GREEN ENERGY PROJECT AT KUTCH BY POWERICA LIMITED

Document Prepared By EKI Energy Services Limited

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity involves commissioning and operation of a 21.6 MW wind power generation project at Bhachau, in the Kutch district of Gujarat by Powerica Ltd. The total installed capacity of 21.6 MW comprises of 12 WTGs, each with a capacity of 1.80 MW. The project provides electricity to the state of Gujarat by effective utilization of renewable resources. The technology has been supplied by Vestas. The project utilizes wind energy for exporting electricity which otherwise would have been generated through alternate fuels (most likely - fossil fuel) based power plants, contributing to reduction in specific emissions (emissions of pollutant) including GHG emissions. Electricity produced from the project activity is supplied to NEWNE grid of India.

The technical details of the WTGs involved in the project activity are as below.

Parameters	**Value**
Make	Vestas
Model	V-100
Rated Power	1800 KW
Rotor diameter	100 m
Swept area	7850 m2
Cut in wind speed	4 m/s
Cut out wind speed	20 m/s
No. of Blades	3
Rotor Speed	14.4 rpm
Hub Height	95 m
Generator Type	Asynchronous with wound rotor, slip rings

All the WTGs involved in the project activity are already commissioned and operational. The WTGs are under operation since the date of commissioning and no event has been identified which may impact GHG emission reduction. The commissioning dates of all the WTGs are provided as below.

WTG ID	WTG No.	Date of Commissioning
VW 21	VWT/1800/11-12/2133	19-July-2011
VW 32	VWT/1800/11-12/2134	16-July-2011
NM82-4	VWT/1800/11-12/2135	14-July-2011
JW 27	VWT/1800/11-12/2136	16-July-2011
NM 82-3	VWT/1800/11-12/2309	29-Dec-2011
JW 30 New	VWT/1800/11-12/2316	31-Dec-2011
NM 82 07	VWT/1800/11-12/2311	29-Dec-2011
JW 09	VWT/1800/11-12/2312	31-Dec-2011
JW 10	VWT/1800/11-12/2313	31-Dec-2011
JW 12	VWT/1800/11-12/2314	31-Dec-2011
JW 13	VWT/1800/11-12/2315	31-Dec-2011
NM 82 06	VWT/1800/11-12/2310	29-Dec-2011

The total emission reductions achieved by this project activity in the monitoring period from 22 October 2012 to 30 September 2018 is 285,875 tCO2e.

1.2 Sectoral Scope and Project Type

The project activity falls under

Sectoral Scope **:** 01 - Energy industries (renewable / nonrenewable sources)
Project Type **:** I - Renewable Energy Projects
Title **:** ACM0002 ver. 12 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources

The methodology also refers to the latest approved versions of:

- "Tool to calculate the emission factor for an electricity system", Version 02.2.1, EB 63
- "Tool for the demonstration and assessment of additionality", Version 06.0.0, EB 66
- "Guidelines for the reporting and validation of plant load factors", Version 01, EB 48

This project is not a grouped project activity.

1.3 Project Proponent

Organization name	Powerica Limited
Contact person	Mr Pradeep Gupta
Title	Head of Wind Energy
Address	601, Dakshina Building, Sector -11, CBD Belapur, Navi Mumbai – 400 016, Maharashtra, 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. Ramkrishna Patil
Title	GM – Operations
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Telephone	+91 9096562065
Email	ramkrishna.patil@enkingint.org

1.5 Project Start Date

The project start date for this project is said to be is 14 July 2011. This is because the first WTG was commissioned on 14 July 2011.

1.6 Project Crediting Period

The project is registered under Clean Development Mechanism (CDM) of UNFCCC with 07 years crediting period (Renewable) (Reference No: 7671) on 22 October 2012[1]. First Crediting period of the project under CDM started on 22 October 2012 and ended on 21 October 2019.

The project has begun generating GHG emission reductions from commissioning. The crediting period for VCS began on 14 July 2011 and ended on 13 July 2021.

The project proponent will also not claim GHG emission reductions under two schemes for the same period.

[1] https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1349877556.69/view

1.7 Project Location

The detail information on the WTG locations along with their individual geographical co-ordinates is provided below.

Sr.No	WTG No.	Latitude (N)	Longitude (E)	Village
1	JW10	23° 11' 56"	70° 32' 48"	Jangi
2	JW12	23° 12' 29"	70° 32' 13"	Jangi
3	JW13	23° 12' 12"	70° 32' 16"	Jangi
4	JW27	23° 12' 49"	70° 33' 35"	Jangi
5	JW30New	23° 11' 59"	70° 31' 55"	Jangi
6	JW9	23° 12' 3"	70° 33' 2"	Jangi
7	NM82-3	23° 11' 53"	70° 35' 26"	Vandhiya
8	NM82-4	23° 12' 5"	70° 35' 19"	Vandhiya
9	NM82-6	23° 11' 59"	70° 35' 47"	Vandhiya
10	NM82-7	23° 11' 53"	70° 35' 58"	Vandhiya
11	VW21	23° 12' 20"	70° 37' 30"	Vandhiya
12	VW32	23° 12' 12"	70° 37' 12"	Vandhiya

1.8 Title and Reference of Methodology

ACM0002 ver. 12 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources
The methodology also refers to the latest approved versions of:
• "Tool to calculate the emission factor for an electricity system", Version 02.2.1, EB 63
• "Tool for the demonstration and assessment of additionality", Version 06.0.0, EB 66
• "Guidelines for the reporting and validation of plant load factors", Version 01, EB 48

1.9 Other Programs

Include the following information, as applicable:

- Emission Trading Programs and Other Binding Limits: The PP has not applied this project in any Emission Trading Programs and other Binding Limits.
- Other Forms of Environmental Credit: The PP has not applied this project in any other form of environmental credits.

- Participation under Other GHG Programs: The PP has participated under CDM mechanism of UNFCCC. The UN reference id 7671[2] of program with this project activity. The PP would not consider the credit from any other mechanism for the current monitoring period. The undertaking is provided to confirm that there is no any double accounting for current monitoring period.

1.10 Sustainable Development

Contribution to sustainable development:

Ministry of Environment and Forests, has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. The project contributes to sustainable development using the following ways.

- **Social well-being:** The project would help in generating employment opportunities during the construction and operation phases. The project activity will lead to development in infrastructure in the region like development of roads and also may promote business with improved power generation.

- **Economic well-being:** The project is a clean technology investment in the region, which would not have been taken place in the absence of the VCS benefits the project activity will also help to reduce the demand supply gap in the state. Due to generation of employment opportunities, the economic condition of project activity region will be improved.

- **Technological well-being:** The successful operation of project activity would lead to promotion of wind based power generation and would encourage other entrepreneurs to participate in similar projects.
- **Environmental well-being**: The project activity being a renewable source of energy, it reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. Due to its zero emission the project activity also helps in avoiding significant amount of GHG emissions.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

All the WTGs involved in the project activity are already commissioned and operational. The WTGs are under operation since the date of commissioning and no event has been identified which may impact GHG emission reduction. The commissioning dates of all the WTGs and technical specifications of WTGs are provided in section 1.1.

The project activity is a greenfield project for generation of electrical energy using wind which is a renewable source of energy. In wind energy generation, kinetic energy of the wind is converted

[2] https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1349877556.69/view

into mechanical energy and subsequently into electrical energy. Wind turbines capture the wind's energy with three propeller-like blades, which are mounted on a rotor, to generate electricity. The turbines sit high atop towers, taking advantage of the stronger and less turbulent wind. As the wind blows through the blades of the windmill, a pocket of low-pressure air forms on the downwind side of the blade. The low-pressure air pocket then pulls the blade towards it, causing the rotor to spin. The rotor turns the shaft that further spins the connected generator. The spinning of this generator produces the required electricity. Since power is generated from wind energy, no emissions are attributed to the project emissions and due to that equivalent amount of fossil-fuel dominated grid can be displaced due to the project activity.

Emission reductions are claimed on the net electrical energy that is supplied to grid which is metered using meters (Main & Check meters) located at the electrical yard of the respective WTGs. These electrical energy meters are electronic tri-vector meters of appropriate accuracy class. Since these meters are not designed to measure high voltages and currents as generated in the WTG, the WTG output is connected to these meters via transformers (CT/PT) for stepping down the generated voltage and current to ranges which the meters can record. As such, these meters have a multiplying factor which when multiplied to the meter reading provides the actual amount of electricity generated. The technology providers for the project have additionally installed an LCS meter at the WTG controller.

The electricity generated is monitored using electrical meters (Main & Check meters) which provide a measure of the actual electrical energy that would have been sourced from a fossil-fuel based power plants in the absence of the project activity. Hence, the fossil-fuel power based grid is the baseline for the project activity.

2.2 Deviations

2.2.1 Methodology Deviations

There is no request for deviation applied during this monitoring period.

2.2.2 Project Description Deviations

The below deviation has been requested for the project activity

As per registered CDM PDD, the calibration frequency is once in a year. The calibration of meters is not in control of PP and same is done by state electricity board. The state electricity board does not follow any fixed calibration frequency, hence deviation is requested for change in calibration frequency as once in five years. This calibration frequency is as per CEA notification http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf , page 12

The change in calibration frequency does not have any impact on ER calculations as during monthly reading state electricity board official and PP representative check the meter conditions. Also both party accepts the reading and PP raise the invoice to state electricity board based on monthly JMR reading. Thus financial obligations are involved which ensures that meters are running accurately.

2.3 Grouped Project

This project activity is not a grouped project activity.

2.4 Safeguards

The project does not involve any potential negative environmental and socio economic impacts and hence this criteria is not applicable to this project activity

2.4.1 No Net Harm

The project does not involve any potential negative environmental and socio economic impacts and hence this criterion is not applicable to this project activity.

2.4.2 Local Stakeholder Consultation

Local Stakeholder consultation had been carried out during CDM registration of this project activity 0n 06/05/2011. There were no comments that required follow up action from PP. The PP also placed a grievance register onsite in where the stakeholder can put down his/her complain and the same if found genuine will be addressed immediately.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	**$EF_{Grid,CM,y}$**
Data unit	tCO2/MWh
Description	Combined Margin Grid emission factor
Source of data	CEA website Version :06 (Valid from 1st March 2011)
Value applied	0.9486
Justification of choice of data or description of measurement methods and procedures applied	No measurement method has been applied; the value has been directly sourced from the registered CDM PDD.
Purpose of the data	This data is used for the calculation of the Baseline Emissions
Comments	-

Data / Parameter	**$EF_{Grid,OM,y}$**
Data unit	tCO2/MWh
Description	Weighted average of 3 years (2007-08, 2008-09,2009-10) CO2 Operating Margin emission factor of the grid

Source of data	CEA website Version :06 (Valid from 1st March 2011)
Value applied	0.9941
Justification of choice of data or description of measurement methods and procedures applied	No measurement method has been applied; the value has been directly sourced from the registered CDM PDD.
Purpose of the data	This data is used for the calculation of the Baseline Emissions
Comments	-

Data / Parameter	**$EF_{Grid,BM,y}$**
Data unit	tCO2/MWh
Description	CO2 Build Margin emission factor of the grid
Source of data	CEA website Version :06 (Valid from 1st March 2011)
Value applied	0.8123
Justification of choice of data or description of measurement methods and procedures applied	No measurement method has been applied; the value has been directly sourced from the registered CDM PDD.
Purpose of the data	This data is used for the calculation of the Baseline Emissions
Comments	-

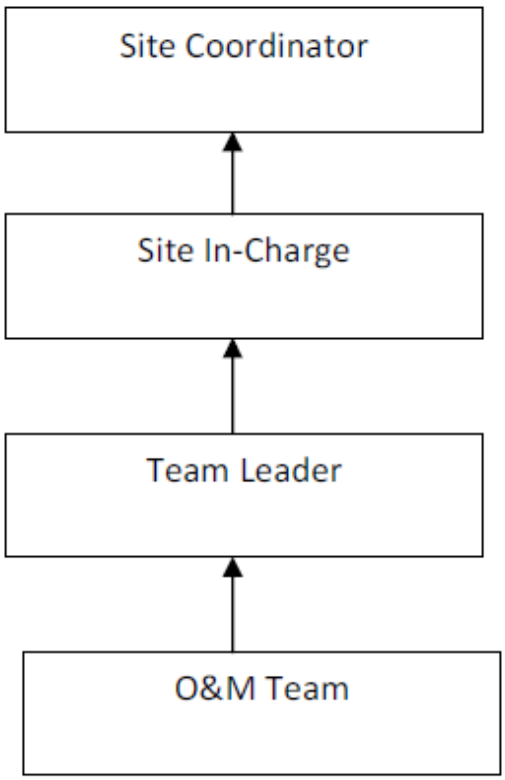
3.2 Data and Parameters Monitored

Data / Parameter	**$EG_{facility,y}$**
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Certificate for share of electricity generated by Wind farm provided by GETCO
Description of measurement methods and procedures to be applied	Measured & Calculated
Frequency of monitoring/recording	Monthly
Value monitored	301,366
Monitoring equipment	Monitoring Equipment: Monitored through the main meter and check meter readings. Both the energy meters are bi-directional tri-vector meters. Meter accuracy: 0.2s of the meter at respective

	substations that are used for the exported electricity metering. 0.5s of the meter at respective WTG yards that would be used for the electricity metering. The meters are calibrated once in five year as per CEA notification and deviation requested. Please refer section 2.2.2 of MR for deviation. For meter details and calibration , please refer section Appendix 1 of MR.
QA/QC procedures to be applied	The Quantity of net electricity generation from the certificates for share of electricity are cross-checked with the invoices for the sale of power by Powerica.
Purpose of the data	This data is used for the calculation of the Baseline Emissions
Calculation method	-
Comments	**Data archived:** Crediting period + 2 yrs

3.3 Monitoring Plan

Since the baseline emission factor is based on an ex-ante determination, monitoring of this parameter is not required. The sole parameter for monitoring is the electricity exported to the grid. The Project is operated and managed by Vestas Wind Technology India Private Limited (Vestas). Vestas has a designated Site-In-Charge (O&M) on site who is responsible for monitoring the electricity exported from the project activity. The organizational structure of the O&M team by Vestas is as follows:



The roles and responsibilities of the O&M team may be elaborated as follows:

O&M Team: The team comprises of site engineers who are directly responsible for carrying out the O & M activity of WTG. They execute the preventive maintenance and attend to break downs as per O&M Manual & Procedures. They respond to breakdown calls and resolve customer complaints. They record all the readings and prepare documentations for Reports, Logs and Daily Generation Reports.

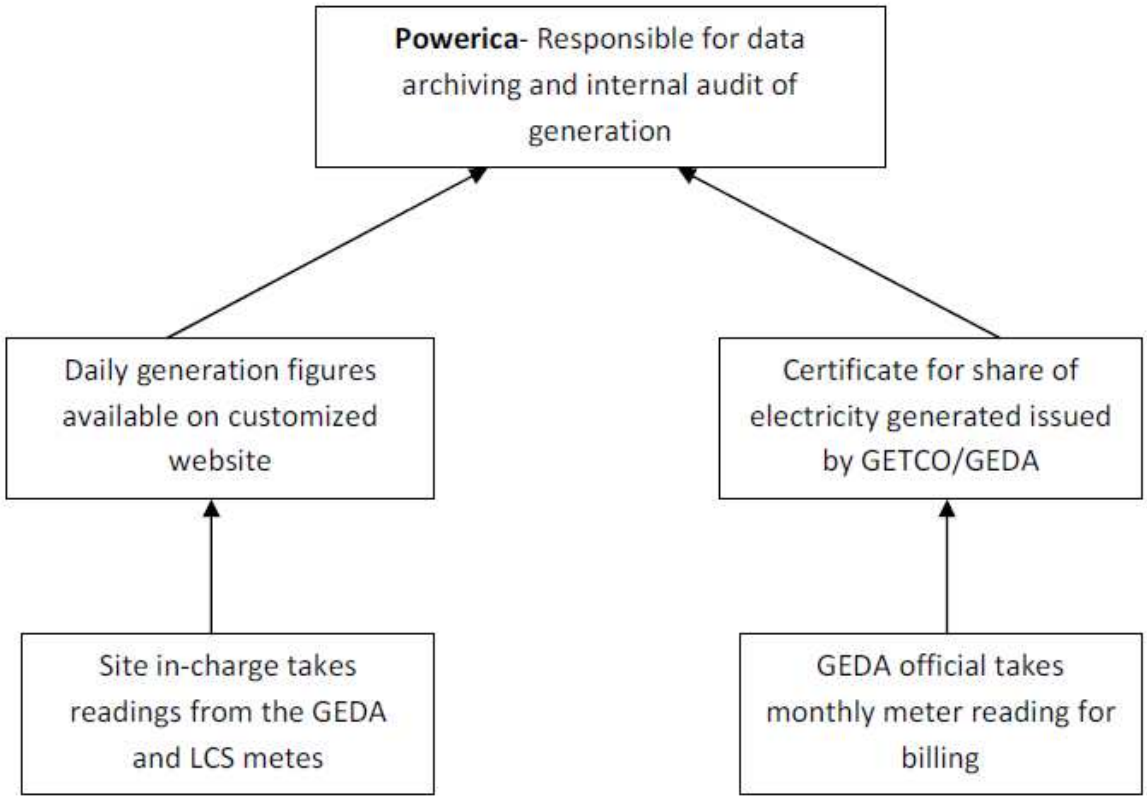
Team Leader: He leads the O&M team and is responsible for attending to the unscheduled breakdown of WTGs and for ensuring that WTG should be restored at earliest. He ensures the proper reading, recording and monitoring of the Generation.

Site-Incharge: He is responsible for the entire site. He has to take timely corrective measures/action to ensure that overall performance of site is met and delivered. He is responsible for the individual site. He executes the preventive maintenance and attends to break downs as per O&M Manual & Procedures. He also checks the daily Generation reports for all the WTGs.

Site Co-ordinator: He is in-charge of overall O&M activities of site. The responsibilities include ensuring complete documentation of the Generation of the site, on-time service delivery, timely response to breakdowns and efficient manpower management for the site.

Further, all new technicians on site are trained by Vestas. Also, the O&M personnel are trained regularly in order to improve their technical skills.

The overall flow of information has been depicted using the following hierarchical structure:



Monitoring Process at Gujarat

Metering of wind power is done as under:

- Joint meter reading is taken at Vandhiya substation meter by representative of GETCO (Gujarat Electricity Transmission Company) and O&M service provider (on behalf of individual wind farm owners). Let the total generation recorded for particular month is 'X' units in sub-station meter.
- Joint meter reading is taken at Local Meter-(transformer yard meter of each WTG) by representative of GETCO (Gujarat Electricity Transmission Company) and O&M service provider (on behalf of individual wind farm owners). Let us assume total generation of Powerica recorded for particular month is 'Y1' units.
- Similarly joint meter reading for other wind farm owners is also taken. Let the generation of individual owner recorded for particular month are 'Y2, Y3,.....Yn' units.
- GETCO distributes 'X' to individual wind farm owners using following formula and issues monthly certificates.
- For Powerica, net units calculated for billing = X * Y1 / ΣYn It must be noted here that the meter readings as mentioned above are calculated as the product of meter multiplication factor and the difference of the current and previous meter readings

Internal audits & Performance review

The records are regularly audited and checked by the senior officials from project proponent basis. The officials monitor readings at site are adequately trained. There are no any discrepancy/inconsistency observed in the values of net electricity supplied to grid value.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The emission factor value has been fixed Ex-ante and the same shall be used for the monitoring period. Net Electricity Generated is obtained by deducting total import (from grid) from total export (to grid). These values are taken from the "Certificate for Share of Electricity Generated by Wind Farm" issued by Gujarat Energy Transmission Corporation Limited (GETCO). This statement is issued on a monthly basis

Baseline emissions are calculated by multiplying the Net electricity exported to the grid with net baseline emission factor, as given in the CDM PDD.

BEy = Baseline Emission Factor (EF Grid,CM,y) x ($EG_{facility,y}$) Where,

BEy = Baseline Emissions (tons/year)
$EG_{facility,y}$: Net Electricity exported to grid (MWh)

BEy = (EF Grid,CM,y) x ($EG_{BL,y}$)

=0.9486 tCO_2 / MWh x 301,366 MWh

=285,875 tCO_2 (Rounded Down)

The emission reductions are calculated as per the equation:

ER = BEy – PEy

ER – Emission Reduction (tCO2/year)
BEy - Baseline Emissions (tCO2/year)
PEy – Project Emissions (tCO2/year)

4.2 Project Emissions

The project activity involves in harnessing wind power. So the emissions from the project are zero. Hence. PEy = 0 tCO2/year

4.3 Leakage

The project proponents have identified no anthropogenic greenhouse gases by sources outside the project boundary that are significant, measurable and attributable to the project activity. Hence, no leakage is considered from the project activity.
LEy = 0 tCO2/year.

4.4 Net GHG Emission Reductions and Removals

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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)
2012	4,244	0	0	4,244
2013	45,887	0	0	45,887
2014	45,278	0	0	45,278
2015	48,299	0	0	48,299
2016	47,508	0	0	47,508
2017	49,951	0	0	49,951
2018	44,708	0	0	44,708
Total	285,875	0	0	285,875

The actual VER is -9 % lower than the estimated VER. This variation is majorly due to the variations in wind flow pattern, grid availability and other parameters which are not in the control of PP.

APPENDIX 1: CALIBRATION DETAILS

The calibration details for meters involved in the project activity and available with PP are as below. The calibration is under control of state electricity board and PP do not have any control on it.

WTG No	Meter Serial No.	Year 2011	Year 2012	Year 2013	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018
JW27	GJU61847	07/06/2011	12/06/2012	27/06/2013	18/02/2014	18/02/2015	10/02/2016	08/03/2017	09/03/2018
NM04	GJU61852	07/06/2011	12/06/2012	27/06/2013	18/02/2014	18/02/2015	10/02/2016	08/03/2017	-
	GJU64200	-	-	-	-	-	-		07/03/2018
VW21	GJU61844	07/06/2011	12/06/2012	27/06/2013	18/02/2014	18/02/2015	10/02/2016	08/03/2017	14/03/2018
VW32	GJU61845	07/06/2011	12/06/2012	27/06/2013	18/02/2014	18/02/2015	10/02/2016	08/03/2017	14/03/2018
NM03	GJU64151	28/11/2011	25/12/2012		18/02/2014	-	-	-	-
	GJU65938	-	-	-	04/05/2014	18/02/2015	27/02/2016	11/03/2017	07/03/2018
NM06	GJU64150	28/11/2011	25/12/2012		22/02/2014	19/02/2015	27/02/2016	11/03/2017	-
	GJU74496	-	-	-	-	-	-	-	07/03/2018
NM07	GJU64154	28/11/2011	25/12/2012		22/02/2014	19/02/2015	27/02/2016	11/03/2017	-
	GJU74498	-	-	-	-	-	-	-	07/03/2018
JW09	GJU64145	28/11/2011	25/12/2012		22/02/2014	19/02/2015	27/02/2016	11/03/2017	09/03/2018
JW10	GJU64174	28/11/2011	25/12/2012		22/02/2014	19/02/2015	27/02/2016	11/03/2017	09/03/2018
JW12	GJU64152	28/11/2011	25/12/2012		22/02/2014	19/02/2015	27/02/2016	11/03/2017	09/03/2018
JW13	GJU64146	28/11/2011	25/12/2012		22/02/2014	19/02/2015	27/02/2016	11/03/2017	09/03/2018
JW30	GJU64165	28/11/2011	25/12/2012		22/02/2014	19/02/2015	27/02/2016	11/03/2017	09/03/2018

The meter replacement details are as below

- GJU61852 meter is replaced by GJU64200. Meter is replaced on 07/03/2018.
- GJU64151 meter is replaced by GJU65938. Meter is replaced on 04/05/2014. The new meter is calibrated on 04/05/2014.
- GJU64150 meter is replaced by GJU74496. Meter is replaced on 07/03/2018.
- GJU64154 meter is replaced by GJU74498. Meter is replaced on 07/03/2018.

Few WTGs calibration in year 2013 is not available with PP, hence not mentioned above. Also for new meters, earlier years details are not required. Hence kept as blank.

All meters are of Secure Make and 0.2s accuracy class. Considering five years calibration frequency as per CEA notification and as per deviation request, there is no any delay in calibration applicable for the project activity.

PP does not have any calibration details for Vandhiya substation meters and these are under control of state electricity board. Also state electricity Board did not calibrated the substation meters, hence substation meter details are not mentioned here.

As per registered CDM PDD, the calibration frequency is once in a year. The calibration of meters is not in control of PP and same is done by state electricity board. The state electricity board does not follow any fixed calibration frequency, hence deviation is requested for change in calibration frequency as once in five years. This calibration frequency is as per CEA notification http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf , page 12
Based on once in five year calibration frequency as per requested deviation, there is no any delay in calibration and no error factor is applicable for current monitoring period.

APPENDIX 2: BREAK DOWN DETAILS

Turbine	Duration	Event	Event text	Comment	Date from	Date to
JW09 [43699]	56:06	309	Pause over RCS 0	Copper cap & strip fixing work.	25/3/2016	27/3/2016
JW10 [43700]	69:26	852	Extr Extr high volt. L_: ___ V	Computer Display off	25/1/2014	28/1/2014
JW10 [43700]	55:12	309	Pause over RCS 0	Copper cap & strip fixing work.	29/3/2016	31/3/2016
JW12 [43701]	93:43	309	Pause over RCS 14 (Remote pause by Manufacturer)	Blade repair work.	1/9/2015	5/9/2015
JW12 [43701]	965:14	309	Pause over RCS __	Blade repair work.	5/9/2015	15/10/2015
JW12 [43701]	56:32	309	Pause over RCS 0	Copper cap & strip fixing work.	12/4/2016	14/4/2016
JW27 [41697]	54:31	309	Pause over RCS 0	Copper cap & Strip Fixing wrok.	22/3/2016	24/3/2016
JW30 [43703]	60:43	220	New SERVICE state: 0, 0	All 3 Blade De-erection/erection work for CIM 2620.	17/4/2015	19/4/2015
JW30 [43703]	51:32	309	Pause over RCS 0	Copper cap & strip fixing work.	6/4/2016	8/4/2016
NM03 [43696]	53:24	220	New SERVICE state: 0, 0	All 3 Blade De-erection/erection work for CIM 2620.	27/4/2015	29/4/2015
NM03 [43696]	52:37	315	ExEx low voltage L_: ___V	Trip due to GETCO line 01 trip.	28/7/2015	30/7/2015
NM03 [43696]	58:16	220	New SERVICE state: 0, 0	Copper cap & Strip fixing work	18/2/2016	20/2/2016
NM04 [41696]	54:31	309	Pause over RCS 0	Copper cap & strip fixing work.	29/2/2016	2/3/2016
NM06 [43697]	56:44	309	Pause over RCS __	Copper cap & strip fixing work.	7/3/2016	9/3/2016
NM07 [43698]	54:40	309	Pause over RCS __	Copper cap & strip fixing work.	10/3/2016	12/3/2016
VW21 [41698]	56:39	309	Pause over RCS 0	Blade A repairing work.	23/7/2015	25/7/2015
VW21 [41698]	54:14	309	Pause over RCS 0	Copper cap & strip fixing work.	28/4/2016	30/4/2016
VW32 [41699]	57:11	309	Pause over RCS 0	Copper cap & strip fixing work.	18/4/2016	20/4/2016