3.5 MW SMALL HYDRO PROJECT IN HIMACHAL PRADESH

Document Prepared by EKI Energy Services Limited

Project Title	3.5 MW Small Hydro Project In Himachal Pradesh
Version	02
Report ID	2033
Date of Issue	25-October-2021
Project ID	2033
Monitoring Period	01-November-2019 to 31-August-2021 (Both days included)
Prepared By	Prakash Kumar Sahu
Contact	Senior Manager Operations – GHG Services EKI Energy Services Limited Email ID : prakash@enkingint.org, registry@enkingint.org +91 9589899649 Address: Office no. 201, Plot 48, Scheme 78 part 2 Vijay Nagar, Near Brilliant Convention Centre Indore - 452010 (M.P, India) Website www.enkingint.org

CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

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

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

The details of the project and the state of installation are mentioned in the table:

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

Total net annual electricity generation of the project considering the combined capacity of 3.5 MW has been estimated to be about 16,665.52 MWh. Both the project components included in this bundled project activity are run-of-river hydroelectric projects. These two hydroelectric projects generate gross energy of approximately 18,280 MWh and export net energy of 16,665 MWh to HPSEB per annum considering auxiliary consumption, transformation losses and transmission losses.

The bundled hydro electric project is a green field activity with the objective to generate electricity by using kinetic energy of water which is a renewable source of energy. Electricity generated from 2 MW Gaur HEP is fed in to 33kV Switchyard at Suman sarwari HEP and Siunr HEP via newly constructed 2.7 km long 33 kV overhead transmission line between Sarwari-III and Suman Sarwari switchyard and henceforth taken to the sub-station of Himachal Pradesh State Electricity Board (HPSEB) at Kullu and In case of 1.5 MW Gopal HEP, the electricity generated is sold to HPSEB through connection with 33 /11 kV Grid sub-station atGarola, Himachal Pradesh.

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

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

The total AC capacity of the project activity is 3.5 MW and the power produced displaces an equivalent amount of power from the grid, which is fed mainly by fossil fuel fired power plants. Hence, it results in reduction of GHG emissions. Estimated GHG emission reductions from the project activity is 14,462 tCO_2e and total GHG emission reductions for the chosen 10 year crediting period is 144,622 tonnes of CO_2e.

Total emission reductions achieved in this monitoring period:

During the Current Monitoring Period from 01-November-2019 to 31-August-2021 (First and last date included) the project activity has contributed 19,788 tCO_2e GHG reductions.

1.2 Sectoral Scope and Project Type

The project activity falls under the following Sectoral scope and Project Type:
Sectoral Scope : 01 - Energy industries (renewable / non-renewable sources)
Project Type : I - Renewable Energy Projects
Methodology :AMS-I.D. -Grid Connected renewable electricity generation – Version 18.0.

The project is not a grouped project activity

1.3 Project Proponent

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

Organization name	Gopal Power Pro Pvt. ltd

Contact person	Mr. Yugal Kishore Garg
Title	VP Finance
Address	339, Functional Industrial Estate Patparganj Delhi DL 110092 IN
Telephone	09818055221
Email	yugalkishore.garg@gopalcorp.com

1.4 Other Entities Involved in the Project

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

1.5 Project Start Date

23/02/2018[1] which is the date of commissioning of first phase of the Project.

1.6 Project Crediting Period

Crediting Period Start date: 23-February-2018

Crediting Period End date: 22-February-2028

The project activity adopts renewable crediting period of 10 years period which can be renewed for maximum 2 times.

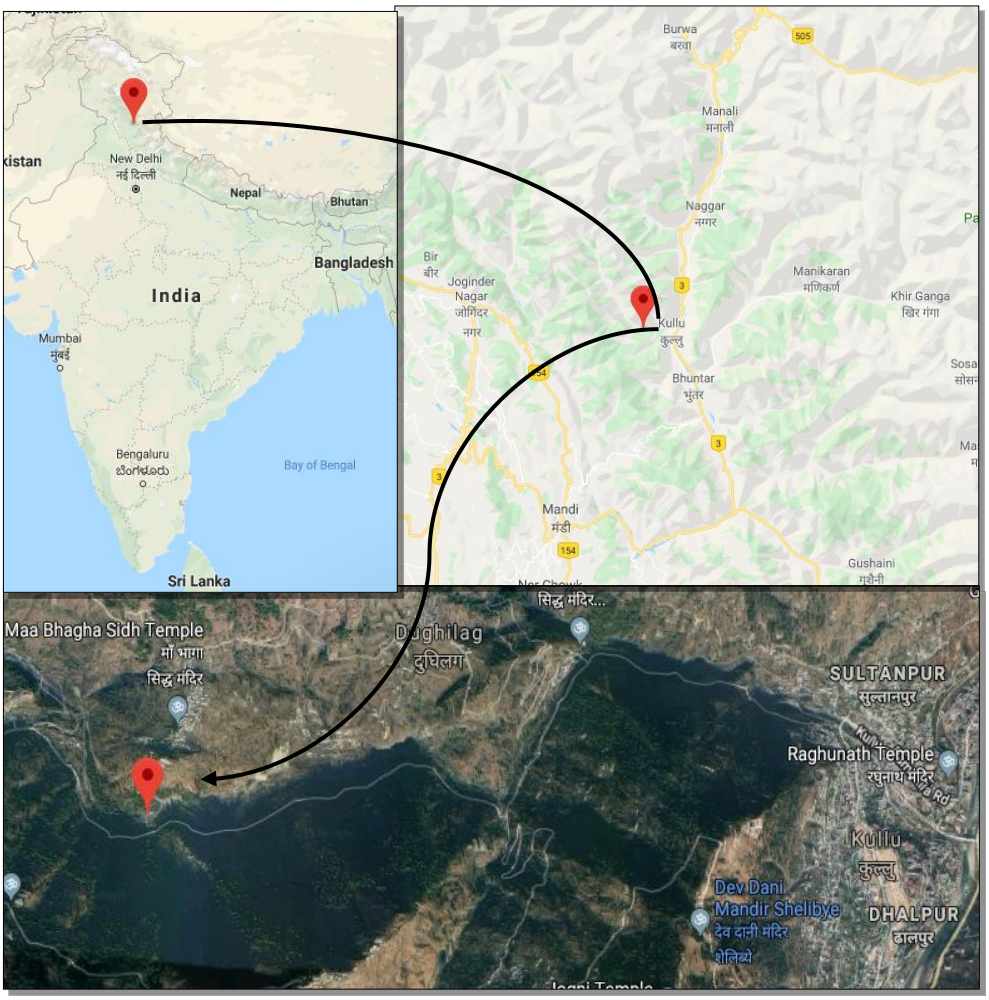
1.7 Project Location

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

S. No.	Name of the Project Proponent	Village	Tehsil	District	State	Latitude	Longitude
1.	Gaur Hydro Pvt Ltd.	Dadka, Sarwari nallah	Kullu	Kullu	Himachal Pradesh	31°57'34.9" N	77°03'55.2" E

[1] As per the commissioning certificate.

2.	Gopal HydroPvt Ltd.	Garola	Bharmour	Chamba	Himachal Pradesh	32°26'17.8"N	76°28'03.9"E



1.8 Title and Reference of Methodology

Title : Grid connected renewable electricity generation

Reference : The project activity meets the eligibility criteria of small scale projectas it is less than 15MW

Methodology : AMS I.D: Grid connected renewable electricity generation (Version 18, EB 81, Annex 24)[2]

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:

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

- Tool to calculate the emission factor for an electricity system - Version 07.0 (EB 100, Annex 04)[3]
- Methodological Tool- Tool for the demonstration and assessment of additionality- Version 07.0.0 (EB 70, Annex 08)[4]

1.9 Participation under other GHG Programs

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

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

1.10 Other Forms of Credit

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

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

1.11 Sustainable Development

Contribution to sustainable development:

Apart from generation of renewable electricity, the project activity would contribute to the sustainable development of the region - socially, environmentally and economically. Ministry of Environment and Forests, has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. The project contributes to sustainable development using the following ways.

- **Social well-being**: The project would help in generating employment opportunities during the construction and operation phases. The project activity leads 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

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

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

also helps to reduce the demand supply gap in the state. The project activity creates local employment generation which helps economic well-being of local people.

- **Technological well-being**: The successful operation of project activity would lead to promotion of solar based power generation and would encourage other entrepreneurs to participate in similar projects. The generation of electricity from the project leads to strengthening of the grid, increasing the energy availability thereby meeting the energy demand to a certain extent leading to technological wellbeing
- **Environmental well-being**: Hydro Electric Project reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. Due to its zero emission the Project activity also helps in avoiding significant amount of GHG emissions.

2 SAFEGUARDS

2.1 No Net Harm

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

The project activity does not cause any harm to the local ecology. It primarily requires the installation of the Hydropower 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

2.2 Local Stakeholder Consultation

As a part of continual improvement process, feedback from the associated stakeholders is vital, therefore a dedicated Visitor register cum grievance register has been placed at the project site which is accessible to stakeholders to provide their feedback on the project. It is appropriate publicly accessible location at which local stakeholders can provide their feedback on the project. This location is also conducive to continuous and regular checks for stakeholder comments. For the global stakeholders, the suggestion and the grievance can be submitted to yugalkishore.garg@gopalcorp.com.

Stakeholder meetings were organized at the time of registration of project activity in order to identify the major challenges around the area, stakeholders were invited well in advance through

printed invitation, calls, meeting and a notice is placed around the local common areas. Various CSR activities around site are carried out. The stakeholder is also request to share their experiences and grievances on continuous basis. Registers is used to records the grievances and feedback.

During the current monitoring period, positive feedback is received regarding site operation. No any grievances received during the current monitoring period, therefore, no any mitigation measures are required. In case of grievances, the nature of probable resolution is discussed with the plant head office and implemented by the site in charge. The grievance copies have been submitted to DOE.

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

Baseline Scenario:

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

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

The baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.Hence, pre-project scenario and baseline scenario are the same.The estimated lifetime of the project activity is considered as 40 years for hydrotechnology. This may increase depending on the operation & maintenance of the plant.The bundled project activity is a new facility (Greenfield) and the electricity generated by the Project

is exported to the Indian Grid. The Project therefore displaces an equivalent amount of electricity which would have otherwise been generated by fossil fuel dominant electricity grid. The Project Proponent plans to avail the carbon credits from VCS i.e. VCUs benefits for the project.

Emission Reductions from anthropogenic sources:

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

The commissioning details of the project are as follows:

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

The technical specifications of the plants are described below[5]:

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

Hydrology & Water Area	
Catchment area	138 Sq. Km.
Annual Rainfall	2653 mm
Atmospheric temperature in °C	Min -2°C, Max+ 35°C
Humidity (%)	98%
Head Works	
Diversion Weir	Trench type weir
Weir level	EL 1421 m
Design Discharge	6 cumecs
Flood Discharge	460 cumecs
Bottom level of trench	Caries from EL 1420 to EL 1419
Power Duct	
Shape of Power Duct	Rectangular
Size of Power Duct	1.8 m x 2.6 m
Length of Power duct	130 m
Water Conductor System	
Shape of water conductor	Circular

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

Size of water conductor	950 m
Desilting tank cum forebay	
Size of Setting Basin	8.5 m wide x 68 m long
Transition (Expansion) from 2.6 m to 8.5 m	18 m
Maximum Flow	8.97 Cumecs
Design discharge	6 Cumecs
Inlet Bottom elevation	EL 1418.94 m
Center elevation of water conductor	EL 1416.88 m
Penstock	
Diameter of Bifurcation	1.28 m
Length of Bifurcated Penstock	25 m
Turbine / Generator	
Design Flow	3 Cumecs
Gross head	48 m
Design net head	41 m
Design discharge of Machine	6 Cumecs (For two units)
Output at "Design Net Head" & "Design Discharge"	100 kW at Generator Terminals + 20% continuous overload capacity
Type of turbine	Horizontal Francis Machine
Type of Speed Regulation	Multi regulation using Digital Electro Hydraulic Type turbine governor.
Type of Generator	Horizontal, synchronous, Brushless excited, Air cooled open ventilated, 3 phase, having sufficient shaft extension to mount turbine runner.
Rated Speed	750 rpm
Generation voltage	3.3 kV Ph-Ph
Generator Rating	1000 kW, 3.3KV, 0.9 pf, +20% cont. overload capacity.
Power Evacuation	
Voltage rating of setup (Generation) transformer	3.3 kV/ 33kV, ONAN, OLTC
Power rating of generating transformer	2800KVA
Type of tap changer	On Load Tap Changer
Transmission Line Voltage	33 kV
Substation	33KV Grid Substation at Suman Sarwari PH
Length of 33KV single transmission line from PH to substation	2.7 Km long, DOF conductor & XLPE cable if necessary

Gopal Hydro Power Pvt. Ltd.

1. Plant Capacity = 2x 0.750 MW (synchronous Generator),
   Generating Voltage 3.3kV
   Voltage 3.3kV
   Current = 154.4A

PF = 0.85Lag
Frequency = 50Hz

2. Turbine = 2nosPelton Horizontal
Model = CJA237-W-105/1x4.5
Capacity = 789kW
Speed 750rpm
Rated Output= 789kW
Rated Speed= 1000rpm
Runaway Speed= 1732rpm for 10 min.
Maximum Head =675mtr.
Rated discharge= 0.163m^3/Sec
Net Head = 675 Mtr

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

4. DG = 25 kVA

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

3.2 Deviations

3.3.1 Methodology Deviations

Not Applicable

3.3.2 Project Description Deviations

There has not been any project description deviation applied during the current monitoring period (01-November-2019 to 31-August-2021).

3.3 Grouped Projects

The project activity 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 14, December 2018 [6]
Value applied	0.9610
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as 3-year generation weighted average using data for the years 2015-2016, 2016-2017& 2017-2018. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 14, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

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

Data / Parameter	$EF_{grid,y}$

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

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

Data / Parameter	$NCV_{Diesel,y}$
Data unit	GJ per mass or volume unit (e.g. GJ/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	$EG_{Export,y}$
Data unit	MWh
Description	Quantity of electricity exported to the grid in year y
Source of data	Joint Meter Reading issued by HPSEB
Description of measurement methods and procedures to be applied	For measuring the energy delivered by the project activity at the interconnection point, one set of Main meter (part of interconnection facility) and check meter is provided by the company and the HPSEB at the interconnection point. Monthly joint meter readings of the main meter and check meter at the interconnection point has been taken by the designated officials of the company and HPSEB. The joint meter readings has been recorded and signed by the authorized representative of both the parties on each of the above instances.
Frequency of monitoring/recording	Continuous Metering, and monthly recording has been done.

<table>
<tr><td>Value monitored</td><td>21,693.83</td></tr>
<tr><td>Monitoring equipment</td><td>For the uninterrupted metering system the PP has kept 2 identical meters which are used as the two sets of Main and Check Meter as mentioned below:
<table>
<tr><td rowspan="2">Gaur Hydro</td><td>HPU 06256</td><td>Meter 1</td></tr>
<tr><td>HPU 06255</td><td>Meter 2</td></tr>
<tr><td rowspan="2">Gopal Hydro</td><td>13193404</td><td>Meter 1</td></tr>
<tr><td>13193345</td><td>Meter 2</td></tr>
</table>
These 2 sets of meters are used alternatively after 6 months. While the one set of meters are in function the other set of meters are kept idle after laboratory tests in ready to use condition. The detail of each meter have been provided below:
<table>
<tr><td></td><td>Gaur HEP</td><td>Gopal HEP</td></tr>
<tr><td>Meter Type</td><td>ABT Meter</td><td>ABT Meter</td></tr>
<tr><td>Manufacturer</td><td>Secure Make</td><td>L & T Make</td></tr>
<tr><td>Accuracy Class</td><td>0.2s</td><td>0.2s</td></tr>
</table>
The main and check meters in each sets are also exchanged on the rotational basis. The summary of Meters used as the main and check meter has been provided in Appendix 2.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The meters have been tested by the Power Grid Corporation of India Ltd, (An external entity and a Government owned enterprises), in the Regional Test Laboratory i.e. Northern Region II (Jalandhar). The meter test records have been maintained in the plant.

The meters is approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years. [7] The monthly electricity supplied/exported by the project activity in the form of JMR report is cross checked with the monthly invoices of sale to the State SEB. In the absence or delay in the meter calibration appropriate Guidelines would be applied appropriately to confirm the conservativeness ofmetering</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of baseline emissions</td></tr>
</table>

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

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

Data / Parameter	$EG_{Import, y}$
Data unit	MWh
Description	Quantity of electricity imported from the grid in year y
Source of data	Joint Meter Reading issued by HPSEB
Description of measurement methods and procedures to be applied	For measuring the energy imported by the project activity at the interconnection point, one set of Main meter (part of interconnection facility) and check meter is provided by the company and the HPSEB at the interconnection point. Monthly joint meter readings of the main meter and check meter at the interconnection point has been taken by the designated officials of the company and HPSEB. The joint meter readings has been recorded and signed by the authorized representative of both the parties on each of the above instances.
Frequency of monitoring/recording	Continuous Metering, and monthly recording has been done
Value monitored	6.70
Monitoring equipment	For the uninterrupted metering system the PP has kept 4 identical meters which are used as the two sets of Main and Check Meter as mentioned below:

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

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

	Gaur HEP	Gopal HEP
Meter Type	ABT Meter	ABT Meter
Manufacturer	Secure Make	L & T Make

	<table><tr><td>Accuracy Class</td><td>0.2s</td><td>0.2s</td></tr></table> The main and check meters in each sets are also exchanged on the rotational basis. The summary of Meters used as the main and check meter has been provided in Appendix 1.
QA/QC procedures to be applied	The meters have been tested by the Power Grid Corporation of India Ltd, (An external entity and a Government owned enterprises), in the Regional Test Laboratory i.e. Northern Region II (Jalandhar). The meter test records have been maintained in the plant. The meters are approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years. [8] The monthly electricity supplied/exported by the project activity in the form of JMR report is cross checked with the monthly invoices of sale to the State SEB. In the absence or delay in the meter calibration appropriate Guidelines is applied appropriately to confirm the conservativeness ofmetering.
Purpose of the data	Calculation of baseline emissions
Calculation method	Electricity imported from the grid by the project activity has been directly monitored by the main meter. Thus, calculation is not necessary for this parameter.
Comments	The data is being archived electronically and kept for 2 years beyond the Crediting Period or last issuance whichever is later

Data / Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Quantity of net electricity exported to the grid in year y
Source of data	Calculated
Description of measurement methods and procedures to be applied	For measuring the net energy export by the project activity at the interconnection point, Following Formula is being used: $EG_{PJ,y} = EG_{Export,y} - EG_{Export,y}$ This net export reading is calculated in through the Monthly joint meter readings of the main meter and check meter at the interconnection point, taken by the designated officials of the

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

<table>
<tr><td></td><td>company and HPSEB. The joint meter readings have been recorded and signed by the authorized representative of both the parties on each of the above instances.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Continuous Metering, and monthly recording has been done</td></tr>
<tr><td>Value monitored</td><td>21,687.14</td></tr>
<tr><td>Monitoring equipment</td><td>For the uninterrupted metering system the PP has kept 4 identical meters which are used as the two sets of Main and Check Meter as mentioned below:
<table>
<tr><td rowspan="2">Gaur Hydro</td><td>HPU 06256</td><td>Meter 1</td></tr>
<tr><td>HPU 06255</td><td>Meter 2</td></tr>
<tr><td rowspan="2">Gopal Hydro</td><td>13193404</td><td>Meter 1</td></tr>
<tr><td>13193345</td><td>Meter 2</td></tr>
</table>
These 2 sets of meters are used alternatively after 6 months. While the one set of meters are in function the other set of meters are kept idle after laboratory tests in ready to use condition. The detail of each meter have been provided below:
<table>
<tr><td></td><td>Gaur HEP</td><td>Gopal HEP</td></tr>
<tr><td>Meter Type</td><td>ABT Meter</td><td>ABT Meter</td></tr>
<tr><td>Manufacturer</td><td>Secure Make</td><td>L & T Make</td></tr>
<tr><td>Accuracy Class</td><td>0.2s</td><td>0.2s</td></tr>
</table>
The main and check meters in each sets are also exchanged on the rotational basis. The summary of Meters used as the main and check meter has been provided in Appendix 1.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The meters have been tested by the Power Grid Corporation of India Ltd, (An external entity and a Government owned enterprises), in the Regional Test Laboratory i.e. Northern Region II (Jalandhar). The meter test records have been maintained in the plant.

The meters is approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years. [9] The monthly electricity supplied/exported by the project activity in the form of JMR report is cross checked with the monthly invoices of sale to the State SEB. In the absence or delay in the meter calibration appropriate Guidelines are applied appropriately to confirm the conservativeness of metering.</td></tr>
</table>

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

Purpose of the data	Calculation of baseline emissions
Calculation method	Electricity imported from the grid by the project activity has been directly monitored by the main meter. Thus, calculation is not necessary for this parameter
Comments	The data is archived electronically and it is kept for 2 years beyond the Crediting Period or last issuance whichever is later

Data / Parameter	$FC_{diesel, y}$
Data unit	Tons
Description	Quantity of Diesel consumed by the standby DG set in year y
Source of data	Records of levels in the diesel storage tanks as per the plant log book.
Description of measurement methods and procedures to be applied	Measurement Procedure: The diesel quantity available in the diesel storage tanks is recorded daily by PP in the plant log book. The diesel consumption has been recorded in the logbook in litres. However, based on the density of diesel of about 0.88[10] kg/litre, the diesel consumption in tons has been calculated for use in theequation to compute project emissions (PE) as mentioned in above section. Accuracy of the Measurement Method: To confirm the accuracy on measurement of quantity of diesel consumed in the project activity can be cross checked against the fuel purchase receipts. Responsibility: Log book has been maintained by the shift in charge and same has been cross checked by the General Manager of the project activity.
Frequency of monitoring/recording	Frequency: Continuously monitored. Recording frequency: monthly and aggregated annually Archiving Policy: Paper & Electronic
Value monitored	0.00066 kt (757 litres)
Monitoring equipment	Manually Monitoring
QA/QC procedures to be applied	The data recorded can be cross checked against the fuel purchase receipts

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

Purpose of the data	Calculation of project emissions
Calculation method	It has been directly monitored. Thus, calculation is not necessary for this project.
Comments	The above parameter is being monitored ex-post and the values will be updated accordingly. The data will be archived electronically and will be kept for 2 years beyond the Crediting Period or last issuance whichever is later

4.3 Monitoring Plan

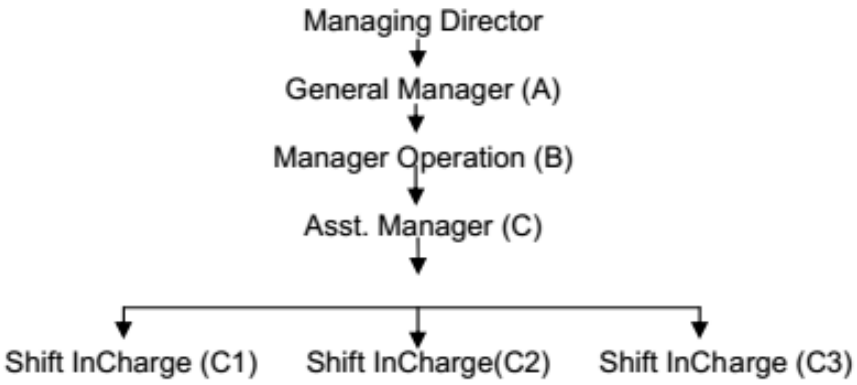
The data monitoring involves the parameters mentioned in the section 3.2. Due care has been taken for the measurement of all these parameters and maintenance of records. Proper training has been imparted to concerned personnel for accurate measurement:

Metering:

Electricity export and import are metered by main and check tri-vector energy meters with an accuracy class of 0.2s installed at the grid interconnection point. The main meter reading is taken jointly on a fixed day of every month for the preceding month and signed by the representatives of state utility and PP. In the event of failure of main meter installed at the substation, the check meter is used in monitoring the electricity data. All the meters are under the custody of HPSEB who is responsible for the calibration of the energy meters as per the industry standards. PP has proposed calibration of meter once in three year. All data is archived electronically and are kept for a minimum of 2 years beyond the crediting period or last issuance whichever is later.

Monitoring Organization:

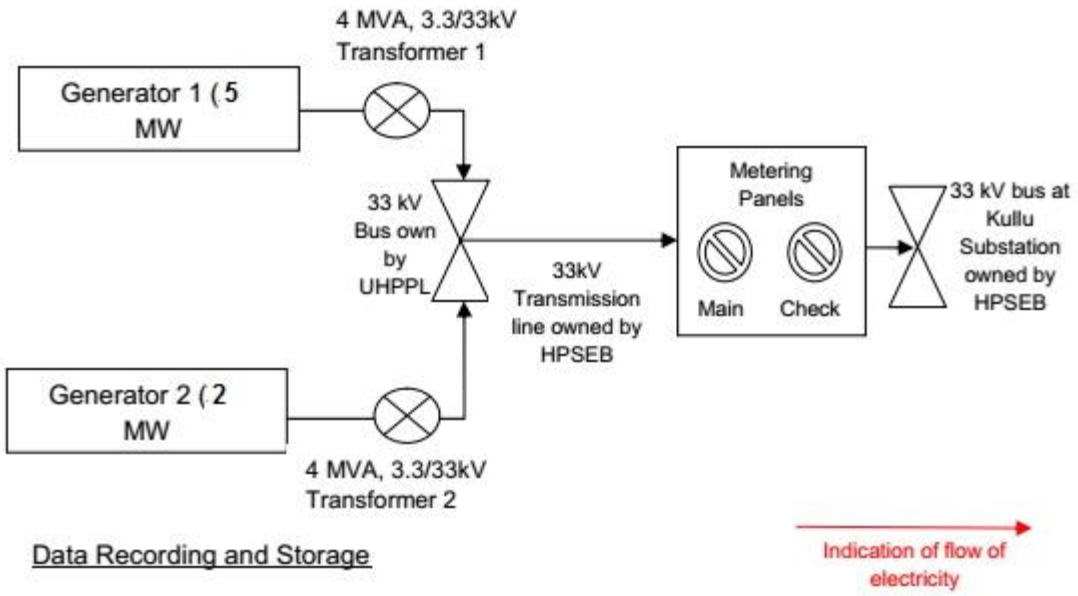
The Project is being managed by the Managing Director (MD), General Manager, Manager (Operations), Technical in-charge and Manager (finance).The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the MD (through a dedicated identified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

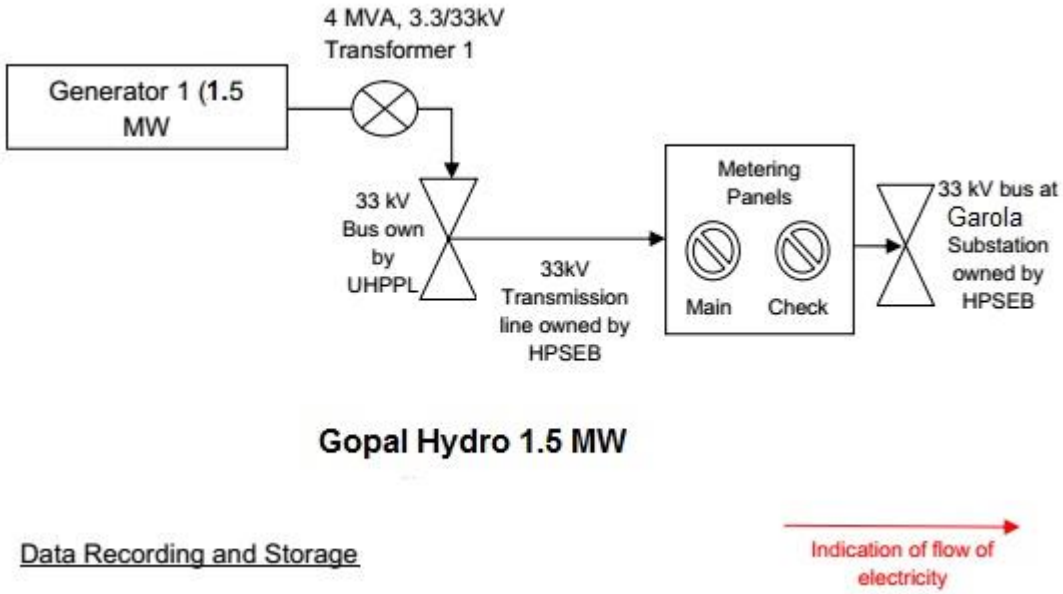


Where,

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

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





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

QA & QC Procedures to be followed:

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

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

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

$BE_y = EG_{PJ,y} X EF_{grid,y}$

Where,

BE_y= Baseline Emissions in year y; tCO_2
$EG_{PJ, y}$= Quantity of net electricity supplied to the grid as a result of the implementation ofthe CDM project activity in year y (MWh)
$EF_{CO2,grid,y}$= CO_2 Emission Factor of the grid in year y; tCO_2/MWh

Thus, baseline emissions can be calculated as

$BE_y = EG_{PJ,y} X EF_{grid,y}$

= (21,693.83-6.70) X0.9127

= 19,792 tCO_2e.

Baseline Emissions from (01-November-2019 to 31-August-2021)

Parameter / Period	Quantity of net electricity supplied to the grid as a result of the implementation of the project activity in year y (MWh) ($EG_{BL,y}$)	CO_2 Emission Factor of the grid in year y (tCO_2/MWh) ($EF_{CO2,grid,y}$)	Baseline Emissions in year y (tCO2) (BE_y)
01-November-2019to 31-December-2019	1077.62	0.9127	983
01-January-2020to 31-December-2020	14,875.45	0.9127	13,576

01-January-2021 – 31-August-2021	5,734.07	0.9127	5,233

5.2 Project Emissions

Since one diesel generator is also being utilized to supply the emergency requirement for the project activity, diesel consumption is monitored in plant log records. Emissions resulting from usage of diesel in the backup diesel generator is accounted as project emissions based on the following equation as provided in the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" version.3[11]. CO_2 emissions from fossil fuel combustion in process are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

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

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

Where:

$PE_{FC,j,y}$= Are the CO_2 emissions from diesel combustion in process j during the year y (tCO_2/yr);
$FC_{i,j,y}$ = Is the quantity of diesel combusted in process j during the year y (mass orvolume unit/yr);
$COEF_{i,y}$= Is the CO_2 emission coefficient of diesel in year y (tCO_2/mass or volume unit)
i = Are the fuel types combusted in process j during the year y

The CO_2 emission coefficient $COEF_{i,y}$: PP has selected the option B as COEF (CO_2emission coefficient of fuel) testing facility for "Weighted average mass fraction of carbon in fuel type i in year y" under option A is not available to PP.

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

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

Where:

$COEF_{i,y}$ = CO_2 emission coefficient of diesel in year y (tCO_2/mass or volume unit)
$NCV_{diesel,y}$= weighted average net calorific value of the diesel in year y (GJ/mass or volume unit)
$EF_{CO2,diesel,y}$ = weighted average CO2 emission factor of diesel in year y (tCO_2/GJ)

Hence, the project emissions for the proposed project activity can be calculated as follows:

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

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

Where,

$FC_{diesel, j, y}$ = quantity of diesel used during the year
$NCV_{diesel, y}$= weighted average net calorific value of diesel in year y
$EF_{co2, diesel, y}$ = weighted average CO_2 emission factor of fuel type diesel in year y

Hence for the Monitoring Period01-November-2019 to 31-August-2021.

Parameter / Period	Quantity of Diesel consumed by the standby DG set in year y ($FC_{diesel,y}$) (Lts)	Weighted Average net Calorific Value of Diesel combusted in the project activity during the year, y ($NCV_{Diesel,y}$) (GJ/Ton)	Weighted average CO_2 emission factor of the diesel consumed in the project activity in year y ($EF_{Co2, diesel, y}$) (tCO_2/TJ)	Project Emission (after rounding up) (tCO_2)
01-November-2019 to 31-December-2019	114	43.3	74.8	1
01-January-2020 to 31-December-2020	508	43.3	74.8	2
01-January-2021 – 31-August-2021	132	43.3	74.8	1

5.3 Leakage

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

5.4 Net GHG Emission Reductions and Removals

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

$ER_y = BE_y - PE_y - LE_y$

Therefore emission reductions generated by the Project during this monitoring period (01-November-2019 to 31-August-2021) are calculated as:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)

01-November-2019 to 31-December-2019	983	1	0	982
01-January-2020 to 31-December-2020	13,576	2	0	13,574
01-January-2021 – 31-August-2021	5,233	1	0	5,232
Total	19,792	4	0	19,788

$ER_y = BE_y - PE_y - LE_y$

$= 19,792 - 4 - 0$

$= 19,788\ tCO_2e$

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

Based upon the annual estimated emission reduction from the project activity, the estimated emission reduction for the current monitoring period is 26,547 tCO_2e, whereas actual emission reductions achieved are 19,788 tCO_2e, which is approximately 25.46% lower than the estimated emission reductions. The generation of electricity depends upon many other climatic conditions, which are not within the control of the project participant. The lower generation during the current verification period is low due to certain natural conditions like water flow etc. Hence, it is acceptable.

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

APPENDIX I: CALIBRATION AND METER DETAILS

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

The Energy Meters details used for the respective project proponents are given below:

Name of the SPVs	Site	Capacity (MW)	Main Meter Details	Check Meter Details	Calibration Date	Due date
Gaur Hydro Power Pvt. Ltd.	Dadka , Kullu	2.0	SL. No. : HPU06256 Make: Secure l Accuracy class: 0.2 s	SL. No. : HPU06255 Make: Secure	25-August-2018	24-August-2023
Gopal Power Pro Pvt. Ltd.	Garola , Chamba	1.5	SL. No. : 13193404 Make: L&T Accuracy class: 0.2 s	SL. No. : 13193345 Make: L & T	18-April-2019 23-January-2020	22-January-2025