# Monitoring report form for CDM project activity
## (Version 08.0)

| MONITORING REPORT | | | |
|---|---|---|---|
| **Title of the project activity** | 12 MW hydropower plant in Bhandardara in Maharashtra, India. | | |
| **UNFCCC reference number of the project activity** | 0430 | | |
| **Version number of the PDD applicable to this monitoring report** | Registered PDD version 09, dated 16/07/2016 | | |
| **Version number of this monitoring report** | 04 | | |
| **Completion date of this monitoring report** | 12/06/2021 | | |
| **Monitoring period number** | 03 (of the 3rd crediting period) | | |
| **Duration of this monitoring period** | 01/01/2018 – 31/03/2019 (Inclusive of both the dates) | | |
| **Monitoring report number for this monitoring period** | N/A | | |
| **Project participants** | ▪ Dodson–Lindblom Hydro Power Private Limited (DLHPPL)<br>▪ Statkraft Markets GmbH<br>▪ WeAct Pty Ltd[1]. | | |
| **Host Party** | India | | |
| **Applied methodologies and standardized baselines** | Methodology: AMS-I.D. - Grid connected renewable electricity generation, version 18; Dated: 28/11/2014<br><br>Standard baseline: Not Applicable | | |
| **Sectoral scopes** | 01, Energy Industries (renewable/non-renewable sources) | | |
| **Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period** | Amount achieved before 1 January 2013 | Amount achieved from 1 January 2013 until 31 December 2020 | Amount achieved from 1 January 2021 |
| | 0 $tCO_2e$ | 54,024[2] $tCO_2e$ | 0 $tCO_2e$ |
| **Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD** | 43,680[3] | | |

[1] The "WeAct Pty Ltd" has been joined as an authorized project participant on 03/02/2017, as per the LOA information available at the UNFCCC webpage; https://cdm.unfccc.int/Projects/DB/BVQI1155728784.01/view?cp=1

[2] Detailed Calculation provided in Emission Reduction (ER) calculation excel sheet.

[3] Refer section E.5.1. Detailed calculation has been provided in ER sheet.

# SECTION A. Description of project activity

## A.1. General description of project activity

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**Purpose of the project activity**

The main purpose of the project activity is to generate electricity from the potential energy in the water released from Bhandardara dam and export the net electricity to the grid.

**Brief description of the installed technology and equipment:**

The Bhandardara dam is one of the oldest masonry gravity dams in Maharashtra state. The construction of the dam started in 1910 and was completed in 1926. There are two hydro power plants near Bhandardara dam. The project activity (capacity – 12 MW) is constructed at the foot of a hill adjacent to the Bhandardara dam named as BH-1. Another hydroelectric project of 34 MW was constructed later 10 kilometers downstream from BH-1, which is referred as BH-2. BH-1 is the small-scale project activity.

The water released from the Bhandardara reservoir for irrigation purpose is conducted to a turbine in the power plant and jetted on to the turbine. This action rotates the turbine, which in turn causes the rotation of the alternator connected to the turbine, thereby producing electricity. One 12 MW Francis type turbine is installed in BH-1. The generated electricity from the project activity after auxiliary consumption is exported to MSTCL grid.

BH-1 has exported about 78,469.20 MWh to grid during the current monitoring period. The plant and equipment facilities have been designed to comply with the applicable stipulations / guidelines of statutory authorities such as State Pollution Control Board etc.

The project activity (BH-1) is constructed at the foot of a hill adjacent to the Bhandardara dam. BH-1 was originally built by the Government of Maharashtra Irrigation Department (GOMID) with a single hydropower generating unit of 10 MW in 1984. In Maharashtra state, all state-owned hydroelectric plants are constructed by Government of Maharashtra Water Resources Department (GOMWRD) and handed over to Maharashtra State Electricity Board (MSEB) (now Maharashtra State Electricity Generation Company) for operation and maintenance. The generating unit at BH-1 was commissioned in 1986 and started commercial operation in 1987. After operating for eight years, a mishap occurred which severely damaged the entire plant and the plant ceased to operate. The rehabilitation and operation of this plant was awarded on a lease, own, operate and transfer basis to Dodson – Lindblom International Inc (DLI), an Ohio, USA, based company. DLI is part of DLZ Corporation, one of the foremost engineering and water resource companies in the Midwestern United States. An operating company by the name of Dodson – Lindblom Hydro Power Private Limited (DLHPPL) was formed to implement and operate the hydropower plants in India. Although, technically it was called rehabilitation, the work involved construction of new plant. The damaged equipment was beyond use and plant could not be used and operated anymore; and hence disposed as scrap. The accident had caused such damage that entire plant had to be reconstructed. Thus, BH1 hydro has been started as a new plant. The generated power from the project activity is connected to state electricity grid owned and operated by Maharashtra State Transmission Company Ltd (MSTCL).

**Relevant dates for the project activity:**

The project has been registered with UNFCCC on 30/09/2006 with renewable crediting period. The project opted for the renewable crediting period and the duration of the first crediting period is from 27/07/2001 – 26/07/2008 and second crediting period is from 27/07/2008 – 26/07/2015. This is third crediting period which is applicable from 27/07/2015 – 26/07/2022. The amount of issued CERs from this project was 214,154 $tCO_2e$ during the first crediting period and the amount of issued CERs from this project was 179,537 $tCO_2e$ during Second crediting period.

This is the third monitoring period under the third crediting period. During the current monitoring period, the project has achieved total emissions reduction of 54,024 $tCO_2e$.

## A.2. Location of project activity

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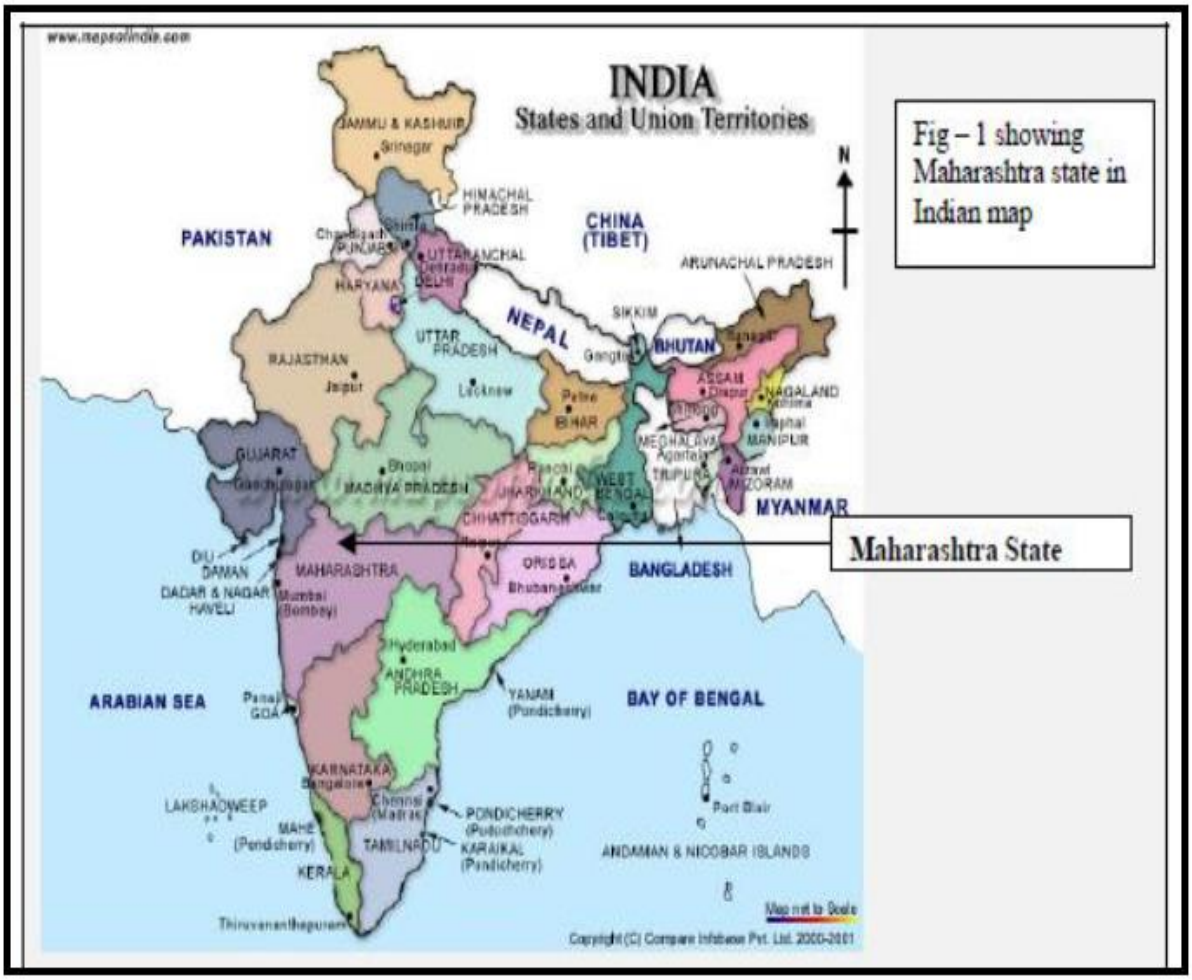
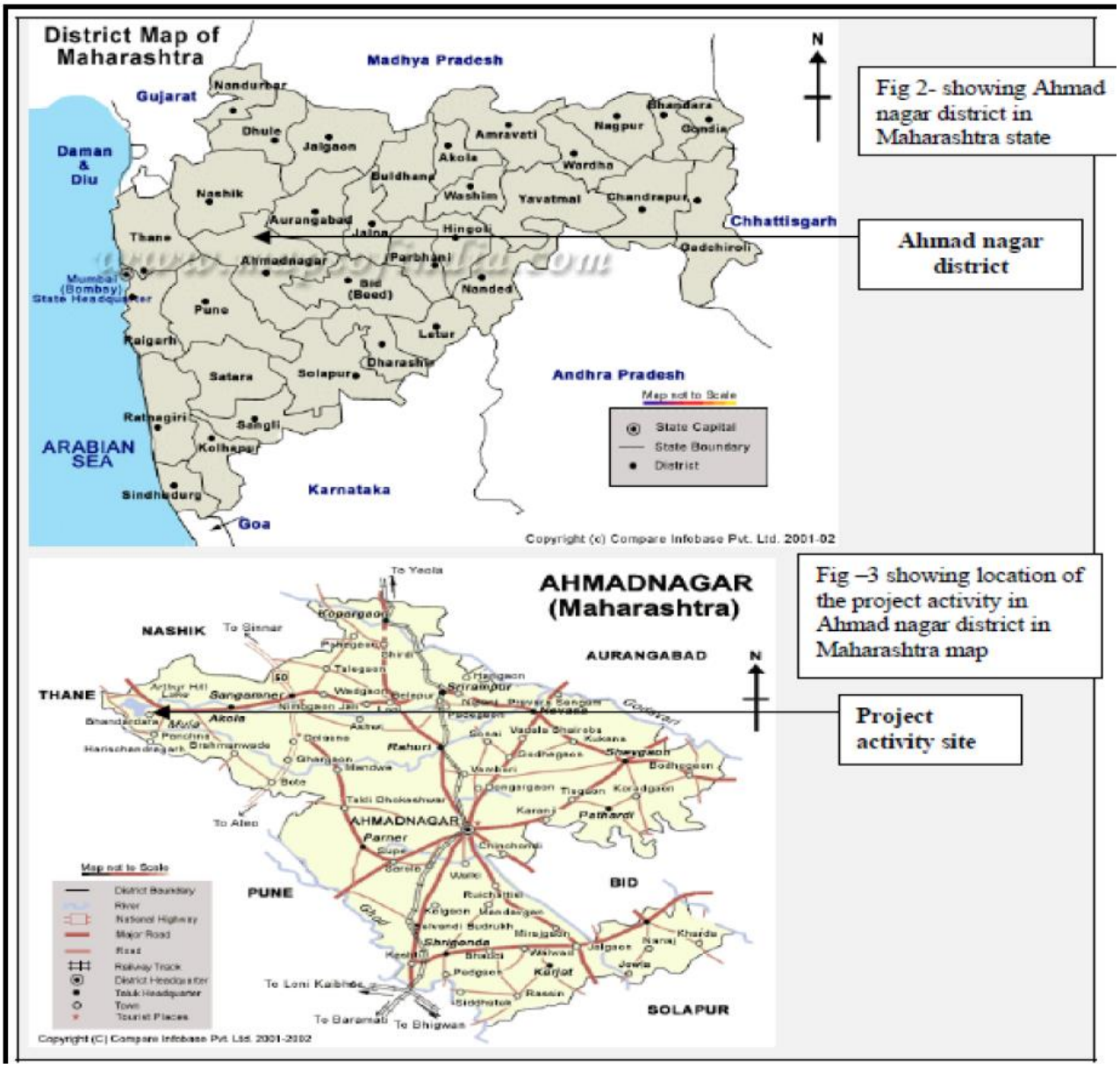
The project activity is located at a foot of a hill adjacent to the Bhandardara dam in Lake Arthur Hill reservoir in the upper Pravara river basin. Bhandardara is about 140 kilometres from Mumbai. The nearest town is Ghoti and closest railhead is at Igatpuri which is 40 kilometres away.

(a) Host Part(ies): India
(b) Region /State/Province: Maharashtra
(c) City/Town/Community: Bhandardara village, Akola Taluk, Ahmednagar district.
(d) Physical/ Geographical location: Latitude 19° 3 3′ 15″ N and longitude 73° 45 ′ 0″ E.

The location of project activity is shown in following figures – Fig 1 & 2:






## A.3. Parties and project participants

| Parties involved | Project participants | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India | Dodson –Lindblom Hydro Power Private Limited (DLHPPL) (Private Entity) | No |
| Switzerland | Statkraft Markets GmbH (Private Entity) | No |
| Australia | WeAct Pty Ltd. (Private Entity) | No |

## A.4. References to applied methodologies and standardized baselines

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Renewable electricity generation for a grid in accordance with approved small-scale methodology AMS I.D.

Type I : Renewable energy project
Sectoral Scope : 01, Energy Industries

Category I.D : Grid connected renewable electricity generation, version 18[4]

Reference : Reference has been taken from the list of the small-scale CDM project activity categories contained in Appendix B of the simplified M&P for small-scale CDM project activities.

Tool reference:
"Tool to calculate the emission factor for an electricity system" Version 5
"Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion, Version 02".

## A.5. Crediting period type and duration

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Crediting Period Selected: Renewable crediting period (3*7 years).

Number of Crediting period: 3rd Crediting Period

Start date of the 3rd Crediting Period : 27/07/2015
End date of the 3rd Crediting Period : 26/07/2022

Duration of the 2nd Crediting Period : 27/07/2008 – 26/07/2015
Duration of 1st Crediting Period : 27/07/2001 – 26/07/2008

[4] Link to Methodology Page: https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

## SECTION B. Implementation of project activity

### B.1. Description of implemented project activity

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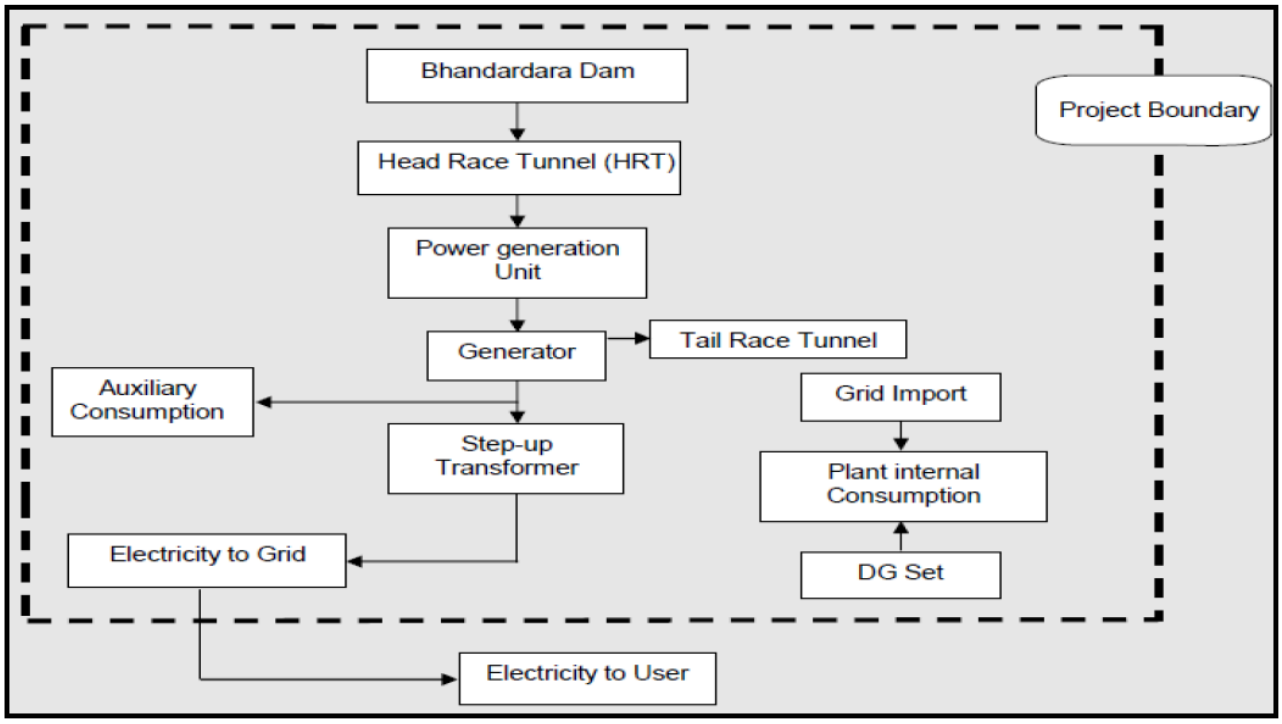
There is one Francis turbine is employed in the project activity. The flowing water is guided through a head race tunnel and penstock gate and jetted on to a turbine. This action rotates the turbine, which is connected to a synchronous generator. The rotation of turbine causes the rotation of the generator thereby producing electricity. The generated electricity is stepped up to 132 kV and exported to MSTCL grid, which is part of regional grid. The technical specifications of the employed technology are provided in Annex 1.

**Schematic Diagram of the Project Activity:**




The capacities of the project equipment's are not changed during this monitoring period and no emergency incidents occurred during this period that may change the applicability of the methodology or change the emission reductions.

### B.2. Post-registration changes

#### B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

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Not Applicable

#### B.2.2. Corrections

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Not Applicable

#### B.2.3. Changes to the start date of the crediting period

>>

Not Applicable

### B.2.4. Inclusion of monitoring plan

>>
Not Applicable

### B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

>>
Not Applicable

### B.2.6. Changes to project design

>>
Not Applicable

### B.2.7. Changes specific to afforestation or reforestation project activity

>>
Not Applicable

## SECTION C. Description of monitoring system

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The monitoring system has been considered in line with monitoring plan prescribed in the renewal PDD, version 9, under the section B.7.3. The details are discussed below:

**Electricity generated by the project activity:** The power exported by the project activity would be monitored to the best accuracy[5] and as per section D.2.

The general principles for monitoring above parameters are based on:

- ✓ Frequency
- ✓ Data recording
- ✓ Reliability
- ✓ Experience and training

**Frequency**

Joint meter reading (JMR) of main and check meters installed at the substation shall be taken and signed by authorised officials of DLHPPL, MSEDCL, MSETCL and GOMWRD generally once every month. Daily data recording by the shift in-charge of DLHPPL is there at generation end. Joint meter reading shall be the basis for monthly invoice of energy exported to the grid.

**Data recording**

Records of the joint meter reading of energy generated and exported to the grid would be maintained by DLHPPL, MSEDCL, MSETCL and GOMWRD. Daily and monthly reports stating the generation and power export would be prepared by the shift in-charge and verified by the plant manager.

**Reliability**

For measuring the energy exported to the grid, one main meter and one check meter are maintained. Joint meter reading of the main meter is the basis of billing and emission reduction calculations, so long the meter is found to be within prescribed limits of error during the periodic check.

Joint meter reading of main and check meters are taken and signed by authorised officials of DLHPPL, MSEDCL, MSETCL and GOMWRD once every month. Records of this joint meter reading are maintained by DLHPPL, MSEDCL, MSETCL and GOMWRD.

The main and check meters installed are jointly inspected and sealed and are not interfered with, by DLHPPL, MSEDCL or MSETCL except in presence of the other party. The meters are checked for accuracy and calibration by the MSETCL as per the provisions in the power purchase agreement (PPA) prevailing at the time of respective accuracy check or calibration. As per the current PPA, the meters are checked for accuracy every six months and the calibration is done once in a year. The meters are checked for accuracy and/or calibrated at MSETCL's laboratory and sealed by MSEDCL, MSETCL and DLHPPL jointly.

If during periodic test check, main meter is found to be within permissible limits of error and check meter is found to be beyond permissible limits, then billing as well as emission reduction calculations are as per main meter as usual. However, the check meter would be calibrated and/ or replaced if required. If during test check, the main meter is found to be beyond permissible limits of error but check meter is found to be within permissible limits, then billing as well as emission reduction calculation for the month and up to date and time of the calibration/replacement of defective main meter shall be as per check meter. The main meter would be immediately

[5] Details of Energy Meters & their testing has been provided in Appendix - 2 of the MR.

calibrated and/ or replaced, as may be necessary where after billing as well as emission reduction calculation would be as per main meter.

If during the periodic test checks, the main and check meter are both found to be beyond permissible limits of error, then both the meters would be immediately calibrated or replaced if required. In such an event, the emission reduction calculations for the period (which starts on the day of the previous accuracy or calibration whichever is later and ends on the day when the meter is calibrated and/ or replaced – also referred to as 'defect period') would be calculated based on the gross electricity generation data taken from the JMR and the auxiliary consumption. For this purpose, the auxiliary consumption would be worked out as a percentage of gross electricity generation pertaining to the same calendar period (also referred to as 'reference period') as that of the defect period corresponding to the previous year. The percentage auxiliary consumption will be the maximum of the monthly percentage auxiliary consumption in the reference period. This maximum of the monthly percentage auxiliary consumption would be used to compute the electricity export and therefore the emission reduction for the defect period.

The meters installed at the generator end shall be checked for accuracy every six months at the MSETCL laboratory and the calibration is done once in a year at MSETCL. If the accuracy of the meter is found to be beyond permissible limit even after calibration then the meter shall be replaced with spare tested, calibrated meter.

DLHPPL shall archive and preserve all the JMRs pertaining to the energy generated and exported by the project activity, for at least two years after end of the crediting period. DLHPPL shall also archive the complete metering data at generation end and export data on paper and all the data would be preserved for at least two years after end of the crediting period.

**Trippings due to grid failure**
Number of trippings due to grid failure are recorded and verified with the allowable pre-defined number for the equipment. Monitoring plan has been established to verify and to ensure that the number of failures is less than prescribed limits.

**Management structure for monitoring of parameters:**
Hourly data recording of the generation and export to the grid will be made by the electrician of the shift and verified by the shift engineer of DLHPPL and these data will be there at generation end. Daily and monthly reports stating the generation and power export are prepared by the shift in-charge and verified by the plant manager of DLHPPL. Plant manager of DLHPPL at site would maintain records of joint meter reading. MSEDCL (MSEB) also maintains the records of joint meter readings at their office.

Monthly invoices are prepared based on Joint meter readings, which will be used for cross checking the energy exported to the grid. The plant manager is a qualified engineer with considerable experience in power industry. All the shift engineers are qualified engineers and have undergone related training including plant operations, data monitoring, report generation etc.

**<u>Procedures for handling data uncertainties:</u>**

***In the event when verification period dates and JMR dates in the project activity, do not coincide***

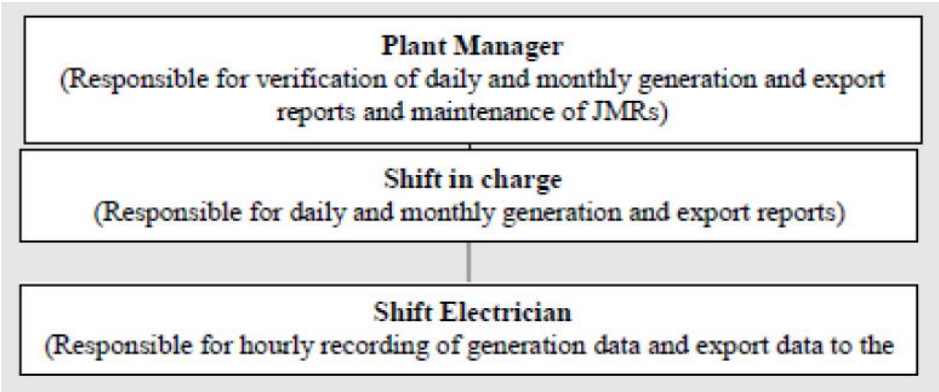
***For electricity exports:***
In the event when the individual verification period dates and the date of JMR pertaining to the project activity do not coincide, the following procedure would be adopted to estimate the electricity supplied to the grid during the specific period/ or days where there is a mismatch. The hourly electricity export readings ($HEE_{main\_meter}$) recorded at the main meters would be monitored by DLHPPL for the project activity in their logbook. For the mismatch period, the hourly electricity export readings would be considered in order to arrive at the electricity supplied/ exported by the project activity to the grid during that period. This method would be followed in cases where the

starting or ending / last dates of the verification period do not match the JMR dates of the project activity.

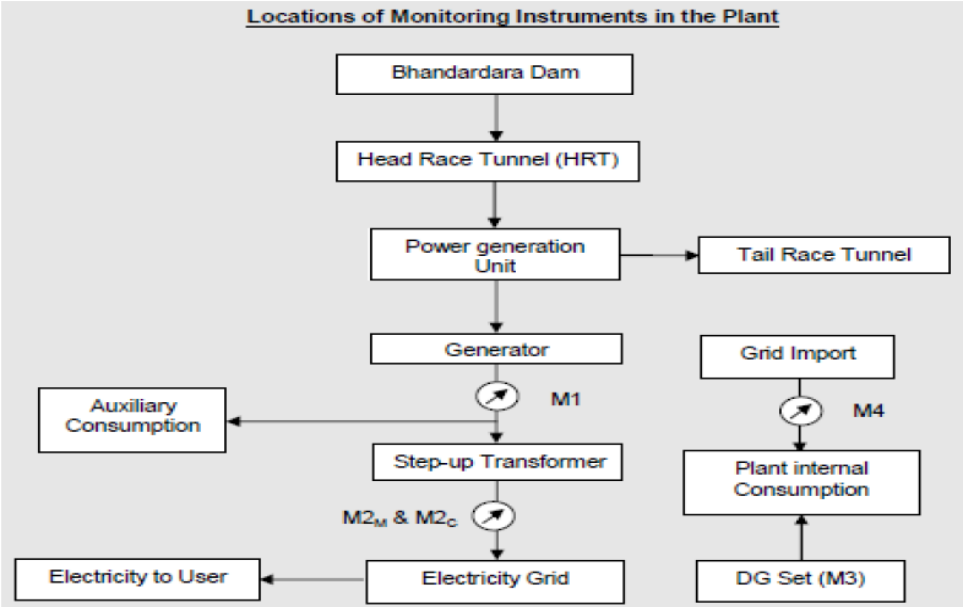
***For electricity imports:***

This is in the event when the individual verification period dates and the date of Monthly records for electricity imports (recorded by MSEDCL) pertaining to the project activity do not coincide. It is to be noted that the units imported are recorded on a monthly basis and issued by the MSEDCL. The maximum monthly electricity imports during the previous 12 months period (prior to the date of mismatch) would be arrived at. For the mismatch period, the maximum monthly electricity import as identified above would be taken and the daily import would be worked out based on the number of days during the concerned month. This daily import as worked out would be applied for those specific days of mismatch to estimate the total import for the mismatch period.

**Schematic diagram for the monitoring data flow at plant**




**Schematic diagram for monitoring system involved in the project activity is provided below:**




M1 : Gross Energy Meter
$M2_M$ : Main Export meter
$M2_C$ : Check Meter
M3 : Measuring scale to monitor diesel consumption in DG set
M4 : Electricity Import Meter

## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante

| **Data/Parameter** | $CO_2$ Emission factor of grid (EFy) = $EF_{CO2,grid,y}$ |
|---|---|
| Unit | $tCO_2/MWh$ |
| Description | Combined Margin $CO_2$ Emission Factor of the NEWNE regional grid |
| Source of data | Central Electricity Authority (CEA), $CO_2$ baseline database for the Indian Power Sector, Version 10 ,Dated 16 December 2014 (Combined Margin Emission Factor for Northern Regional Grid) published by Central Electric Authority (CEA), India http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver10.pdf , dated 15 December 2007 |
| Value(s) applied | 0.6890 |
| Choice of data or measurement methods and procedures | CEA has estimated the simple operating margin and build margin emission factors for the Western regional grid. For calculating the $CO_2$ emission factor as per combined margin method for the second crediting period, the weights of 0.25 for operating margin and 0.75 for build margin are considered as per 'Tool to calculate the emission factor for an electricity system (Version 05.0). As per tool, the operating margin has been calculated as weight average value; whereas being the third crediting period, the value of build margin emission factor calculated during the second crediting period has been used. |
| Purpose of data/parameter | Calculation of baseline emission. |
| Additional comments | The emission factor has been fixed for the third crediting period. |

| **Data/Parameter** | Net Calorific values of diesel ($NCV_{diesel}$) |
|---|---|
| Unit | GJ/Ton |
| Description | Net calorific value of diesel |
| Source of data | IPCC default data |
| Value(s) applied | 43.3 |
| Choice of data or measurement methods and procedures | IPCC default values at the upper limit of uncertainty at a 95% confidence intervals as provided in Table 1.2 of Chapter 1 of Vol 2 (Energy) of the 2006 IPCC guidelines on National GHG inventories, indicates that the NCV of diesel oil is 43.3 TJ/Gg which is equivalent to 43.3 GJ/ton |
| Purpose of data/parameter | Calculation of project emission |
| Additional comments | Future revision of the IPCC guidelines would be taken into account in case revisions occur during the current crediting period. |

| **Data/Parameter** | $CO_2$ emission factor of diesel ($EF_{CO2\_diesel}$) |
|---|---|
| Unit | $tCO_{2e}/GJ$ |
| Description | $CO_2$ emission factor of diesel |
| Source of data | IPCC |
| Value(s) applied | 0.0748 |
| Choice of data or measurement methods and procedures | IPCC default values at the upper limit of uncertainty at a 95% confidence intervals as provided in Table 1.4 of Chapter 1 of Vol 2 (Energy) of the 2006 IPCC guidelines on National GHG inventories indicates that CO2 emission factor for diesel is 74,800 kg/TJ which is equivalent to 0.0748 tons/ GJ |
| Purpose of data/parameter | Calculation of project emission |
| Additional comments | Future revision of the IPCC guidelines would be taken into account in case revisions occur during the current crediting period. |

## D.2. Data and parameters monitored

| **Data/Parameter** | Electricity Exported (EGy) |
|---|---|
| Unit | kWh |
| Description | Quantity of electricity exported to the grid by the project activity |
| Measured/calculated/ Default | Measured |
| Source of data | Joint Meter Readings (JMRs) taken and signed by authorized officials of MSEDCL |
| Value(s) of monitored parameter | 7,84,69,200 |
| Monitoring equipment | Main Energy Meter and Check Energy Meters are used for net energy export[6] |
| Measuring/reading/recording frequency | Continuous monitoring, hourly measurement and at least monthly recording |
| Calculation method (if applicable) | Not applicable as the data is directly monitored. |
| QA/QC procedures | For measuring the energy exported to the grid, one main meter and one check meter are maintained. Joint meter reading of the main meter is the basis of billing and emission reduction calculations, so long as the meter is found to be within prescribed limits of accuracy during the periodic check.<br><br>Monthly joint meter reading of main and check meters are taken and signed by authorized officials of DLHPPL, MSEDCL, MSETCL and GOMWRD generally once every month. Records of this joint meter reading are maintained by DLHPPL, MSEDCL, MSETCL and GOMWRD.<br><br>The Meters are checked for accuracy and calibration by the MSETCL as per the provisions in the power purchase agreement (PPA) prevailing at the time of respective accuracy check or calibration. As per the current PPA, the meters are checked for accuracy every six months and the calibration is done once in a year. (Please refer to Appendix - 2 for details). |
| Purpose of data/parameter | Calculation of baseline emission |
| Additional comments | The data would be archived up to two years after the end of crediting period. |

| **Data/Parameter** | Electricity Import ($E_{Import}$) |
|---|---|
| Unit | kWh |
| Description | Electricity Imported from the grid by the project activity |
| Measured/calculated/ default | Measured |
| Source of data | Monthly billing records of MSEDCL |
| Value(s) of monitored parameter | 58,162<br>(monthly details are provided in the emission reduction spread sheet) |

[6] Meter details are provided in Annex 1.

| | |
|---|---|
| Monitoring equipment | The energy is imported at 33 kV feeder and a separate independent energy meter is installed by MSEDCL to measure the units imported by DLHPPL. The units are recorded monthly and bills are issued by MSEDCL. Bills of MSEDCL shall be the source of data electricity imported. This data will be used to estimate the emissions due to the electricity imported from the grid and it will be considered as part of project emissions when on a monthly basis the electricity imported is equal to or more than 0.5 % of the electricity exported. |
| Measuring/reading/recording frequency | Continuous monitoring, hourly measurement and at least monthly recording |
| Calculation method (if applicable) | Not applicable as the data is directly monitored. |
| QA/QC procedures | Import meter is under the custody of MSEDCL, and DLHPPL has no access to meter and the calibration details pertaining to the same. Hence, calibration records are not maintained by DLHPPL for the import meter. The Import meter Energy Meter accuracy is 0.5s. . |
| Purpose of data/parameter | Calculation of Project emission |
| Additional comments | The data would be archived up to two years after the end of crediting period. |

| **Data/Parameter** | Gross Electricity Generation ($E_{Gen}$) |
|---|---|
| Unit | kWh |
| Description | Gross Electricity generated by the project activity |
| Measured/calculated/ default | Measured |
| Source of data | Joint Meter Readings (JMR) taken & signed by authorized officials of MSEDCL. |
| Value(s) of monitored parameter | 7,99,79,790 |
| Monitoring equipment | Gross energy meter is used to measure gross energy generation by the plant |
| Measuring/reading/recording frequency | Continuous monitoring, hourly measurement and at least monthly recording |
| Calculation method (if applicable) | Not Applicable as the data is directly monitored |
| QA/QC procedures | The data is directly measured and monitored at the project site. The Gross Main Energy Meter accuracy is 0.2s. The meters installed at the generator end shall be checked for accuracy for every six months and the calibration is done once in a year. If the accuracy of meter is found to be beyond permissible limit even after calibration then the meter shall be replaced with spare tested, calibrated meter. |
| Purpose of data/parameter | Calculation of baseline emission. |
| Additional comments | The data would be archived up to two years after the end of crediting period. |

| **Data/Parameter** | Auxiliary Consumption |
|---|---|
| Unit | kWh |
| Description | Unit consumed by the project activity |
| Measured/calculated/ default | Calculated |
| Source of data | Joint Meter Readings (JMRs) taken and signed by authorized officials of MSEDCL and the gross electricity generation readings. |

| | |
|---|---|
| Value(s) of monitored parameter | 1510590 |
| Monitoring equipment | NA. Data is calculated once in month. |
| Measuring/reading/recording frequency | NA. Data is calculated once in month. |
| Calculation method (if applicable) | The data is calculated using the gross electricity generation ($E_{Gen}$) and electricity exported to the grid ($EG_y$) as per the JMR. The difference between the gross electricity generation ($E_{Gen}$) and electricity exported to the grid ($EG_y$) as per the JMR gives the total Auxiliary Consumption in the plant. This Auxiliary consumption includes losses in Generator step up transformer, in cables and in excitation system, which are not actually measured. Besides these, other auxiliary consumptions are measured at Unit Auxiliary Board. |
| QA/QC procedures | The data is calculated using the gross electricity generation ($E_{Gen}$) and electricity exported to the grid (EGy) as per the JMR. This data is also used in calculating electricity export in the event of simultaneous failure and/or defect in accuracy of both the main meter & check meter. |
| Purpose of data/parameter | Calculation of baseline emission. |
| Additional comments | This data would be calculated based on gross electricity generation and electricity exported as per the JMRs. This data will also be used in calculating electricity export in the event of simultaneous failure and /or defect in accuracy of both the main meters and check meters. |

| | |
|---|---|
| **Data/Parameter** | Hourly Electricity Export ($HEE_{main\ Meter}$) |
| Unit | kWh |
| Description | Hourly electricity exported to the grid by the project activity as recorded at the main meter and check meter. This parameter is relevant to conditions/ circumstances (those days) where the dates of Joint Meter Readings (JMRs) pertaining to the project activity do not match the individual verification periods |
| Measured/calculated/ default | This data is recorded on an hourly basis by DLHPPL based on data recorded at the main meter. |
| Source of data | Log Book Records for the main meter |
| Value(s) of monitored parameter | This parameter is used only for apportioning only. Details are provided in the emission reduction spread sheet |
| Monitoring equipment | Main Energy Meter and Check Energy Meters are used for net energy export |
| Measuring/reading/recording frequency | Continuous monitoring, hourly measurement and at least monthly recording. This parameter is relevant to conditions/ circumstances (those days) where the dates of Joint Meter Readings (JMRs) pertaining to the project activity do not match the individual verification periods. |
| Calculation method (if applicable) | Not applicable as the data is directly monitored. |
| QA/QC procedures | For measuring the hourly energy exported to the grid, one main meter and one check meter are maintained. The hourly meter reading of the main meter is the basis of emission reduction calculations, so long as the meter is found to be within prescribed limits of accuracy during the periodic check. The Main Energy Meter and Check Energy Meters accuracy is 0.2s. Hourly meter reading of the check meters would be used for cross checking.<br>The meters are checked for accuracy and calibration by the MSETCL as per the provisions in the power purchase agreement (PPA) prevailing at the time of respective accuracy check or calibration. As per the current PPA, the meters are checked for accuracy every six months and the calibration is done once in a year. |
| Purpose of data/parameter | Calculation of Project emission |
| Additional comments | The data would be archived upto two years after the end of crediting period. |

| **Data/Parameter** | Diesel Consumption (DC) |
|---|---|
| Unit | Litre |
| Description | Diesel consumption by the standby DG set |
| Measured/calculated/ default | Measured |
| Source of data | Daily records of levels in the diesel storage tanks as per the plant log book. |
| Value(s) of monitored parameter | 189 |
| Monitoring equipment | Based on the density of diesel of about 0.88 [7] kg/litre, the diesel consumption would be calculated. |
| Measuring/reading/recording frequency | Continuously and recorded monthly basis. |
| Calculation method (if applicable) | The diesel quantity available in the diesel storage tanks is recorded daily by DLHPPL in the plant log book. The diesel consumption would be recorded in the logbook in litres. However, based on the density of diesel of about 0.8817 kg/litre, the diesel consumption in tons would be calculated for use in the equation to compute project emissions (PE) as per section B.6.3. |
| QA/QC procedures | The measured data will be cross checked with diesel procurement. |
| Purpose of data/parameter | Calculation of project emission |
| Additional comments | Project emissions due to diesel consumption will be calculated as below: $PE_{DC,y} = \_DC_y \times NCV_{diesel} \times EF_{CO2\_diesel}$ The data would be archived upto two years after the end of crediting period. |

## D.3. Implementation of sampling plan

>>

Not Applicable.

[7] 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.pdf

## SECTION E. Calculation of emission reductions or net anthropogenic removals

### E.1. Calculation of baseline emissions or baseline net removals

>>

The procedures and formulas used for estimation of the baseline emission factor and the assumptions made have been detailed below. The emission reduction of the small-scale project activity is the net electricity exported to the grid (EGy) in MWh multiplied by the baseline emission factor in $tCO_2$/MWh.

**Baseline emission factor**

The Baseline emission factor (EF) is 0.6890 tCO2 /MWh has been estimated and validated for Western regional grid of India, the applicable grid for the project activity.

This is fixed ex-ante for the crediting period as per the registered PDD. DLHPPL has exported 78469.29 MWh from the plant in this monitoring period.

Hence, the Baseline Emission is calculated as below;

Baseline Emissions = (0.689 tCO2e/MWh x 78469.29 MWh)
= 54,065 $tCO_{2e}$. (rounded down value has been considered)

### E.2. Calculation of project emissions or actual net removals

>>

The project emissions[8] for this project activity have occurred due to the following reasons:

Project Emissions on account of Electricity Imported Project Emissions on account of Electricity Imported are calculated as per the equation below:

$$PE_{Import,\,y} = E_{Import,y} \times EF_{grid,\,CM,\,y}$$

Where,

$PE_{Import,\,y}$ - Project emissions from import of electricity from the grid during the year y

$E_{Import,y}$ - Electricity imported from the grid by the project activity during the year y = 58.16 MWh

$EF_y = EF_{Western\ grid,\ CM,\ y}$ - Baseline Emission Factor for the Western regional grid (Combined Margin Approach) whose value is fixed for the crediting period at 0.689 tCO2e/MWh

Therefore;

$PE_{Import,\,y} = 58.16 \times 0.689 = 40.07\ tCO_{2e}$

**Diesel consumption** The project also involved consumption of minor quantity of Diesel in standby DG Set. The formula used to calculate the project emissions due to diesel consumption is provided below:

$PE_{Diesel} = \sum DC_y \times Density_{Diesel} \times NCV_{Diesel} \times EF_{CO2Diesel}$

Where,

[8] Detailed Calculation is provided in emission reduction calculation sheet.

$PE_{Diesel}$ = Project Emission due to use of Diesel consumed during this monitoring period in DG set
DCy = Diesel Consumption in Liters (L)
$Density_{Diesel}$ = Density of Diesel (0.88Kg/Lit)
$NCV_{Diesel}$ = Net Calorific Value of Diesel
$EF_{CO2Diesel}$ = IPCC 2006 Emission factor for Diesel
$PE_{Diesel}$ = 189 L x (0.88 X 10^-3) tonne/L x 43.3 GJ/tonne x 0.0748 tCO2 /GJ
= 0.539 $tCO_{2e}$

Thus, total Project Emission,
$PEy = PE_{Import,y} + PE_{Diesel,y}$
= 40.07 + 0.539 = 40.61 =41 $tCO_{2e}$ (Rounded up value has been considered)

### E.3. Calculation of leakage emissions

>>
As per category I.D of Appendix B of the simplified M&P for small-scale CDM project activities, leakage is to be considered only if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity. Since this does not apply for the project activity **hence there is no leakage issues associated with the project activity and no formula is used to estimate leakage due to the project activity.**

### E.4. Calculation of emission reductions or net anthropogenic removals

| | Baseline GHG emissions or baseline net GHG removals (t $CO_2e$) | Project GHG emissions or actual net GHG removals (t $CO_2e$) | Leakage GHG emissions (t $CO_2e$) | GHG emission reductions or net anthropogenic GHG removals (t $CO_2e$) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Before 01/01/2013 | From 01/01/2013 until 31/12/2020 | From 01/01/2021 | Total amount |
| **Total** | 54,065 | 41 | 0 | 0 | 54,024 | 0 | 54,024 |

### E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

| Amount achieved during this monitoring period (t $CO_2e$) | Amount estimated ex ante for this monitoring period in the PDD (t $CO_2e$) |
|---|---|
| 54,024 | 43,680 |

### E.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the PDD"

>>
As per registered CDM-PDD (version 09, dated: 16/07/2016) page 1, the annual estimated volume of CERs is 35,042 $tCO_{2e}$. The total nos. of days included in this mentoring period (i.e. 01/01/2018 to 31/03/2019, inclusive of both the days) = 455. Thus, to calculate the ex-ante estimated value of ER corresponding to this monitoring period, the annual estimated ER value (as per registered PDD) has been extrapolated for the equivalent period, i.e. 455 days, which results in 43,680[9] $tCO_{2e}$. Whereas actual ER achieved is 54,024 $tCO_2e$. The detailed calculation has been provided in ER calculation sheet.

[9] Ex-ante estimated annual ER as per registered PDD = 35,042; = 35,042/365 = 96 $tCO_{2e}$ per day.

Ex-ante estimated value corresponds to this monitoring period = 96 * 455 = 43,680 $tCO_{2e}$.

## E.6. Remarks on increase in achieved emission reductions

>>

It is evident that there is increase in the actual emission reductions achieved during the current monitoring period as compared to the projected emission reduction for the comparable period. There is around 23.68%[10] higher emission reduction achieved during the current monitoring period as compared to the projected ERs of equivalent period.

Reason for higher generation during the current monitoring period is that during the year 2017-18 & 2018-19 (which starts from 'Apr 2017 to Mar 2018' and 'Apr 2018 to Mar 2019') there has been very less rainfall in the downstream catchment area of the Bhandardara & BH-1 hydro project. Due to this, Maharashtra Water Resources Authority (i.e. "Jalsampada Bibhag, Maharashtra Govt.", also currently referred to as GoMWRD) has given the order to release the water from the upstream reservoirs like Bhandardara & BH-1 and few other dams to augment storage of Paithan dam to regulate the water for irrigation purpose throughout the draught year. Since, BH-1 plant operation is mainly dependent on irrigation water release, hence during the particular year more water was made available for power generation compared to regular year of operation. Consequently, this led to the generation of higher electricity in the month of October 2018 which is generally low generation month in a year as per historic trend[11], followed by July, August and November 2018 which is not an usual scenario in regular years. On the other hand, in the month of June 2018, the water availability in the lower catchment area (i.e. Paithan dam area) was low, hence there was requirement of water release from the upper dam, i.e. Bhandarara BH-1. During this time (i.e. May & June 2018) the water storage available at Bhandardara dam was above BH-1 Power MDDL (Minimum Draw Down Level) for power generation; due to this, BH-1 plant was in operation during the month of June 2018 while releasing the water from the dam; whereas June month is generally the no-generation month or the least generation month in a year due no requirement of Irrigation water release from the upper dams in the region. This can be verified from the previous water years' data (referred under footnote 11 and under appendix 3) which clearly shows that there is zero generation in the month of June in all regular years (except 2017 when a very nominal generation was received due to similar reason as mentioned above).

Also it can be verified from the data sheet that the month of July, October & November are generally the low generation months in regular years. But because of the unplanned release of water (as mentioned in the above para, also supporting references submitted to DOE such as plant level records of water release request, letter from village authorities etc.), in the month of June 2018 and also during Oct & Nov 2018, BH-1 plant achieved overall higher generation during the current monitoring period as compared to a regular year of operation (i.e. the ex-ante estimation). This scenario is beyond the control of PP as the state government considers the irrigation requirement as a first priority.

## E.7. Remarks on scale of small-scale project activity

>>

The project activity is a Type-I category small scale (12 MW) hydroelectric project and there is no change in the rated capacity of project activity has happened during this monitoring period and crediting period which may lead to the change in the scale of project activity.

[10] Please refer ER calculation sheet.

[11] ER sheets from previous monitoring periods have been referred to analyse the generation data. A separate generation data sheet has been prepared to show comparison of generations from previous months. Also, Appendix-3 is now included to present the summary of the generation trend in support of the description provided under section E.6

## Appendix - 1

Technical Specification of BH-1:

The power plant consists of water conductor, intake, power house, generation unit and a transformer.

| | |
|---|---|
| **Bhandardara Reservoir** | |
| Type of dam | Masonary gravity dam |
| Gross Storage | 318 Million cubic meter ($Mm^3$) |
| Live storage for power | 249 $Mm^3$ |
| Top of dam | 746.06 m |
| **Water conductor** | |
| Number | 1 |
| Type | Steel |
| Design discharge | 24 $m^3/s$ |
| Size | 3.0 m dia |
| Length | 318.8 m |
| Intake | |
| Full Supply Level | 744.73 m |
| Minimum draw down level for power | 720.7 m |
| **Power House** | |
| Type | Surface RCC and masonry |
| Size | 21.5m X 29.25m |
| Floor Level | 674.15m |
| Level of CL turbine | 665.5m |
| Capacity of OH crane | 65/15 tonnes |
| **Turbine Unit** | |
| Max gross head | 77m |
| Net design head | 69m |
| Design discharge | 19.25 $m^3$/sec |
| Type of generating unit | Vertical, Francis, top mounted thrust bearing |

| | |
|---|---|
| Number | 1 |
| Installed Capacity | 12.564 MW |
| Excitation | Static |
| Serial No: | V-0037/1 |
| Generator Unit | |
| Guaranteed Output | 12 MW |
| Rated Power Factor | 0.9 |
| Efficiency at 0.9 power factor | 97.62% at 100% load |

## Appendix - 2

Details of Energy Meters & their calibration due dates:

| | Gross Generation Meter | Export Main Meter | Export Check Mater |
|---|---|---|---|
| Make | Siemens Landis & Gyr Z.U | Elester | Elester |
| Accuracy Class | 0.2s | 0.2s | 0.2s |
| Serial Number | 73932341 | 14831461 | 14831477 |
| Calibration Frequency | Once in a year | Once in a year | Once in a year |
| Date of testing | 06/12/2017 | 05/12/2017 | 15/12/2017 |
| Validity Date | 05/12/2018 | 04/12/2018 | 14/12/2018 |
| Date of testing | 13/07/2018 | 11/07/2018 | 11/07/2018 |
| Validity Date | 12/07/2019 | 10/07/2019 | 10/07/2019 |

Note: The calibration schedule is not under the direct control of the PP and it is solely under the control of State Electricity Board, i.e. MSEDCL. The MSEDCL had conducted the half-yearly calibration of all energy meters. Therefore, all energy meters were checked for accuracy in every six months though the calibration frequency is once in a year. All the energy meter found under the permissible range of error i.e. 0.2%. The validity of calibration is one year as per the NABL certified Lab but PP has adopted & followed the six monthly accuracy check & yearly calibration validity period throughout the current monitoring period; Hence, there is no delay against calibration validity of energy meter. Therefore, all the energy meters were ultimately checked for accuracy in every six months and the calibration validity is once in a year.

## Appendix - 3

Generation and ER trend analysis of past 7 years:

Table A:

| Month | Jan-18 | Jan-17 | Jan-16 | Jan-15 | Jan-14 | Jan-13 | Jan-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 2385240 | 4079540 | 0 | 113110 | 2578390 | 0 | 5752390 |
| % Variation as compared to 2018 | | *71.0%* | *-100.0%* | *-95.3%* | *8.1%* | *-100.0%* | *141.2%* |

| Month | Feb-18 | Feb-17 | Feb-16 | Feb-15 | Feb-14 | Feb-13 | Feb-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 4899040 | 7145510 | 2395560 | 3497740 | 3391920 | 7352340 | 4653190 |
| % Variation as compared to 2018 | | *45.9%* | *-51.1%* | *-28.6%* | *-30.8%* | *50.1%* | *-5.0%* |

| Month | Mar-18 | Mar-17 | Mar-16 | Mar-15 | Mar-14 | Mar-13 | Mar-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 8969810 | 9916430 | 1049480 | 6744620 | 3916340 | 3515500 | 5263610 |
| % Variation as compared to 2018 | | *10.6%* | *-88.3%* | *-24.8%* | *-56.3%* | *-60.8%* | *-41.3%* |

| Month | Apr-18 | Apr-17 | Apr-16 | Apr-15 | Apr-14 | Apr-13 | Apr-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 9263810 | 8671910 | 0 | 6238470 | 3895630 | 1802140 | 2863510 |
| % Variation as compared to 2018 | | *-6.4%* | *-100.0%* | *-32.7%* | *-57.9%* | *-80.5%* | *-69.1%* |

| Month | May-18 | May-17 | May-16 | May-15 | May-14 | May-13 | May-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 6709140 | 6615490 | 0 | 1682390 | 2064460 | 0 | 2461610 |
| % Variation as compared to 2018 | | *-1.4%* | *-100.0%* | *-74.9%* | *-69.2%* | *-100.0%* | *-63.3%* |

| Month | Jun-18 | Jun-17 | Jun-16 | Jun-15 | Jun-14 | Jun-13 | Jun-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 3479620 | 265900 | 0 | 0 | 0 | 0 | 0 |
| % Variation as compared to 2018 | | ***-92.4%*** | ***-100.0%*** | ***-100.0%*** | ***-100.0%*** | ***-100.0%*** | ***-100.0%*** |

| Month | Jul-18 | Jul-17 | Jul-16 | Jul-15 | Jul-14 | Jul-13 | Jul-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 8159980 | 5764420 | 3519240 | 1310580 | 89170 | 3910290 | 55250 |
| % Variation as compared to 2018 | | ***-29.4%*** | ***-56.9%*** | ***-83.9%*** | ***-98.9%*** | ***-52.1%*** | ***-99.3%*** |

| Month | Aug-18 | Aug-17 | Aug-16 | Aug-15 | Aug-14 | Aug-13 | Aug-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 10795590 | 9938020 | 10814780 | 6841080 | 7876490 | 8234640 | 2131210 |
| % Variation as compared to 2018 | | *-7.9%* | *0.2%* | *-36.6%* | *-27.0%* | *-23.7%* | *-80.3%* |

| Month | Sep-18 | Sep-17 | Sep-16 | Sep-15 | Sep-14 | Sep-13 | Sep-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 3067810 | 4787360 | 8139470 | 5707040 | 5796250 | 5611290 | 7412420 |
| % Variation as compared to 2018 | | *56.1%* | *165.3%* | *86.0%* | *88.9%* | *82.9%* | *141.6%* |

| Month | Oct-18 | Oct-17 | Oct-16 | Oct-15 | Oct-14 | Oct-13 | Oct-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 8562900 | 1840820 | 1489360 | 10003700 | 0 | 3273540 | 4390480 |
| % Variation as compared to 2018 | | ***-78.5%*** | ***-82.6%*** | ***16.8%*** | ***-100.0%*** | ***-61.8%*** | ***-48.7%*** |

| Month | Nov-18 | Nov-17 | Nov-16 | Nov-15 | Nov-14 | Nov-13 | Nov-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 4876370 | 0 | 0 | 8966850 | 606940 | 0 | 1631320 |
| % Variation as compared to 2018 | | ***-100.0%*** | ***-100.0%*** | ***83.9%*** | ***-87.6%*** | ***-100.0%*** | ***-66.5%*** |

| Month | Dec-18 | Dec-17 | Dec-16 | Dec-15 | Dec-14 | Dec-13 | Dec-12 |
|---|---|---|---|---|---|---|---|
| Gross Electricity Generation (kWh) | 1370 | 0 | 0 | 4777640 | 4137630 | 5921720 | 5491010 |
| % Variation as compared to 2018 | | *-100.0%* | *-100.0%* | *348632.8%* | *301916.8%* | *432142.3%* | *400703.6%* |

Table B:

Details of year wise generation and PLF comparison:

| Year | Annual generation data (kWh) | Calculated PLF | Variation Against Projected PLF | Variation against data for year 2018 |
|---|---|---|---|---|
| 2018 | 71170680 | 67.70% | 19.32% | NA |
| 2017 | 59025400 | 56.15% | 7.77% | -17.07% |
| 2016 | 27407890 | 26.07% | -22.31% | -61.49% |
| 2015 | 55883220 | 53.16% | 4.78% | -21.48% |
| 2014 | 34353220 | 32.68% | -15.70% | -51.73% |
| 2013 | 39621460 | 37.69% | -10.69% | -44.33% |
| 2012 | 42106000 | 40.06% | -8.32% | -40.84% |
| Average: | 47081124 | 44.79% | -3.59% | |
| | | | | |
| Values as per registered PDD : | 5,08,57,000 | 48.38% | (Reg. PDD, ver 09, dt 16/07/2016, page no. 29) | |

Table C:

Details of ER in previous Monitoring Period:

| Monitoring Period | Actual ER achieved (tCO2) | Variation compared to ex-ante |
|---|---|---|
| MP: 01 Jan 2018 - 31 Mar 2019 (current) = | 54024 | 23.68% |
| MP: 01 Nov 2016 - 31 Dec 2017 = | 39849 | -2.56% |
| MP: 27 Jul 2015 - 31 Oct 2016 = | 42996 | -3.27% |
| MP: 01 Jan 2013 - 26 Jul 2015 = | 63160 | -29.78% |
| MP: 01 Apr 2012 - 31 Dec 2012 = | 17852 | -32.38% |

- - - - -

## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 08.0 | 6 April 2021 | Revision to:<br>• Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR). |
| 07.0 | 31 May 2019 | Revision to:<br>• Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN);<br>• Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period;<br>• Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes;<br>• Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods;<br>• Make editorial improvements. |
| 06.0 | 7 June 2017 | Revision to:<br>• Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN);<br>• Make editorial improvements. |
| 05.1 | 4 May 2015 | Editorial revision to correct version numbering. |
| 05.0 | 1 April 2015 | Revisions to:<br>• Include provisions related to delayed submission of a monitoring plan;<br>• Provisions related to the Host Party;<br>• Remove reference to programme of activities;<br>• Overall editorial improvement. |
| 04.0 | 25 June 2014 | Revisions to:<br>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));<br>• Include provisions related to standardized baselines;<br>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;<br>• Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*;<br>• Editorial improvement. |
| 03.2 | 5 November 2013 | Editorial revision to correct table in page 1. |
| 03.1 | 2 January 2013 | Editorial revision to correct table in section E.5. |

| *Version* | *Date* | *Description* |
|---|---|---|
| 03.0 | 3 December 2012 | Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11). |
| 02.0 | 13 March 2012 | Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20). |
| 01.0 | 28 May 2010 | EB 54, Annex 34. Initial adoption. |

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