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

Document Prepared by EKI Energy Services Limited

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|---|---|
| Project Title | 3 MW Hydro Power Project by Darjeeling Power Pvt. Ltd. |
| Version | 04 |
| Report ID | VVER 1739 |
| Date of Issue | 11-December-2022 |
| Project ID | VCS 1739 |
| Monitoring Period | 02-January-2018 to 28-February-2022 (Inclusive of both days) |
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# CONTENTS

# 1 PROJECT DETAILS

## 1.1 Summary Description of the Implementation Status of the Project

The project activity is a new 3 MW Shaung hydro power plant in the Kinnaur 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 VCS 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 15-April-2016. During the current monitoring period the net electricity generated is 62,040.82 MWh and resulting generation of 58,694 VCU's.

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.

## 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 181, EB 81, and Annex 24)

The project is not a grouped project activity

## 1.3 Project Proponent

| | |
|---|---|
| Organization name | Darjeeling Power Pvt. Ltd. |
| Contact person | Uday Khot |
| Title | Manager |
| Address | Empire House, 3rd Floor, 219 Dr. D.N.Road, Fort, Mumbai-400001, India. |
| Telephone | 9920485027 |
| Email | finance@somani.com, accounts@somani.com |

## 1.4 Other Entities Involved in the Project

| | |
|---|---|
| Organization name | EKI Energy Services Limited |
| Role in the Project | Project Consultant |
| Contact person | Shital Patil |
| Title | Project Manager |
| Address | Office No 201, Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore 452010, India |
| Telephone | +91-7972836470 |
| Email | shital@enkingint.org/ registry@enkingint.org |

1 https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

## 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-April-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 Location

The project activity is located in the state of Himachal Pradesh, India. The site wise location detail 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°26'40" N | 78°12'38" E |

The satellite image of project site is given below.



## 1.8 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, and Annex 242)

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 system3 - Version 06.0 (EB 97, Annex 07)

## 1.9 Participation under other GHG Programs

Not applied for any other GHG programs.

## 1.10 Other Forms of 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 cross checked that PP is not claiming REC benefits, the same can be verified with the REC accreditation body of India

## 1.11 Sustainable Development Contributions

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.

2 https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

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

- 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.

**Table 1: Sustainable Development Contributions**

<table>
<tr><th>Row number</th><th>SDG Target</th><th>SDG Indicator</th><th>Net Impact on SDG Indicator</th><th>Current Project Contributions</th><th>Contributions Over Project Lifetime</th></tr>
<tr><td>1)</td><td>7.2</td><td>7.2.1: Renewable energy share in the total final energy consumption</td><td>Implemented activities to increase</td><td>About 62,040 MWh renewable electricity has supplied to Indian grid during the reported period that helps to increase the renewable energy share in the energy mix.</td><td>Overall, 87,819.82 MWh (25,777.97[4] + 62,040[5]) renewable electricity has supplied to Indian grid throughput the project lifetime that helps to increase the renewable energy share in the energy mix. The electricity supplied as per monitoring period are as follow
<table>
<tr><td>Monitoring period</td><td>Electricity supplied (MW)</td></tr>
<tr><td>15-April-2016 to 01-January-2018</td><td>25,777.97</td></tr>
<tr><td>02-January-2018 to 28-February-2022</td><td>62,042.82</td></tr>
<tr><td>Total</td><td>87,819.82</td></tr>
</table>
</td></tr>
</table>

4 For monitoring period 15-April-2016 to 01-January-2018 (https://registry.verra.org/mymodule/ProjectDoc/Project_ViewFile.asp?FileID=24406&IDKEY=k98klasmf8jflkasf8098afnasfkj98f0a9sfsakjflsakjf8dl33655874)
5 For monitoring period 02-January-2018 to 28-February-2022

<table>
<tr>
<td>2)</td>
<td>13.0</td>
<td>Tonnes of greenhouse gas emissions avoided or removed</td>
<td>Implemented activities to increase</td>
<td>By supplying 62,040 MWh clean electricity (generated through Solar PV) to Indian grid, the project avoided release of 58,694 $tCO_2e$ in to the atmosphere during the reporting period.</td>
<td>Overall prevented the release of 83,080 $tCO_2e$ into the atmosphere since project commissioning. The green house emission per monitoring period are as follows
<table>
<tr><th>Monitoring period</th><th>Net GHG emission reductions ($tCO_2e$)</th></tr>
<tr><td>15-April-2016 to 01-January-2018</td><td>24,386</td></tr>
<tr><td>02-January-2018 to 28-February-2022</td><td>58,694</td></tr>
<tr><td>Total</td><td>83,080</td></tr>
</table>
</td>
</tr>
<tr>
<td>3)</td>
<td>8.6</td>
<td>8.6.1 Proportion of youth (aged 15-24 years) not in education, employment or training</td>
<td>Implemented activities to reduce</td>
<td>The Project organizes 05 trainings for the staff on the monitoring of the plant operation, and the emergency and safety procedures during current monitoring period.</td>
<td>Overall, 05 trainings are provided since project commissioning.</td>
</tr>
</table>

# 2 SAFEGUARDS

## 2.1 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 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.

2. 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.

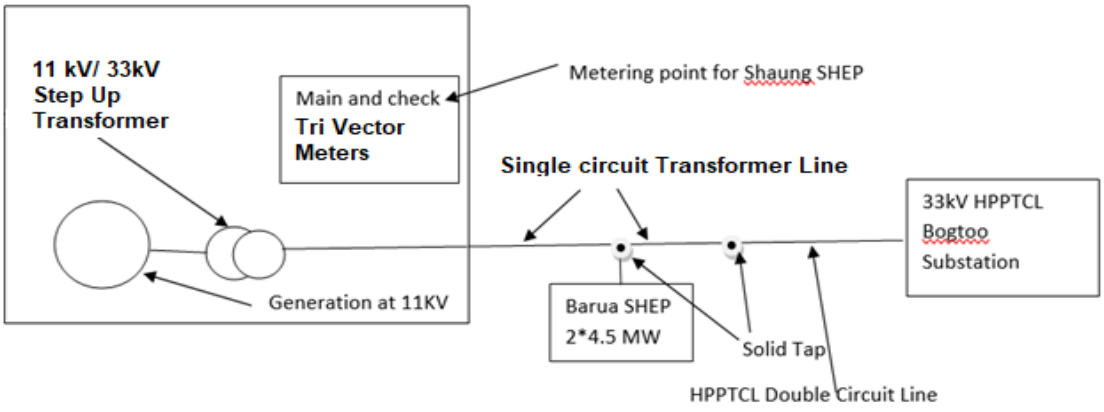
3. The most common method for allowing fish to pass by an artificial obstruction such as the raised crested diversion weir as in the case of 3 MW Hydro project is the fish ladder. The design of Fish passage of 3 MW H.E. Project, Himachal Pradesh has been carried out largely in-line with the recommendations 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.

4. 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.

5. 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 $m^3$/sec whichever is greater. Accordingly, for 3 MW Hydro project, sacrificial discharge of 1.761 $m^3$/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.

6. 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.

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




**HPPTCL - Himachal Pradesh Power Transmission Corporation Limited**
**SHEP - Small Hydro Electric Project**
**KV - Kilovolt**
**MW - Maga Watt**

Figure 1 Single line diagram of project activity

8. 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.

9. 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.

10. 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.

## 2.2 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 – 01-February-2011

Date of Meeting – 08-February-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 environmentally 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 & economic benefits of the

project. He also elaborated about carbon mechanism & its requirement for the current project. After the detailed discussions, the session was open for questions from stakeholders.

Most of the questions are related to employment opportunities, economic development, free electricity supply, benefits from project to villagers and other development activities

The process of local stakeholder consultation is continuous. During the current monitoring period, the project proponent has kept grievance register in plant site office and sought comments/grievances/suggestions from local stakeholders including local community, government agencies and NGOs. Besides, the PP has also kept provision for submitting comments/grievances/suggestions from local stakeholders through direct mail. However, no major comments/grievances/suggestions have been received from the aforementioned stakeholders during the current monitoring period and all such minor suggestions have been taken care by the PP.

## 2.3 AFOLU-Specific Safeguards

Not applicable to this as this is not an AFOLU project activity

# 3 IMPLEMENTATION STATUS

## 3.1 Implementation Status of the Project Activity

The 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 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-February-2009 |
| 2. | Board Decision for implementation of the project activity | 04-February-2009 |
| 3. | NOC from Gram Panchayat | 14-October-2009 |
| 4. | NOC from State Govt. | 26-November-2009 |
| 5. | Land Diversion permission from Himachal PradeshForest Dept. | 24-December-2009 |
| 6. | Service Contract Agreement | 09-March-2011 |
| 7. | Start of Civil Works | 04-October-2011 |
| 8. | Sanction of Credit Facility from Bank of Maharashtra | 27-March-2012 |
| 9. | Operation and Maintenance Contract signed | 14-October-2014 |
| 10. | PPA signed | 20-May-2016 |
| 11. | Commercial Operation of Power House | 15-April-2016 |
| 12. | Provisional Consent order by HPSPCB | 03-August-2016 |

The Project activity is a new facility (Greenfield) and the electricity generated by the Project exported to the Indian Grid. The Project therefore displace an equivalent amount of electricity which otherwise been generated by fossil fuel dominant electricity grid. The Project Proponent plan 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 58,694 $tCO_2e$ per year, thereon displacing 62,040.82 MWh 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 11 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 Bagtoo of Himachal Pradesh State Electricity Board. The metering is provided at the project site which is the point where the power gets exported to the grid, therefore transmission losses 0.90% of units supplied from shaung, SHEP is considered. Distance between power station and sub-station is around 24.5 kms.

**Table 2 Components list of the project activity**

| SR. NO. | PARTICULARS | Value (Number) |
|---|---|---|
| 1. | Horizontal twin jet Pelton Wheel Turbine with all the accessories | 1 |
| 2. | Electro hydraulic Micro Processor basedDigital Governor with all accessories | 1 |
| 3. | Inlet Ball Valve | 1 |
| 4. | Penstock Butterfly Valve withaccessories | 1 |
| 5. | Oil Pressure Pumping System forGovernor and MIV | 1 |
| 6. | Neutral Grounding Panel | 1 |
| 7. | Lightning Arrestor and VoltageTransformer cubicle | 1 |
| 8. | 11 KV Breaker Panel | 1 |
| 9. | Auxiliary Transformer | 1 |
| 10. | Estimated design Life time | 30 years. |

**Table 3 Technical specifications of generator**

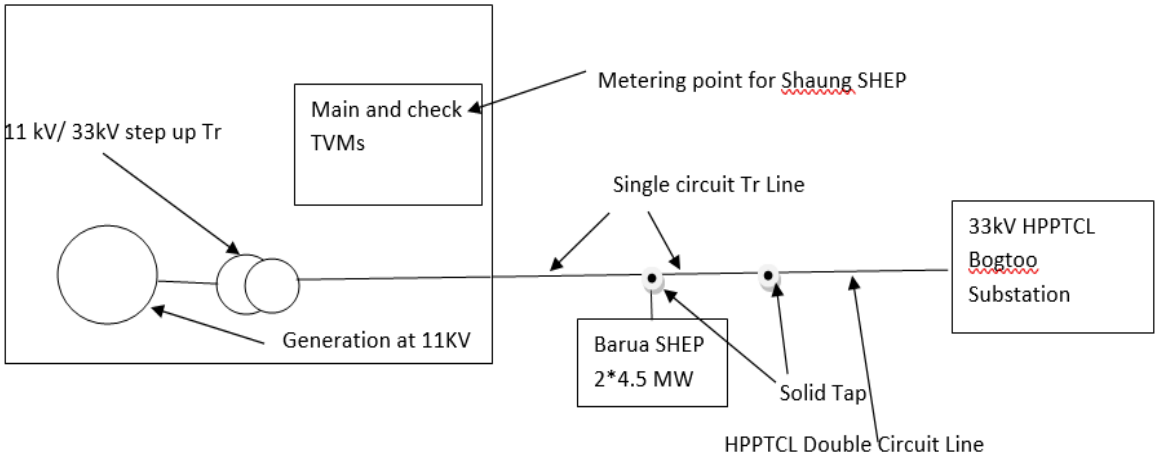
| | |
|---|---|
| Number of Generators | 1 |
| Rated Output | 3000 KW + 25% over load |
| Power Factor | 0.85 |
| Rated Voltage | 3.3 KV +/- 10% |

| | |
|---|---|
| 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 |

**Table 4 Technical specifications of turbines**

| | |
|---|---|
| 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:




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.

## 3.2 Deviations

### 3.2.1 Methodology Deviations

There is no methodology deviation requested during the current verification and also during previous joint validation and verification.

### 3.2.2 Project Description Deviations

Below deviations is taken during the current monitoring period from 02-January-2018 to 28-February-2022 (Inclusive of both days)

1. In section 1.8 Description of the project activity of Joint project description and monitoring report: VCS version 3 dated 05-April-2018 mentioned that 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, but in actual generation voltage of the TDPS generator is 11 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 Bagtoo of Himachal Pradesh State Electricity Board. The metering is provided at the project site which is the point where the power gets exported to the grid, therefore transmission losses 0.90% of units supplied from shaung, SHEP is considered. Thus, deviation is sought for the change in generation voltage and change in sub-station. This is permanent type of deviation. The change doesn't alter the project design, additionality, emission reduction and its calculations.

2. In section 4.3 monitoring plan of Joint project description and monitoring report: VCS version 3 dated 05-April-2018 detail about transmission losses not mentioned, however details regarding transmission losses have been added in section 4.3 of the monitoring report of monitoring period from 02-January-2018 to 28-February-2022 (Inclusive of both days). The change doesn't alter the project design, additionality, emission reduction and its calculations. The nature of deviation is permanent.

3. In section 4.3 monitoring plan of Joint project description and monitoring report: VCS version 3 dated 05-April-2018 details of procedure of Emergency preparedness are not mentioned. However, details procedure to measure energy when both the meters are not working and also measure taken for any breakdown/fault in the plant has been updated in section 4.3 of the monitoring report of monitoring period from 02-January-2018 to 28-February-2022 (Inclusive of both days). The change doesn't alter the project design, additionality, emission reduction and its calculations. The nature of deviation is permanent.

## 3.3 Grouped Projects

The project is not a grouped project activity.

# 4 DATA AND PARAMETERS

## 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 126, May-2017 |

6 https://cea.nic.in/wp-content/uploads/baseline/2020/07/database_12.zip

| | |
|---|---|
| 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 "CO2 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 127, May-2017 |
| 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 3-year generation weighted average using data for the years 2013-14, 2014-15 & 2015-16. The data are obtained from "CO2 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 | $EF_{grid,CM,y}$ |
| Data unit | $tCO_2/MWh$ |
| Description | Combined Margin $CO_2$ emission factor in year y |
| Source of data | Calculated from CEA database, Version 128, May-2017 |
| 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: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$<br>Where: |

7 https://cea.nic.in/wp-content/uploads/baseline/2020/07/database_12.zip

8 https://cea.nic.in/wp-content/uploads/baseline/2020/07/database_12.zip

| | |
|---|---|
| | $EF_{grid,BM,y}$= Build margin $CO_2$ emission factor in year y ($tCO_2/MWh$)<br>$EF_{grid,OM,y}$= Operating margin $CO_2$ emission factor in year y ($tCO_2/MWh$)<br>$W_{OM}$ = Weighting of operating margin emissions factor (%) = 50%<br>$W_{BM}$= 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.<br>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.<br>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.<br>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.<br>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 Baseline 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 to be 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.<br>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 Bagtoo Substation.<br>$EG_{PJ,y} = EG_{export} - EG_{import} - EG_{trans}$<br>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 |
| Frequency of monitoring/recording | Continuous monitoring, hourly measurement and at least monthly recording |
| Value monitored | 62,040.82 |

| | |
|---|---|
| Monitoring equipment | Monitoring: Bidirectional Tri vector meter will be used Data type: Measured<br><br>Type of meter: Static type meter (Main & Check).<br><br>Both are Bidirectional meters. Class of meter: 0.2s.<br><br>For Calibration details please refer Appendix- 1. |
| QA/QC procedures to be applied | The calibration of all the meters will be undertaken at required intervals (once is five years as per CEA notification) and faulty meters will be duly replaced immediately. The meters will be of accuracy class 0.2s. The meter accuracy class and calibration interval are 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.<br><br>The Net electricity exported to the grid will be cross checked against the invoice raised by the PP towards the DISCOM. |
| Purpose of the data | Calculation of Baseline emissions |
| Calculation method | NA |
| 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 annum |
| 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.<br><br>Data type: Measured<br><br>Archiving procedure: Paper and Electronic<br><br>Recording Frequency: Daily<br><br>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 |

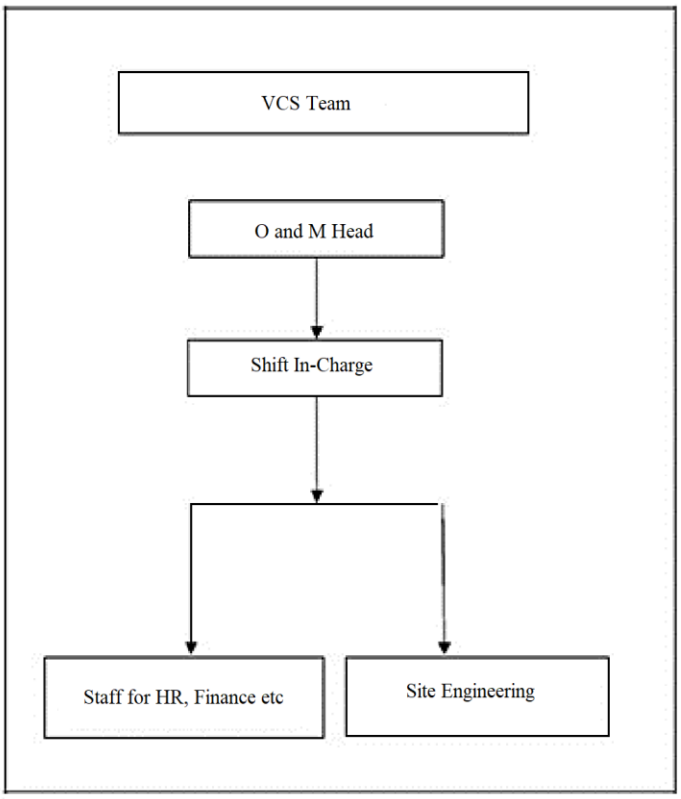
| | |
|---|---|
| Value monitored | 1,449 |
| Monitoring equipment | Monitoring: The diesel consumed shall be monitored as and when consumed on the basis of level measuring scale. |
| QA/QC procedures to be applied | The recorded diesel consumption figures will be crosschecked with the purchase receipt. |
| Purpose of the data | Calculation of Project emissions |
| Calculation method | NA |
| 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 VCS 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 equipment's 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. The metering is provided at the project site, which is the point where the power gets exported to the grid, therefore transmission losses 0.90% of units supplied from shaung, SHEP is considered. 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 VCUs for the project activity whichever occurs later.

### Emergency preparedness

In case Main meter or Check meter is found to be outside the acceptable limits of accuracy or faulty or not functioning properly, it will be repaired, recalibrated or replaced as soon as possible. In the event that the Main meter is not in service as a result of maintenance, repairs or testing, the Check meter will be used for readings.

Further, State utility applied following procedure to measure the consumption of energy when meter was replaced/calibrated.
If both the main and check/backup meters are replaced then the correction applied to the consumption registered by the main meter to arrive at the correct consumption of energy for billing

purposes for the period of two billing months prior to the month in which calibration/replacement has been done and up to the time of calibration/replacement of the meter.

PP don't have the control over the above procedure applied by state utility.

In case of any abrupt breakdown, the fault will be immediately identified by the O& M personnel. All minor faults shall be handled by the O& M personnel, in case of any major faults, the grid personnel will be informed and replacement of the equipment shall be made within 24 hours.

Operation and Maintenance team will be trained for emergency situations also the team is trained to combat safety issues if occur any.

**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 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

## 5.1 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:

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

| Parameter | $EG_{PJ,y}$ | $EF_{grid,CM,y}$ | $BE_y$ |
|---|---|---|---|
| Year | MWh | $tCO_2/MWh$ | $tCO_2$ |
| 02-January-2018 to 31-December-2018 | 15568.73 | 0.9462 | 14.731 |
| 01-January-2019 to 31-December-2019 | 14983.32 | 0.9462 | 14.177 |
| 01-January-2020 to 31-December-2020 | 15009.89 | 0.9462 | 14.202 |
| 01-January-2021 to 31-December-2021 | 15699.42 | 0.9462 | 14,854 |
| 01-January-2022 to 28-February-2022 | 779.46 | 0.9462 | 737 |
| **Total ($tCO_{2e}$)** | | | **58,701** |

## 5.2 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)

| Parameter | $EF_{Diesel}$ | $QC_{diesel}$ | $PE_y$ (Roundup Value) |
|---|---|---|---|
| Year | Litres | $tCO_2$/litre | $tCO_{2e}$ |
| 02-January-2018 to 31-December-2018 | 164 | 0.00269 | 1.00 |
| 01-January-2019 to 31-December-2019 | 873 | 0.00269 | 3.00 |
| 01-January-2020 to 31-December-2020 | 109 | 0.00269 | 1.00 |
| 01-January-2021 to 31-December-2021 | 297 | 0.00269 | 1.00 |
| 01-January-2022 to 28-February-2022 | 6 | 0.00269 | 1.00 |
| **Total ($tCO_{2e}$)** | | | **7** |

## 5.3 Leakage

As per paragraph 42 of the approved methodology AMS- I. D. (Version 18, EB 81, Annex 24), General guidance on leakage in biomass project activities shall be followed to quantify leakages pertaining to the use of biomass residues. As this project activity is Hydro power generation project and not a biomass project hence leakage emissions considered are zero.

## 5.4 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 ($tCO_2e$) |
|---|---|---|---|---|
| 02-January-2018 to 31-December-2018 | 14,731 | 1 | 0 | 14,730 |
| 01-January-2019 to 31-December-2019 | 14,177 | 3 | 0 | 14,174 |
| 01-January-2020 to 31-December-2020 | 14,202 | 1 | 0 | 14,201 |

| | | | | |
|---|---|---|---|---|
| 01-January-2021 to 31-December-2021 | 14,854 | 1 | 0 | 14,853 |
| 01-January-2022 to 28-February-2022. | 737 | 1 | 0 | 736 |
| **Total** | 58,701 | 07 | 0 | 58,694 |

It is to be noted here that as per the ER estimated for the current monitoring period, the emission reductions were estimated to be 68,268 $tCO_2e$, whereas actual emission reductions achieved are 58,694 $tCO_2e$, which is approximately 14.02% lower than the estimated emission reductions. The PLF were considered at the time of validation 71.1 %, whereas actual PLF during current monitoring period is 59.40% for 2018, 57.01% for 2019, 57.12% for 2020 and 59.74% for 2021.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 from November to April months of each year.

# APPENDIX 1: METER CALIBRATION DETAILS

| Meter Number and Type | Make and Type | Calibration Dates | Calibration valid till |
|---|---|---|---|
| HPU05424 (Main Meter) | Secure, E3M024 | 22-January-2016 | 21-January-2021 |
| HPU05425 (Check Meter) | | 22-January-2016 | 21-January-2021 |
| HPU05424 (Main meter) | | 01-February-2017 | 31-January-2022 |
| HPU 05425 (Check meter) | | 01-February-2017 | 31-January-2022 |
| | | **HPU005424 (Main Meter), HPU005425 (Check Meter) replaced with HPU 06383 (Main meter), HPU 06384 (Check meter) on 02-August-2017** | |
| HPU 06383 (Main meter) | | 01-August-2017 | 31-July-2022 |
| HPU 06384 (Check meter) | | 01-August-2017 | 31-July-2022 |
| HPU 06383 (Main meter) | | 18-August-2018 | 17-August-2023 |
| HPU 06384 (Check meter) | | 18-August-2018 | 17-August-2023 |
| HPU 06383 (Main meter) | | 12-August-2019 | 11-August-2024 |
| HPU 06384 (Check meter) | | 12-August-2019 | 11-August-2024 |
| HPU 06383 (Main meter) | | 01-October-2021 | 30-September-2026 |
| HPU 06384 (Check meter) | | 01-October-2021 | 30-September-2026 |
| **Substation meters** | | | |
| HPU005623 (Main Meter) | | 01-August-2017 | 31-July-2022 |
| HPU005624 (Main Meter) | | 01-August-2017 | 31-July-2022 |