inhabited areas. The structure of project (including reservoir, barrage and other facilities) is not very big in size to cause any significant disturbance to the eco-system. No significant deforestation is required at the weir side location. Implementation of the scheme would help in conservation of forest by replacing the firewood for cooking and heating purposes with electricity.

Socio-Economic Impact

There is no rehabilitation and resettlement has been taken place by the project activity. No relocation of the human population occurred around the project activity. Project activity acquires small pieces of land for which adequate compensation was paid to the local villages; this compensation would help the local population to start new business in the nearby area.

15% of the generated electricity is being delivered to the state grid as royalty which has improved the power scene in the nearby area.

Environment Pollution

Since it is hydro project so there is no issue regarding air pollution. On the other hand power generation from the project results in air quality improvement and emission reductions caused by burning of fossil fuels and firewood.

Impact of Noise Quality

Equipment's which are being used in project activity has the ability to keep the noise level below 90 dB for an exposure time of 8 hours as enforced by OSHA (Occupational Safety and Health Administration). During the construction phase, the personnel operating and stationed near the Heavy Earth Moving Vehicles and Concrete Mixing Machines provided with adequate Personal Protective Equipment (PPEs) to avoid damage to the health. The noise generated in the construction process did not have any significant impact on the ambient noise levels. Hence there is no significant noise impact has been observed.

If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The MPCL is an environmentally benign 'clean energy' and cost effective solution to meet the region's growing energy demands. Efforts have been made to enhance the existing resources and minimize the adverse impact on the ecosystem through suitable planning. Environmental Impact Assessment for the project has been carried out and the clearance for the project has been obtained.

2.4 Public Comments

Brief description how comments by local stakeholders have been invited and compiled:

MPCL identified the people, groups and organizations that were interested or have got involved with this project implementation as stakeholder. MPCL sent a communication to all the identified stakeholders about the project activity. They conducted open consultation where all the stakeholders were given an opportunity to present their views and opinions regarding the MPCL project. All these communication processes were aimed at

- Transparency
- Accountability
- Flexibility
- Increased stakeholder awareness of project related issues
- Broad stakeholder input and involvement
- Efficiency and effectiveness
- Promotion of stakeholder confidence
- Understanding of stakeholder perspective.

The following are the identified stakeholders for the project activity

1. Government Parties

- HPSEB (Himachal Pradesh State Electricity Board)
- Pollution Control Board of Himachal Pradesh & Environmental Department of Himachal Pradesh
- Ground Water Department
- MNES (Ministry of Non-Conventional Energy Sources)

2. Non- Government Parties

- Gram Panchayat of Jari Village
- Land Owner
- Non-Government Organization (NGOs)
- Consultants
- Equipment suppliers

Stakeholder list includes various government and non-government parties, which are involved with the Project activity at various stages of its implementation.

Summary of the comments received:

Government Parties

Himachal Pradesh State Electricity Board (HPSEB)

As an importer of the power, the HPSEB is a major stakeholder in the MPCL project activity. They hold the key to the commercial success of the MPCL project. HPSEB has already cleared the MPCL project and MPCL signed Power Purchase Agreement (PPA) with HPSEB.

Himachal Pradesh Pollution Control Board (HPPCB), Environment Department of Himachal Pradesh

Himachal Pradesh Pollution Control Board (HPPCB) and Environmental Department of Government of Himachal Pradesh have prescribed standards of environmental compliance and monitor the adherence to the standards. The MPCL project received No Objection Certificate (NOC) from Himachal Pradesh Pollution Control Board for commissioning of the project. Project proponent has also taken consent from Environmental Department of Himachal Pradesh.

Ministry of Non-Conventional Sources and Ground Water Department

Ministry of Non-Conventional Sources, Government of India has been promoting the energy renewable project such as wind, solar, hydro, mini hydro, biomass-based projects to conserve available sources (such as fossil fuel, diesel and natural gas) for future uses. Effort implementing this hydro project was appreciated by the MNES.

Consent of Ground water department is mandatory in the implementation of the hydro projects, since this project does not affect the quality and quantity of the ground water in the region, so project activity has been given the approval to implement and operate the hydro power plant in the region.

Non-government parties

Village panchayat and Local Populace

The village Panchayat / local elected body of representative administering the local area are a true representative of local population in a democracy like India. Hence, their consent/permissions to set this project were necessary. MPCL has completed the necessary consultation and documented their approval for this project.

Local population comprises of the local people in and around the MPCL project area. The roles of the local people are as a beneficiary of the MPCL project. The construction of MPCL project and continuous operation included local manpower working at the same plant site. Since, the MPCL project provided good direct and indirect employment opportunities the local populace is encouraging and providing complete support to the MPCL project.

The MPCL project does not require any major displacement of local population. The Project activity has acquired land from local population and local population have been given compensation for this thing. So project activity has not received any adverse comment from their side.

Non-Government Organizations (NGOs), Consultants, Equipment Suppliers

The NGOs got involved with the MPCL project during various stages of its implementation. They have provided complete support to the MPCL project activity.

Project consultants were involved in the MPCL project to take care of various pre contracts and post contract project related activities like preparation of detailed project report (DPR), preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors/ suppliers, supervision of project implementation, successful commissioning and trial runs.

Equipment supplier delivered all the equipment as per specification within the schedule and MPCL successfully commissioned the plant.

Land Owner

Project activity acquired land from few local land owners. Acquisition process has been done after taking consent of the land owners and land owners have been compensated for losing their land by the project activity. Land owners have not shown any adverse reply against this process.

2.5 AFOLU-Specific Safeguards

The project activity deals with generation of electricity using hydro power and not from AFOLU projects. Hence not applicable.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The following approved methodology has been applied to the project activity:

For Third Crediting Period

Title: Grid-connected electricity generation from renewable sources

Reference: Approved consolidated baseline methodology ACM0002, Version 20.0³, 28-November-2019, EB 105.

Title and reference of tools applied to the project activity:

³ <https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG>

“Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”; Version: 03.0.1⁴

Tool to calculate the emission factor for an electricity system” (Version 07.0)⁵

For Second Crediting Period

Title: Consolidated baseline methodology for grid-connected electricity generation from renewable sources.

Reference: Approved consolidated baseline methodology ACM0002, Version 12.1.0; 26-November-2010, EB 58

Title and reference of tools applied to the project activity:

“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

3.2 Applicability of Methodology

The justification of the project activity vis-à-vis applicability conditions in the ACM0002 Version 20.0 is described in the following Table. This methodology is applicable to grid- connected renewable power generation project activities under the following conditions.

The project activity vis-à-vis applicability conditions in the ACM0002

Applicability Conditions in the ACM0002	Project activity vis-à-vis applicability conditions
According to para 3 of ACM0002 , version 20.0, the methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield power plant; (b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plants/units; (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	The project activity is hydro power generation through installation of greenfield power plant as there was no power plant in that area prior to installation of this power plant. This project activity is not a capacity addition to an existing plant or retrofit of an existing operating plant or rehabilitation of an existing plant or replacement of an existing plant. So only option (a) is applicable.

⁴ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf>

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

As per para no. 4 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 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.	The project activity is installation of a new grid connected run-of-the river hydro power project. The project is a green-field project and does not involve capacity additions, retrofits or replacements.
In case of hydro power plants: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs. (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, as per definitions given in the Project Emissions section, is greater than 4 W/m². (c) The project activity results in new single or multiple reservoirs and the power density, as per definitions given in the Project Emissions section, is greater than 4 W/m². (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, as per definitions given in the Project Emissions section, is lower than or equal to 4 W/m², all of the following conditions shall apply: The power density calculated using the total installed capacity of the integrated project, as per definitions given in the Project	This is a run of the river hydro power project which does not involve construction of any reservoir. Since the power density of the project activity is greater than 4 W/m² so as per applied methodology for the project activity, there would not be any project emission. Calculation of the power density is shown in section 3.2 of the PD.

Emissions section, 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.	
Para 6 is related to integrated hydro power plant.	The proposed project activity is not related to integrated hydro power plant.
Methodology is not applicable to the following: (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.	The Project activity is installation of a new grid connected run-of-the river hydro power project and does not involve switching from fossil fuel to renewable energy. This is a run of the river hydro power project and not a biomass plant.
Applicability conditions of “Tool to calculate the emission factor for an electricity system”	
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 activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly.
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, the conditions specified in “Appendix 2: 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 percent 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.	Since the project activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly.

In case of VCS projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project activity is located in India, a non-Annex I country. Therefore, this criterion is not applicable for the project activity.
Under this tool, the value applied to the CO ₂ emission factor of biofuels is zero.	The project activity is a grid connected hydro power project and not a biomass power plant. Therefore, this criterion is not applicable for the project activity.
Applicability conditions of "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period"	
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 project activity condition is applicable and the stepwise procedure has been applied in section 3.4.
The tool consists of two steps. The first step provides an approach to evaluate whether the current baseline is still valid for the next crediting period. The second step provides an approach to update the baseline in case that the current baseline is not valid anymore for the next crediting period.	This project activity current baseline remain same and there is no impact if circumstances, existing at the time of requesting renewal of crediting period. Therefore, the first step is met for the project activity.

Hence, it is concluded that the proposed project activity satisfies all the applicability conditions of the methodology ACM0002 version 20.0.

3.3 Project Boundary

GHG gases considered for the emission reduction estimation within project boundary:

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
		Other	No	-
Project		CO ₂	No	Minor emission source

Source	Gas	Included?	Justification/Explanation
For hydro power plants, emissions of CH ₄ from the reservoir	CH ₄	No	Minor emission source
	N ₂ O	No	Minor emission source
	Other	No	-

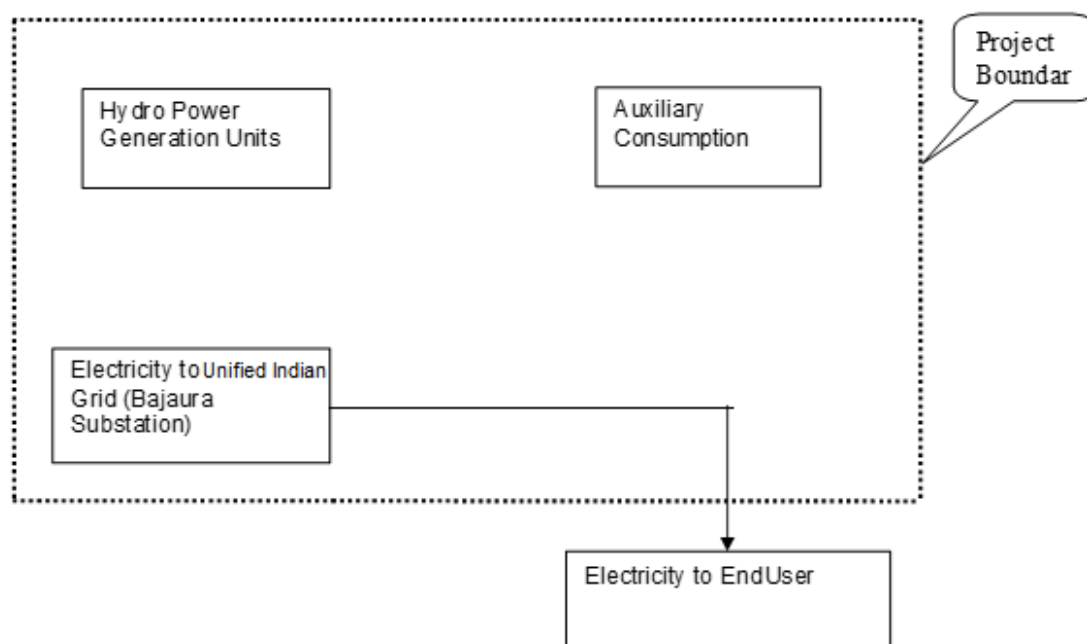


Figure 2: Project Boundary

3.4 Baseline Scenario

As per the approved consolidated methodology ACM0002, version 20.0 since the project activity involves the installation of a new grid-connected hydro power plant, the baseline scenario is the following: 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, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

Since the project activity is the installation of a new grid-connected hydroelectric power plant hence the baseline scenario is the same as described above. In the following section Combined Margin for the grid has been calculated as per “Tool to calculate the emission factor for an electricity system”.

Updated baseline for the third crediting period in line with the “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period.” Version 03.0.1⁶.

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 283 to 286 of Project Standard version 03.0.

The tool stipulates the following steps to be carried out.

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

The baseline scenario remains unchanged and is in compliance with all the relevant mandatory national and/or sectoral policies.

Step 1.2: Assess the impact of circumstances

The baseline scenario identified at the validation of the project activity was 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. Thus this project activity was a voluntary investment which intends to replace equivalent amount of electricity at grid from renewable source. PP was not bound to incur this investment; hence absence of project activity (i.e. the investment) does not lead to any continued baseline practice for PP within their scope whereas the continued operation of the project activity would continue to replace equivalent amount of electricity at grid. Hence, the same baseline as identified in the previous crediting period is still valid for the project. Therefore, the assessment of the changes in market characteristics is not required for the renewal of the project's crediting period.

Nevertheless, there is an impressive growth attained by the Indian Power Sector within the recent years, the installed capacity has grown from mere 1,713 MW in 1950 to 382,151.22 MW as on 31.03.2021. Sector-wise de-tails of installed capacity are shown in Table 1. However, it is evident from Table 1⁷ that the installed capacity is predominantly coal based and therefore, is a major source of carbon dioxide emissions in India. Hence, there exists scope for reducing the CO₂ emissions in the country by increased use of renewable energy sources.

Furthermore, project participant has considered the latest available CO₂ Baseline Database (CEA database, version 17) at the time of requesting renewal of the crediting period for establishing the baseline emission factor, which itself considered all the new circumstances. Hence, the new circumstances do not have an impact on the baseline emission. As per below table, the fossil fuel based thermal power generation is dominant over the renewable based power generation, thus baseline scenario remains same as original.

Table 1: Sector- wise installed capacity (MW) as on 31/03/2021(CEA Database version 17)

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

⁷ https://cea.nic.in/wp-content/uploads/tpe_cc/2022/02/User_Guide_ver_17_2021.pdf

Sector	Thermal					Nuclear	Hydro	RES	Total
	Coal	Lignite	Gas	Diesel	Total				
State	65931.50	1150.00	7087.36	236.01	74404.86	0.00	27069.50	2395.27	103869.64
Central	62570.00	3640.00	7237.91	0.00	73447.91	6780.00	15646.72	1632.30	97506.93
Private	74173.00	1830.00	10598.74	273.70	86875.45	0.00	3493.00	90406.21	180774.66
All India	202674.50	6620.00	24924.01	509.71	234728.22	6780.00	46209.22	94433.79	382151.22

Thus, current baseline remain same and there is no impact if circumstances, existing at the time of requesting renewal of crediting period.

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

As explained in step 1.2, the baseline scenario was the electricity import/generation from the power plants connected to the electricity grid. The project activity in green field project and there is no any baseline equipment or investment involved in project activity. Therefore this condition is not applicable to the project activity.

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

This step stipulates that “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.”

In the context of the present project activity the emission factor has been updated along with the approach used to calculate the emission factor.

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

As evident from the explanation provided above the baseline scenario remains unchanged. Only the approach used to calculate the baseline emission factor is updated as per the latest version of CEA database available at the time of PD submission for renewal.

In line with the project standard version 03.0, the impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant EB guidance with regard to renewal of the crediting period at the time of requesting renewal of crediting period; and the correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period

Impact of the national and/or sectoral policies and circumstances upon the baseline scenario of the project activity

The Government of India enacted the Electricity Act in the year 2003 to harmonize and rationalize the provisions in the existing laws. The Act consolidated the laws relating to generation, transmission, distribution, trading and use of electricity. With the Enactment of the act, the then

existing laws viz, The Indian Electricity Act 1910, The Electricity Supply Act, 1948 and The Electricity Regulatory Commissions Act, 1998 were repealed. The Electricity Act 2003 was in force at the time of the completion of the baseline study for the registered PD.

Section 3 of the said act required the Central Government to prepare the national electricity policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy. In accordance with the section 3 of the Electricity Act 2003, the Central Government notified the National Electricity Policy⁸ on 12-February-2005 which was in force at the time of completion of the baseline study as stated in the registered PD of the project activity. This policy has not been revised since then and is currently in force as well.

In addition to the above policies, State Electricity Regulatory Commissions (SERCs) have announced preferential tariffs and Indian Renewable Energy Development Agency (IREDA) provides term loan assistance towards establishing biomass power projects. All these fiscal and financial incentives were in force at the time of completion of the baseline study for the registered PD of the project activity and still continue to exist.

The state electricity regulatory commission issues tariff order in respect of procurement of power generated from renewables and there is no mandatory national and/or sectoral policies have come into effect that would affect the compliance of the current baseline. Hence, it can be concluded the current baseline complies with all relevant mandatory national and/or sectoral policies that 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.

However, in spite of the financial incentives given by the government to renewable power projects in India the generation from the low cost must run resources connected to the Southern Grid has not increased to such an extent that this would lead to more than 50% contribution from the low cost must run resources towards the total generation from the Southern Grid.

The approved small scale methodology for Grid connected renewable electricity generation, ACM0002 (Version 20.0), has been used to determine the baseline and the estimation of emission reductions for the applicable crediting period. As referred in the methodology "Tool to calculate the emission factor for an electricity system" (version 07.0) has been used to determine continued validity of the baseline based on combined margin (CM) calculations.

As per CEA database version 17, the fossil fuel dominated electricity is more than renewable sector and is continuing with same pattern. In light of the above discussion it is to be concluded that in accordance with relevant guidelines stipulated in the Project Standard version 03.0, national and/or sectoral policies and circumstances had been considered towards formulating the OM & BM baseline scenario. Hence the baseline scenario as applied for the present project activity remains justified.

As per the approved large scale methodology for Grid connected renewable electricity generation, ACM0002 (Version 20.0) para 22: "If the project activity is the installation of a 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

⁸<http://www.cercind.gov.in/Act-with-amendment.pdf>

addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “TOOL07: Tool to calculate the emission factor for an electricity system”.

The project activity involves setting up of hydro project to produce electricity and supply to the grid. In the absence of the project activity, the equivalent amount of power would have been supplied by the Indian grid, which is fed mainly by fossil fuel fired plants.

In the absence of the project activity, the equivalent amount of power would have been drawn from the Indian grid. Hence, the baseline for the project activity is the equivalent amount of power from the Indian grid.

The combined margin ($EF_{grid,CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source (where available) and made publically available. The CEA database version 17 is the latest available data at the time of PD submission to DOE for validation, hence same is considered for emission factor calculations.

The combined margin of the Indian grid used for the project activity is as follows:

Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	0.8870tCO ₂ /MWh	Combined margin CO ₂ emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.25) & build margin (0.75) values, sourced from Baseline CO ₂ Emission Database, Version 17.0, Oct 2021 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,OM,y}$	0.9522 tCO ₂ /MWh	Operating margin CO ₂ emission factor for the project electricity system in year y	Calculated as the last 3 year (2018-19, 2019-20, 2020-21) generation-weighted average, sourced from Baseline CO ₂ Emission Database, Version 17.0, Oct 2021 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,BM,y}$	0.8653tCO ₂ /MWh	Build margin CO ₂ emission factor for the project electricity system in year y	Baseline CO ₂ Emission Database, Version 17.0, Oct 2021 published by Central Electricity Authority (CEA), Government of India

The version 07.0⁹ of the said tool has been used by the CEA for the calculation. Determination of emission factor figures have been calculated and provided below.

⁹ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

The following section details the steps mentioned above in order to calculate the combined margin emission factor;

Step 1: Identify the relevant electricity systems

As described in tool “For determining the electricity emission factors, identify the relevant project electricity system. Similarly, identify any connected electricity systems”. It also states that “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”. Keeping this into consideration, the Central Electricity Authority (CEA), Government of India has divided the Indian Power Sector into five regional grids viz. Northern, Eastern, Western, North-eastern and Southern.

However since August 2006, all regional grids except the Southern Grid had been integrated and were operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids were treated as a single grid named as NEWNE grid from FY 2007-08 onwards for the purpose of this CO₂ Baseline Database. As of 31 December 2013, the Southern grid has also been synchronized with the NEWNE grid, hence forming one unified Indian Grid. Since the project supplies electricity to the Indian grid, emissions generated due to the electricity generated by the Indian grid as per CM calculations will serve as the baseline for this project.

Table: Geographical Scope of Indian Electricity Grid

Northern	Eastern	Western	North-Eastern	Southern
Chandigarh	Bihar	Chhattisgarh	Arunachal Pradesh	Andhra Pradesh
Delhi	Jharkhand	Gujarat	Assam	Karnataka
Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadar & Nagar Haveli	Meghalaya	Tamil Nadu
Jammu & Kashmir	Sikkim	Madhya Pradesh	Mizoram	Telangana
Punjab	Andaman & Nicobar	Maharashtra	Nagaland	Puducherry
Rajasthan		Goa	Tripura	Lakshadweep
Uttar Pradesh				
Uttarakhand				

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

As per the tool the 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. Project proponents have chosen Option I: 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 one of the following methods, which are described under Step 4:

- (a) Simple OM; or
- (b) Simple adjusted OM; or
- (c) Dispatch data analysis OM; or
- (d) Average OM.

The data required to calculate Simple adjusted OM and Dispatch data analysis OM is not possible due to lack of availability of data to project developers. The choice of other two options for calculating operating margin emission factor depends on generation of electricity from low-cost/ must-run sources. In the context of the methodology low cost/must run resources typically include hydro, geothermal, wind, low cost biomass, nuclear and solar generation.

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)

	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
India	15.1%	14.6%	14.3%	14.5%	17.0%	16.5%

Data Source: Central Electricity Authority (CEA) database Version 17, Oct'2021¹⁰

The above data clearly shows that the percentage of total grid generation by low-cost/ must-run plants (on the basis of average of five most recent years) for the Indian grid is less than 50 % of the total generation. Thus the Average OM method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation.

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.

¹⁰https://cea.nic.in/wp-content/uploads/tpe_cc/2022/02/User_Guide_ver_17_2021.pdf

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

(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.

OR

(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 emissions factor to be updated annually during monitoring.

PP has chosen ex-ante option for calculation of Simple OM emission factor using a 3-year generation-weighted average, based on the most recent data available at the time of submission of the PD to the DOE for validation.

OM determined at validation stage will be the same throughout the crediting period. There will be no requirement to monitor & recalculate the emission factor during the crediting period.

Step 4: Calculate the operating margin emission factor ($EF_{grid,OMSimple,y}$) according to the selected method

The operating margin emission factor has been calculated using a 3 year data vintage:

Net Generation in Operating Margin (GWh) (incl. Imports)			
	2018-19	2019-20	2020-21
INDIAN Grid	995,957	965,009	958,218

Simple Operating Margin (tCO ₂ /MWh) (incl. Imports)			
	2018-19	2019-20	2020-21
INDIAN Grid	0.9603	0.9555	0.9405

Weighted Generation Operating Margin	
INDIAN Grid	0.9522

Step 5: Calculate the build margin (BM) emission factor ($EF_{grid,BM,y}$)

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 72:

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

(a) **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 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.

(b) **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 as described above is chosen by PP to calculate the build margin emission factor for the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PD and is fixed for the entire crediting period.

Build Margin (tCO ₂ /MWh) (not adjusted for imports)	
	2020-21
INDIAN Grid	0.8653

Step 6: Calculate the combined margin (CM) emission factor (EF_{CM,grid,y})

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 81:

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

(a) Weighted average CM; or

(b) Simplified CM.

PP has chosen option (a) i.e weighted average CM to calculate the combined margin emission factor for the project activity.

The combined margin emissions factor is calculated as follows:

$$EF_{CM,grid,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$$

Where:

EF_{grid,BM,y} = Build margin CO₂ emission factor in year y (t CO₂/MWh)

EF_{grid,OM,y} = Operating margin CO₂ emission factor in year y (t CO₂/MWh)

W_{OM} = Weighting of operating margin emissions factor (per cent)

W_{BM} = Weighting of build margin emissions factor (per cent)

The following default values should be used for W_{OM} and W_{BM} :

All other projects: $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period, and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

. Since project activity is of Hydro power generation, the above weightage has been considered for OM and BM.

$$\begin{aligned}\text{Therefore, } EF_{grid,y} &= 0.9522 * 0.25 + 0.8653 * 0.75 \\ &= 0.8870 \text{ tCO}_2/\text{MWh}\end{aligned}$$

Baseline emission factor (EF_y):

The baseline emission factor is calculated using the combined margin approach as described in Step 6 above:

$$\text{Therefore, } EF_y = EF_{CM,grid,y} = 0.8870 \text{ tCO}_2/\text{MW}$$

3.5 Additionality

The project proponents have used VCS to analyze the additionality argument vis-à-vis project activity.

The project has selected the appropriate baseline and its project emissions are found to be below the selected baseline. In order to determine the baseline, the project will use either of the following criteria

- Determine the baseline based on existing or historical emissions
- Determine the baseline based on its industry benchmark under similar social, economic, environmental and technological circumstances
- Determine the baseline by identifying the most likely new project activity providing the same level of services as the proposed project.

The Project activity is a run-of-the-river hydel project which supply power through the NR Grid (Now synchronized with NEWNE grid). The power generated by the project activity displaces the power that would have otherwise been generated using fossil-fuel as in the current supply mix of the grid. NR grid was operating with a mix of hydro, nuclear (Total 28%) and fossil fuel (Total 72%) power plants.

The GEF as discussed in section B.2 is taken from publically available source and is based on historical data of power plant performances. CEA has access to all the required data and has done the calculation in a transparent and conservative manner based on guidelines as per ACM0002 Version 20.0.

This clearly demonstrates that baseline has been determined based on genuine historical data and project activity being a renewable source power shall add to greenhouse gas reductions in real sense.

The VCU (Verified Carbon Units) criteria require that project from which emission reductions are created pass an additionality test. Through the additionality test the project proponent shall show that mitigation measures result in real reduction in greenhouse gases against a transparent emission baseline. Project additionality shall be done based on one of the criteria prescribed in VCS. The following logic has been used by project proponents:

Test 1 - The project test:

Step 1: Regulatory Surplus

- The project activity is not mandated by any enforced law, statute or other regulatory framework. And project activity is in compliance with applicable laws and regulations. For power generation, the Indian Electricity Act of 2003 does not restrict or empower any authority to limit the fuel choice.
- There is no regulation in India that imposes either formal or voluntary targets, to be met by such project activity
- The applicable environmental regulations do not restrict the use of hydro energy
- There is no legal requirement on the choice of a particular technology

Also there were not any policies before 11-November-2001 that gives comparative advantage to less emission intensive i.e. hydro power project thus project activity is regulatory surplus.

Step 2: Implementation Barriers

There is minimal private sector participation in hydro power generation in India. Nearly 98% of installed capacity is with Government owned utilities. Lack of private sector participation in hydro power sector is due to difficulties in arranging finance for the projects. Further, most hydro projects in India have run up high capital costs, faced considerable implementation delays, run into geological related problems and faced significant rehabilitation & resettlement related problems, which have contributed to the high financial risk now associated with hydropower projects. In addition, private power generation in India has a chequered past, since state utilities are the usual off takers and the financial standing of most state-owned utilities is in a perilous state. Given this background, most private investors are wary of venturing into hydro power development in India.

Step 3: Common Practice analysis

The project activity is the first hydro Independent Power Producers (IPPs) in Himachal Pradesh, India. It is also the first Merchant power plant in the country. An analysis of total power generated in northern region shows that there are not many large scale hydro power projects promoted by private players, hence it is one of its kind in the region.

Fossil fuel based power plant have been considered most popular power generation alternatives in India since they give high return on investment and availability of easy project finance. Installed capacity of fossil fuel based thermal power plants are increasing year by year very rapidly. The encouraged development of thermal power project is illustrated through a consideration of five-year plans over the last 50 years (as shown below in the Table 7). Five year plans are developed by the Planning Commission to identify the planed capacity addition to the national and regional grid.

Table 4: Contribution of different major sources of power sector in five-year plans

Plan and Year	Hydro (%)	Thermal (%)	Nuclear and Wind (%)
1 st Plan 1956	35	65	0
3 rd Plan 1966	46	54	0
5 th Plan 1979	41	57	2
7 th Plan 1990	29	69	2
9 th Plan 2002	25	71	4

Project activity is the first large scale hydro project in state and an example for the other project developers in the state. It is also first IPP (Independent Power Producer) in India.

The above analysis clearly and strongly demonstrates that project activity has led to greenhouse gas reduction over and above a transparent and conservative baseline.

3.6 Methodology Deviations

There is no request for methodology deviation applied during current monitoring period.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Emission Reduction Calculation Approach - The emission reductions are calculated as a product of the net quantity of electricity supplied to the grid and emission factor of the NEWNE grid. The calculation approach is explained below:

Table 5: Emission Reduction Estimation

Parameters	UoM	Value	Source
Capacity	MW	86	Purchase order
Running hours	per day	24	-
Working days	per year	365	-
PLF	%	43.1%	Based on actual data since operation of project activity
Auxiliary consumption	%	0.33%	Based on actual data since operation of project activity
Transmission losses	%	0.76%	Based on actual data since operation of project activity
Gross power generation	MWh	324698	Calculated
Auxiliary power consumption	MWh	1072	Calculated
Power loss due to transmission	MWh	2468	Calculated
Net power supplied to grid	MWh	321159	Calculated

Gross power generation in a year by the project activity: $86 \times 24 \times 365 \times 0.431 = 324698.16$ MWh

Auxiliary power generation in a year by the project activity: $324698.16 \times 0.33\% = 1071.50$ MWh

Transmission losses in a year by the project activity: $324698.16 \times 0.76\% = 2467.70$ MWh

Therefore,

Net power supplied to the grid in a year by the project activity:

$$324698.16 - 1071.50 - 2467.70 = 321158.96 \text{ MWh}$$

Combined Margin/ Grid Emission Factor = $0.8870 \text{ tCO}_2/\text{MWh}$

The baseline emission for the project activity is calculated as follows:

$$\begin{aligned} BE_y &= 321158.96 \text{ MWh} \times 0.8870 \text{ tCO}_2/\text{MWh} \\ &= 284,869 \text{ tCO}_2/\text{year (Rounded Down)} \end{aligned}$$

4.2 Project Emissions

The project emission in case of hydro projects includes the CH₄ emission from the reservoir and emission due to fossil fuel combustion. Since the project activity is a ROR project without any reservoir, so CH₄ emission would be zero.

As per methodology ACM0002 Version 20.0, for hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH₄ and CO₂ emissions from the reservoir, estimated as follows:

(a) If the power density of the project activity (PD) is greater than 4 W/m² and less than or equal to 10 W/m²:

$$PE_{HP,y} = \frac{EF_{Res} * TEG_y}{1000}$$

$PE_{HP,y}$ = Project emissions from water reservoirs (tCO₂e/yr)

EF_{Res} = Default emission factor for emissions from reservoirs of hydro power plants in year y (kgCO₂e/MWh)

TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh)

(b) If the power density of the project activity (PD) is greater than 10 W/m²: Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$):

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD = Power density of the project activity (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

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 reservoirs, this value is zero

For the project is a new hydro power plant, so the Cap_{BL} and A_{BL} are both zero.

For the project activity:

$$\text{Cap}_{PJ} = 860000000 \text{ W}$$

$$\text{Cap}_{BL} = 0 \text{ W}$$

$$A_{PJ} = 18250 \text{ m}^2$$

$$A_{BL} = 0$$

$$\text{Power density of the project activity, PD} = (860000000 - 0) / (18250 - 0)$$

$$= 4712.32 \text{ W/m}^2$$

Since Power density is greater than 4 W/m²; therefore,

$$PE_{HP,y} = 0$$

Since during previous crediting period, fossil fuel has never been used for the project activity and it is expected not to be used in the project activity during the current crediting period so project emission due to fossil fuel combustion (P_{EFF,y}) is considered zero.

So

$$\text{Total project emissions (P}_{E_y}) = P_{EHP,y} + P_{EFF,y}$$

$$= 0 + 0$$

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

4.3 Leakage

No leakage emissions are considered for the proposed project activity since no energy generating equipment is transferred from another activity and/or the existing equipment is transferred to another activity.

Therefore, as specified in ACM0002, project participants do not need to consider leakage. Hence, LE_y=0.

4.4 Estimated Net GHG Emission Reductions and Removals

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)
2021-2022	284,869	0	0	284,869
2022-2023	284,869	0	0	284,869
2023-2024	284,869	0	0	284,869
2024-2025	284,869	0	0	284,869
2025-2026	284,869	0	0	284,869
2026-2027	284,869	0	0	284,869
2027-2028	284,869	0	0	284,869
2028-2029	284,869	0	0	284,869
2029-2030	284,869	0	0	284,869
2030-2031	284,869	0	0	284,869
Total	2,848,690	0	0	2,848,690

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	EF _{BM, grid, y}
Data unit	tCO ₂ /MWh

Description	Build margin CO ₂ emission factor for Unified Indian Grid in the year y
Source of data	CO ₂ Baseline Database for the Indian Power Sector, User Guide (Version 17 ¹¹) & version 06.
Value applied:	0.8653 0.8120 ¹²
Justification of choice of data or description of measurement methods and procedures applied	The value is taken from the database developed by Central Electricity Authority (CO ₂ Baseline database for the Indian power sector, Version 17.0). The database is Government of India's official publication based on the 'Tool to calculate the emission factor for an electricity system'
Purpose of Data	For the calculation of grid emission factor
Comments	CEA CO ₂ Baseline Database for most recent three years

Data / Parameter	EF _{OM, grid, y}
Data unit	tCO ₂ /MWh
Description	Operating margin CO ₂ emission factor for Unified Indian Grid in the year y
Source of data	CO ₂ Baseline Database for the Indian Power Sector, User Guide (Version 17) & version 06.
Value applied:	0.9522 0.9940 ¹³
Justification of choice of data or description of measurement methods and procedures applied	The value is taken from the database developed by Central Electricity Authority (CO ₂ Baseline database for the Indian power sector, Version 17.0). The database is Government of India's official publication based on the 'Tool to calculate the emission factor for an electricity system'.

¹¹ https://cea.nic.in/wp-content/uploads/tpe_cc/2022/02/User_Guide_ver_17_2021.pdf

¹² Build margin emission factor 0.812 has been used for the second crediting period of this project.

¹³ Operating margin emission factor 0.994 has been used for the second crediting period of this project.

Purpose of Data	For the calculation of grid emission factor for estimating the baseline emissions
Comments	CEA CO ₂ Baseline Database for most recent three years

Data / Parameter	EF _{CM, grid, y}
Data unit	tCO ₂ /MWh
Description	Combined margin CO ₂ emission factor for Unified Indian Grid in the year y
Source of data	Grid emission factor calculation: $EF_{grid,CM,y} = 0.25 \times EF_{grid,OM,y} + 0.75 \times EF_{grid,BM,y}$ $= 0.25 \times 0.9522 + 0.75 \times 0.8653$ $= 0.8870 \text{ tCO}_2/\text{MWh}$ Values of OM and BM are taken from CEA User Guide, CO₂ Baseline Database for the Indian Power Sector, Version 17 & version 06.
Value applied:	0.8870 0.8580¹⁴
Justification of choice of data or description of measurement methods and procedures applied	The values are taken from the database developed by Central Electricity Authority (CO ₂ Baseline database for the Indian power sector, Version 17.0). The database is Government of India's official publication based on the 'Tool to calculate the emission factor for an electricity system'.
Purpose of Data	For the calculation of emission reductions from the project activity.
Comments	The calculation is done ex ante.

¹⁴ Combined margin emission factor 0.858 has been used for the second crediting period of this project.

5.2 Data and Parameters Monitored

Data / Parameter	EG _{PJ,y}
Data unit	MWh
Description	Net Electricity supplied to the Unified Indian Grid by the project activity during the year y
Source of data	Meters installed at three locations, at generation point, plant sent out point and at Bajaura Substation, accurately monitors electricity supplied to the grid. Joint Meter readings taken at all three stations have been used to achieve the parameter EG _y .
Description of measurement methods and procedures to be applied	This is calculated value and formula for the same is given below under section of calculation method.
Frequency of monitoring/recording	Continuous Monitoring and Monthly Recording
Value applied	321158.96
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To calculate baseline emission.
Calculation method	$EG_y = [EG_{Malana} - EG_{Aux, Malana} - L_{Malana}]$
Comments	Data will be archived in electronic form for two years after the end of crediting period or of the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	EG _{Gen, Malana}
Data unit	MWh
Description	Energy generated by 86 MW Hydro Project in Himachal Pradesh at the Generation point.
Source of data	Joint Meter Reading (JMR) by State Electricity Board (SEB)
Description of measurement methods and procedures to be applied	Meter installed at the generation point shall be used to record this parameter. SEB take the reading on monthly basis and issue the JMR.

Frequency monitoring/recording of	Monitoring Frequency: Continuous Recording Frequency: Monthly
Value applied	As per actual data
Monitoring equipment	Type: Electricity Meter Accuracy Class of meters: 0.2 % Serial Number: As per available at site during verification period
QA/QC procedures to be applied	Meters are maintained by state electricity board. These meters are calibrated once in three year and the records maintained by state electricity department.
Purpose of data	To calculate baseline emission.
Calculation method	-
Comments	-

Data / Parameter	EG _{Malana}
Data unit	MWh
Description	Energy supplied by the 86 MW Hydro Project in Himachal Pradesh to the Malana transmission line at Malana Yard.
Source of data	Calculated
Description of measurement methods and procedures to be applied	This is calculated value and formula for the same is given below under section of calculation method.
Frequency monitoring/recording of	Monitoring Frequency: Continuous Recording Frequency: Monthly
Value applied	As per actual data
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To calculate baseline emission.
Calculation method	$EG_{Malana} = (EG_{Gen, Malana} - EG_{Aux, Malana})$
Comments	-

Data / Parameter	EG _{Toss}
Data unit	MWh
Description	The units/ Energy supplied by the Toss Hydro Power Project to the Malana transmission line at Malana Yard.
Source of data	Monthly meter readings issued by HPSEB
Description of measurement methods and procedures to be applied	Meter installed at the Malana yard shall be used to record this parameter
Frequency of monitoring/recording	Monitoring Frequency: Continuous Recording Frequency: Monthly
Value applied	As per actual data
Monitoring equipment	Type: Electricity Meter Accuracy Class of meters: 0.2 % Serial Number: As per available at site during verification period
QA/QC procedures to be applied	Meters are maintained by state electricity board. These meters are annually calibrated and the records maintained by state electricity department.
Purpose of data	To calculate baseline emission.
Calculation method	-
Comments	-

Data / Parameter	EG _{M&T}
Data unit	MWh
Description	Total Energy sent out both Malana and Toss hydro power project to the Malana transmission line at Malana yard.
Source of data	Joint Meter Reading (JMR) by SEB
Description of measurement methods and procedures to be applied	Meter installed at the Malana yard shall be used to record this parameter.
Frequency of monitoring/recording	Monitoring Frequency: Continuous Recording Frequency: Monthly

Value applied	As per actual data
Monitoring equipment	Type: Electricity Meter Accuracy Class of meters: 0.2 % Serial Number: As per available at site during verification period
QA/QC procedures to be applied	Meters are maintained by state electricity board. These meters are annually calibrated and the records maintained by state electricity department.
Purpose of data	To calculate baseline emission.
Calculation method	-
Comments	-

Data / Parameter	EG _{Aux, Malana}
Data unit	MWh
Description	Auxiliary consumption by 86 MW Hydro Project in Himachal Pradesh
Source of data	Calculated
Description of measurement methods and procedures to be applied	This is calculated value and formula for the same is given below under section of calculation method.
Frequency of monitoring/recording	-
Value applied	As per actual data
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To calculate baseline emission.
Calculation method	$EG_{Aux, Malana} = [EG_{Gen, Malana} + EG_{Toss} - EG_{M\&T}]$
Comments	-

Data / Parameter	EG _{Bajoura, M&T}
Data unit	MWh
Description	Energy injected at Bajoura substation by both Malana and Toss hydro power project
Source of data	Joint Meter Reading issued by SEB
Description of measurement methods and procedures to be applied	Meter installed at the Bajoura Substation shall be used to record this parameter.
Frequency of monitoring/recording	Monitoring Frequency: Continuous Recording Frequency: Monthly
Value applied	As per actual data
Monitoring equipment	Type: Electricity Meter Accuracy Class of meters: 0.2 % Serial Number: As per available at site during verification period
QA/QC procedures to be applied	Meters are maintained by state electricity board. These meters are annually calibrated and the records maintained by state electricity department.
Purpose of data	To calculate baseline emission.
Calculation method	-

Data / Parameter	L _{Transmission}
Data unit	MWh
Description	Total transmission losses between Malana yard and Bajoura substation
Source of data	Calculated
Description of measurement methods and procedures to be applied	This is calculated value and formula for the same is given below under section of calculation method.
Frequency of monitoring/recording	-
Value applied	As per actual data

Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To calculate baseline emission.
Calculation method	$L_{\text{Transmission}} = (EG_{\text{M\&T}} - EG_{\text{Bajaura, M\&T}})$
Comments	-

Data / Parameter	L_{Malana}
Data unit	MWh
Description	Share of losses of 86 MW Hydro Project in Himachal Pradesh
Source of data	Calculated
Description of measurement methods and procedures to be applied	This is calculated value and formula for the same is given below under section of calculation method.
Frequency of monitoring/recording	-
Value applied	As per actual data
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To calculate baseline emission.
Calculation method	$L_{\text{Malana}} = \frac{L_{\text{Transmission}} * EG_{\text{Malana}}}{EG}$
Comments	-

Data / Parameter	L_{TOSS}
Data unit	MWh

Description	Share of losses of Toss hydro power project
Source of data	Calculated
Description of measurement methods and procedures to be applied	This is calculated value and formula for the same is given below under section of calculation method.
Frequency of monitoring/recording	-
Value applied	As per actual data
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	To calculate baseline emission.
Calculation method	$L_{TOSS} = \frac{L_{Transmission} * EG_{Toss}}{EG}$
Comments	-

Data / Parameter	A _{pj}
Data unit	m ²
Description	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site
Description of measurement methods and procedures to be applied	Measured from topographical surveys, maps, satellite pictures, etc
Frequency of monitoring/recording	Yearly
Value applied	18250
Monitoring equipment	-

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

Data / Parameter	CapPJ
Data unit	W (Watt)
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	Determine the installed capacity based on recognized standards
Frequency of monitoring/recording	Yearly
Value applied	86,000,000
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	-
Calculation method	-
Comments	-

5.3 Monitoring Plan

Project Management Plan:

A team is constituted with participation from relevant departments. People are trained on concept and monitoring plan. This team is responsible for data collection and archiving. This team meet periodically to review project activity check data collected, emissions reduced etc. On a weekly basis, the monitoring reports is checked and discussed by the seniors and

team members/managers. In case of any irregularity observed, it shall be informed to the concerned person for necessary actions. On monthly basis, these reports shall be forwarded at the management level.

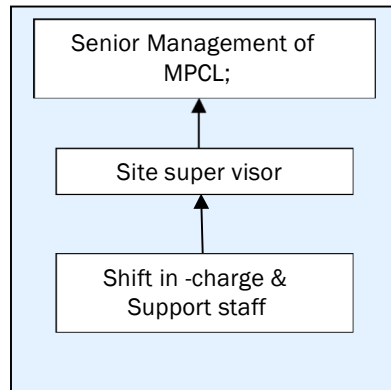


Figure 3: Project Management Plan

Senior Management of MPCL/Technical Head: Overall responsibility of compliance with the monitoring plan.

Site Supervisor: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation.

Shift In-charge: Responsibility of daily report generation

Data Monitoring:

The methodology requires monitoring of the following:

- Electricity generation from the project activity

Energy supplied to Grid

The energy supplied to grid is measured using electricity meters located at Bajaura substation. The net electricity supplied is measured as

$$EG_y = \text{Total Generation} - \text{Auxiliary Consumption} - \text{Transmission Losses}$$

In the current practice another hydroelectric power project (Toss) was allowed to utilise the Malana –Bus for sending out the generated electricity. A common meter is now being used to measure the electricity being sent out by Malana and Toss collectively at Malana Yard.

Since there is a common meter for measuring the electricity sent out from Malana Bus Bar hence now the calculation of auxiliary consumption and transmission losses are based on combined energy sent out & combined energy injected at Bajaura Sub Station. The calculation for auxiliary consumption and transmission losses for Malana HEP is described in the section 4.2 of the VCS-PD. Calculation is based on the authenticated Letter issued by HPSEB, 12-October-2009.

Gross generation at Malana is being measured by meter at generation point. The source of values taken for this parameter is the Joint Meter Reading (JMR). Energy sent out by Toss is measured by meter at the Toss incoming line, the meter readings are recorded and maintained by HPSEB.

The total energy sent out by Malana and Toss combined is measured by meter at Malana Bus, the source for these values is the JMR. The total energy injected at Bajoura substation by Malana and Toss combined is measured by meter at Bajoura substation. Auxiliary consumption and the share of transmission loss by Malana are calculated as per formula given in section 4.2. The total energy injected by Malana at Bajoura substation is calculated by subtracting the auxiliary consumption and Malana's share of transmission loss from the Gross generation by Malana.

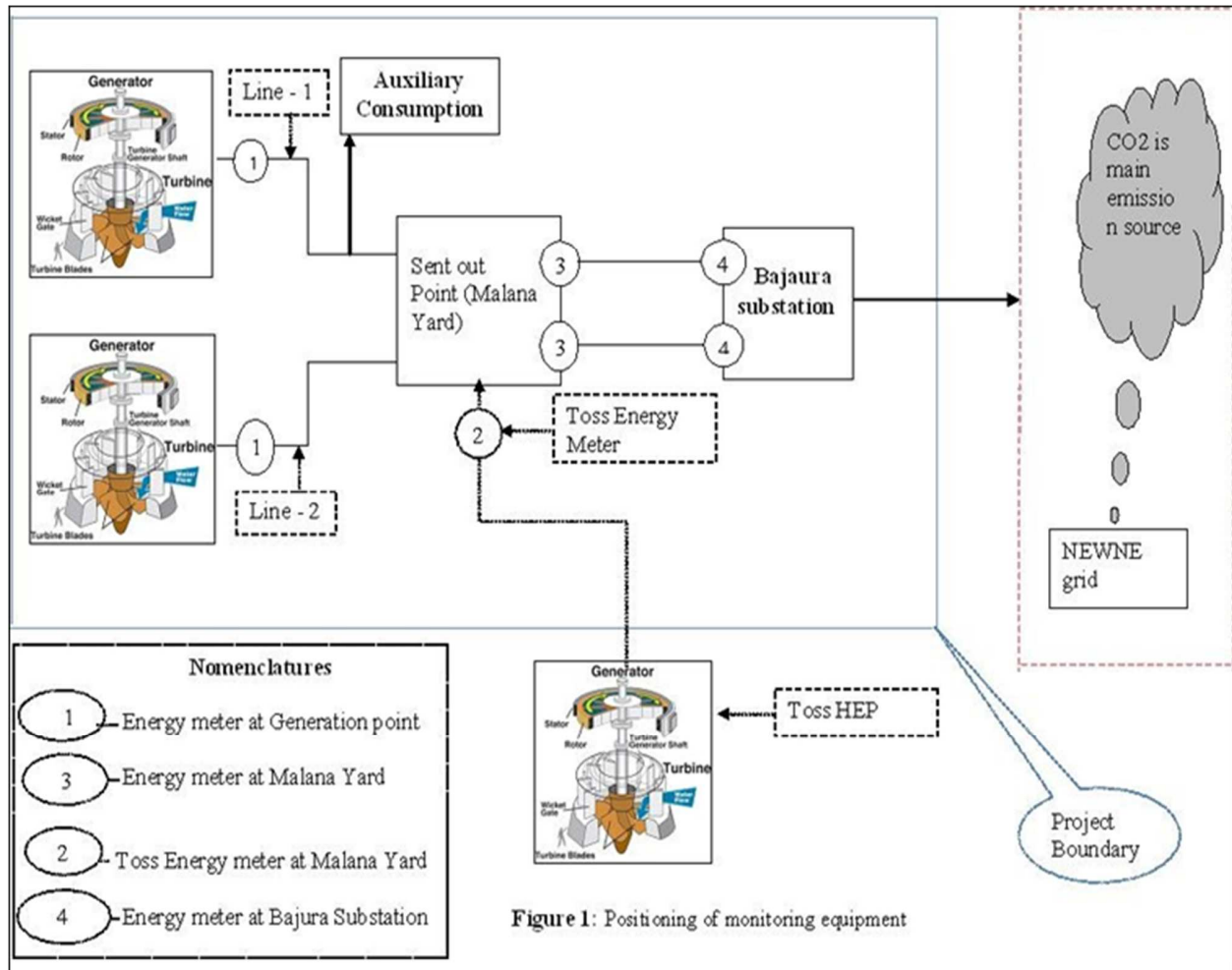
Completeness-

For Electricity generation data: The project activity will install the latest state-of-art monitoring and control equipment that measure, record, report, monitor and control various key parameters. Real time data collection will happen using these control systems. An hourly log of data will also be prepared by the shift in-charge. A daily report of aggregation of these data will also be prepared. Parameters monitored are the total power generated, power exported to the grid and auxiliary power consumed (other parameters like head availability, grid issues, frequency etc will also be maintained hourly in the log).

Reliability-

For electricity generation data: automatic control meters for power generation and exports will be regularly maintained. The regular plant operating & maintenance procedures will also include process of regular meter testing, calibration & maintenance. All these meters are calibrated & tested before installation and the calibration of meters is done once in three year at Government of India Lab

Actual power generation data will also be metered using power output meter at the substation. The billing invoices for the power sold and meter readings could be used to validate the data accuracy.



Frequency-

The measurement is recorded and monitored on a continuous basis. An hourly log is prepared by the shift in-charge. At the end of the day, hourly data is aggregated in a daily report. The meters to be provided shall be of 0.2 accuracy class.

Training-

Training needs have been identified in project document; however, the group is already operating a plant in Manikaran valley & experienced staff will be available for plant O&M.

Report generation on monitoring-

After verification of the data and due diligence on correctness if required an annual report on monitoring and estimations shall be maintained and record to this effect shall be maintained for verification.

Internal audits of project compliance-

Audits shall be carried out to check the correctness of procedures and data monitored by the internal auditing team entrusted for the work. Report on internal audits done, faults found and corrective action taken shall be maintained and kept for external auditing.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	EG _{PJ,y}											
Data unit	MWh											
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the project activity in year y											
Value applied:	<table><tr><th>Year</th><th>MWh</th></tr><tr><td>2020</td><td>16,717.32</td></tr><tr><td>2021(up to 04-July-2021)</td><td>91,515.31</td></tr><tr><td>2021(from 05-July-2021 to 31-Oct-2021)</td><td>200,831.61</td></tr><tr><td>Total</td><td>309064.26</td></tr></table>		Year	MWh	2020	16,717.32	2021(up to 04-July-2021)	91,515.31	2021(from 05-July-2021 to 31-Oct-2021)	200,831.61	Total	309064.26
Year	MWh											
2020	16,717.32											
2021(up to 04-July-2021)	91,515.31											
2021(from 05-July-2021 to 31-Oct-2021)	200,831.61											
Total	309064.26											
Comments	Data will be archived in electronic form for two years after the end of crediting period or of the last issuance of CERs for this project activity, whichever occurs later.											

Data / Parameter	$EG_{Gen, Malana}$
Data unit	MWh
Description	Energy generated by Malana Hydro Power project at the Generation point.
Value applied:	308535.04

Comments	-
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Data / Parameter	EG _{Malana}
Data unit	MWh
Description	Energy supplied by the Malana Hydro Power Project to the Malana transmission line at Malana Yard.
Value applied:	308213.11
Comments	-

Data / Parameter	EG _{Toss}
Data unit	MWh
Description	The units/ Energy supplied by the Toss Hydro Power Project to the Malana transmission line at Malana Yard.
Value applied:	130477.2
Comments	-

Data / Parameter	EG _{M&T}
Data unit	MWh
Description	Total Energy sent out both Malana and Toss hydro power project to the Malana transmission line at Malana yard.
Value applied:	438690.31
Comments	-

Data / Parameter	EG _{Aux, Malana}
Data unit	MWh
Description	Auxiliary consumption by Malana hydro power project
Value applied:	321.29
Comments	-

Data / Parameter	EG _{Bajoura, M&T}
Data unit	MWh
Description	Energy injected at Bajoura substation by both Malana and Toss hydro power project
Value applied:	439914.92
Comments	-

Data / Parameter	L _{Transmission}
Data unit	MWh
Description	Total transmission losses between Malana yard and Bajoura substation
Value applied:	-1224.61
Comments	-

Data / Parameter	L _{Malana}
Data unit	MWh

Description	Share of losses of Malana hydro power project
Value applied:	-394.87
Comments	-

Data / Parameter	L _{Toss}
Data unit	MWh
Description	Share of losses of Toss hydro power project
Value applied:	-829.73
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
Value applied:	18250
Comments	-

Data / Parameter	C _{apPJ}
Data unit	W (Watt)
Description	Installed capacity of the hydro power plant after the implementation of the project activity

Value applied:	86,000,000
Comments	-

6.2 Baseline Emissions

Baseline Emissions (BE_y):

Baseline Emission in 2020 from 01-November-2020 to 31-December-2020,

$$\begin{aligned}
 BE_y &= EG_{PJ, facility, y} \times EF_{grid, CM, y} \\
 &= 16717.32 \text{ MWh} \times 0.858 \text{ tCO}_2\text{e/MWh} \\
 &= \mathbf{14,343.46 \text{ tCO}_2\text{e}} \text{ (Rounded Down Value)}
 \end{aligned}$$

Baseline Emission in 2021 from 01-January-2021 to 04-July-2021,

$$\begin{aligned}
 BE_y &= EG_{PJ, facility, y} \times EF_{grid, CM, y} \\
 &= 91515.31 \text{ MWh} \times 0.858 \text{ tCO}_2\text{e/MWh} \\
 &= \mathbf{78,520.14 \text{ tCO}_2\text{e}} \text{ (Rounded Down Value)}
 \end{aligned}$$

Baseline Emission in 2021 from 05-July-2021 to 31-October-2021,

$$\begin{aligned}
 BE_y &= EG_{PJ, facility, y} \times EF_{grid, CM, y} \\
 &= 200831.61 \text{ MWh} \times 0.8870^{15} \text{ tCO}_2\text{e/MWh} \\
 &= \mathbf{178,137.64 \text{ tCO}_2\text{e}} \text{ (Rounded Down Value)}
 \end{aligned}$$

6.3 Project Emissions

As project emission is as same as demonstrated in above section 4.2. therefore, project emissions is considered as zero, PE_y = 0

6.4 Leakage

No other leakage emissions are considered. LE_y = 0

6.5 Net GHG Emission Reductions and Removals

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where

¹⁵ From 05-July-2021, third crediting period of the project activity started so the Combined Margin Emission Factor of third crediting period 0.8870 tCO₂/MWh has been applied.

ER_y = Emission reductions in year y (t CO₂e)

BE_y = Baseline emissions in year y (t CO₂e)

PE_y = Project emissions in year y (t CO₂e)

LE_y = Leakage emissions in year y (t CO₂e)

The net GHG emission reduction for this project activity for current monitoring period is shown table below:

Table: Net Emission Reduction from 01-November-2020 to 04-July-2021 (Monitoring Period under Second Crediting Period)

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2020	14343	0	0	14343
2021	78520	0	0	78520
Total	92,863	0	0	92,863

Table: Net Emission Reduction from 05-July-2021 to 31-Oct-2021 (Monitoring Period under Third Crediting Period)

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2021	178,137	0	0	178,137
Total	178,137	0	0	178,137

The total emission reduction for current monitoring period (01-Nov-2020 to 31-Oct-2021) is = (92863 + 178137) tCO₂e

= 271,000 tCO₂e.

The total monitoring period (01-November-2020 to 31-October-2021) is of 365 days within which first 246 days are under Second Crediting Period and next 119 days are under Third Crediting Period. The estimated annual emission reduction as per PD is 275,532 tCO₂ for second crediting period. The estimated annual emission reduction as per PD is 284,869 tCO₂ for third crediting period.

So, the estimated emission reduction for the first 246 days of monitoring period which are under Second Crediting Period will be

$$= (275532/365) \times 246$$

$$= 185701 \text{ tCO}_2\text{e}$$

The estimated emission reduction for the next 119 days of monitoring period which are under Third Crediting Period will be

$$= (284869/365) \times 119$$

$$= 92875 \text{ tCO}_2\text{e}$$

So, the estimated emission reduction in current monitoring period

$$= (185701 + 92875) \text{ tCO}_2\text{e}$$

$$= 278,576 \text{ tCO}_2\text{e}$$

The % fall in emission reduction in current monitoring period as compared to estimated emission reduction is $= (271000 - 278576)/278576$

$$= 0.0272$$

$$= 2.72\%$$

The fall (-2.72%) in generation as compared to estimated emission reduction is justified as the generation in hydro power plant is dependent on weather conditions.

The Total Net emission reduction summary for total monitoring period is as below

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01-November-2020 to 31-December-2020	14,343	0	0	14,343
01-January-2021 to 31-October-2021	256,657	0	0	256,657
Total	271,000	0	0	271,000

APPENDIX I: METER CALIBRATION DETAILS

The details of the calibrations of the Energy Meters have been provided in the table below.

Location of the Meter	Meter No.	Date of calibration	Due date of calibration
Malana G-1 Main Meter	HPU05820	06-August-2020	05-August-2021
	18168106 ¹⁶	06-August-2020	05-August-2021
		04-August-2021	03-August-2022
Malana G-1 Check Meter	HPU06253	06-August-2020	05-August-2021
		04-August-2021	03-August-2022
Malana G-2 Main Meter	HPU05821	06-August-2020	05-August-2021
	18168111 ¹⁷	05-August-2020	04-August-2021
		04-August-2021	03-August-2022
Malana G-2 Check Meter	HPU06254	06-August-2020	05-August-2021
		04-August-2021	03-August-2022
Malana Line-1 Main Meter	HPU05987	06-August-2020	05-August-2021
		04-August-2021	03-August-2022
Malana Line-1 Check Meter	HPU06607	06-August-2020	05-August-2021
		04-August-2021	03-August-2022
Malana Line-2 Main Meter	HPU05988	06-August-2020	05-August-2021
		04-August-2021	03-August-2022
Malana Line-2 Check Meter	HPU06608	06-August-2020	05-August-2021
		04-August-2021	03-August-2022
Bajaura Line-1 Main Meter	KRB09865	06-August-2020	05-August-2021
		04-August-2021	03-August-2022
Bajaura Line-1 Check Meter	HPU06609	06-August-2020	05-August-2021
		04-August-2021	03-August-2022
Bajaura Line-2 Main Meter	HPU05989	06-August-2020	05-August-2021
		04-August-2021	03-August-2022
Bajaura Line-2 Check Meter	HPU06610	06-August-2020	05-August-2021
		04-August-2021	03-August-2022

¹⁶ The old Main Meter with SL. No. HPU05820 was replaced with the new Main Meter with SL. No. 18168106, which was calibrated and installed on 08-October-2020.

¹⁷ The old Main Meter with SL. No. HPU05821 was replaced with the new Main Meter with SL. No. 18168111, which was calibrated and installed on 08-October-2020.

APPENDIX II: BREAKDOWN DETAILS

Date	Breakdown Hours	Reason
07-November-2020	0.28	GRID FAILURE
23-December-2020	6.50	Planned shutdown for Runner Replacement
02-January-2021	0.28	GRID FAILURE
17-February-2021 to 28-February-2021	277.00	Planned S/D for Unit - 2 annual maintenance & Upgradation of SCADA System.
10-March-2021	0.14	GRID FAILURE
12-April-2021 to 30-April-2021	446:00	Planned S/D for Unit - 1 annual maintenance and SCADA Upgradation work
01-May-2021 to 03-May-2021	59:00	Planned S/D for Unit - 1 annual maintenance and SCADA Upgradation work
10-June-2021	0.30	GRID FAILURE
05-August-2021	2.21	GRID FAILURE
09-September-2021	0.43	GRID FAILURE
13-October-2021	4.45	Planned S/D for Unit - 2 Runner replacement work