3 MW HYDRO POWER PROJECT BY DARJEELING POWER PVT. LTD.

Document Prepared By EKI Energy Services Limited

Project Title	3 MW Hydro Power Project by Darjeeling Power Pvt. Ltd.
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1 PROJECT DETAILS

1.1 Summary Description of the Project and its Implementation Status

The project activity is a new 3 MW Shaung hydro power plant in the Kinnour district, Himachal Pradesh, India with 25% continuous over load installed capacity. It is a run-of-the-river power project.

Shaung Mini Hydropower project was allotted to Darjeeling Power Pvt. Ltd. for harnessing the power potential of Shaung stream. The Shaung Mini Hydropower is a run of river power project of 3 MW power generation on Shaung stream. Shaung stream is a tributary of river Bapsa. Power house is located near village Shaung. Diversion cum trench weir is proposed to withdraw the requisite design discharge +50% addition for de- silting.

Being a renewable resource, using Hydro power energy to generate electricity contributes to resource conservation. Darjeeling Power Pvt. Ltd has developed this project keeping in consideration of the funding available under the VCS mechanism. This is because the project activity qualifies as a CDM project as it would be feeding clean power to the Indian electricity grid of India there by helping in reduction of GHG emissions. The project activity is also responsible for sustainable economic growth and conservation of environment through use of Hydro power energy as a renewable source of energy.

Project Type	Project Capacity (in MW)	Owner of Project	Project Location	State
Hydro	3 MW	Darjeeling Power Pvt. Ltd.	Kinnaur	Himachal Pradesh

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 16,404 tonnes of CO_2e per year and total GHG emission reductions for the chosen 10 year crediting period will be 164,040 tonnes of CO_{2e}.

The Project activity is a new facility (Greenfield) and the purpose of the project activity is to generate electricity by the utilization of hydro power, and selling the generated electrical energy from the project to the respective state utilities under the Indian Grid.

The total capacity of the project activity is 3 MW and the project is commissioned on 15th April 2016. During the current monitoring period the net electricity generated is 25,777 MWh and resulting generation of 24,386 VCU's.

In this process there is no significant consumption of any fossil fuel and hence the project does not lead to any greenhouse gas emissions. Thus, electricity would be generated through sustainable means without causing any negative impact on the environment.

In the Pre- project scenario the equivalent amount of electricity delivered to the grid by the project activity, would have otherwise been generated by the operation of grid-connected fossil fuel based power plants and by the addition of new generation sources.

The major milestones achieved for the implementation of the project activity of 3 MW Hydro Power project by Darjeeling Power Pvt. Ltd. are as follows:

Sr No.	Description	Date
1.	Completion of Detailed Project Report	02/02/2009
2.	Board Decision for implementation of the project activity	04/02/2009
3.	NOC from Gram Panchayat	14/10/2009
4.	NOC from State Govt.	26/11/2009
5.	Land Diversion permission from Himachal Pradesh Forest Dept.	24/12/2009
6.	Service Contract Agreement	09/03/2011
7.	Start of Civil Works	04/10/2011
8.	Sanction of Credit Facility from Bank of Maharashtra	27/03/2012
9.	Operation and Maintenance Contract signed	14/10/2014
10.	PPA signed	20/05/2016
11.	Commercial Operation of Power House	15/04/2016
12.	Provisional Consent order by HPSPCB	03/08/2016

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, EB 81, Annex 24[1])

The project is not a grouped project activity.

1.3 Project Proponent

Organization name	Darjeeling Power Pvt. Ltd.
Contact person	Mr. Sunil Lavti
Title	Authorized Signatory
Address	Empire House, 3rd Floor, 219 Dr. D.N.Road, Fort, Mumbai- 400001, India.
Telephone	-
Email	finance@somani.com , accounts@somani.com

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

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the project	Project Advisory
Contact person	Bhaskar Dutta
Title	Manager- Operations
Address	Office No 201, Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore-452010, India
Telephone	+91-9109916710
Email	bhaskar@enkingint.org

1.5 Project Start Date

Project Start Date: 15-April-2016

The project start date is the date on which the project was commissioned under the Project activity.

The commissioning details for the 3 MW Hydro project activity is given below:

Project Investor	Capacity (MW)	State	Date of Commissioning
Darjeeling Power Pvt. Ltd.	3 MW	Himachal Pradesh	15-04-2016

1.6 Project Crediting Period

Crediting Period Start date: 15-April-2016

Crediting Period End date: 14-April-2026

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

As the Estimated GHG emission reductions or removals per year is 16,404 (tCO_2e) which is less than 300,000 tonnes of CO_2e per year, thus the project falls in the category of Project.

Project Scale	
Project	✓
Large project	

Year	Estimated GHG emission reductions or removals

	(tCO_2e)
Year 1	16,404
Year 2	16,404
Year 3	16,404
Year 4	16,404
Year 5	16,404
Year 6	16,404
Year 7	16,404
Year 8	16,404
Year 9	16,404
Year 10	16,404
Total estimated ERs	164,040
Total number of crediting years	10
Average annual ERs	16,404

1.8 Description of the Project Activity

The proposed project activity involves the installation of Hydro Power Project. The total installed capacity of the project is 3 MW. The project is promoted by Darjeeling Power Ltd. The Details of the project installation have been provided in the section 1.1.

The 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 VCS benefits for the Project.

In the Pre- project scenario the equivalent amount of electricity delivered to the grid by the project activity, would have otherwise been generated by the operation of grid-connected fossil fuel based power plants and by the addition of new generation sources.

The project shall result in replacing anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 16,404 tCO_2e per year, thereon displacing 17,337 MWh/year amount of electricity from the grid.

Hydro Power Project Technology Details –

The technology employed, converts potential energy to electrical energy. In hydro power generation, energy of water is converted into mechanical energy and subsequently into electrical energy. The technology is an environment friendly technology since there are no GHG emissions associated with the electricity generation. There is no transfer of technology involved in the project activity.

The project activity comprises of 3 MW Hydro Power project in the state of Himachal Pradesh. The generating unit consists of a horizontal shaft arrangement. Turbine unit discharges water into tailrace channel at the downstream end of the power house. The service bay is placed at the far end of the powerhouse where road access is contemplated.

The generation voltage is 6.6 kV. It is stepped up to 33 kV by a power transformer and is then transmitted through an overhead line to a 33 kV substation at Nathpa of Himachal Pradesh State Electricity Board. The metering is provided at the Nathpa sub-station which is the point where the power gets exported to the grid.

Technical details of the project activity are as follows:

SR. NO.	PARTICULARS	DETAILS
1.	Horizontal twin jet Pelton Wheel Turrbine with all the accessories	1
2.	Electro hydraulic Micro Processor based Digital Governor with all accessories	1
3.	Inlet Ball Valve	1
4.	Penstock Butterfly Valve with accessories	1
5.	Oil Pressure Pumping System for Governor and MIV	1
6.	Neutral Grounding Panel	1
7.	Lightning Arrestor and Voltage Transformer cubicle	1
8.	11 KV Breaker Panel	1
9.	Auxiliary Transformer	1
10.	Estimated design Life time	30 years.

Technical Specifications of the Generator are as follows:

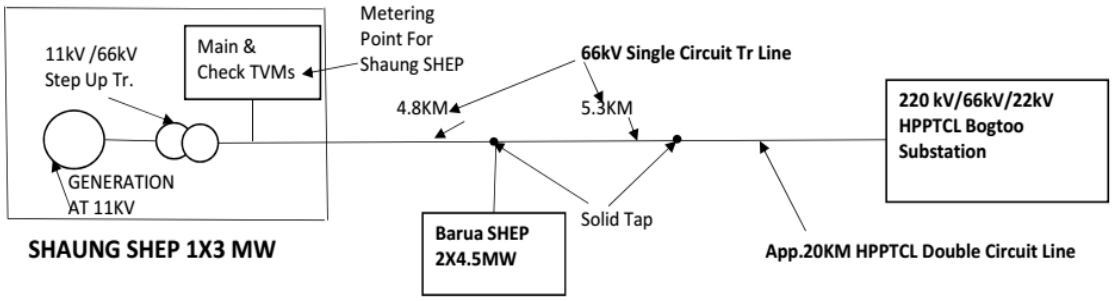
Number of Generators	1
Rated Output	3000 KW + 25% overload
Power Factor	0.85
Rated Voltage	3.3 KV +/- 10%
Frequency	50 Hz
Range of Frequency Variation	50 +/- 3%
Number of Phases	3, star connected
Inertia Constant	Not less than 1.0
Short Circuit Ratio	Not less than 1.0

Technical Specifications of the Turbine are as follows:

Number of Turbines	1
Type	Horizontal Shaft Pelton
Power Factor	3191 KW + 20% Overload
Rated Net Head	530.27 meter
Nominal Discharge	0.70 Cumecs
Maximum Pressure Rise	25%

Maximum Speed Rise	25%

Schematic Line diagram of the project site is given below:



SCHEMATIC DIAGRAM POWER EVACUATION SHAUNG SHEP

Emission Reductions from anthropogenic sources:

The hydro 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 hydro power 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.

1.9 Project Location

The project activity is located in the state of Himachal Pradesh, India. The site wise location details of the project is given below.

Project Investor	Project Type	Capacity (MW)	Location	State	Latitude	Longitude
Darjeeling Power Pvt. Ltd.	Hydro	3 MW	Shaung, Kinnaur	Himachal Pradesh	$31^0$26'40" N	$78^0$12'38" E

The satellite image of project site is given below:

1.10 Conditions Prior to Project Initiation

The project is a Greenfield hydro power project and does not involve generation of GHG emissions for the purpose of their subsequent reduction, removal or destruction. Thus prior to project initiation, there was nothing at site.

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 di oxide 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. 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 woolen 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

The Project is owned by Darjeeling Power Ltd., hence it possess right of use of ER credits. The Ownership is demonstrated through the following documents.

1) Commissioning certificates for Hydro Project in the name of Darjeeling Power Ltd. issued by respective state nodal agencies /authorities of the Himachal Pradesh State of India.

2) Power Purchase Agreement with respective State Electricity Board of Himachal Pradesh for sale of electricity by the Darjeeling Power 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 Project has no intend to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

However it can be crosschecked that PP is not claiming REC benefits, the same can be verified with the REC accreditation body of India[2].

1.12.4 Participation under Other GHG Programs

Not applied for any other GHG programs.

1.12.5 Projects Rejected by Other GHG Programs

The Project is not rejected by other GHG programs.

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

1.13 Additional Information Relevant to the Project

Eligibility Criteria

This is not a grouped project activity. Thus, this section is not applicable for this project.

Leakage Management

Not applicable to the project activity.

Commercially Sensitive Information

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

Sustainable Development

Contribution to sustainable development:

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 will generate power using zero emissions hydro based power generation which helps to reduce GHG emissions and specific pollutants like SOx, NOx, and SPM associated with the conventional thermal power generation facilities.

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

- **Environmental well-being**: Hydro being a renewable source of energy, it reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. 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 15 MW
Methodology : AMS I.D: Grid connected renewable electricity generation (Version 18, EB 81, Annex 24[3])
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[4] - Version 06.0 (EB 97, Annex 07)

2.2 Applicability of Methodology

The project activity involves generation of grid connected electricity from renewable hydro energy. The project activity has a proposed capacity of 3 MW which will qualify for a small scale CDM project activity under Type-I of the small scale methodologies. The project status is corresponding to the methodology AMS I.D version 18.0 and applicability of methodology are discussed below.

<table>
<tr><th>Applicability Criterion</th><th>Project Case</th></tr>
<tr><td>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.</td><td>The project activity is a Renewable Energy Project i.e. Hydro Power Project which falls under applicability criteria option 1(a) i.e., “Supplying electricity to a national or a regional grid”. Hence the project activity meets the given applicability criterion.</td></tr>
<tr><td>2. Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A) applies is included below:
<table><tr><th></th><th>Project type</th><th>AMS-I.A</th><th>AMS-I.D</th><th>AMS-I.F</th></tr><tr><td>1</td><td>Project supplies electricity to a national/regional grid</td><td></td><td>√</td><td></td></tr><tr><td>2</td><td>Project displaces grid electricity</td><td></td><td></td><td>√</td></tr></table></td><td>The 1st option of Table of AMS I.D. Version 18, EB 81 is applicable.</td></tr>
</table>

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

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v6.pdf

	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)		√		
4	Project supplies electricity to a mini grid 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	√			
3. This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).					The project is installation of new hydro based electricity generation 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					The proposed project activity is a run – off the river small hydro project, where water from the tail race of Bapsa river, will be taken as an intake and is diverted through the power house to generate renewable power. Hence no reservoirs are used for the power generation. Hence not applicable.

Project Emissions section, is greater than 4 W/m^2.	
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 is a 3 MW hydro electricity generation. 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 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 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, the hydro project is a Green field project activity and this project is not the enhancement or up gradation project.
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 hydro 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 hydro power project and is not a biomass project. Hence the criteria is not applicable to the project activity.

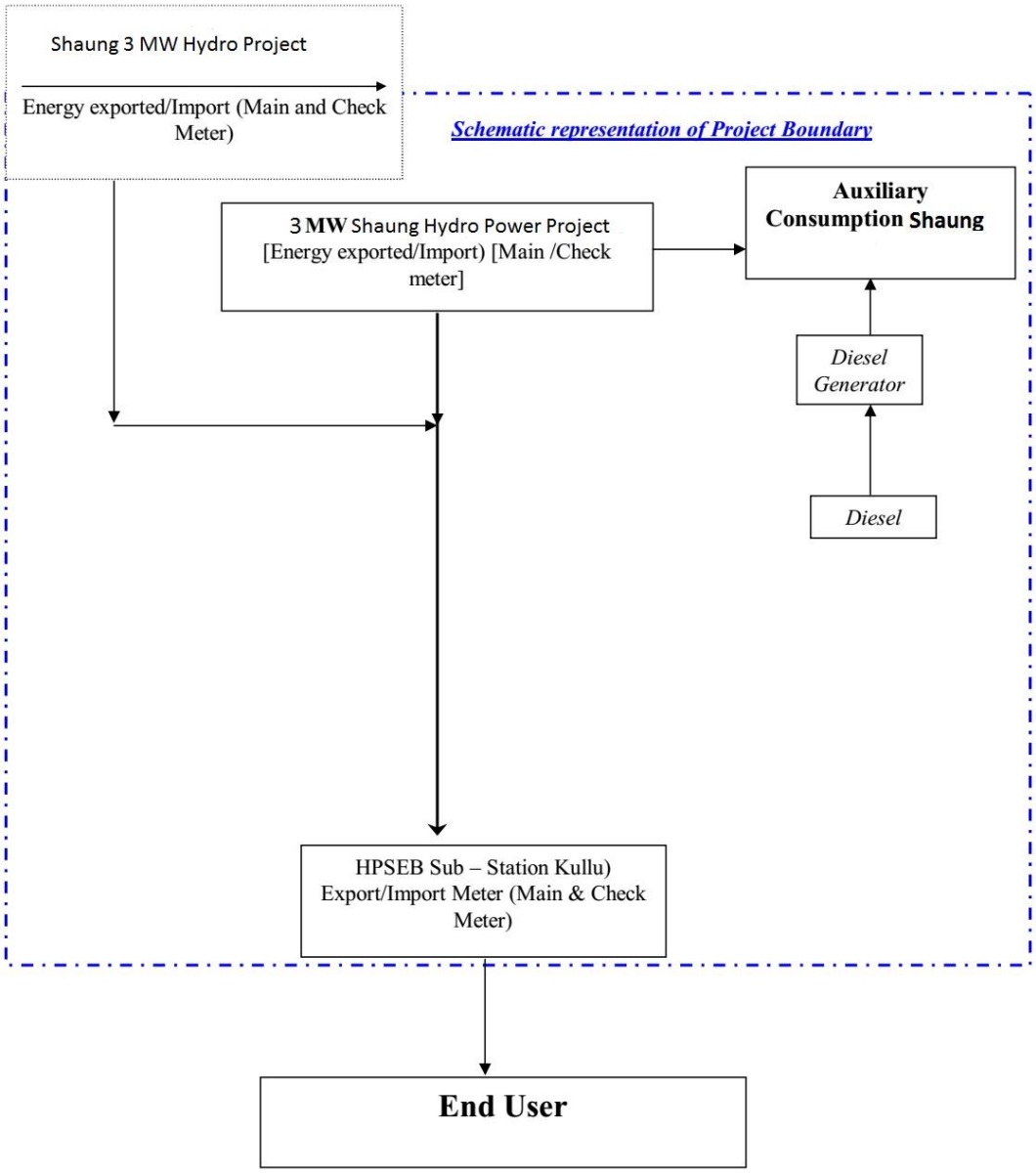
2.3 Project Boundary

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 stand by power requirements (basic lighting for staff) in case the power plant is not operating and there is also no supply from the grid.

The project boundary is depicted in the figure below:



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

Source		Gas	Included?	Justification/Explanation
B	Grid	CO_2	Yes	Main emission source

Source		Gas	Included?	Justification/Explanation
	connected electricity generation	CH_4	No	Minor emission source
		N_2O	No	Minor emission source
		Other	No	No CO_2 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 ($EF_{grid, CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source (where available) and made publically available. The CEA database version 12 is the latest available data at the time of PD submission to DOE for validation, hence same is considered for emission factor calculations.

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

Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	0.9462 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 12.0, May 2017 published by Central Electricity Authority (CEA), Government of India

$EF_{grid,OM,y}$	0.9843 tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system in year y	Calculated as the last 3 year (2013-14, 2014-15, 2015-16) generation-weighted average, sourced from Baseline CO_2 Emission Database, Version 12.0, May 2017 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,BM,y}$	0.9083 tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system in year y	Baseline CO_2 Emission Database, Version 12.0, May 2017 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. 10 EB 83 Annex 14), 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 MW Hydro Project:

According to the "Tool for demonstration and assessment of Additionality (EB 70, Annex 8)[5]", 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 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 5, EB 92[6] -

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 5 EB 92.

Benchmark Calculation for 3 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 92 Annex 5, "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

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

[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v7.0.pdf

provided in Appendix of EB 92 Annex 12[7]. The benchmark thus selected complies as per the relevant guidelines on Investment Analysis.

Further as per guidance 17 of EB 92 Annex 5, "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 years8, as per the inflation forecast rate provided by Reserve Bank of India.

Benchmark Calculation

The benchmark has been considered in accordance with Guidance 16 of EB 92 Annex 5, "The values in the table in Appendix A may also be used, as a simple default option".

As suggested in Appendix A in EB 92 Annex 5, default value benchmark is presented below:

Appendix A in EB 92 Annex 5 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = 11.06%

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 92, Annex 5 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 5, EB 92[9] 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 92, Annex 5, 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[10] = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where,

[7] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v7.0.pdf

[8] 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.

[9] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v7.0.pdf

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

Real Benchmark = Default Value, i.e., 11.06% (as per Appendix of Annex 5, EB 92)
Inflation rate = Projected Inflation Rate for India

Benchmark estimation:

Appendix in EB 92, Annex 5 specifies default value of expected return on equity in real terms for Energy Industries (Group 1) in India = **11.06%**

Inflation Forecast for India as per RBI website[11]:

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 10 Years**	**Benchmark 10 Years**
Darjeeling Power Pvt. Ltd.	5.40%	17.06%

Thus benchmark of **17.06%** 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.

Input Values for the equity IRR Calculations are as follows:

Details of the project		**Source**
State where the project is situated	Himachal Pradesh	
No. of machines	1	As per DPR
Capacity /machine (MW)	3.00	As per DPR
Total Capacity (MW)	3.00	Calculated Value
Expected Date of Commissioning	15-Feb-16	Assumption
Life of the plant (Yrs.)	30	As per DPR
Generation of electricity		
PLF (%) for first 12 years	71.71%	DPR pg 94
PLF (%) for last 18 years	63.11%	DPR pg 94
Annual generation (kWh)	18,845,388	Calculated Value
Transmission Losses	8.00%	As per DPR
Tariff rate at the decision making (INR/kWh)	3.00	as per HPERC Tariff Order[12]
Water Royalty to be paid to Govt. after 12 years	12.00%	As per DPR

[11] https://rbi.org.in/Scripts/PublicationsView.aspx?id=13050

[12] http://hperc.org/File/appenB6-7.pdf

Transmission & Wheeling Losses (%)	8.00%	As per DPR pg 286
Operation and maintenance cost and Insurance		
O & M Expenses (INR Mn.)	9.59	As per DPR
O & M free for (Yr.)	-	As per DPR
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.)	2.79	CERC Order March 2012[13]
Financial parameters		
TOTAL COST (INR Mn.)	279.40	As Per DPR
Loan Amount (INR Mn.)	195.58	As per DPR
Equity Investment (INR Mn.)	83.82	Calculated Value
Term loan		
Loan Amount (INR Mn.)	195.58	As per DPR pg 285
Interest rate (%)	11.50%	As per DPR pg 285
Loan Tenure (Qtr.)	48	As per DPR pg 285
Repayment Period (Qtr.)	48	Calculated Value
Repayment instalments value (INR Mn.)	4.075	Calculated Value
1st instalment from (Qtr. end)	30-Jun-16	Considered from the next Quarter End
Book Depreciation (SLM Method)		
Gross Depreciable Value (INR Mn.)	279.40	Calculated Value
Salvage Value (%)	10.00%	Page 15 of CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2012[14]
Salvage value (INR Mn.)	27.94	Calculated Value
Net Depreciable Value (INR Mn.)	251.46	Calculated Value
Residual Value (INR Mn.)	27.94	Calculated Value
IT Depreciation		
IT Depreciation (WDV Method) (%)	12.73%	As per companies act 2013
Income Tax		
Financial Year	**FY 2010-11**	
Income tax rate (%)	30.00%	As Per Income Tax Rule, Pg 30 Para E(I)[15]

[13] http://www.cercind.gov.in/2012/orders/RE_35_2012.pdf
[14] http://www.cercind.gov.in/2012/regulation/CERC_RE-Tariff-Regualtions_6_2_2012.pdf
[15] http://indiabudget.nic.in/ub2011-12/fb/bill1.pdf

MAT (%)	18.50%	As Per IT rule Pg 4[16]
Service Tax (%)	14.00%	As Per Income Tax Rule
Surcharge (%)	10.00%	As Per Income Tax Rule, Pg 30
Education cess (%)	3.00%	As Per Income Tax Rule, Pg 5, 11 and 12
Final Tax rates		
Income tax rate (%)	33.99%	Calculated Value
MAT (%)	20.96%	Calculated Value
Service Tax (%)	14.42%	Calculated Value

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.

Based on result of IRR excel spreadsheets, equity IRR is less than Benchmark.

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 EB 92, Annex 5, 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:

	Equity IRR without CDM		Benchmark (Equity IRR)	
Final Results	8.07%		17.06%	
Sensitivity Analysis	**Equity IRR**			
Variation %	**-10%**	**Normal**	**10%**	**Breaching Value**
PLF	4.43%	8.07%	11.30%	25.85%
O&M	8.92%	8.07%	6.74%	-98.46%
Project Cost	10.45%	8.07%	5.86%	-26.74%
Tariff Rate	4.43%	8.07%	11.30%	25.85%

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

[16] http://indiabudget.nic.in/ub2012-13/mem/mem1.pdf

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 EB 48 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

There is no methodology deviation.

3 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

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:

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

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)

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (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 06 is calculated as below.

CO_2 Baseline Database for the Indian Power Sector, Version 12, May 2017[17] 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 06.0, EB 97, Annex 7), 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	Andhra

[17] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver12.pdf

			Pradesh	Pradesh
Delhi	Jharkhand	Gujarat	Assam	Karnataka
Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadar& Nagar Haveli	Meghalaya	Tamil Nadu
Jammu & Kashmir	Sikkim	Madhya Pradesh	Mizoram	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)

	2011-12	2012-13	2013-14	2014-15	2015-16
India	19.6%	16.9%	18.6%	16.8%	15.1%

Data Source: Central Electricity Authority (CEA) database Version 12, May'2017[18]

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

[18] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver12.pdf

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)			
	2013-14	2014-15	2015-16
INDIAN Grid	7,21,632	8,08,417	8,71,740

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2013-14	2014-15	2015-16
INDIAN Grid	1.00	0.99	0.96

Weighted Generation Operating Margin	
INDIAN Grid	**0.9843**

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 06.0, EB 97, Annex 7) 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)	
	2015-16
INDIAN Grid	**0.9083**

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 06.0, EB 97, Annex 7) para 82:

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

(a) Weighted average CM; or

(b) Simplified CM.

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:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (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, $EF_{grid,CM,y}$ = 0.9083*0.50 + 0.9843*0.50
= 0.9462 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, $EF_y = EF_{grid,CM,y} = 0.9462$ t CO_2/MWh.

$BE_y = 17,337 \times 0.9462 = 16,404$ tCO_2 e

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:

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

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

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

$CO_{EFi,y}$ = 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 $CO_{EFi,y}$

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

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

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

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

$EF_{CO2,i,y}$ = 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 on National 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.

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)
Year 1	16,404	0	0	16,404
Year 2	16,404	0	0	16,404
Year 3	16,404	0	0	16,404
Year 4	16,404	0	0	16,404
Year 5	16,404	0	0	16,404
Year 6	16,404	0	0	16,404
Year 7	16,404	0	0	16,404

Year 8	16,404	0	0	16,404
Year 9	16,404	0	0	16,404
Year 10	16,404	0	0	16,404
Total	164,040	0	0	164,040

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 12, May 2017[19]
Value applied	0.9843
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 06" as 3-year generation weighted average using data for the years 2013-14, 2014-15 & 2015-16. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 12, 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 12, May 2017[19]
Value applied	0.9083
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 06" as per the latest data available for the most recent year 2015-16. The data is obtained from "CO_2 Baseline Database for Indian Power Sector" version 12, 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	$EF_{grid,CM,y}$

[19] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver12.pdf

Data unit	tCO_2/MWh
Description	Combined Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 12, May 2017[19]
Value applied	0.9462
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%
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/m^3, 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	$EG_{PJ,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project (3 MW Hydro) plant/unit to the grid in year y
Source of data	Joint Meter Reading reports from state electricity board
Description of measurement methods and procedures applied	The value of net electricity generation supplied to the grid as per Monthly Joint Meter Reading report forms the basis for calculation of the emission reductions; which can be cross checked from the invoice raised to DISCOM. Net electricity supplied to grid will be calculated as the difference of the measured values of "export", "import" and transmission losses of electricity through the dedicated SEB energy meter installed at the interconnection point at Nathpa Substation. $EG_{PJ,y} = EG_{export} – EG_{import} - EG_{trans}$[20] Monthly meter readings are taken from the main and check meter installed at metering point and certified by the representatives of SEB Officials and the representatives of the project proponent for apportioning procedure refer section 4.3

[20] It is to be noted here that due to change in interconnection point of project activity with the substation, transmission losses are being accounted every month from July 2016 onwards. The value obtained as a difference between export, import and transmission losses is being used for billing purpose and for calculating the baseline emission reduction resulting from the project activity.

Frequency of monitoring/recording	Continuous monitoring, hourly measurement and at least monthly recording
Value applied:	17,337 MWh
Monitoring equipment	Monitoring: Bidirectional Tri vector meter will be used Data type: Measured Type of meter: Static type meter (Main & Check). Both are Bidirectional meters. Class of meter: 0.2s. For Calibration details please refer Annex- 2.
QA/QC procedures applied	The calibration of all the meters will be undertaken at required intervals (once is five years as per CEA notification[21]) and faulty meters will be duly replaced immediately. The meters will be of accuracy class 0.2. The meter accuracy class and calibration interval is under purview of state electricity board and PP do not have any control on it. It is also noted that apportioning procedure (if applicable) is under control of state electricity board and PP do not have any control on it. The Net electricity exported to the grid will be cross checked against the invoice raised by the PP towards the DISCOM.
Purpose of data	Calculation of Baseline emissions
Calculation method	-
Comments	The data would be archived electronically and maintained for the entire crediting period plus two years.

Data / Parameter	QC_{Diesel}
Data unit	Litres
Description	Volume of Diesel Consumed per annumn
Source of data	Plant records for monitoring diesel consumption by the DG set
Description of measurement methods and procedures to be applied	Monitoring: The diesel consumed shall be monitored as and when consumed on the basis of level measuring scale. Data type: Measured Archiving procedure: Paper and Electronic Recording Frequency: Daily Responsibility: Plant manager would be responsible for regular inspection of the records & shift in charge is responsible for recording the diesel consumed.
Frequency of monitoring/recording	Continuous monitoring, hourly measurement and monthly recording
Value monitored	-
Monitoring equipment	Monitoring: The diesel consumed shall be monitored as

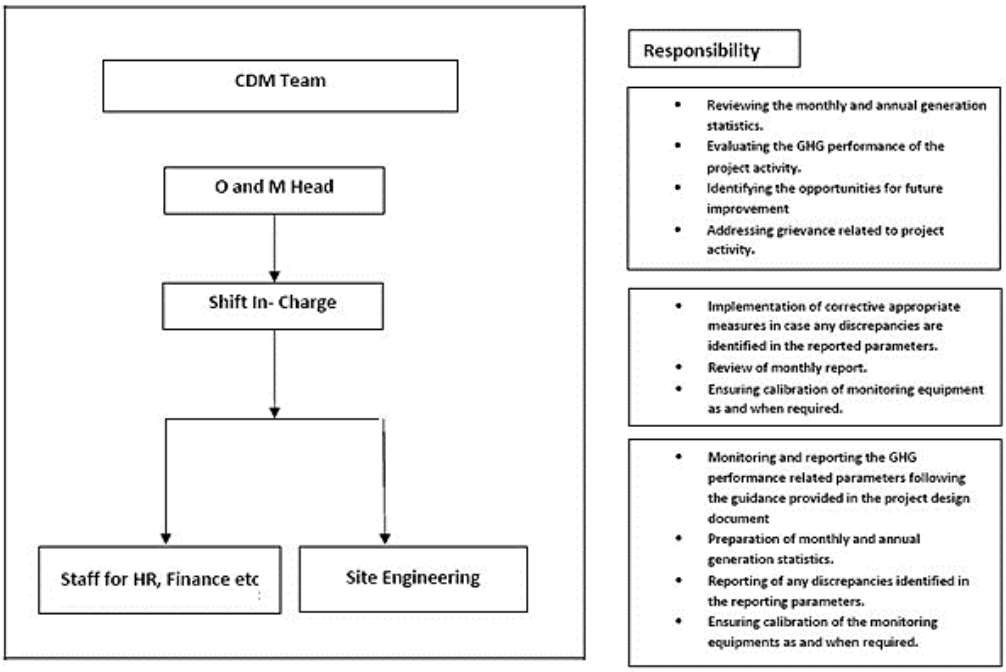
[21] http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf, page 12

	and when consumed on the basis of level measuring scale.
QA/QC procedures to be applied	The recorded diesel consumption figures will be crosschecked with the purchase receipt.
Purpose of the data	Calculation of Project emissions
Calculation method	-
Comments	The data will be kept for two years after the end of the crediting period

4.3 Monitoring Plan

The monitoring plan is developed in accordance with the modalities and procedures for CDM project activities and is proposed for grid-connected hydro power project. The monitoring plan, which will be implemented by the project participant describes about the monitoring organisation, parameters to be monitored, monitoring practices, quality assurance, quality control procedures, data storage and archiving.

The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the project participant. PP proposed the following structure for data monitoring, collection, data archiving and calibration of equipments for this project activity. The team comprises of the following members:



Data Measurement

The export and import energy will be measured continuously using above mentioned Main and Check meters located at the project site. Readings of meters shall be taken on monthly basis by authorized officer of SEB in the presence of PP or representative of PP. Based on the Meter Reading Statement, invoices will be raised. These invoices can be used for cross checking the meter readings taken for the respective project activity.

Data collection and archiving

Readings from meters will be collected in the presence of the plant in-charge. Export and Import data would be recorded and stored in logs as well as in electronic form on a daily basis. The records are checked periodically by the Plant Manager and discussed thoroughly with the plant supervisor. The period of storage of the monitored data will be 2 years after the end of crediting period or till the last issuance of VERs for the project activity whichever occurs later.

Emergency preparedness

The project activity will not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

Personnel training

In order to ensure a proper functioning of the project activity and a properly monitoring of emission reductions, the staff will be trained. The plant helpers will be trained in equipment operation, data recording, reports writing, operation and maintenance and emergency procedures in compliance with the monitoring plan.

5 SAFEGUARDS

5.1 No Net Harm

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[22] small hydro project of less than 25 MW falls under White Category and are practically non-polluting.

Also following safety and structural features are incorporated to combat any adverse impact on ecology of the project area:

1. The placement of raised crested diversion weir across the river, has been done with due considerations to the effect on fish present in water. The weir is located at an altitude of +/- 1100 m above main sea level where the climate remains pleasant throughout the year. Critically important to the survival of fish population are water quality, water temperature and mobility. Catchment area upstream of the diversion weir is sparsely populated with plenty of vegetation. As such quality of water remains good throughout the year to facilitate fish population.

   Some species of migratory fish normally ascend the tributaries of Bapsa river during the spawning season. However, in Bapsa river, no large size fishes are reported to be available. Water in the river flows in a shallow depth and thus remains sufficiently warm to keep the existing fish species surviving. Cold water fish species such as trout is not present in water.

   The most common method for allowing fish to pass by an artificial obstruction such as the raised crested diversion weir as in the case of 3 MW Hydro project is the fish ladder. The design of Fish

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

passage of 3 MW H.E. Project, Himachal Pradesh has been carried out largely in-line with the recommendations contained in "Design of Small Dams, United States Department of the Interior, Bureau of Reclamation". Examples of the type of fish ladder provided for 3 MW Hydro project have been depicted in a technical paper titled "Atlantic States Marine Fisheries Commission Fish Passage Working Group Upstream Fish Passage Technologies for Managed Species" published in September 2010.

2. Implementation of 3 MW Hydro project was taken-up under the guidelines laid down by HPJVNL – the appointed Nodal Agency of the Govt. of Himachal Pradesh. Himachal Pradesh is having a large number of small hydropower projects had been implemented as per the guidelines laid down by its State Nodal Agency HIMURJA. Thus, taking cue from HIMURJA, the Nodal Agency of Himachal Pradesh namely HPJVNL had laid down similar guidelines for implementation of small hydro schemes by the Private Developers.

   As per the guidelines, it was mandatory to release Sacrificial Discharge, which would be Greater of 10% of Discharge which is available for 130 days in a 50% dependable year or 0.3 m3/sec whichever is greater. Accordingly, for 3 MW Hydro project, sacrificial discharge of 1.761 m3/sec, which is equal to 10% of the discharge available or 130 days in a 50% dependable year is being continuously released from the diversion weir. This discharge is being released perennially through a V-notch provided within the body of the weir. The V-notch abuts the left side wall of the gate pier and feeds the fish ladder and thus serves the twin purpose of releasing the desired minimum flow as well as providing the passage for movement of fish.

3. Design head being 54.5 m, although silt particles greater than 0.5 mm size could have been permitted to remain in the diverted water without causing appreciable early removal of metal from the turbine runners, a surface type de-silting tank has been provided to remove silt particles down to 0.2 mm size. The de-silting tank has been provided immediately downstream of the intake gates. The Dufour type de-silting tank comprises of twin basins placed parallel to each other and silt flushing pipes release the accumulated silt particles about 150 m downstream of the weir. The removal of silt particles, which leads to flushing of the de-silting tank; is accomplished through opening of the silt flushing gates provided on the silt flushing pipes. In addition to the above, a silt flushing valve placed centrally in the left side wall of the de-silting tank has been provided. This valve is opened occasionally to remove the excessive silt load during monsoon months.

   The river bed where silt flushing discharge is released comprises of rocky and bouldery strata, which does not get uprooted due to the action of silt laden flushing discharge which is released at a high velocity.

   As stated earlier, silt trapping and flushing operations are required to be carried out only during the monsoon months when discharge in the river is quite high. During this period, river discharge often exceeds the discharge which is required to be passed through the intake gates. Since the small reservoir created upstream of the diversion weir always remains filled upto the brim, the high incoming discharge in the river overtops the weir and flows further downstream. The silt particles released from the silt flushing pipes are thus carried away further downstream by the river discharge overtopping the weir.

   Bapsa river is a tributary of the mighty river Satluj. The entire range of the river between the diversion weir site and confluence point with River Satluj thus remains largely unaffected because of the silt flushing operations carried out in the de-silting tank 3 MW Shaung H.E. Project.

   Water in River Bapsa remains largely clean for almost 9 months of the year (except the three monsoon months). Silt flushing gates of the two silt flushing pipes as well as the centrally placed

silt flushing valve therefore, remain "shut" for almost 9 months. However, to keep the system in a healthy operating condition, these gates and the silt flushing valve are opened for about 15-20 minutes once every month even during the non-monsoon period when there is no silt in the water.

5.2 Environmental Impact

The project activity has no significant impact on the environment. The project being a small scale 3 MW hydro power project and hence EIA is not required.

Further this can be evident from the Schedule I of the EIA notification S.O.1533 (E) dated 14th September 2006[23] , hydro power project of less than 50 MW are exempted from obtaining prior environmental clearance and thus an EIA is not required.

5.3 Local Stakeholder Consultation

The Local Stakeholder Meetings were organized for local stakeholder consultation and informed local stakeholder regarding the meeting. The followings are the local stakeholders for the project activity:

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

All the stakeholders have been invited through public notice to attend the stakeholders meeting.

The details of the Stakeholder Meetings are as follows:
Date of invitation – 1/02/2011
Date of Meeting – 08/02/2011
Location of Meeting - Project site, Shaung, Himachal Pradesh

In the introductory speech, the representative of Darjeeling Power Pvt. Ltd (Project Investor), Mr. Shyam Sundar welcomed the gathering and given a brief about the climate mitigation project activity. Subsequent to the introductory speech, stakeholders were explained about the electricity generation from hydro project is an environmental friendly power generation technology contributing to reduction in GHG emissions. They were also explained about the benefits of the hydro power projects like, increasing energy availability and improving quality of power and its assistance to the local population by providing employment opportunities to both skilled & unskilled labours.

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 & economical 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.

Most of the questions are related to employment opportunities, economic development, free electricity supply, benefits from project to villagers and other development activities. The question raised by the villagers are summarised below:

Q: Does the project provides employment opportunities or improve economic development of the area?

[23] http://envfor.nic.in/legis/eia/so1533.pdf

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 plant 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 shall be sold to State Electricity Board under a formal PPA 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 Stakeholder	Ram Pravesh Singh
Occupation	Shopkeeper
1. **Question:** This project will cause harm? **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 Stakeholder	Manohar Rathor
Occupation	Student
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 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 Stakeholder	Vishnu Singh
Occupation	Villager

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 Stakeholder	Mehbob Khan
Occupation	Villager
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 of power. 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 30 January 2018- 1 March 2018 and no comments were received during that period[24].

[24] http://vcsprojectdatabase.org/#/pipeline_details/PL1739

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 (Hydro) plant/unit to the grid in year y
Value applied:	25,777
Comments	The data would be archived electronically and maintained for the entire crediting period plus two years.

Data / Parameter	QC_{Diesel}
Data unit	Litres
Description	Volume of Diesel Consumed per annumn
Value applied:	1,445
Comments	The data would be archived electronically and maintained for the entire crediting period plus two years

6.2 Baseline Emissions

As per the approved methodology AMS I.D version 18 baseline emissions for the project activity are calculated by multiplying the net quantity of electricity supplied by this project activity ($EG_{PJ, y}$) with the CO_2 baseline emission factor for the electricity displaced due to the project ($EF_{grid,CM,y}$) as follows:

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

Where,

$EF_{grid,CM,y}$	=	Baseline emission factor
	=	0.9462 tCO_2e/MWh
$EG_{PJ,y}$	=	Net electricity supplied to the NEWNE regional grid (MWh)
	=	25,777 MWh
BEy	=	25,777 * 0.9462
	=	24,390 tCO_2e

6.3 Project Emissions

The project activity is a hydro power project.

Project emissions would cover all the emissions which will result from operation of the project. The only source of emissions from the project activity is the DG set at the plant and the associated emissions due to operation of the same have been calculated in the following manner

$PE_y = EF_{Diesel} * QC_{diesel}$

Where:

PE_y = Project Emissions (tCO_2e)

EF_{Diesel} = Emission Factor of Diesel (tCO_2e/litre)

QC_{Diesel} = Quantity of diesel consumed (litres)

Substituting the values,

EF_{Diesel} = 0.00269 tCO_2/liter (Please refer ER sheet for this factor)

QC_{Diesel} = 1,445 liters

PE_y = 1,445 X 0.00269 = 4 tCO_2e (nearest integer value)

6.4 Leakage

No Project Emissions are considered from the project activity as per approved methodology AMS-I.D. - Version 18.

6.5 Net GHG Emission Reductions and Removals

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)
Year 2016	10,199	2	0	10,197
Year 2017	14,191	2	0	14,189
Total	24,390	4	0	24,386

It is to be noted here that as per the ER estimated for the current monitoring period, the emission reductions was estimated to be 28,179 tCO_2e, whereas actual emission reductions achieved are 24,386 tCO_2e, which is approximately 13% lower than the estimated emission reductions. The generation of electricity depends upon the water availability, which is influenced by natural phenomena of melting of snows and rainfall and not within the control of the project participant. The lower generation during the current verification period was hence due to lower availability of water during the same period.

ANNEXURE 1: BREAKDOWN DETAILS FOR THE CURRENT MONITORING PERIOD

Month	Date	Equipment	Reason	Duration of Time
Apr-16	20.04.2016	66 Kv line	Line break	3:30
	21.04.2016		Shutdown taken by Brua	1:20
	23.04.2016	Numerical Relay	Relay Setting work by Flovel	1:00
	24.04.2016		Shutdown taken by Flovel Team	1:00
	25.04.2016		Grid Failure from Nathpa	1:43
	27.04.2016		Shutdown taken by Flovel Team	1:40
	28.04.2016		Grid Failure from Nathpa	1:20
	29.04.2016	Nozzle 1	Nozzle Struck	1:00
May-16	01.05.2016		Grid Failure from Nathpa	4:27
	03.05.2016		Grid Failure from Nathpa	1:30
	04.05.2016		Grid Failure from Nathpa	1:55
	07.05.2016		Shutdown taken by Flovel Team	1:20
	08.05.2016		Grid Failure from Nathpa	1:00
	09.05.2016		Shutdown taken by HPPTCL	3:40
	10.05.2016		Grid Failure from Nathpa	2:45
	13.05.2016		Grid Failure from Nathpa	8:50
	14.05.2016		Grid Failure from Nathpa	24:00:00
	15.05.2016		Grid Failure from Nathpa	14:10
			MIV not open at PPV	1:20
			Grid Failure from Nathpa	8:30
	20.05.2016		Grid Failure from Nathpa	12:00
	21.05.2016		Shutdown taken by Flovel Team	2:00
	22.05.2016		Grid Failure from Nathpa	4:27
	23.05.2016		Grid Failure from Nathpa	1:30
			High Grid voltage	1:55
	24.05.2016		High Grid voltage	1:20
	27.5.2016		Grid Failure from Nathpa	1:00
	30.05.2016		Grid Failure from Nathpa	3:40
	31.05.2016		Grid Failure from Nathpa	4:30
Jun-16	01.06.2016		Grid Failure from Nathpa	1:05
		MIV	MIV Creep failure fault	1:30
	13.06.2016		Grid Failure from Nathpa	4:30
	14.06.2016		Grid Failure from Nathpa	3:35
			Grid Failure from Nathpa	7:55
	15.06.2016		Grid Failure from Nathpa	4:10

	17.06.2016		Grid Failure from Nathpa	19:00
	18.06.2016		Grid Failure from Nathpa	12:30
	21.06.2016		Grid Failure from Nathpa	1:50
	23.06.2016		Grid Failure from Nathpa	9:35
	24.06.2016		Grid Failure from Nathpa	6:20
	27.06.2016		Grid Failure from Nathpa	1:20
Jul-16	03.07.2016		Grid Failure from Nathpa	2:40
	04.07.2016		Grid Failure from Nathpa	10:55
	08.07.2016		Grid Failure from Nathpa	2:00
			Grid Failure from Nathpa	13:00
	09.07.2016		Grid Failure from Nathpa	2:55
	18.07.2016		Grid Failure from Nathpa	2:45
	29.07.2016		Grid Failure from Nathpa	1:00
	30.07.2016		Grid Failure from Nathpa	1:20
Aug-16	03.08.2016		Grid Failure from Nathpa	1:10
	04.08.2016		Grid Failure from Nathpa	2:30
	05.08.2016		Efficiency testing work	1:10
			Grid Failure from Nathpa	9:40
	06.08.2016		Efficiency testing work	2:00
			Grid Failure from Nathpa	8:55
	07.08.2016		Grid Failure from Nathpa	2:00
	13.08.2016		Grid Failure from Nathpa	1:00
	14.08.2016		Grid Failure from Nathpa	3:00
	15.08.2016		Grid Failure from Nathpa	1:00
	19.08.2016		Grid Failure from Nathpa	11:20
	20.08.2016		Grid Failure from Nathpa	7:20
	21.08.2016		Grid Failure from Nathpa	4:10
	27.08.2016		Grid Failure from Nathpa	3:40
			Shutdown taken by Flovel Team	7:00
Sep-16	06.09.2016		Grid Failure from Nathpa	14:00
	07.09.2016		Grid Failure from Nathpa	9:50
Oct-16	1.10.2016		TVM meter changing work	1:00
	21.10.2016		Grid Failure from Nathpa	6:50
	30.10.2016		Grid Failure from Nathpa	1:00
Nov-16	16.11.2016		Grid Failure from Nathpa	4:35
Dec-16	01.12.2016		Grid Failure from Nathpa	5:10
	18.12.2016		Shutdown taken by HPPTCL	7:20
	19.12.2016		Shutdown taken by HPPTCL	9:25
	20.12.2016		Shutdown taken by HPPTCL	6:30
	21.12.2016		Shutdown taken by HPPTCL	5:45
Jan-17	09.01.2017		Due to less flow of water	10:35

	10.01.2017		Due to less flow of water	12:10
	11.01.2017		Due to less flow of water	7:20
	12.01.2017		Due to less flow of water	4:00
	16.01.2017		Due to less flow of water	5:00
	20.01.2017		Shutdown taken by HPPTCL	9:05
	21.01.20017		Shutdown taken by HPPTCL	10:40
	25.01.2017		Grid Failure from Nathpa	6:00
	26.01.2017		Grid Failure from Nathpa	1:40
	05.02.2017		Grid Failure from Nathpa	1:30
			High Grid voltage	2:10
	07.02.2017	SF6 Breaker	Low pressure of Gas	2:20
		Governor	Governor problem	2:50
Feb-17	11.02.2017		Grid Failure from Nathpa	19:45
	12.02.2017		Grid Failure from Nathpa	24:00:00
	13.02.2017		Grid Failure from Nathpa	15:00
	14.02.2017		Shutdown taken by HPPTCL	9:20
	27.02.2017		Grid Failure from Nathpa	5:00
	04.03.2017	Nozzle 2	Nozzle 2 Repalcement work	20:30
	05.03.2017	Nozzle 2	Nozzle 2 Repalcement work	10:00
Mar-17	08.03.2017		Grid Failure from Nathpa	6:00
	29.03.2017		High Grid voltage	1:00
			High Grid voltage	1:50
	05.04.2017		Grid Failure from Nathpa	2:45
			High Grid voltage	6:55
	06.04.2017		Grid Failure from Nathpa	14:00
			High Grid voltage	4:35
	07.04.2017		Grid Failure from Nathpa	24:00:00
	08.04.2017		Grid Failure from Nathpa	6:00
Apr-17	11.04.2017		Grid Failure from Nathpa	2:40
	13.04.2017		Grid Failure from Nathpa	3:15
	15.04.2017		High Grid voltage	5:20
	19.04.2017		Grid Failure from Nathpa	1:05
		Excitation panel	Excitation panel fault	1:00
	22.04.2017		Grid Failure from Nathpa	1:25
			High Grid voltage	1:15
	23.04.2017		High Grid voltage	3:45
	17.05.2017		Shutdown taken by HPPTCL	9:20
	18.05.2017		Shutdown taken by HPPTCL	12:05
May-17	23.05.2017		Shutdown taken by HPPTCL	6:00
	25.05.2017		Shutdown taken by HPPTCL	2:06
	26.05.2017		Grid failure from boktoo	1:10

	27.05.2017		Shutdown taken by HPPTCL	12:10
	28.05.2017		Shutdown taken by HPPTCL	21:50
	29.05.2017		Shutdown taken by HPPTCL	12:20
Jun-17	06.06.2017		Grid failure from boktoo	4:40
	07.06.2017		Grid failure from boktoo	2:00
	10.06.2017		Grid failure from boktoo	1:00
Jul-17	03.07.2017		Grid failure from boktoo	1:50
	04.07.2017		Shutdown taken by HPPTCL	5:40
	05.07.2017		Shutdown taken by HPPTCL	9:15
	11.07.2017		Shutdown taken by HPPTCL	10:26
	12.07.2017		Shutdown taken by HPPTCL	12:35
	13.07.2017		Shutdown taken by HPPTCL	3:10
	17.07.2017		Grid failure from boktoo	3:28
			Grid failure from boktoo	3:13
	20.07.2017		Grid failure from boktoo	4:40
			Machine fault	3:35
Aug-17	02.08.2017	TVM Meter panel	Shutdown for TVM meter replacement	1:30
			Machine fault	2:00
	09.08.2017		Shutdown taken by HPPTCL	4:30
		NOZZLE 2 TRANSDUCER	Transducer Failure	13:30
	10.08.2017	NOZZLE 2 TRANSDUCER	Transducer Failure	24:00:00
	11.08.2017	NOZZLE 2 TRANSDUCER	Transducer Failure	24:00:00
	12.08.2017	NOZZLE 2 TRANSDUCER	Transducer Failure	17:45
	14.08.2017	Nozzle operation	Manual Mode of both nozzle	8:55
Sep-17	02.09.2017		Grid failure from boktoo	1:45
	09.09.2017		Grid failure from boktoo	1:30
	10.09.2017		Grid failure from boktoo	5:20
	15.09.2017		Shutdown taken by HPPTCL	2:00
	22.09.2017		Grid failure from boktoo	2:50
	23.09.2017		Grid failure from boktoo	1:50
	25.09.2017	Drain valve	Drain valve Damage	22:20
	26.09.2017	Drain valve	Drain valve Damage	24:00:00
	27.09.2017	Drain valve	Drain valve Damage	10:00
Oct-17	16.10.2017		Grid failure from boktoo	1:20
	20.10.2017		Grid failure from boktoo	1:50
	23.10.2017		Grid failure from boktoo	1:30
	25.10.2017		Shutdown taken for Auto Mode	1:15
			Grid failure from boktoo	1:50

	26.10.2017		Grid failure from boktoo	2:40
	27.10.2017		Grid failure from boktoo	1:15
	29.10.2017		Grid failure from boktoo	3:50
	30.10.2017		Grid failure from boktoo	4:15
	31.10.2017		Grid failure from boktoo	1:15
			Grid failure from boktoo	6:40
Nov-17	02.11.2017		Grid failure from boktoo	5:45
	03.11.2017		Grid failure from boktoo	10:45
	04.11.2017		Grid failure from boktoo	6:40
	05.11.2017		Grid failure from boktoo	2:35
	06.11.2017		Grid failure from boktoo	1:00
			High Grid voltage	4:35
	07.11.2017		Grid failure from boktoo	6:45
	08.11.2017		Grid failure from boktoo	2:00
			Grid failure from boktoo	5:15
	09.11.2017		Grid failure from boktoo	1:45
			Grid failure from boktoo	2:15
			Grid failure from boktoo	6:00
	10.11.2017		Grid failure from boktoo	7:25
	11.11.2017		Grid failure from boktoo	5:15
	12.11.2017		Grid failure from boktoo	5:40
	13.11.2017		Grid failure from boktoo	3:45
	14.11.2017		Grid failure from boktoo	6:35
	15.11.2017		Grid failure from boktoo	9:00
	16.11.2017		Grid failure from boktoo	6:00
	17.11.2017		Grid failure from boktoo	6:10
	18.11.2017		Grid failure from boktoo	3:10
	19.11.2017		Grid failure from boktoo	2:20
	20.11.2017		Grid failure from boktoo	2:55
	21.11.2017		Grid failure from boktoo	1:00
	25.11.2017		Grid failure from boktoo	1:40
Dec-17	01.12.2017		Grid failure from boktoo	5:15
	08.12.2017		Grid failure from boktoo	1:10
	11.12.2017		Grid failure from boktoo	4:20
	25.12.2017		Grid failure from boktoo	1:15

ANNEXURE 2: CALIBRATION DETAILS FOR THE CURRENT MONITORING PERIOD

Meter Number and Type	Make and Type	Calibration Dates	Validity
HPU005424 (Main Meter)	Secure, E3M024	22/01/2016	21/01/2021
HPU005425 (Check Meter)		22/01/2016	21/01/2021
HPU005623[25] (Main Meter)[26]		01/08/2017	31/07/2022
HPU005624[27] (Main Meter)		01/08/2017	31/07/2022

[25] Substation Meters

[26] Due to change in interconnection point of project activity with the substation, the metering is being done with above set of main and check meters only.

[27] Substation Meters