

PARBATI HYDROELECTRIC PROJECT, STAGE III



Document Prepared By EKI Energy Services Limited

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Table of Contents

1	Project Details.....	3
1.1	Summary Description of the Implementation Status of the Project	3
1.2	Sectoral Scope and Project Type	3
1.3	Project Proponent.....	4
1.4	Other Entities Involved in the Project	4
1.5	Project Start Date	4
1.6	Project Crediting Period.....	5
1.7	Project Location	5
1.8	Title and Reference of Methodology.....	7
1.9	Other Programs	7
1.10	Sustainable Development.....	7
2	Implementation Status	8
2.1	Implementation Status of the Project Activity	8
2.2	Deviations	8
2.2.1	Methodology Deviations	8
2.2.2	Project Description Deviations.....	8
2.3	Grouped Project	9
2.4	Safeguards	10
2.4.1	No Net Harm	10
2.4.2	Local Stakeholder Consultation	10
3	Data and Parameters.....	10
3.1	Data and Parameters Available at Validation	10
3.2	Data and Parameters Monitored	11
3.3	Monitoring Plan.....	14
4	Quantification of GHG Emission Reductions and Removals	16
4.1	Baseline Emissions	16
4.2	Project Emissions	17
4.3	Leakage	17
4.4	Net GHG Emission Reductions and Removals	17
	APPENDIX 1: <NA>	18

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The Parbati Hydroelectric Project, Stage III is Greenfield Hydro Power Project located on river Sainj and Jiwa nallah a tributary of Beas River near village Bihali, Kullu district of Himachal Pradesh state of India.

It is a run-of-the-river scheme whose design discharge includes the diversion of the tail race releases of Parbati Stage-II Power house as well as inflows from river Sainj and Jiwa nallah. This inflow of 177 cumec from Sainj river through 7.875 km long headrace tunnel utilized for generation of 520 MW (4x130 mw) in underground power house near village Bihali. Tailrace outlet near village Larji. The Underground powerhouse is designed for installation of four generating units each having a capacity of 130 MW and is utilised to generate 1,975.95 MU of electricity as per registered VCS PD.

The purpose of the project activity is to generate electrical power using hydel energy, through the operation of run of the river hydro turbines. The hydel energy generated from the hydel power plant is evacuated to the State Grid System which is part of NEWNE Grid.

Generating power through hydel plant is a clean technology as no Carbon intensive fossil fuel is burnt during the process. A hydel turbine produces power by harnessing the available potential energy. Thus, there are no GHG emissions associated with the functioning of the hydro turbines.

This in result replaces anthropogenic emissions of greenhouse gases (GHG's) estimated to be approximately 1,912,324 tCO₂e per year, thereon displacing 1,975,950 MWh/year amount of electricity from the grid as mentioned in registered VCS PD.

In the Pre- project scenario the entire 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.

The project is implemented and commissioning details are mentioned in section 1.5 of this MR.

The project was registered at VCS (Project I.D. 1425) and the details of the same can be viewed on http://www.vcsprojectdatabase.org/#/project_details/1425

The expected operational lifetime of the project is for 35 years. The total emission reductions achieved under this monitoring period is 630,977 tCO₂.

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:

ACM0002: Grid-connected electricity generation from renewable sources --- Version 16.0

<http://cdm.unfccc.int/methodologies/DB/EY2CL7RTEHRC9V6YQHLAR6MJ6VEU83>

Further the project activity is not among the grouped projects, which allows the expansion of project activity subsequent to project validation. Initial project activity instances identified in the project description will remain same throughout VCS verification cycle

1.3 Project Proponent

Roles and Responsibilities of the Project Proponents:

- Overall responsibility of implementation of the VCS project
- Daily monitoring and record keeping
- Collection of credit reports
- Generating the invoices as per credit reports

Organization name	NHPC Limited
Contact person	Mr. R. K. Gupta
Title	Executive Director, R&D Division
Address	NHPC Limited, NHPC Office Complex, Sector 33, Faridabad - 121003, Haryana, India
Telephone	-
Email	-

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the project	Project Consultant
Contact person	Mr. Manish Dabkara
Title	CEO
Address	Office No. 201, EnKing Embassy Plot No. 48, Scheme No. 78 Part II, Vijay Nagar INDORE – 452001
Telephone	+91-731-4289086
Email	manish@enkingint.org

1.5 Project Start Date

Project Start Date: 24-Mar-2014 (Earliest Date of commissioning);

The project start date is the earliest commissioning date amongst all the Four Hydro Turbine

Units which are part of this Large Scale Hydro power project.

Project Name	Unit No	Turbine capacity	Location	Commissioning date
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Parbati Hydroelectric Project, Stage III	I	130 MW	Kullu, Himachal Pradesh	24-Mar-14
	II	130 MW	Kullu, Himachal Pradesh	24-Mar-14
	III	130 MW	Kullu, Himachal Pradesh	30-Mar-14
	IV	130 MW	Kullu, Himachal Pradesh	6-Jun-14

1.6 Project Crediting Period

The project crediting period shall be a maximum of ten years which will be renewed at most twice.

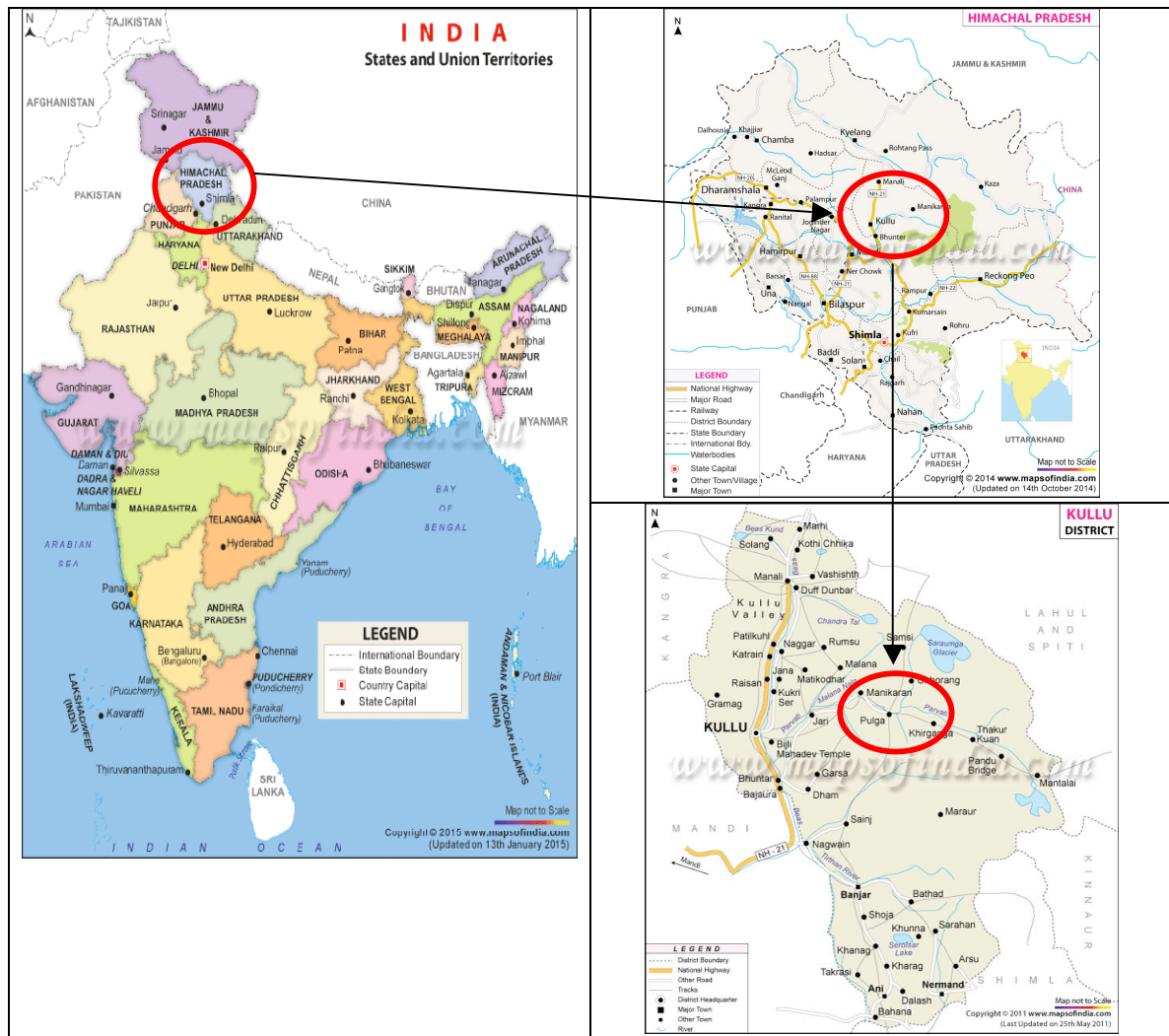
The start date of first crediting period is 24/03/2014 and end date as 23/03/2024

Current monitoring period is from 24/03/2014 to 29/03/2015. This is first monitoring period of project activity.

1.7 Project Location

The Parbati Stage-III hydroelectric project is installed across Sainj and Jiwa nallah near Bihali village in Kullu distt. in the state of Himachal Pradesh. The geographical co-ordinates of the project activity are Latitude: 32.5833N, Longitude= 77.5833E.

The map below shows the exact location of the project activity:



1.8 Title and Reference of Methodology

Project Type: I – Renewable Energy Projects

Methodology:

ACM0002: Grid-connected electricity generation from renewable sources --- Version 16.0

<http://cdm.unfccc.int/methodologies/DB/EY2CL7RTEHRC9V6YQHLAR6MJ6VEU83>

1.9 Other Programs

The project activity has not been registered with any other program.

1.10 Sustainable Development

Apart from generation of renewable electricity, the project activity contribute to the sustainable development of the region - socially, environmentally and economically. Ministry of Environment and Forests (MoEF), Government of India, has stipulated the following indicators for sustainable development.

1. Social well-being;
2. Economic well-being;
3. Environmental well-being; and
4. Technological well-being

Social well-being

The project activity results in creating job opportunities for the local population on temporary and permanent basis. Manpower is required both during erection and operation of the renewable energy projects. This would result in the improvement in living standards of the local community.

The installation of the renewable energy projects also led to development of basic infrastructure like roads, communication with the nearby cities etc. which also improved in living standards of the local population.

Economic well-being

The project activity creates direct and indirect job opportunities to the local community during installation and operation of the renewable energy projects.

The investment for the project activity instances under grouped project activity would lead to the improvement in the economic activity in the local area.

Environmental well-being

The project activity utilizes renewable energy for generating electricity which otherwise would have been generated through alternate fuel (most likely - fossil fuel) based power plants, contributing to reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions. As renewable energy projects produce no end products in the form of solid waste (ash etc.), they address the problem of solid waste disposal encountered by most other sources of power. Being a renewable resource, to generate electricity contributes to

resource conservation. Thus the project causes no negative impact on the surrounding environment.

Technological well-being:

Clean technology transfer in renewable energy generation and optimal use of renewable energy in the industry.

There is no any provision is required to monitor and report these sustainable development indicators as per national rules and regulations.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

1. Starting date of the operation of the project activity 24/03/2014, which is the earliest date of commissioning of the unit I of the project activity and 06/06/2014 which is date of the commissioning of the last unit IV of the project activity bundle.
2. The project activity consists of four units each having 130 MW capacity totaling 520 MW capacities and supplying the entire electricity to the state grid. There has been no major downtime of equipments, overhaul times or exchange of equipments in the project activity during the current monitoring period.
3. During the current monitoring period there no events and/or situations have occurred that may impact the applicability of the applied methodology.

2.2 Deviations

2.2.1 Methodology Deviations

Not applicable

2.2.2 Project Description Deviations

Deviation 1 –

In registered VCS PD, the export parameter mentioned source as Joint Meter Reading (JMR) / Monthly Special Energy Meter statement (SEM) from the energy meters, however project activity does not have JMR or monthly energy meter statement, hence deviation is requested to use source as “Deviation Settlement Account document” for export parameter. Also there are no invoices raised for actual export value, thus actual export cannot be cross checked with invoices but can compare with Monthly Generation Report.

Justification - Since hydro projects involves scheduling of energy and invoice is based on scheduled energy, however the difference between scheduled energy and actual energy is reflected in Deviation Settlement Account document. There is no any JMR prepared for the project activity and no invoices are raised based on actual export values. Thus for proposed project activity, the deviation settlement account data has been considered for actual electricity supplied to grid parameter and also same data can be cross checked with Monthly Generation Report. The deviation Settlement account document considers actual export through online measurement of line1 and line 2 meters. The Monthly generation report gives the gross

generation by the project activity and this monthly generation report value should be higher than export value mentioned in deviation Settlement account document. The change is sources for the export parameter and it's cross check mechanism is mentioned as deviation in VCS MR.

Deviation 2 –

- a) In registered VCS PD, the source of data for import parameter is mentioned as Monthly electricity sales bills raised by State Electricity Board, however PP do not have these bills, thus PP has submitted import data certified by state electricity board. Thus deviation is requested for the source of import data.
- b) The project activity involves Import parameter as a monitoring parameter and PP has monitored this parameter. However the latest calibration reports of import meters are available with PP, thus project description deviation is requested for the delay in calibration and application of error factor conservatively as per CDM guidelines..

Justification –

- a) The state electricity board takes monthly reading of import meters and determines the import by the project activity. Due to non availability of all sales bills, PP has taken certification from state electricity board for the import data and same can be considered as authentic data for the import parameter.
- b) The non- availability of earlier calibration of import meters are justified as below and conservative approach has been followed for import values for the current monitoring period
 - 1. The import meters are not under control of PP.
 - 2. As per VCS Registered PD “The Import meters will be calibrated and maintained by state electricity Board”, thus PP do not have import meters calibration certificates.
 - 3. Since there is monetary transaction involved and PP need to pay to state electricity Board for import of electricity, thus state electricity board ensures that meters are running accurately. PP do not have any role for calibration of meters.
 - 4. It is the state electricity board who decides about when to do calibration of import meters. The state electricity board is not sharing calibration certificates to PP for import meters and this is common practice followed by them.
 - 5. Since earlier calibration certificates are not available with PP, however the latest calibration certificates are available with PP and calibration certificate shows the error is within permissible limit of accuracy class. Hence as a conservative approach, the error factor is applied for import as per CDM guidelines.

2.3 Grouped Project

Not applicable

2.4 Safeguards

2.4.1 No Net Harm

As per VCS Guidelines, this section is not mandatory being project is under verification and DOE Contract is prior to 19/04/2017.

2.4.2 Local Stakeholder Consultation

As per VCS Guidelines, this section is not mandatory being project is under verification and DOE Contract is prior to 19/04/2017.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	EF _{grid,OM,y}
Data unit	tCO ₂ /MWh
Description	Operating Margin CO2 emission factor in year y
Source of data	Calculated from CEA database, Version 10, December 2014
Value applied	0.9862 (NEWNE Grid)
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 04.0.0" as 3-year generation weighted average using data for the years 2011-2012, 2012-2013 & 2013-2014. The data are obtained from "CO2 Baseline Database for Indian Power Sector" version 10.0, published by the Central Electricity Authority, Ministry of Power, Government of India
Purpose of the data	To calculate baseline emission reduction
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 CO2 emission factor in year y
Source of data	Calculated from CEA database, Version 10, December 2014
Value applied	0.9495 (NEWNE Grid)
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 04.0.0" for the years 2013- 2014. The data are obtained from "CO2 Baseline Database for Indian Power Sector" version 10.0, published by the Central Electricity Authority, Ministry of Power, Government of India
Purpose of the data	To calculate baseline emission reduction

Comments	This parameter is fixed ex-ante for the entire crediting period.
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Data / Parameter	EF _{grid,CM,y}
Data unit	tCO ₂ /MWh
Description	Combined Margin CO ₂ emission factor in year y
Source of data	Calculated from CEA database, Version 10, December 2014
Value applied	0.9678 (NEWNE Grid)
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 CO₂ emission factor in year y (tCO₂/MWh) $EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 50% W_{BM} = Weighting of build margin emissions factor (%) = 50%
Purpose of the data	To calculate baseline emission reduction
Comments	This parameter is fixed ex-ante for the entire crediting period.

3.2 Data and Parameters Monitored

Data / Parameter	EG _{PJ,y}
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	It is a calculated based on EG _{Export,y} , EG _{Import,y}
Description of measurement methods and procedures to be applied	Net electricity supplied to grid are calculated as Net electricity generated and supplied by the project plant/unit to the grid = Electricity exported by the project to the grid at project site switch yard – Electricity imported by the project from the grid at interconnection point of the Regional Supply $EG_{PJ,y} = EG_{Export,y} - EG_{Import,y}$
Frequency of monitoring/recording	Monthly recording.
Value monitored	651,970
Monitoring equipment	Not Applicable as it is a calculated value
QA/QC procedures to be applied	Net electricity supplied to grid is a calculated value. Therefore QA/QC is provided for individual parameters EG_{Export,y} , EG_{Import,y}: EG_{Export,y} is sourced from the deviation settlement account statement published by Northern Regional Power Committee as mentioned in deviation (section 2.2 of MR)

	EG_{Import,y} is sourced from the certified data from State Electricity Board, which is a government organization responsible for monitoring the electricity, thus the values are authentic and credible as mentioned in deviation (section 2.2 of MR).
Purpose of the data	To calculate baseline emission reduction
Calculation method	$EG_{PJ,y} = EG_{Export,y} - EG_{Import,y}$
Comments	-

Data / Parameter	EG _{Export,y}
Data unit	MWh
Description	Quantity of Electricity exported by the project to the grid at project site switch yard in year y
Source of data	Deviation Settlement Account statement issued by Northern Regional Power Committee as mentioned in deviation (section 2.2 of MR)
Description of measurement methods and procedures to be applied	Electricity exported by the project to the grid at project site switch yard is the Net Transmitted Units recorded and monitored by the metering system installed at the project site switch yard. The metering system comprises of four individual special energy meters (SEMs) (acts as standby meters) installed at the project site switch yard, for each generating units. These are connected via two transmission lines of 400 kV, each having its own SEM meter (main meter and check meter). In case, anyone transmission line is not in service than complete load is shifted to other transmission line which is in operation. The energy meters are tri-vector meter which are installed and sealed by the Power Grid Corporation Limited in the presence of the representatives of the power producer. The energy meters have capacity of recording both import & export; however net transmitted units are recorded & monitored. Northern Regional Power Committee monitors the export of project activity through online on daily basis and publishes weekly Deviation Settlement Account where actual export value is mentioned. The check meter shall be used during the period the main metering system is not in service. Further in case of failure of both main meter and check meter, sum of the net electricity generation recorded by four individual special energy meters (SEMs) and individual auxiliary meters shall be used for accounting and billing purpose.

	Records of Deviation Settlement account is used for the calculation of Electricity exported by the project to the grid at project site switch yard. The deviation Settlement account statement mentioned collectively total export of all units and all transmission lines.
Frequency of monitoring/recording	Continuous measurement and monthly recording
Value monitored	654,566
Monitoring equipment	Tri-Vector Energy Meters of 0.2s accuracy class
QA/QC procedures to be applied	Energy meters are calibrated once in a five year and no faulty meters observed. $EG_{Export,y}$ can be cross checked from Monthly Generation Report. The Monthly generation report gives the gross generation by the project activity and this monthly generation report value should be higher than export value mentioned in deviation Settlement account document. The change is sources for the export parameter and it's cross check mechanism is mentioned as deviation in VCS MR.
Purpose of the data	To calculate baseline emission reduction
Calculation method	The deviation Settlement account statement mentioned collectively total export of all units and all transmission lines.
Comments	The data would be archived electronically and maintained for the entire crediting period plus two years

Data / Parameter	$EG_{Import,y}$
Data unit	MWh
Description	Quantity of Electricity imported by the project from the grid at interconnection point of the Regional Supply in year y
Source of data	Data certified by state electricity board
Description of measurement methods and procedures to be applied	The Project activity has provision for two 11kV Electricity Supply line from State Electricity Boards system however only single line is connected which is used to import electricity during start-up, shutdown and the lean period. The Electricity imported during start-up, shutdown and the lean period would also be recorded and monitored. Especially, in winter season when the project is partially or totally unable to operate, the project may draw energy required for start up and maintenance of the project from the State Electricity Boards system, which shall be metered at the interconnection point of the regional

	supply. The data is recorded by duly tested and sealed meter installed by State Electricity Board. The meter will be calibrated and maintained by State Electricity Board. PP have delayed calibrations on April 2017, thus error factor is applied conservatively for import values as mentioned in Deviation (section 2.2 of MR). Records of monthly electricity sales bills raised by State Electricity Board are used as evidence for power imported from the State Electricity Grid. Electricity imported by the project from the grid is certified by state electricity board as mentioned in Deviation (section 2.2 of MR).
Frequency of monitoring/recording	Continuous measurement and monthly recording.
Value monitored	2596
Monitoring equipment	Energy Meters of 0.5s accuracy class
QA/QC procedures to be applied	Energy meters are to be calibrated once in a five year and faulty meters to be replaced immediately. No such evidence occurred during current monitoring period. The meters are calibrated and maintained by State Electricity Board. PP have delayed calibrations on April 2017, thus error factor is applied conservatively for import values. EG_{Import,y} is sourced from the document certified by state electricity board.
Purpose of the data	To calculate baseline emission reduction
Calculation method	EG _{Import,y} is sourced from the document certified by state electricity board
Comments	The data would be archived electronically and maintained for the entire crediting period plus two years

3.3 Monitoring Plan

The project proponents at the power station have a procedure to ensure proper monitoring of the VCS project activity. The project activity has installed monitoring and control equipment that measure, record, report, monitor and control various key parameters.

The methodology requires monitoring of the net electricity supplied from the project activity.

The proponent shall maintain complete and accurate records and all other data required for the purpose of proper administration and operation of the hydro power plant. The data will be kept for at least 2 years after the end of the crediting period.

1. Purpose - The purpose of monitoring the project is to assess the annual emission reductions in tonnes of CO₂ that the project activity has achieved.
2. Data to be reported - EG_{export} & EG_{import} in MWh and periodical calibrations of monitoring equipments
3. Origin of data and monitoring including estimation approach- Net electricity generated. and supplied to grid is a calculated value whereas EG_{export} is sourced from Monthly Joint Meter

Reading (JMR) / Monthly Special Energy Meter statement (SEM) and EG_{import} is sourced from Monthly electricity sales bills raised by State Electricity Board

4. Meter Details:

- Details of MAIN & CHECK METER for LINE-1

MAIN METER for LINE-1		CHECK METER for LINE-1	
Meter Serial No.	NP-8576-A	Meter Serial No.	NP-8577-A
Model	ER300P	Model	ER300P
Make	L&T	Make	L&T
Accuracy Class	0.2S	Accuracy Class	0.2S

Details of MAIN & CHECK METER for LINE-2

MAIN METER for LINE-2		CHECK METER for LINE-2	
Meter Serial No.	NP-8592-A	Meter Serial No.	NP-8540-A
Model	ER300P	Model	ER300P
Make	L&T	Make	L&T
Accuracy Class	0.2S	Accuracy Class	0.2S

All meters are calibrated on 11/06/2013, thus the calibration validity of these meters are till 10/06/2018.

The details of import meters are as below

Location of Import meter	BHB 1 (OLD OFFICE)	BHB 8 (Administrative Building)	SPB1 (Sapangin i Township)	BHB12 (Power House)	SJP16 (Dam Site)	BHB13 (Surge Shaft)	LDT 1 (TRT)
Meter serial Number	HPS30825	HPS47566	6645897	07044580	6769799	229228	226972
Make	Secure	Secure	L& T	L& T	L& T	HPL Electric & power Pvt Ltd	HPL Electric & power Pvt Ltd
Accuracy Class	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s	0.5s
Calibration date	19/04/2017	19/04/2017	20/04/2017	19/04/2017	20/04/2017	19/04/2017	20/04/2017
Calibration due date	19/04/2022	19/04/2022	20/04/2022	19/04/2022	20/04/2022	19/04/2022	20/04/2022

The PP is importing electricity through regional supply lines. These meters will be calibrated and maintained by state electricity board and PP do not have any control on it. Also PP does not have the calibration certificates for these import meters for current monitoring period.

The PP have calibration certificates of period April 2017 and the result of delayed calibration is within permissible limit thus PP has applied accuracy class of meters as error factor as a conservative approach.

5. Monitoring times and periods - The data is monitored on a continuous basis but are recorded on a monthly basis with the energy meters installed at the site.
6. Data Accuracy - As per clause 4.0, Metering Arrangement of the Power Purchase Agreement (PPA) the metering arrangement including its installation, testing, maintenance and collection transportation and processing of data required for energy exchange shall be governed as per the notification/ directives issued/or to be issued by Central Electricity Regulatory Commission and as per relevant provisions contained in IEGC as amended from time to time. The Central Electricity Authority (CEA) notification regarding Installation and Operation of meters regulations, 2006, says that meters are required to be tested once in 5 years (refer clause 18 of the guideline). Thus, the meters recording the electricity exported are calibrated at least once 5 years.
7. Emission Reduction Calculation Approach - The emission reductions are calculated as a product of the net electricity generated from the project activity and the combined margin emission factor. The calculation approach is explained in detail under section 3 of registered VCS PD document.
8. Monitoring roles and responsibilities: A project team would be constituted for the monitoring of the project. This team is responsible for data collection and archiving. The team met periodically to review the data collected as per monitoring plan. In case of any irregularity observed by any of the team members, it will be informed to the concerned person for necessary actions to be taken. No any irregularity observed for current monitoring period. The following is the team structure for project monitoring:
 - a. Unit Head: Overall responsibility of compliance with the monitoring plan.
 - b. Power Plant In-charge: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation
 - c. Shift In-charge: Responsibility of daily report generation from the SCADA system/ log-books
9. Managing Data Quality: The Power plant In-charge would prepare the report pertaining to the recorded values of the monitored parameters as by the shift-in- charge. The day to day records were verified by Unit Head, compiled and documented. The company introduced a safe storage of data. NHPC is an ISO – 9000, and ISO – 14000 certified company having an integrated management system. It ensures also requirements are met for the project also.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

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

Where,

$EF_{grid,CM,y}$ = Combined Margin CO₂ emission factor in year y

$EG_{PJ,y}$ = Net electricity supplied to the NEWNE regional grid (MWh)

Period	Grid	Baseline emission factor (tCO ₂ /MWh)	Net Electricity generation (MWh)	Baseline emissions (ER _y)
24/03/2014 to 29/03/2015	NEWNE	0.9678	651,970	630,977

Total				630,977
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4.2 Project Emissions

As per registered VCS PD, there are no any project emissions occurred for the project activity

Period	Project Emissions (PE _y)
24/03/2014 to 29/03/2015	0

4.3 Leakage

As per registered VCS PD, there are no any leakage emissions occurred for the project activity.

Period	Project Leakage (LE _y)
24/03/2014 to 29/03/2015	0

4.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
24/03/2014 to 29/03/2015	630,977	0	0	630,977
Total	630,977	0	0	630,977

Vintage wise VCUs

From 24/03/2014 to 28/12/2014 – 599,981 tCO₂e

From 29/12/2014 to 29/03/2015 – 30,996 tCO₂e

APPENDIX 1: <NA>

Not Applicable.