3.5 MW SMALL HYDRO PROJECT IN HIMACHAL PRADESH

Document Prepared By EKI Energy Services Limited

Project Title	3.5 MW Small Hydro Project In Himachal Pradesh
Version	02
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Monitoring Period	23-02-2018 to 31-10-2019 (including first and last dates)
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1 PROJECT DETAILS

1.1 Summary Description of the Project and its Implementation Status

The project activity involves generation of 3.5 MW hydro power by utilizing naturally available potential energy of water in the Sarwari nullah (tributary of river Beas) / Riavi river located in Kullu and Chamba district respectively in the state of Himachal Pradesh.

The 3.5 MW bundled small hydro project is a greenfield hydroelectric power project located in the state of Himachal Pradesh, India comprising of two hydroelectric projects – Sarwari –III Hydro Electric Project of capacity 2 MW by Gaur Hydro Power Pvt. Ltd and Siunr Hydro Electric Project of capacity 1.5 MW by Gopal Hydro Power Pvt. Ltd with capacity 2 MW and 1.5 MW by Gaur Hydro Power Pvt. Ltd. Sarwari –III Hydro Electric Project is located in Kullu district and while Siunr Hydro Electric Project is located in Chamba district of Himachal Pradesh. Both the projects are run-of-river (RoR) type hydropower projects built on the Sarwari Nallah (a tributary of river Beas) and river Ravi respectively.
The details of the project and the state of installation are mentioned in the table:-

Name of the SPVs investing in HEPs	Capacity in MW	Connection with Grid	State	Usage of Electricity
Gaur Hydro Power Pvt. ltd.	2 MW	Indian Grid	Himachal Pradesh	Sale to grid
Gopal Hydro Power Pro. Pvt. ltd.	1.5 MW	Indian Grid	Himachal Pradesh	Sale to grid
Total	**3.5 MW**			

Total net annual electricity generation of the project considering the combined capacity of 3.5 MW has been estimated to be about 16,665.52 MWh.

Both the project components included in this bundled project activity are run-of-river hydroelectric projects. These two hydroelectric projects will generate gross energy of approximately 18,280 MWh and export net energy of 16,665 MWh to HPSEB per annum considering auxiliary consumption, transformation losses and transmission losses..
The bundled hydroelectric project is a green field activity with the objective to generate electricity by using kineticenergy of water which is a renewable source of energy. Electricity generated from 2 MW Gaur HEP will be fed in to 33kV Switchyard at Suman sarwari HEP and Siunr HEP via newly constructed 2.7 km long 33 kV overhead transmission line between Sarwari-III and Suman Sarwari switchyard and henceforth taken to the sub-station of Himachal Pradesh State Electricity Board (HPSEB) at Kullu. and In case of 1.5 MW Gopal HEP, the electricity generated will be sold to HPSEB through connection with 33 /11 kV Grid sub-station atGarola , Himachal Pradesh.

The project was commissioned in phases. The first project phase encompasses the installation of a 2 MW generating unit by Gaur Hydro Power Pvt. Ltd. which was commissioned on 23/02/2018. A second 1.5 MW generating unit by Gopal Hydro Power Pro Pvt. Ltd. was commissioned on dated 05/05/2019.

The project activity is a renewable energy power project which uses potential energy for power Generation. The energy flow is as follows: potential energy at the project location is converted into mechanical energy using the turbines and subsequently into electrical energy by the generator. The generated electricity is planned to be sold to Indian grid which otherwise would have been supplied through the fossil fuel based power plants connected to the grid. This project will reduce Green House Gas (GHG) emission of 14,462 tCO_2/annum (144,622tCO_2 in crediting period of 10years) by harnessing clean energy instead of using fossil fuel based power generation. The project activity replaces fossil fuel based generated electricity in the INDIAN grid and therefore clearly contributes to the abatement of greenhouse gases.

The total AC capacity of the project activity is3.5 MW and the power produced displaces an equivalent amount of power from the grid, which is fed mainly by fossil fuel fired power plants. Hence, it results in reduction of GHG emissions. GHG emission reductions from the project activity will be 14,462 tCO2e and total GHG emission reductions for the chosen 10 year crediting period will be 144,622 tonnes of CO_2e.

Total emission reductions achieved in this monitoring period:

During the Current Monitoring Period from 23/02/2018 to 31/10/2019 (First and last date included) the project activity has contributed 16,876 tCO_2e GHG reductions.

1.2 Sectoral Scope and Project Type

The project activity falls under the following Sectoral scope and Project Type:

Sectoral Scope : 01 - Energy industries (renewable / non-renewable sources)
Project Type : I - Renewable Energy Projects
Methodology :AMS-I.D. -Grid Connected renewable electricity generation – Version 18.0[1]

The project is not a grouped project activity.

1.3 Project Proponent

Organization name	**Gaur Hydro Power Pvt. ltd**
Contact person	Mr. Yugal Kishore Garg
Title	VP Finance
Address	339, Functional Industrial Estate Patparganj Delhi DL 110092 IN
Telephone	09818055221
Email	yugalkishore.garg@gopalcorp.com

Organization name	**Gopal Power Pro Pvt. ltd**
Contact person	Mr. Yugal Kishore Garg
Title	VP Finance
Address	339, Functional Industrial Estate Patparganj Delhi DL 110092 IN
Telephone	09818055221
Email	yugalkishore.garg@gopalcorp.com

[1] http://cdm.unfccc.int/UserManagement/FileStorage/2P7FS6ZQAR84LG3NMKYUH50WI9ODBC

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the project	Project Consultancy
Contact person	Manish Dabkara
Title	CEO
Address	Office No 201, Plot No 48, Scheme 78, Part 2, Vijay Nagar, Indore-452010, Madhya Pradesh
Telephone	+91 9907534900
Email	manish@enkingint.org

1.5 Project Start Date

23/02/2018[2] which is the date of commissioning of first phase of the Project. The PP name is Gaur Hydro Power Pvt. ltd. Hence the project start date is 23/02/2018.

1.6 Project Crediting Period

Crediting Period Start date: 23/02/2018
Crediting Period End date: 22/02/2028
The project activity adopts renewable crediting period of 10 years period which can be renewed for maximum 2 times.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	✓
Largeproject	

As per section 3.9.1 of VCS standard Version 4.0, the projects are classified as follows:

1) Projects: Less than or equal to 300,000 tonnes of CO_2e per year
2) Large projects: Greater than 300,000 tonnes of CO_2e per year

As the estimated annual average GHG emission reductions or removal per year is 14,462tCO_2e which is less than 300,000 tonnes of CO_2e per year, thus the project falls in the category of Projects.

Year	Estimated GHG emission reductions or removals (tCO_2e)
23/02/2018 to 22/02/2019	8950

[2] As per the commissioning certificate.

23/02/2019 to 22/02/2020	13,992
23/02/2020 to 22/02/2021	15,210
23/02/2021 to 22/02/2022	15,210
23/02/2022 to 22/02/2023	15,210
23/02/2023 to 22/02/2024	15,210
23/02/2024 to 22/02/2025	15,210
23/02/2025 to 22/02/2026	15,210
23/02/2026 to 22/02/2027	15,210
23/02/2027 to 22/02/2028	15,210
Total estimated ERs	144,622
Total number of crediting years	10
Average annual ERs	14,462

1.8 Description of the Project Activity

The project activity involves the installation of Hydro Electric Projects. The total capacity of the project is 3.5MW. The bundled hydroelectric project is promoted by Gaur Hydro Power Pvt. Ltd. and Gopal Hydro Power Pro Pvt. Ltd. The project activity uses hydro energy to generate direct current form turbine that will be converted into alternating current by inverters. The project activity install a new power plant (i.e. Hydro Electric) at a site where no renewable power plant was operating prior to the implementation of the project activity (green-field plant). The generated electricity will be supplied to the INDIAN grid. The project activity follows AMS-I.D. Version 18.0 methodology.

Baseline Scenario:

As per the applicable methodology, a Greenfield power plant is defined as “a new renewable energy power plant that is constructed and operated at a site where no renewable energy power plant was operated prior to the implementation of the project activity”.

As the project activity falls under the definition of a Greenfield power plant, the baseline scenario as per applied methodology is the following:

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. Hence, pre-project scenario and baseline scenario are the same. The estimated lifetime of the project activity is considered as 40 years for hydro technology. This may increase depending on the operation & maintenance of the plant. The bundled project activity is a new facility (Greenfield) and the electricity generated by the Project will be exported to the Indian Grid. The Project will therefore displace an equivalent amount of electricity which would have otherwise been generated by fossil fuel dominant electricity grid. The Project Proponent plans to avail the carbon credits from VCS i.e. VCUs benefits for the project.

Emission Reductions from anthropogenic sources:

The solar power generated from the Project will be displacing the electricity generated from thermal power stations feeding into Indian grid and will be replacing the usage of diesel generators for meeting the power demand during shortage periods. Since, the hydroelectric electricity is Green House Gas (GHG) emissions free, the power generated will prevent the anthropogenic GHG emissions generated by the fossil fuel based thermal power stations comprising coal, diesel, furnace oil and gas. The estimation of GHG reductions by this project is limited to carbon dioxide (CO_2) only.

The commissioning details of the project are as follows:

S.No.	Name of the Project Owner	Capacity (MW)	Commissioning Dates
1.	Gaur Hydro Power Pvt. ltd	2.0	23/02/2018
2.	Gopal Hydro Power Pvt. ltd	1.5	05/05/2019
Total		**3.5**	

The technical specifications of the plants are described below[3]:

1.M/S Gaur Hydro Pvt Ltd. (2 MW)

Hydrology & Water Area	
Catchment area	138 Sq. Km.
Annual Rainfall	2653 mm
Atmospheric temperature in °C	Min -2°C, Max+ 35°C
Humidity (%)	98%
Head Works	
Diversion Weir	Trench type weir
Weir level	EL 1421 m
Design Discharge	6 cumecs
Flood Discharge	460 cumecs
Bottom level of trench	Caries from EL 1420 to EL 1419
Power Duct	
Shape of Power Duct	Rectangular
Size of Power Duct	1.8 m x 2.6 m
Length of Power duct	130 m
Water Conductor System	
Shape of water conductor	Circular
Size of water conductor	950 m
Desilting tank cum forebay	
Size of Setting Basin	8.5 m wide x 68 m long
Transition (Expansion) from 2.6 m to 8.5 m	18 m
Maximum Flow	8.97 Cumecs
Design discharge	6 Cumecs

[3]It is to be noted that in future there is possibility of slight change in configuration of projects implemented; however total project capacity of each project will remain same as above.

Inlet Bottom elevation	EL 1418.94 m
Center elevation of water conductor	EL 1416.88 m
Penstock	
Diameter of Bifurcation	1.28 m
Length of Bifurcated Penstock	25 m
Turbine / Generator	
Design Flow	3 Cumecs
Gross head	48 m
Design net head	41 m
Design discharge of Machine	6 Cumecs (For two units)
Output at "Design Net Head" & "Design Discharge"	100 kW at Generator Terminals + 20% continuous overload capacity
Type of turbine	Horizontal Francis Machine
Type of Speed Regulation	Multi regulation using Digital Electro Hydraulic Type turbine governor.
Type of Generator	Horizontal, synchronous, Brushless excited, Air cooled open ventilated, 3 phase, having sufficient shaft extension to mount turbine runner.
Rated Speed	750 rpm
Generation voltage	3.3 kV Ph-Ph
Generator Rating	1000 kW, 3.3KV, 0.9 pf, +20% cont. overload capacity.
Power Evacuation	
Voltage rating of setup (Generation) transformer	3.3 kV/ 33kV, ONAN, OLTC
Power rating of generating transformer	2800KVA
Type of tap changer	On Load Tap Changer
Transmission Line Voltage	33 kV
Substation	33KV Grid Substation at Suman Sarwari PH
Length of 33KV single transmission line from PH to substation	2.7 Km long, DOF conductor & XLPE cable if necessary

Gopal Hydro Power Pvt. Ltd.

1. Plant Capacity = 2x 0.750 MW (synchronous Generator),
Generating Voltage 3.3kV
Voltage 3.3kV
Current = 154.4A
PF = 0.85Lag
Frequency = 50Hz

2.Turbine = 2nos Pelton Horizontal
Model = CJA237-W-105/1x4.5
Capacity = 789kW

Speed 750rpm
Rated Output= 789kW
Rated Speed= 1000rpm
Runaway Speed= 1732rpm for 10 min.
Maximum Head =675mtr.
Rated discharge= 0.163m³/Sec
Net Head = 675 Mtr

3. Transformer = 2500 kVA
3.3KV/33KV ONAN OLTC
Rating = 2500kVA
IS :2026
HV voltage 33kV
LV Voltage 3.3 kV
HV Current 43.74A
LV Current 437.40A

4. DG = 25 kVA

There is no technology transfer from Annex-I countries for this project activity.

1.9 Project Location

The bundled hydro electric project is located in the state of Himachal Pradesh in districts of Kullu and Chamba.

S. No.	Name of the Project Proponent	Village	Tehsil	District	State	Latitude	Longitude
1.	Gaur Hydro Pvt Ltd.	Dadka, Sarwari nallah	Kullu	Kullu	Himachal Pradesh	31°57'34.9" N	77°03'55.2" E
2.	Gopal Hydro Pvt Ltd.	Garola	Bharmour	Chamba	Himachal Pradesh	32°26'17.8" N	76°28'03.9"E

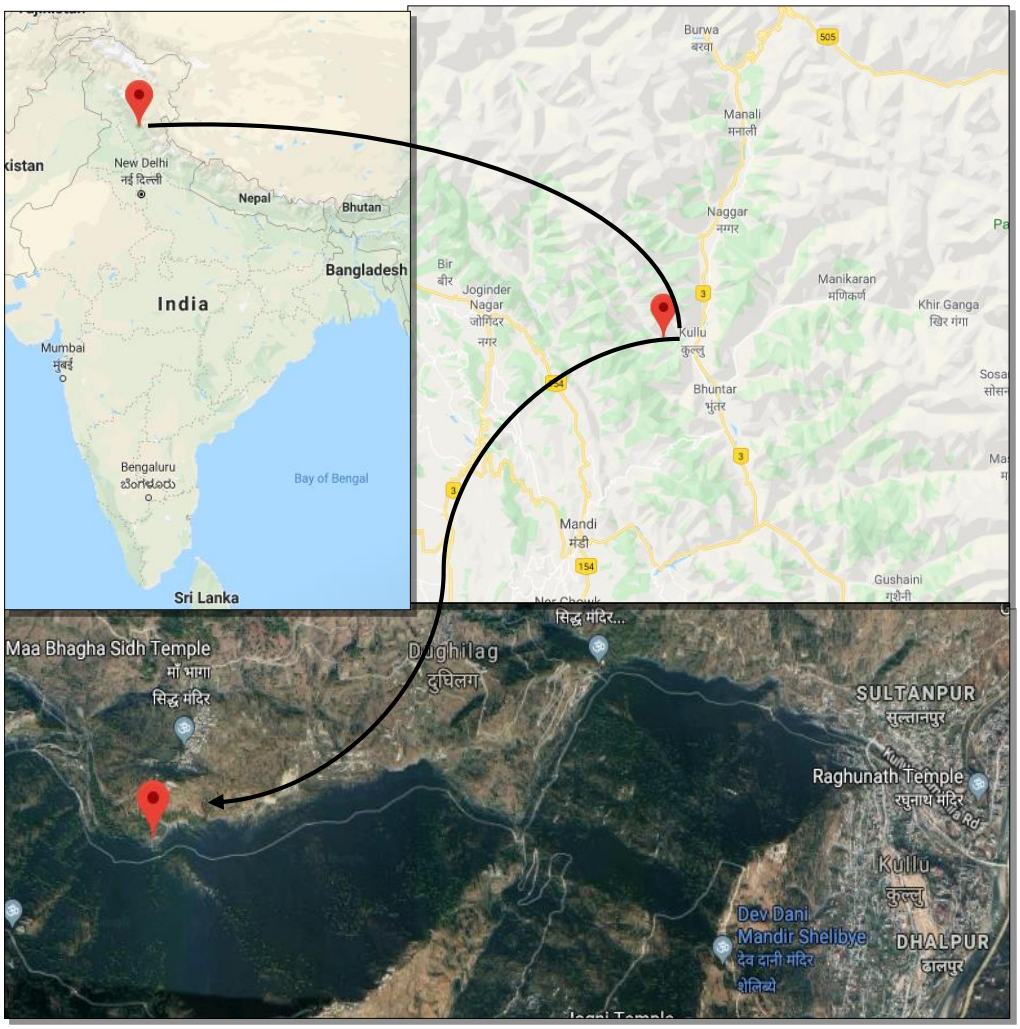


Figure 1. Satellite Location

1.10 Conditions Prior to Project Initiation

The project is a Greenfield hydroelectric project and does not involve generation of GHG emissions for the purpose of their subsequent reduction, removal or destruction. Prior to the initiation of the project activity, the equivalent amount of electricity would have been drawn from grid connected or new power plants, in Indian Grid. The grid is predominantly coal based and therefore is a major source of carbon dioxide emissions in India. The main emission in the pre project scenario is the power plants connected to the Indian Grid, and main GHG involved is CO_2. Project activity thus helps in exploiting the small hydro potential and leads to a cleaner environment through lower greenhouse gas emissions and other pollutants and greater energy security of the nation through lower fuel consumption, fossil fuel conservation for other activities. Since the project activity generates electricity through sustainable means, it will not cause any negative impact on the environment and there by contribute to climate change mitigation efforts. The baseline identified in section 2.4 is same as the pre-project scenario.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Project has received necessary approvals for development and commissioning for Hydro Power project from the state Nodal agencies and is in compliance to the local laws and regulations.

As per Central Pollution Control Board (Ministry of Environment & Forests, Govt. of India), final document on revised classification of Industrial Sectors under Red, Orange, Green and White Categories (February 29, 2016)

The newly introduced White category of industries pertains to those industrial sectors which are practically non-polluting such as Biscuit trays etc. from rolled PVC sheet (using automatic vacuum forming machines), Cotton and woollen hosiers making (Dry process only without any dying/washing operation), Electric lamp (bulb) and CFL manufacturing by assembling only, Scientific and mathematical instrument manufacturing, Solar power generation through photovoltaic cell, wind power and mini hydel power (less than 25 MW).

There shall be no necessity of obtaining the Consent to Operate'' for White category of industries. An intimation to concerned SPCB / PCC shall suffice.

Since project activity falls under white category and the non-polluting nature of project fulfils the compliance to the local laws and regulations. The state nodal agency approval is submitted to DOE.

Further the PP obtained necessary approvals from below state govt. agencies:

1. Provisional Consent order received from Himachal State Pollution Control Board
2. No Objection Certificate from Himachal Pradesh Public Works Department.
3. Land diversion consent from Department of Forests

1.12 Ownership and Other Programs

1.12.1 Project Ownership

As per VCS Program Definitions version 4.0, the project ownership is the legal right to control and operate the project activities.

Gaur Hydro Power Pvt. Ltd and Gopal Power Pro Pvt. Ltd. are the project proponents (PP) of the bundled project activity and each of them has the legal right to control and operate the project activities.

The project ownership has been demonstrated through below supporting documents:

1. **Commissioning certificates –** The letter from respective State Nodal Agency to the project proponents 'for registration of commissioning of generation facility indicates that PPs have the legal right to control and operate the project activities.

2. **Power Purchase Agreement –** The Power Purchase Agreements (PPAs) with local DISCOM ((HPSEBL) in the name of the PPs indicate that PP have the legal right to control and operate the project activities.

Based on above evidences, the project ownership is with **Gaur Hydro Pvt Ltd. and Gopal Power Pro Pvt. Ltd.**

1.12.2 Emissions Trading Programs and Other Binding Limits

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 in any Emission Trading program or other binding limits.

1.12.3 Other Forms of Environmental Credit

The proposed project activity neither has nor intends to generate any other form of GHG related environmental credit for GHG emission reductions or removals claimed under the VCS Program. The project activity is neither has nor intends to generate any other form of GHG related environmental credit for GHG emission reductions or removals claimed under the VCS Program. As such, the project will be offered for consideration under the VCS program only.

However, it can be crosschecked that PP is not claiming REC benefits, the same can be verified with the REC accreditation body of India[4].

1.12.4 Participation under Other GHG Programs

The proposed project activity has not been registered and is not seeking registration under any other GHG programs.

This project activity is not participating in any other GHG program.

1.12.5 Projects Rejected by Other GHG Programs

The project activity is not participating in other Environmental credits, other GHG programs and has not been rejected by other GHG programs.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

The project activity is not a grouped project activity.

Leakage Management

This project activity is renewable energy project based on hydroelectric technology, therefore no leakage emissions are considered. Thus leakage management plan and implementation of leakage and risk mitigation measures are not applicable for this project activity.

Commercially Sensitive Information

[4] https://recregistryindia.nic.in/index.php/general/publics/accredited_regens_pdf

Not applicable. No any commercially sensitive information has been excluded from the public version of the project description. There is no commercially sensitive information.

Sustainable Development

Contribution to sustainable development:

Apart from generation of renewable electricity, the project activity would contribute to the sustainable development of the region - socially, environmentally and economically. Ministry of Environment and Forests, 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 would help in generating employment opportunities during the construction and operation phases. The project activity will 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 will also help to reduce the demand supply gap in the state. The project activity creates local employment generation which helps economic well-being of local people.

- **Technological well-being:** The successful operation of project activity would lead to promotion of solar based power generation and would encourage other entrepreneurs to participate in similar projects. The generation of electricity from the project leads to strengthening of the grid, increasing the energy availability thereby meeting the energy demand to a certain extent leading to technological wellbeing

- **Environmental well-being**: Hydro Electric Project reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. Due to its zero emission the Project activity also helps in avoiding significant amount of GHG emissions.

Further Information

Not Applicable.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Title : Grid connected renewable electricity generation
Reference : The project activity meets the eligibility criteria of small scale project as it is less than 15MW

Methodology : AMS I.D: Grid connected renewable electricity generation (Version 18, EB 81, Annex 24[5])
Type I : Energy industries (renewable / non-renewable sources)
Category : Approved Consolidated Methodology (AMS I.D)

Tools referred with above methodology and applicable for project activity are:

- Tool to calculate the emission factor for an electricity system[6] - Version 07.0 (EB 100, Annex 04)

- Methodological Tool- Tool for the demonstration and assessment of additionality[7] - Version 07.0.0 (EB 70, Annex 08)

2.3 Applicability of Methodology

The project activity under the project activity will meets the applicability conditions of the approved baseline and monitoring methodology AMS I.D, Version 18.0, Sectoral Scope 1, as described below:

Applicability	**Project activity vis-à-vis applicability Conditions**
1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid. (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	The project activity is a Renewable Energy Project i.e. Hydro Electric Power Project which falls under applicability criteria option 1(a). Hence the project activity meets the given applicability criterion.
2. Illustration of respective situations under which each of the methodology (i.e. "AMS-I.D.: Grid connected renewable electricity generation", "AMS-I.F.: Renewable electricity generation for captive use and mini-grid" and "AMS-I.A.: Electricity generation by theuser) applies is included in the appendix[8].	The 1st option or 3rd option (of Table 2 of AMS I.D. Version 18, EB 81 is applicable (please refer footnote) as project supplies electricity to national grid.

[5] http://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

[6] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[7] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[8]

	Project type	AMS-I.A	AMS-I.D	AMS-I.F
1	Project supplies electricity to a national/regional grid		√	
2	Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)			√
3	Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)		√	

3. This methodology is applicable to 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 activity instance is installation of new hydro based electricity generation green field plants (not addition to existing system). Option "a" is applicable.
4. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	The project is a run-of-river hydroelectric project without any reservoir and thus the criterion is not applicable to this project activity.
5. If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	The project activity involves only renewable component with capacity less than 15 MW. Unit does not co-fire fossil fuels. Hence the criterion is not applicable to the project activity.
6. Combined heat and power (co-generation) systems are not eligible under this category.	The Project activity is a renewable hydro electric energy project and is not a combined heat and power system. Hence the criteria is not applicable to the project activity
7. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[9] from the existing units.	The project activity is Greenfield and there is no existing power generation facility at the site. Hence the criteria is not applicable to the project activity
8. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable, this project is a Green field project activity and this project is not the enhancement or up gradation project.

4	Project supplies electricity to a mini grid[8] system where in the baseline all generators use exclusively fuel oil and/or diesel fuel			√
5	Project supplies electricity to household users (included in the project boundary) located in off grid areas	√		

[9] Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct".

9. In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored.	The Project activity is a renewable hydroelectric power project and is not a landfill gas, waste gas, waste water treatment and agro-industries projects or recovered methane emissions project. Hence the criteria is not applicable to the project activity
10. In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply.	The Project activity is a renewable hydroelectric power project and is not a biomass project. Hence the criterion is not applicable to the project activity.

Tool to calculate the emission factor for an electricity system[10] - Version 07.0 (EB 100, Annex 04)

Applicability Criterion	**Project Case**
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	The project is a grid connected Greenfield solar power project and thus the tool is 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 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 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.	Steps involved in calculation of Emission Factor is included in section 3.1 of the PD as per the requirement of the tool
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.	Project is located in non-Annex I country and hence the tool is applicable
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	The project is a solar project and there is no involvement of biofuels.

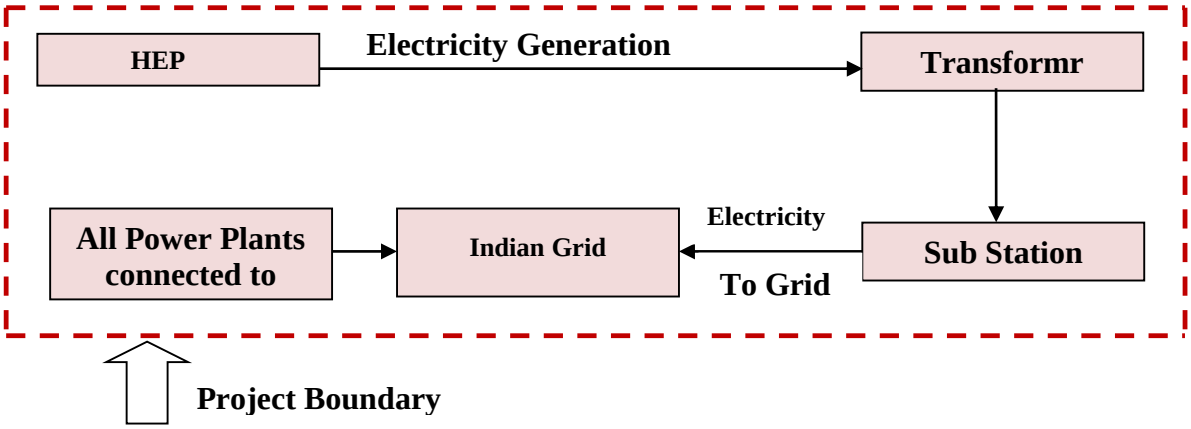
[10] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

2.3 Project Boundary

As per AMS I.D version 18 - "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to".

The project boundary includes the intake, tunnel, penstock, powerhouse, plant and the transmission system till the evacuation point (which is at the HPSEB electrical substation). The electrical energy exported to the grid is monitored at this point. The proposed project activity will evacuate power to the Indian grid. Therefore the entire Indian grid and all connected power plants have been considered in the project boundary for the proposed VCS project activity. The project boundary also includes a stand-by diesel generator (DG) set which will be operated only for standby power requirements (basic lighting for staff) in case the power plant is not operating and there is also no supply from the grid.

PROJECT BOUNDARY



The GHG emission sources considered for the project boundary and their explanations are as follows:

Source		Gas	Included?	Justification/Explanation
Baseline	Grid connected electricity generation	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
		Other	No	No other emissions are emitted from the project
Project	Greenfield Hydro Power Project Activity.	CO_2	Yes	CO_2 emissions due to fossil fuel in the project
		CH_4	No	Project activity does not emit CH_4
		N_2O	No	Project activity does not emit N_2O
		Other	No	Project activity does not emit other forms of GHG emissions

2.4 Baseline Scenario

As per the approved consolidated Methodology AMS I.D (Version 18.0, EB 81): *"If the project activity is the installation of a Greenfield power plant, the baseline scenario is 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".*

The project activity involves setting up of hydro projects to harness the power of water 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 ($EF_{grid,y}$) 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 14 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
$EF_{grid,y}$	0.9127 tCO_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 (0.50) & build margin (0.50) values, sourced from Baseline CO_2 Emission Database, Version 14.0, December 2018 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,OM,y}$	0.9610tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system in year y	Calculated as the last 3 year (2015-16, 2016-17, 2017-18) generation-weighted average, sourced from Baseline CO_2 Emission Database, Version 14.0, December 2018 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,BM,y}$	0.8644tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system in year y	Baseline CO_2 Emission Database, Version 14.0, December 2018 published by Central Electricity Authority (CEA), Government of India

2.5 Additionality

As per Guidelines on the Demonstration of Additionality of Small-scale Project Activities (Ver. 13, to establish the project additionality, it has to be shown that the project activity would not have occurred anyway due to at least one of the following barriers:

- **Investment barrier:** a financially more viable alternative to the project activity would have led to higher emissions;
- **Technological barrier:** a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
- **Barrier due to prevailing practice:** prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
- **Other barriers:** without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The project investor has selected Investment barrier to demonstrate in a conservative and transparent manner that the proposed CDM project activity is financially unattractive. In line with the guidelines stipulated under Annex 34 of EB 35 ("Non-binding best practice examples to demonstrate additionality for SSC project activities"), a benchmark analysis is used in the project case under investment barrier.

Specify the methodology or standardized baseline that establish automatic additionality for the proposed project activity (including the version number and the specific paragraph, if applicable).	NA
Describe how the proposed project activity meets the criteria for automatic additionality in the relevant methodology or standardized baselines.	NA

Selection of Financial Indicator for 3.5MW Hydro Project:

According to the "Tool for demonstration and assessment of Additionality (EB 101, Annex 11)[11]", the financial indicator can be based either on (1) project IRR or (2) equity IRR. There is no general preference between the approaches (1) or (2). The benchmark chosen for analysis shall be fully consistent with the choice of approach. Therefore in accordance with the guidance, the relevant financial indicator for project activity has been chosen as post tax equity IRR.

Determine appropriate analysis method

As per Sub-step 2a, Paragraph (1), as the project activity is selling the generated electricity to state electricity board& getting financial benefits other than CDM benefits hence, Option- I (Apply simple cost analysis) is not applicable under this situation. Also as per EB-92, Annex 5, clause no.19 "If the alternative to the project activity is the supply of electricity from a grid this is not to be considered

[11] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v9.0.pdf

an investment and a benchmark approach is considered appropriate". Hence Option-II (Apply investment comparison analysis) is also not applicable under this situation. So the project investor has chosen Option- III or benchmark analysis as an appropriate analysis method to demonstrate the investment barrier.

Appropriateness of using benchmark analysis for additionality demonstration and its conformity to guidance 16 of Annex 11, EB 101[12] -

Considering the fact that the alternative to the project is the supply of electricity from the grid & the choice of the developer is to invest or not to invest, benchmark analysis has been considered appropriate to circumstances where the baseline does not require investment or is outside the direct control of the project developer, i.e. cases where the choice of the developer is to invest or not to invest. Benchmark analysis has been considered appropriate for demonstration of additionality, which is in conformity with guidance 16 of Annex 11 EB 101.

Benchmark Calculation for 3.5 MW Hydro project

As per the guidelines of Methodological Tool- Investment Analysis, para 16, "The applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for an equity IRR. Benchmarks supplied by relevant national authorities are also appropriate". Since in this project activity, equity IRR has been considered as financial indicator, hence as per guidance 16, Required/expected returns on equity are considered as appropriate benchmarks and benchmark supplied by relevant national authorities has been used.

Since the choice of benchmark is based upon parameters that are standard in the market, hence as per Guidance 20 of EB 101 Annex 11, "the cost of equity should be determined either by: (a) selecting the values provided in the Appendix; or by (b) calculating the cost of equity using CAPM". Hence as per option (a), the default value for India is being considered as per the value provided in Appendix of EB 101 Annex 11[13]. The benchmark thus selected complies as per the relevant guidelines on Investment Analysis.

Further as per guidance 17 of EB 101 Annex 11, "In situations where an investment analysis is carried out in nominal terms and the available IRR benchmarks are in real terms, project participants shall convert the real term values of benchmarks to nominal values by adding the inflation rate. The inflation rate shall be obtained from the inflation forecast of the central bank of the host country for the duration of the crediting period". Following the above guidance, the default value is being converted to nominal values by adding inflation rate for 10 years[14], as per the inflation forecast rate provided by Reserve Bank of India.

[12] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v9.0.pdf

[13] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v9.0.pdf

[14] Since RBI provides inflation forecast only for 5 years and 10 years, hence inflation forecast for 10 years is being considered keeping in view length of crediting period to be 7 years.

Benchmark Calculation

Choice of Benchmark:

As per Investment Analysis tool, Required/expected returns on equity are appropriate benchmarks for an equity IRR. The Equity IRR is considered as the financial indicator and the benchmarks used is cost of equity. Hence, the benchmarks used are applicable to the project activity and the type of IRR calculation presented

At the time of decision made of project activity, the methodological tool "Investment Analysis" (version 7 & 8) were the latest available tools to the PP at the time of decision making. However, the request for registration for Version 7 could be submitted till 31/10/2017 and for version 8 the registration request could be submitted till 28/11/2018. Hence, PP has used Methodological Tool for Investment Analysis version 09 (EB 101, Annex 11). Upon comparison of the detail of version 07.0, 08.0 and version 09.0 of the methodological tools it was observed that, there is no major difference in the versions except for the change of default value for benchmark calculation. The default value as mentioned in version 07 was 11.06% for the group 1 projects in India, in the version 08 it was 10.73% for group 1 project in India and Value as mentioned in version 09 is 9.79% for group 1 project in India which is clearly more conservative than version 07 &08 values. Hence, version 09 is used which is appropriate and more conservative for benchmark calculation and PP has considered the same tool for default value of return on equity for the respective SPVs. The default value of Return on Equity for Group-1 projects in India is 9.79 % as per EB 101, Annex 11.

As per paragraph 7 of Appendix A of the above mentioned document, “In situations where an investment analysis is carried out in nominal terms, project participants can convert the real term values provided in the table below to nominal values by adding the inflation rate. The inflation rate shall be obtained from the **inflation forecast of the central bank of the host country for the duration of the crediting period**. If this information is not available, the target inflation rate of the central bank shall be used. If this information is also not available, then the average forecasted inflation rate for the host country published by the IMF (International Monetary Fund World Economic Outlook) or the World Bank for the next five years after the start of the project activity shall be used”. For the concerned project activity, the inflation rate has been considered from the inflation forecast published by the Reserve Bank of India.

The benchmark has been considered in accordance with Guidance 16 of EB 101 Annex 11, “The values in the table in Appendix A may also be used, as a simple default option”.

As suggested in Appendix A in EB 101 Annex 11, default value benchmark is presented below:

Appendix A in EB 101 Annex 11 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = 9.79%

Methodology deployed for arriving at a suitable value of Benchmark using Default Value has been described below:

- As the proposed project activity generates power utilizing hydro energy, Group 1 as per para 5 of Appendix of EB 101, Annex 11 has been identified as a suitable category.
- The investment analysis has been carried out in Nominal terms. The investment decision date of the project activity is on 4th February, 2011. Accordingly, Default value as given in Para 6,

Appendix of Annex 11, EB 101[15] has been adjusted by adding suitable forecasted inflation rate taken from RBI (Central Bank, India).

- Project investor has calculated Benchmark based on WPI mean inflation rate. As per Para 17 of EB 101, Annex 11, the inflation forecast should be for the duration of the crediting period. The project investor has calculated benchmark using 10 years forecast and the same is considered as Benchmark for the project activity.

The benchmark has been computed in the following manner:

Nominal Benchmark[16] = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where,
Real Benchmark = Default Value, i.e., 9.79% (as per Appendix of Annex 11, EB 101)
Inflation rate = Projected Inflation Rate for India

Benchmark estimation:

Appendix in EB101, Annex 11 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **9.79%**

Inflation Forecast for India as per RBI website[17]:

Since RBI publishes the inflation forecast for 5 years and 10 years, PP has considered the maximum 10 year inflation considering the renewable crediting period of total 30 years.

Project Investor	**Inflation Forecast**	**Benchmark**
	10 Years	**10 Years**
Gaur Hydro Power Private Limited	5.10%	15.39%
Gopal Power Pro. Private Limited	5.10%	15.39%

Thus benchmark of **15.39%** has been selected for this project activity.

Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III):

The Post tax Equity IRR is evaluated for the entire lifetime of the project activity, i.e. 30 years. It is calculated based on the cash outflows from and cash inflows into the project activity.

The Post tax Equity IRR is evaluated for the entire lifetime of the project activity, i.e. 30 years. It is calculated based on the cash outflows from and cash inflows into the project activity.

The IRR and Benchmark analysis are calculated in excel spreadsheet and same will be submitted to DOE during validation of project activity.

[15] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v9.0.pdf

[16] As per Fisher Equation, https://en.wikipedia.org/wiki/Fisher_equation

[17] https://m.rbi.org.in/scripts/PublicationsView.aspx?id=15761

Based on result of IRR excel spreadsheets, equity IRR is less than Benchmark. The detailed input assumptions are presented in Appendix 2

This substantiates that the investment is not financially attractive (Equity IRR for the project activity is less than the Benchmark).Thus it can be easily concluded that project activity is additional & is not business as usual scenario.

Sensitivity Analysis

Addressing Guidance 28 & 29 of EB101, Annex 11, following factors has been subjected to sensitivity analysis:

1. PLF
2. O&M Cost
3. Project Cost
4. Tariff

The results of the sensitivity analysis are as follows:

Gaur Hydro Power Pvt. Ltd.

	Equity IRR without CDM		Benchmark (Equity IRR)	
Final Results	9.19%		15.39%	
Sensitivity Analysis	Equity IRR			
Variation %	-10%	Normal	10%	Breaching Value
PLF	7.05%	9.19%	11.38%	27.42%
O&M	9.47%	9.19%	8.95%	-272.41%
Project Cost	11.21%	9.19%	7.62%	-24.71%
Tariff Rate	7.05%	9.19%	11.38%	27.42%

Gopal Power Pro. Pvt. Ltd.

	Equity IRR without CDM		Benchmark (Equity IRR)	
Final Results	8.78%		15.39%	
Sensitivity Analysis	Equity IRR			
Variation %	-10%	Normal	10%	Breaching Value
PLF	6.31%	8.78%	11.25%	27.57%
O&M	9.33%	8.78%	8.21%	-132.75%
Project Cost	10.74%	8.78%	7.21%	-27.59%
Tariff Rate	6.31%	8.78%	11.25%	27.57%

The rationale of sensitivity is, "The ultimate objective of the sensitivity analysis is to determine the likelihood of the occurrence of a scenario other than the scenario presented, in order to provide a cross-check on the suitability of the assumptions used in the development of the investment analysis."

The results of sensitivity analysis show that even with a variation of +10% & -10% in project cost, O&M cost, PLF and Tariff Rate Equity IRR is significantly lower than the benchmark. And it is evident from the results given above; the project remains additional even under the most favourable conditions.

Probability to breach the benchmark:
Sensitivity Parameter 1 : PLF
PLF considered in financials for is as per DPR provided by a Third Party and thus in line with **"Guidelines for the reporting and validation of Plant load factors" stated in EB48 Annex11 option 3(b)**. Hence, variation in PLF of more than 10% is unlikely to happen as the PLF has been reported as per the Third Party Report based on long term data.
Sensitivity Parameter 2 : O&M
The sensitivity analysis reveals that O&M will breach the benchmark at negative values and is hypothetical case. Since the O&M cost is subject to escalation (as evidence by the O&M agreement) and also subject to inflationary pressure, any reduction in the O&M costs is highly unlikely. Hence, the reduction in the O&M cost is highly unlikely.
Sensitivity Parameter 3 : Project Cost
Project Cost for financial analysis is considered from DPR of the project activity, being available at the time of investment making decision to go ahead with the project activity. The actual project cost is lower than the DPR cost. Since the Purchase Order cost is firm, there is no possibility of project cost going below this level. However, Sensitivity is carried out for threshold level below which benchmark is not breached.
Sensitivity Parameter 4 : Tariff Rate
The tariff is determined by PPA which is fixed for entire lifetime of the project activity. Hence, there is no probability to get variation for the same. However, Sensitivity is carried out for +/-10% even then the benchmark is not breached.

2.6 Methodology Deviations

Not Applicable

3 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVAL

3.1 Baseline Emissions

As per the approved consolidated Methodology AMS I.D (Version 18.0, EB 81):

Baseline emissions include only CO_2 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:

$BE_y = EG_{PJ,y} \times EF_{grid,y}$

Where:

BE_y = Baseline emissions in year y (t CO_2/yr)

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

$EF_{grid,y}$ = 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" (t CO_2/MWh)

As per methodology, combined grid emission factor as per the "Tool to calculate the emission factor for an electricity system" version 07 is calculated as below.

CO_2 Baseline Database for the Indian Power Sector, Version 14, December 2018[18]published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per Methodological tool: Tool to calculate the emission factor for an electricity system (Version 07.0, EB 100, Annex 4), following six steps have been followed:

(a) **Step 1:** Identify the relevant electricity systems;

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

(c) **Step 3:** Select a method to determine the operating margin (OM);

(d) **Step 4:** Calculate the operating margin emission factor according to the selected method;

(e) **Step 5:** Calculate the build margin (BM) emission factor;

(f) **Step 6:** Calculate the combined margin (CM) 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, however, 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 synchronised 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

[18] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadar& Nagar Haveli	Meghalaya	Tamil Nadu
Jammu & Kashmir	Sikkim	Madhya Pradesh	Mizoram	Puducherry
Punjab	Andaman & Nicobar	Maharashtra	Nagaland	Lakshadweep
Rajasthan		Goa	Tripura	Telangana
Uttar Pradesh				
Uttarakhand				

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.

The Project Participant has chosen only grid power plants 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)

	2013-14	2014-15	2015-16	2016-17	2017-18
India	18.6%	16.8%	15.1%	14.6%	14.3%

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 CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

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 ($EF_{grid,OM,y}$) 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)			
	2015-16	2016-17	2017-18
INDIAN Grid	8,71,753	9,16,278	9,60,693

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2015-16	2016-17	2017-18
INDIAN Grid	0.9655	0.9636	0.9543

Weighted Generation Operating Margin	
INDIAN Grid	**0.9610**

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 73:

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)	
	2017-18
INDIAN Grid	**0.8644**

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

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 82:

The calculation of the combined margin (CM) emission factor ($EF_{grid,y}$) 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:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (t CO_2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (t CO_2/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}:

Being a hydro power project: W_{OM}= 0.50 and W_{BM}= 0.50 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods. Since project activity is of hydro power generation, the above weightage has been considered for OM and BM.

Therefore, $EF_{grid,y}$ = 0.9610*0.50 + 0.8644*0.50
= 0.9127 t CO_2/MWh

Baseline emission factor (EF_y):

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

Therefore, $EF_y = EF_{grid,y}$= 0.9127tCO_2/MWh.

BE_y= 16665.5 x 0.9127 = 14,462tCO_2e

3.2 Project Emissions

As per the approved consolidated Methodology AMS I.D (Version 18.0, EB 81):"For most renewable energy power generation project activities, $PE_y = 0$.

As per applied methodology only emission associated with the fossil fuel combustion, emission from operation of geo-thermal power plants due to release of non-condensable gases, emission from water reservoir of Hydro should be accounted for the project emission. Since the project activity is a hydro power project,

CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the Methodological tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 3.0). The project activity envisages the installation of one DG set to meet the emergency requirements of power house. Emissions due to use of diesel in DG set will be accounted as project emissions based on the following derived equation based on tool.

CO_2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum FC_{i,j,y} \times CO_{EFi,yi}$$

Where: $PE_{FC,,}$ = Are the CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr)

$FC_{i,,}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr)

$CO_{EFi,}$ = Is the CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)

i = Are the fuel types combusted in process j during the year y

Since the chemical composition of fossil fuel is not available with PP, the option B of tool is followed for CO_2 emission coefficient $CO_{EFi,}$

Option B: The CO_2 emission coefficient $CO_{EFi,}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type i, as follows:

$$CO_{EFi,} = NCV_{i,} \times EF_{CO2,,y}$$

Where: $CO_{EFi,}$ = Is the CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)

$NCV_{i,}$ = Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)

$EF_{CO2,,}$ = Is the weighted average CO_2 emission factor of fuel type i in year y (tCO_2/GJ)

i = Are the fuel types combusted in process j during the year y

As per tool, IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 and 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines

onNational GHG Inventories is considered as ex –ante values for the current crediting period for NCV and CO_2 emission factor of diesel.

3.3 Leakage

No other leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected. Hence Leakage Emissions $LE_y = 0\ tCO_2$

3.4 Estimated Net GHG Emission Reductions and Removals

Reductions are calculated as follows:

$ER_y = BE_y – PE_y$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e/yr)
BE_y	=	Baseline emissions in year *y* (t CO_2/yr)
PE_y	=	Project emissions in year *y* (t CO_2e/yr)

Therefore, Net GHG Emission Reductions and Removals are calculated as follows:
$ER_y = BE_y – PE_y$

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)
23/02/2018 to 22/02/2019	8950	0	0	8950
23/02/2019 to 22/02/2020	13,992	0	0	13,992
23/02/2020 to 22/02/2021	15,210	0	0	15,210
23/02/2021 to 22/02/2022	15,210	0	0	15,210
23/02/2022 to 22/02/2023	15,210	0	0	15,210
23/02/2023 to 22/02/2024	15,210	0	0	15,210
23/02/2024 to 22/02/2025	15,210	0	0	15,210

23/02/2025 to 22/02/2026	15,210	0	0	15,210
23/02/2026 to 22/02/2027	15,210	0	0	15,210
23/02/2027 to 22/02/2028	15,210	0	0	15,210
Total	144,622	0	0	144,622

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 14, December 2018[19]
Value applied	0.9610
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as 3-year generation weighted average using data for the years 2015-2016, 2016-2017& 2017-2018. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 14, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 14, December 2018[19]
Value applied	0.8644
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as per the latest data available for the most recent year 2018. The data is obtained from "CO_2 Baseline Database for Indian Power Sector" version 14, published by the Central Electricity Authority, Ministry of Power, Government of India.

[19] http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,y}$
Data unit	tCO_2/MWh
Description	Combined Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 14, December 2018[19]
Value applied	0.9127
Justification of choice of data or description of measurement methods and procedures applied	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$= Build margin CO_2 emission factor in year *y* (tCO_2/MWh) $EF_{grid,OM,y}$= Operating margin CO_2 emission factor in year *y* (tCO_2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 50% W_{BM}= Weighting of build margin emissions factor (%) = 50% Calculated as per "Tool to calculate the emission factor for an electricity system, version 07.0.0". The data is obtained from "CO_2 Baseline Database for Indian Power Sector" Version 14, December 2018, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$NCV_{Diesel,y}$
Data unit	GJ per mass or volume unit (e.g. GJ/m³, GJ/ton)
Description	net calorific value of Diesel
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied	43.3 GJ/Ton

Justification of choice of data or description of measurement methods and procedures applied	Fuel supplier does not provide emission factor in their invoices and also this parameter value is not available top through measurement. Also Regional or national default values are not available. Hence IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. This is in line with Methodological tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 3.0). In case of density is required, the same is considered as 0.83 Kg/Lit as per CEA database version 12
Purpose of Data	For the calculation of the Project Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{CO2,Diesel,y}$
Data unit	tCO_2/TJ
Description	CO_2 Emission Factor of Diesel
Source of data	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied	74.8
Justification of choice of data or description of measurement methods and procedures applied	Fuel supplier does not provide emission factor in their invoices and also this parameter value is not available top through measurement. Also Regional or national default values are not available. Hence IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. This is in line with Methodological tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 3.0).
Purpose of Data	For the calculation of the Project Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{Export,y}$
Data unit	MWh
Description	Quantity of electricity exported to the grid in year y
Source of data	Joint Meter Reading issued by HPSEB
Description of measurement methods and procedures to be applied	For measuring the energy delivered by the project activity at the interconnection point, one set of Main meter (part of interconnection facility) and check meter has provided by the company and the HPSEB at the interconnection point. Monthly joint meter readings of the main meter and check meter at the interconnection point has been taken by the designated officials of the company and HPSEB.

<table>
<tr><td></td><td>The joint meter readings has been recorded and signed by the authorized representative of both the parties on each of the above instances.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Continuous Metering, and monthly recording has been done</td></tr>
<tr><td>Value monitored</td><td>16665.51</td></tr>
<tr><td>Monitoring equipment</td><td>For the uninterrupted metering system the PP has kept 2 identical meters which are used as the two sets of Main and Check Meter as mentioned below:
<table>
<tr><td rowspan="2">Gaur Hydro</td><td>HPU 06256</td><td>Meter 1</td></tr>
<tr><td>HPU 06255</td><td>Meter 2</td></tr>
<tr><td rowspan="2">Gopal Hydro</td><td>13193404</td><td>Meter 1</td></tr>
<tr><td>13193345</td><td>Meter 2</td></tr>
</table>
These 2 sets of meters are used alternatively after 6 months. While the one set of meters are in function the other set of meters are kept idle after laboratory tests in ready to use condition. The detail of each meter have been provided below:
<table>
<tr><td></td><td>Gaur HEP</td><td>Gopal HEP</td></tr>
<tr><td>Meter Type</td><td>ABT Meter</td><td>ABT Meter</td></tr>
<tr><td>Manufacturer</td><td>Secure Make</td><td>L & T Make</td></tr>
<tr><td>Accuracy Class</td><td>0.2s</td><td>0.2s</td></tr>
</table>
The main and check meters in each sets are also exchanged on the rotational basis. The summary of Meters used as the main and check meter has been provided in Appendix 2.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The meters have been tested by the Power Grid Corporation of India Ltd, (An external entity and a Government owned enterprises), in the Regional Test Laboratory i.e. Northern Region II (Jalandhar). The meter test records have been maintained in the plant.
The meters is approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years.[20] The monthly electricity supplied/exported by the project activity in the form of JMR report is cross checked with the monthly invoices of sale to the State SEB. In the absence or delay in the meter calibration appropriate Guidelines will be applied appropriately to confirm the conservativeness ofmetering</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of baseline emissions</td></tr>
</table>

[20] http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf

Calculation method	Electricity exported to grid by the project activity has been directly monitored by the main meter. Thus, calculation is not necessary for this parameter.
Comments	The data will be archived electronically and will be kept for 2 years beyond the Crediting Period or last issuance whichever is later

Data / Parameter	$EG_{Import, y}$
Data unit	MWh
Description	Quantity of electricity imported from the grid in year y
Source of data	Joint Meter Reading issued by HPSEB
Description of measurement methods and procedures to be applied	For measuring the energy imported by the project activity at the interconnection point, one set of Main meter (part of interconnection facility) and check meter has provided by the company and the HPSEB at the interconnection point. Monthly joint meter readings of the main meter and check meter at the interconnection point has been taken by the designated officials of the company and HPSEB. The joint meter readings has been recorded and signed by the authorized representative of both the parties on each of the above instances.
Frequency of monitoring/recording	Continuous Metering, and monthly recording has been done
Value monitored	0
Monitoring equipment	For the uninterrupted metering system the PP has kept 4 identical meters which are used as the two sets of Main and Check Meter as mentioned below:

Gaur Hydro	HPU 06256	Meter 1
	HPU 06255	Meter 2
Gopal Hydro	13193404	Meter 1
	13193345	Meter 2

These 2 sets of meters are used alternatively after 6 months. While the one set of meters are in function the other set of meters are kept idle after laboratory tests in ready to use condition. The detail of each meter have been provided below:

	Gaur HEP	Gopal HEP
Meter Type	ABT Meter	ABT Meter
Manufacturer	Secure Make	L & T Make
Accuracy Class	0.2s	0.2s

	The main and check meters in each sets are also exchanged on the rotational basis. The summary of Meters used as the main and check meter has been provided in Appendix 1.
QA/QC procedures to be applied	The meters have been tested by the Power Grid Corporation of India Ltd, (An external entity and a Government owned enterprises), in the Regional Test Laboratory i.e. Northern Region II (Jalandhar). The meter test records have been maintained in the plant. The meters is approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years.[21] The monthly electricity supplied/exported by the project activity in the form of JMR report is cross checked with the monthly invoices of sale to the State SEB. In the absence or delay in the meter calibration appropriate Guidelines will be applied appropriately to confirm the conservativeness ofmetering
Purpose of the data	Calculation of baseline emissions
Calculation method	Electricity imported from the grid by the project activity has been directly monitored by the main meter. Thus, calculation is not necessary for this parameter
Comments	The data will be archived electronically and will be kept for 2 years beyond the Crediting Period or last issuance whichever is later

Data / Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Quantity of net electricity exported to the grid in year y
Source of data	Calculated
Description of measurement methods and procedures to be applied	For measuring the net energy export by the project activity at the interconnection point, Following Formula will be used: $EG_{PJ,y} = EG_{Export,y} - EG_{Export,y}$ This net export reading is calculated in through the Monthly joint meter readings of the main meter and check meter at the interconnection point, taken by the designated officials of the company and HPSEB. The joint meter readings have been recorded and signed by the authorized representative of both the parties on each of the above instances.
Frequency of monitoring/recording	Continuous Metering, and monthly recording has been done
Value monitored	16665.5

[21] http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf

<table>
<tr><td>Monitoring equipment</td><td>For the uninterrupted metering system the PP has kept 4 identical meters which are used as the two sets of Main and Check Meter as mentioned below:
<table>
<tr><td rowspan="2">Gaur Hydro</td><td>HPU 06256</td><td>Meter 1</td></tr>
<tr><td>HPU 06255</td><td>Meter 2</td></tr>
<tr><td rowspan="2">Gopal Hydro</td><td>13193404</td><td>Meter 1</td></tr>
<tr><td>13193345</td><td>Meter 2</td></tr>
</table>
These 2 sets of meters are used alternatively after 6 months. While the one set of meters are in function the other set of meters are kept idle after laboratory tests in ready to use condition. The detail of each meter have been provided below:
<table>
<tr><td>Meter Type</td><td>ABT Meter</td><td></td></tr>
<tr><td>Manufacturer</td><td>Secure Make</td><td></td></tr>
<tr><td>Accuracy Class</td><td>0.2s</td><td></td></tr>
</table>
The main and check meters in each sets are also exchanged on the rotational basis. The summary of Meters used as the main and check meter has been provided in Appendix 1.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The meters have been tested by the Power Grid Corporation of India Ltd, (An external entity and a Government owned enterprises), in the Regional Test Laboratory i.e. Northern Region II (Jalandhar). The meter test records have been maintained in the plant.
The meters is approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years.[22] The monthly electricity supplied/exported by the project activity in the form of JMR report is cross checked with the monthly invoices of sale to the State SEB. In the absence or delay in the meter calibration appropriate Guidelines will be applied appropriately to confirm the conservativeness ofmetering</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Calculation method</td><td>Electricity imported from the grid by the project activity has been directly monitored by the main meter. Thus, calculation is not necessary for this parameter</td></tr>
<tr><td>Comments</td><td>The data will be archived electronically and will be kept for 2 years beyond the Crediting Period or last issuance whichever is later</td></tr>
</table>

Data / Parameter	$FC_{diesel, y}$
Data unit	Tons
Description	Quantity of Diesel consumed by the standby DG set in year y
Source of data	Records of levels in the diesel storage tanks as per the plant log book.

[22] http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf

Description of measurement methods and procedures to be applied	Measurement Procedure: The diesel quantity available in the diesel storage tanks is recorded daily by PP in the plant log book. The diesel consumption has been recorded in the logbook in litres. However, based on the density of diesel of about 0.88[23] kg/litre, the diesel consumption in tons has been calculated for use in the equation to compute project emissions (PE) as mentioned in above section. Accuracy of the Measurement Method: To confirm the accuracy on measurement of quantity of diesel consumed in the project activity can be cross checked against the fuel purchase receipts. Responsibility: Log book has been maintained by the shift in charge and same has been cross checked by the General Manager of the project activity.
Frequency of monitoring/recording	Frequency: Continuously monitored. Recording frequency: monthly and aggregated annually Archiving Policy: Paper & Electronic
Value monitored	0
Monitoring equipment	Manually Monitoring
QA/QC procedures to be applied	The data recorded can be cross checked against the fuel purchase receipts
Purpose of the data	Calculation of project emissions
Calculation method	It has been directly monitored. Thus, calculation is not necessary for this project.
Comments	The above parameter will be monitored ex-post and the values will be updated accordingly. The data will be archived electronically and will be kept for 2 years beyond the Crediting Period or last issuance whichever is later

4.3 Monitoring Plan

The data monitoring involves the parameters mentioned in the section 3.2. Due care has been taken for the measurement of all these parameters and maintenance of records. Proper training has been imparted to concerned personnel for accurate measurement:

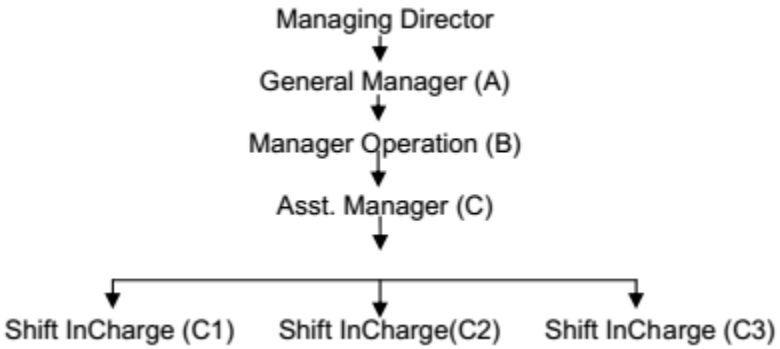
Metering:
Electricity export and import are metered by main and check tri-vector energy meters with an accuracy class of 0.2s installed at the grid interconnection point. The main meter reading is taken jointly on a fixed day of every month for the preceding month and signed by the representatives of state utility and PP. In the event of failure of main meter installed at the substation, the check meter will be used in monitoring the electricity data. All the meters are under the custody of HPSEB will

[23]Reference: Requirement of High Speed Diesel (HSD) fuel as per IS 1460: 1995 as specified under Motor spirit and High Speed Diesel Control Orders by the Ministry and Petroleum and Natural Gas (MoPNG) dated 28 December 1998 available at http://petroleum.nic.in/newgazette/GN%20No.511%20dtd%2029-12-98.p

be responsible for the calibration of the energy meters as per the industry standards. PP has proposed calibration of meter once in three year. All data will be archived electronically and will be kept for a minimum of 2 years beyond the crediting period or last issuance whichever is later.

Monitoring Organization:

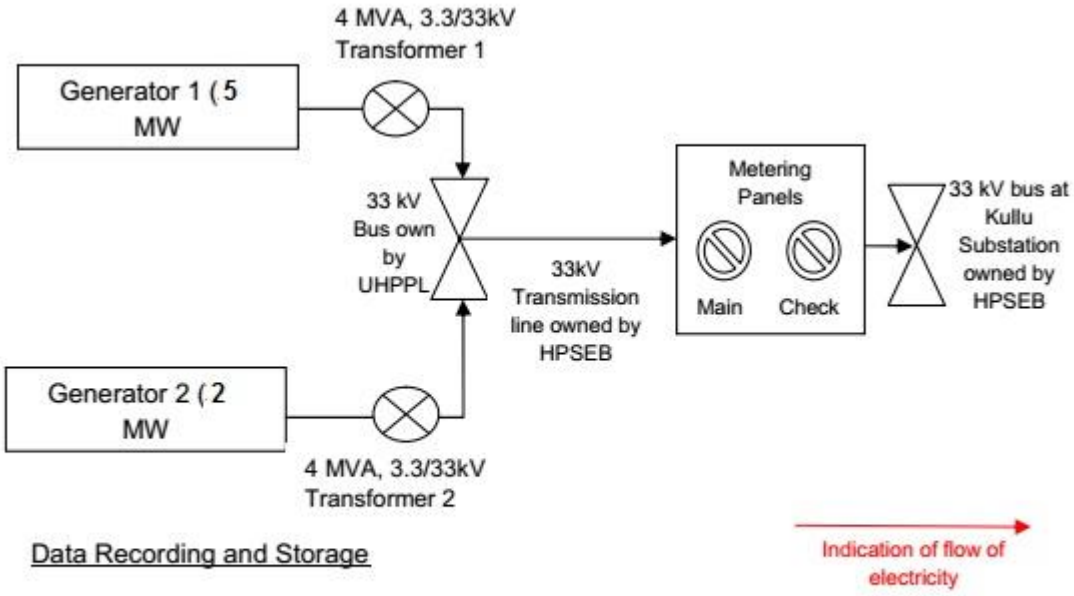
The Project is being managed by the Managing Director (MD), General Manager, Manager (Operations), Technical in-charge and Manager (finance)The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the MD (through a dedicated identified person) The identified person is in charge of GHG monitoring activities and prepare necessary audit reports for review by the management. The identified person in charge is also assisted by a team of experienced personnel indiscipline's such as mechanical and electrical with experience in plant operation, measurements and management. The primary responsibility of the team is to collect, measure, monitor, record and reports the information on various data items to the person in charge and the General Manager, in accordance with the applicable standards. Periodic calibration of various instruments used in the monitoring of the data and recordkeeping of the same is also the responsibility of this team. The responsibility of storage and archiving of information in good condition also lies with the designated person in charge. The person in-charge also undertake periodic verifications and onsite inspections to ensure the quality of the data collected by the team.

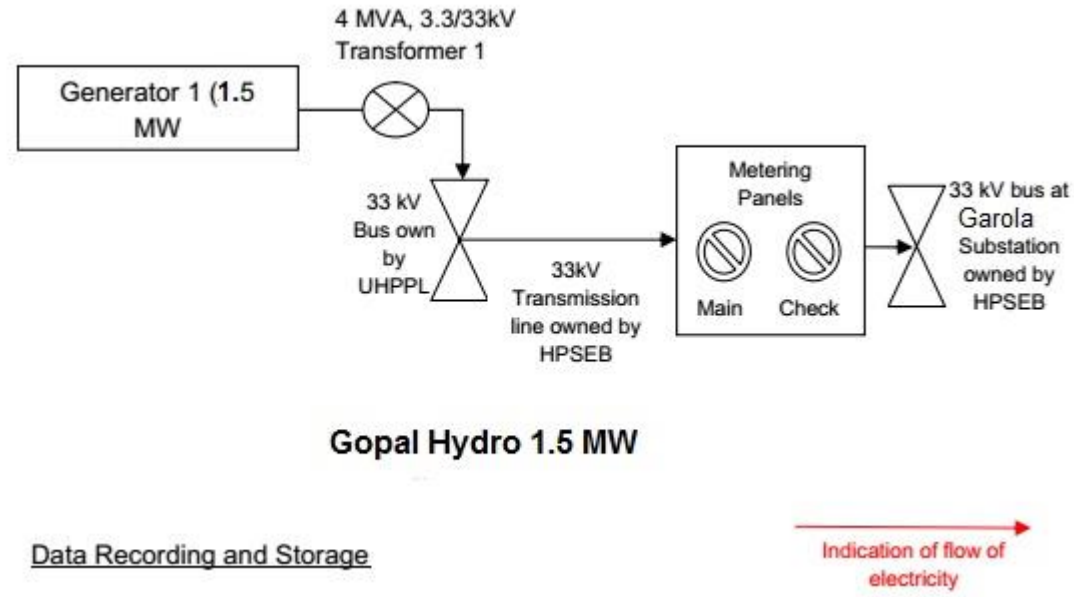


Where,

A	:	General Manager is the responsible for the overall project activities
B	:	Manger Operation is responsible for the technical aspects of the project including calibration of the energy in due time.
C	:	Asst. Manager (C) will assist the Manager Operation and will be look after the day to day shift activity of the project.
C1,C2,C3	:	3 Shift In Charge who are placed in 3 shifts and also take care of the technical faults occurring in the plant

Monitoring equipment comprises of energy meters, which monitor the energy fed by the plant to grid system by the proposed project. Project proponents has installed two energy meters. One is main meter and the other is check meter. Both the meters are calibrated at regular intervals. The baseline emission factor is taken from the official data published by the Central Electricity Authority for the Integrated Indian grid. GHG Data Collection System: The data flow of the collected GHG data is mentioned below line diagram:





The net energy fed to the grid system by the project activity is recorded by project proponents using Main Meter. However at the time of non-performance of main meter, the check meter is referred. The document which contains all details such as the equipment data, calibration status, previous readings, current reading, export, net billable units, date and time of recording etc. This document is used as a basic document for monitoring and verification of the net energy exported to the grid. The State Electricity Board pays to the project proponent based on this document.

QA & QC Procedures to be followed:

There has not been a single instance of meter failure during the monitoring period considered, hence no such process was applied. However the scheduled calibrations were done as per the industry standard.

5 SAFEGUARDS

5.1 No Net Harm

The facility does not produce any pollution in process of power generation as it utilizes renewable energy source that is hydro energy to generate electricity for captive consumption. Hence there is positive impact on the environment due to this small-scale project activity of reducing the pollution caused by fossil fuels would have been used in baseline scenario. Further this project will have no air pollution, no water pollution and no noise pollution. The project activity has obtained the No Objection Certificate for Consent to Establish from the concern agencies.

The project activity does not cause any harm to the local ecology. It primarily requires the installation of the Hydro power project, interfacing the generators with the State Electricity Board by setting up HT transmission lines and installation of other accessories.

Also as per the Central Pollution Control Board of India notification[24] small hydro project of less than 25 MW falls under White Category and are practically non-polluting

5.2 Environmental Impact

As per the prevailing regulations of the Host Party i.e. India represented by the Ministry of Environment and Forests (MoEF), Govt. of India, Environment Impact Assessment Notification no. 3067 dated 01/12/20094 and February 2016 the project activity does not require Environment Impact Assessment to be conducted.

However, the following is a brief summary of the assessment of environmental impacts of the development of project activity.
1. Only small portion of land will be used for construction of this project. Hence, practically, with the construction of this project there will be no adverse impact on the forest, wild life or aquatic animals.
2. The topography of the area comprises of compact strata and steep slope. The unstable strata would be used for plantation to enhance the green area around the project.
3. The project is based on run-of-the-river and does not require the construction of a reservoir, dam or pond. The catchment area of small weir dam is restricted to river bed only and so there will not be any submergence of the area. Hence, any problem related to reservoir induced seismicity and rehabilitation will not occur.
4. Since the project does not require the construction of a reservoir, there is no induced risk of incidences of infectious diseases.
5. Roads and paths approaching project site and water supply arrangements would be made for the construction site which would help in overall infrastructure development of the region.
.

[24] http://envfor.nic.in/sites/default/files/Latest_118_Final_Directions.pdf

5.3 Local Stakeholder Consultation

The local stakeholder consultation for the project activity have been carried out. The Local Stakeholder consultation documents have been provided to DOE during validation of project activity.

The PPs has identified the relevant stakeholders and sends personal invitation letters as well as issued public notice well in advance.

The following local stakeholders were identified by the PPs:

- Local community
- Local village administration
- Technology suppliers
- Local vendors

The stakeholder meeting process is followed in the following sequence

• Welcome Speech by the organizers.

• Introduction to 'GHG' programme

• Interactive Sessions with the stakeholders.

• Vote of Thanks

Sl. No.	SPVs Name	Venue	Invitation Notice Date	LSHM Meeting Date
1.	Gaur Hydro Power Pvt. Ltd.	Project site, Village-Dadka, District- Kullu, Himachal Pradesh	08-11-2017	17-11-2017
2.	Gopal Power Pro.Pvt. Ltd.	Project site, Village – Garola, District – Chamba, Himachal Pradesh	01-02-2019	08-02-2019

Meeting started with opening speech by representative of project participant. He introduced all guests on dais. The representative of project participant explained Technical aspects of project to stakeholders. He also explained about social, environmental and economic benefits of the project. He also elaborated about carbon mechanism & its requirement for the current project. After the detailed discussions, the session was open for questions from stakeholders.

Villagers were totally in support for setting up of these kinds of projects in the region. The PPs also placed a grievance register onsite in where the stakeholder can put down his/her complain and the same if found genuine will be addressed immediately. Most of the questions are related to employment opportunities, economic development, free electricity supply, benefits from project to

villagers and other development activities. Also, regular stakeholder engagement is one the key focus at the site. The questions raised by the villagers are summarised below:

Q. Will the project provide employment opportunities or improve economic development of the area?
A. Yes, the project will provide economic development of the area and will provide employment opportunities to the local people depending upon their skill and qualification.

Q: Will the operation of the project plants result in increased temperature in the surroundings?

A: There will be no impact on ambient temperature due to operation of the plant.

Q: Will the project help in improving the electricity supply to the villagers or neighbourhood areas?

A: The electricity generated from the project plants shall be sold to State Electricity Board under formal PPAs who in turn shall sell it to state DISCOM whose responsibility is to distribute electricity in their respective jurisdiction including surrounding villages. It is envisaged that this would improve the electricity availability situation in the neighbourhood area.

Q: How the project activity benefit the villages around the project site and their residents?

A: The project activity will benefit the nearby villagers by providing employment opportunities to local or nearby people and also provides immense opportunity for economic development of the area like increase in business opportunities in the form of civil works for and other form of various employment opportunities will be created, hiring of vehicle etc., improvement in transportation; and various social activities shall help to uplift the standard of living.

There were some specific questions asked by some locals during the stakeholder meeting. The same has been summarized below.

Name of the stakeholder	Tanya Sharma
Occupation	Embroidery worker
1. Question: Will this project cause any harm to local ecology/environment/livelihood of the community? Answer: No, this project will not cause any harm to environment or day to day livelihood. 2. Question: What are the other things that can be done from water? Answer: As of now we can generate electricity from the hydro energy. 3. Question: Monsoon season will produce more electricity?	

Answer: Yes, the electricity generated in monsoon would be higher as compared to winter season.	
Name of the stakeholder	S K Pant
Occupation	Teacher
1. Question: Is there any way to generate power at night? Answer: No, there is no alternative. 2. Question: What is the lifetime of the hydro project? Answer: The project has an average operational lifetime of 30 years 3. Question: How will it help reduce pollution? Answer: No pollutants are released. 4. Question: Will there be harmful emission from project? Answer: No there will be no radiations.	

Name of the stakeholder	Amit Rautela
Occupation	Shopkeeper
1. Question: What are the reason for setting up project here? Answer: In this region water flow is available more as compared to other location. Hence, this project site has been chosen. 2. Question: Will there be any negative impact on our land or cultivation? Answer: No, there will be no harm to the lands or cultivation. 3. Question: Will we get 24 hr electricity from this project? Answer: Due to this project there will be an increase in the share of the power that is supplied to the village.	

4. Question: Will there be employment opportunity for the youth? Answer: Yes, there will be employment opportunities for the people of the village.

Name of the stakeholder	Ruhi Jaiswal
Occupation	Teacher
1. Question: What are the advantages of Hydro Plant? Answer: The main advantage is that it do not cause any pollution and generates clean form ofpower. 2. Question: Can we install hydro plant at our home? Answer: No, it requires special technology 3. Question: Will it increase temperature in neighbourhood? Answer: No, there will not be increase in temperature in nearby area. 4. Question: Will it reduce power cut problem? Answer: Yes, it will help to reduce the problem of power cut in the village	

All the above queries were suitably and satisfactorily replied / clarified by project participant's representatives. 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.

The meeting was concluded by vote of thanks to all the participants. The Minutes of meeting with commenting sheet from LSH, invitation letter receipt copy shall be submitted to the DOE.

There are no any negative comments received for the project activity. 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. The PP also placed a grievance register onsite in where the stakeholder can put down his/her complain and the same if found genuine will be addressed immediately.

5.4 Public Comments

This project was under public comment from 21 November 2019 - 21 December 2019 and no comments were received during that period[25].

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 generation supplied by the project (Solar) plant/unit to the grid
Values applied:	18494.12
Comments	The data would be archived electronically and maintained for the entire crediting period plus two years.

6.2 Baseline Emissions

According to the paragraph 22 of the 18^{ve}rsion of AMS I.D, the baseline emissions are the product of electrical energy baseline $EG_{PJ,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$BE_y = EG_{PJ,y} X EF_{grid,y}$
Where,
BE_y = Baseline Emissions in year y; tCO_2
$EG_{PJ, y}$= Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2,grid,y}$= CO_2 Emission Factor of the grid in year y; tCO_2/MWh
Thus, basline emissions can be calculated as
$BE_y = EG_{PJ,y} X EF_{grid,y}$
=18494.12 X0.9127
=16878 tCO_2e.

Baseline Emissions from (23-February -2018 to 31 October - 2019)

Parameter / Period	Quantity of net electricity supplied to the grid as a result of the implementation of the project activity in year y (MWh) ($EG_{BL,y}$)	CO_2 Emission Factor of the grid in year y (tCO_2/MWh) ($EF_{CO2,grid,y}$)	Baseline Emissions in year y (tCO2) (BE_y)

[25] https://www.vcsprojectdatabase.org/#/pipeline_details/PL2033

23/02/2018 – 31/12/2018	6,943.05	0.9127	6,336
01/01/2019 – 31/10/2019	11,551.07	0.9127	10,542

6.3. Project Emissions

Since one diesel generator is also being utilized to supply the emergency requirement for the project activity, diesel consumption shall be monitored in plant log records. Emissions resulting from usage of diesel in the backup diesel generator will be accounted as project emissions based on the following equation as provided in the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" version.3[26]CO_2 emissions from fossil fuel combustion in process are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

CO_2 emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum FC_{i,j,y} \times COEF_{i,y}$$

Where:

$PE_{FC,j,y}$ = Are the CO_2 emissions from diesel combustion in process j during the year y (tCO_2/yr);
$FC_{i,j,y}$ = Is the quantity of diesel combusted in process j during the year y (mass or volume unit/yr);
$COEF_{i,y}$ = Is the CO_2 emission coefficient of diesel in year y (tCO_2/mass or volume unit)
i = Are the fuel types combusted in process j during the year y
The CO_2 emission coefficient $COEF_{i,y}$: PP has selected the option B as COEF (CO_2 emission coefficient of fuel) testing facility for "Weighted average mass fraction of carbon in fuel type i in year y" under option A is not available to PP.

Option B: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of the diesel, as follows:

$$\mathbf{COEF_{i,y} = NCV_{diesel,y} \times EF_{co2,diesel,y}}$$

Where:
$COEF_{i,y}$ = CO_2 emission coefficient of diesel in year y (tCO_2/mass or volume unit)
$NCV_{diesel,y}$ = weighted average net calorific value of the diesel in year y (GJ/mass or volume unit)
$EF_{CO2,diesel,y}$ = weighted average CO2 emission factor of diesel in year y (tCO2/GJ)
Hence, the project emissions for the proposed project activity can be calculated as follows:

$$\mathbf{PE_{diesel,j,y} = FC_{diesel,j,y} \times NCV_{diesel,y} \times EF_{co2,diesel,y}}$$

Where,
$FC_{diesel,j,y}$ = quantity of diesel used during the year
$NCV_{diesel,y}$ = weighted average net calorific value of diesel in year y
$EF_{co2,diesel,y}$ = weighted average CO2 emission factor of fuel type diesel in year y

Hence for the Monitoring Period23/02/2018 to 31/10/2019)

[26] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

Parameter / Period	Quantity of Diesel consumed by the standby DG set in year y ($FC_{diesel,y}$) (Lts)	Weighted Average net Calorific Value of Diesel combusted in the project activity during the year, y ($NCV_{Diesel,y}$) (GJ/Ton)	Weighted average CO_2 emission factor of the diesel consumed in the project activity in year y ($EF_{Co2,diesel,y}$) (tCO_2/TJ)	Project Emission (after rounding up) (tCO_2)
23/02/2018 – 31/12/2012	362	43.3	74.8	1.03
01/01/2019 – 31/10/2019	209	43.3	74.8	0.60

6.4 Leakage

As per AMS ID version 18 "If the energy generating equipment is transferred from another activity, leakage is to be considered". It is denoted by LE_y, However there is no equipment transferred from another activity hence, Hence $LE_y=0$

6.5 Net GHG Emission Reductions and Removals

The emission reductions (ER_y) by the Project activity during a given year y is the difference between baseline emissions (BE_y), project activity emissions (PE_y) and leakage (LE_y), as follows:

$ER_y = BE_y - PE_y - LE_y$

Therefore emission reductions generated by the Project during this monitoring period (23-Feb-2018 to 31-October -2019)are calculated as:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2018	6,336	1.03	0	6335
2019	10,542	0.60	0	10541
Total	**16878**	**1.63**	**0**	**16876**

$ER_y = BE_y - PE_y - LE_y$ = **16,878 – 1.63 – 0 = 16,876 tCO_2e**

There was no breakdown of the bundled project activity during the current monitoring period.

It is to be noted here that as per the estimated emission reduction to be achieved from the project activity for the current monitoring period is 18,572 tCO_2e, whereas actual emission reductions achieved are 16,876 tCO_2e, which is approximately 9% lower than the estimated emission reductions. The generation of electricity depends upon many other climatic conditions, which are not within the control of the project participant. The lower generation during the current verification period is low due to certain natural conditions like water flow etc. Hence, it is acceptable.

Apart from above comparison, the estimated emission reduction comparison with actual emission reductions based on operation days of each PP. Based on actual operational days, the estimation for operational days and actual emission reductions are compared and found that for the project activity the power generation was on a lower side and witnessed downfall in PLF.

Project Investor	**Capacity (MW)**	**Estimated VCUs during current monitoring period**	**Actual VCUs during current monitoring period**	**% change**
Gaur Hydro Power Pvt. Ltd.	2	15485	14739	-4.81%
Gopal Power Pro Pvt.Ltd.	1.5	3087	2137	-30.77 %

Appendix 1: Calibration and Meter Details

Metering arrangement, monitoring practice, accuracy class, calibration frequencyare under control of state electricity board, the PPs do not have any control on monitoring practice and calibration of meters.Being Greenfield project activity and commissioned within 2 years, all meters are used for monitoring purpose are pre calibrated before installation as per state electricity board regulations, thus installed pre calibrated meters have validity of calibration till 5 years of commissioning date.
The Energy Meters details used for the respectiveproject proponents are given below::

Name of the SPVs	Site	Capacity (MW)	Main Meter Details	Check Meter Details	Calibration Date	Due date
Gaur Hydro Power Pvt. Ltd.	Dadka, Kullu	2.0	SL. No. : HPU06256 Make: Secure I Accuracy class: 0.2 s	SL. No. : HPU06255 Make: Secure	02-02-2018	01-02-2023
Gopal Power Pro Pvt. Ltd.	Garola, Chamba	1.5	SL. No. : 13193404 Make: L&T Accuracy class: 0.2 s	SL. No. : 13193345 Make: L & T	18-04-2019	17-04-2024

Appendix: 2 : Input Parameters for Additionality

Investor Name - Gaur Hydro Power Pvt. Ltd.	Equity IRR without CDM	Benchmark (Equity IRR)
	9.19%	15.39%

Assumption and financial of the project

Details of the project		Source		Link
State where the project is situated	Himachal Pradesh			
No. of machines	2	As Per DPR		
Capacity /machine (MW)	1.00	As Per DPR		
Total Capacity (MW)	2.00	Calculated Value		
Expected Date of Commissioning	23-Feb-18	Assumption		
Life of the plant (Yrs.)	40	As per DPR		
Generation of electricity				
PLF (%) for first 12 years	60.84%	As per DPR		
Annual generation (kWh)	10,659,168	Calculated Value		

Transmission Losses	**8.00%**	**As per DPR**	
Tariff rate at the decision making (INR/kWh)	**2.95**	**As per DPR**	
Water Royalty to be paid to Govt. till 12 years	**6.00%**	**As per DPR**	
Water Royalty to be paid to Govt. after 12 years	**12.0%**	**As per DPR**	
Transmission & Wheeling Losses (%)	**8.00%**	**As per DPR**	
Operation and maintenance cost and Insurance			
O & M Expenses (INR Mn.)	**1.92**	**As Per DPR**	
O & M free for (Yr.)	**-**	**Not Applicable**	
Escalation in the operational expenses (%)	**5.00%**	**As Per DPR**	
Administrative expenses (INR MN)	**1.50**	**Administration and Miscellaneous expenses were worked out by PP during investment decision**	
Insurance (INR Mn.)	**1.70**	**CERC Order March 2012**	http://www.cercind.gov.in/2012/orders/RE_35_2012.pdf
Financial parameters			
TOTAL COST (INR Mn.)	**170.48**	**As Per DPR**	
Loan Amount (INR Mn.)	**119.34**	**As Per DPR**	
Equity Investment (INR Mn.)	**51.14**	**Calculated Value**	
Term loan			
Loan Amount (INR Mn.)	**119.34**	**As per DPR**	
Interest rate (%)	**13.00%**	**As per DPR**	
Loan Tenure (Qtr.)	**40**	**As per DPR**	
Moratorium Period (Qtr.)	**-**		
Repayment Period (Qtr.)	**40**	**Calculated Value**	
Repayment instalments value (INR Mn.)	**2.983**	**Calculated Value**	

1st instalment from (Qtr. end)	**30-Jun-18**	**Considered from the next Quarter End**	-
Book Depreciation (SLM Method)			
Gross Depreciable Value (INR Mn.)	**170.48**	**Calculated Value**	
Salvage Value (%)	**10.00%**	**Page 15 of CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012**	http://www.cercind.gov.in/2012/regulation/CERC_RE-Tariff-Regualtions_6_2_2012.pdf
Salvage value (INR Mn.)	**17.05**	**Calculated Value**	
Net Depreciable Value (INR Mn.)	**153.43**	**Calculated Value**	
Residual Value (INR Mn.)	**17.05**	**Calculated Value**	-
IT Depreciation			
IT Depreciation (WDV Method) (%)	**12.73%**	**As per companies act 2013**	http://taxadda.com/companies-act-2013/depreciation-rates-as-per-companies-act-2013/
Income Tax			
Financial Year	**FY 2017-18**		
Income tax rate (%)	**30.00%**	**As Per Income Tax Rule, Pg 29 Para E(I)**	http://indiabudget.nic.in/ub2011-12/fb/bill1.pdf
MAT (%)	**18.50%**	**As Per IT rule Pg 9**	http://indiabudget.nic.in/ub2012-13/mem/mem1.pdf
Service Tax (%)	**12.00%**	**As Per Income Tax Rule, Pg 14**	http://pib.nic.in/newsite/erelease.aspx?relid=47885
Surcharge (%)	**10.00%**	**As Per Income Tax Rule, Pg 29 Para E(I)**	http://indiabudget.nic.in/ub2011-12/fb/bill1.pdf
Education cess (%)	**3.00%**	**As Per Income Tax Rule, Pg 5, 11 and 12**	http://indiabudget.nic.in/ub2011-12/fb/bill1.pdf
Final Tax rates			
Income tax rate (%)	**33.99%**	**Calculated Value**	
MAT (%)	**20.96%**	**Calculated Value**	

Service Tax (%)	**12.36%**	**Calculated Value**	

Investor Name - Gopal Hydro Power Pvt. Ltd.	**Equity IRR without CDM**	**Benchmark (Equity IRR)**
	8.78%	**15.39%**

Assumption and financial of the project

Details of the project		**Source**	**Link**
State where the project is situated	**Himachal Pradesh**		
No. of machines	**2**	**As Per DPR**	
Capacity /machine (MW)	**0.75**	**As Per DPR**	
Total Capacity (MW)	**1.50**	**Calculated Value**	
Expected Date of Commissioning	**5-May-19**	**Assumption**	
Life of the plant (Yrs.)	**40**	**As per DPR**	
Generation of electricity			
PLF (%) for first 12 years	**58.00%**	**As per DPR**	
Annual generation (kWh)	**7,621,200**	**Calculated Value**	
Transmission Losses	**10.00%**	**As per DPR**	
Tariff rate at the decision making (INR/kWh)	**2.50**	**As per DPR**	
Water Royalty to be paid to Govt. till 12 years	**6.00%**	**As per DPR**	
Water Royalty to be paid to Govt. after 12 years	**12.0%**	**As per DPR**	
Transmission & Wheeling Losses (%)	**10.00%**	**As per DPR pg 286**	
Operation and maintenance cost and Insurance			
O & M Expenses (INR Mn.)	**2.33**	**As Per DPR**	
O & M free for (Yr.)	**-**	**Not Applicable**	
Escalation in the operational expenses (%)	**5.00%**	**As Per DPR**	

Administrative expenses (INR MN)	**1.00**	**Administration and Miscellaneous expenses were worked out by PP during investment decision**	
Insurance (INR Mn.)	**1.50**	**CERC Order March 2012**	http://www.cercind.gov.in/2012/orders/RE_35_2012.pdf
Financial parameters			
TOTAL COST (INR Mn.)	**149.52**	**As Per DPR**	
Loan Amount (INR Mn.)	**104.66**	**As Per DPR**	
Equity Investment (INR Mn.)	**44.86**	**Calculated Value**	
Term loan			
Loan Amount (INR Mn.)	**104.66**	**As per DPR pg 285**	-
Interest rate (%)	**10.50%**	**As per DPR pg 285**	-
Loan Tenure (Qtr.)	**40**	**As per DPR pg 285**	-
Moratorium Period (Qtr.)	**12**		
Repayment Period (Qtr.)	**28**	**Calculated Value**	-
Repayment instalments value (INR Mn.)	**3.738**	**Calculated Value**	-
1st instalment from (Qtr. end)	**30-Jun-22**	**Considered from the next Quarter End**	-
Book Depreciation (SLM Method)			
Gross Depreciable Value (INR Mn.)	**149.52**	**Calculated Value**	
Salvage Value (%)	**10.00%**	**Page 15 of CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012**	http://www.cercind.gov.in/2012/regulation/CERC_RE-Tariff-Regualtions_6_2_2012.pdf
Salvage value (INR Mn.)	**14.95**	**Calculated Value**	
Net Depreciable Value (INR Mn.)	**134.57**	**Calculated Value**	

Residual Value (INR Mn.)	**14.95**	**Calculated Value**	-
IT Depreciation			
IT Depreciation (WDV Method) (%)	**12.73%**	**As per companies act 2013**	http://taxadda.com/companies-act-2013/depreciation-rates-as-per-companies-act-2013/
Income Tax			
Financial Year	**FY 2019-20**		
Income tax rate (%)	**30.00%**	**As Per Income Tax Rule, Pg 29 Para E(I)**	http://indiabudget.nic.in/ub2011-12/fb/bill1.pdf
MAT (%)	**18.50%**	**As Per IT rule Pg 9**	http://indiabudget.nic.in/ub2012-13/mem/mem1.pdf
Service Tax (%)	**12.00%**	**As Per Income Tax Rule, Pg 14**	http://pib.nic.in/newsite/erelease.aspx?relid=47885
Surcharge (%)	**10.00%**	**As Per Income Tax Rule, Pg 29 Para E(I)**	http://indiabudget.nic.in/ub2011-12/fb/bill1.pdf
Education cess (%)	**3.00%**	**As Per Income Tax Rule, Pg 5, 11 and 12**	http://indiabudget.nic.in/ub2011-12/fb/bill1.pdf
Final Tax rates			
Income tax rate (%)	**33.99%**	**Calculated Value**	
MAT (%)	**20.96%**	**Calculated Value**	
Service Tax (%)	**12.36%**	**Calculated Value**	