WIND BASED POWER GENERATION BY PANAMA WIND ENERGY PRIVATE LIMITED IN MAHARASHTRA, INDIA

India's Largest Carbon Credit Developer & Supplier

Document Prepared by EKI Energy Services Limited

Project Title	Wind based power generation by Panama Wind Energy Private Limited in Maharashtra, India
Version	02
Report ID	UN8524
Date of Issue	31-March-2020
Project ID	1671
Monitoring Period	01-April-2019 to 29-February-2020 (Inclusive of both days)
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The purpose of the project activity is to generate power using renewable energy source (wind) and sell the power generated to the state grid. The 100.8 MW wind power project is also known as Project Sky. The project activity uses Wind Turbine Generators (WTGs) manufactured by General Electric (GE). The project activity generates electricity using wind potential and converts it into kinetic energy using Wind turbines, which drives the alternators to generate energy. The generated electricity is exported to the regional grid system which is under the purview of the NEWNE grid of India. The project initially aimed to install 100.8 MW by March 2012, however, till now only 72 MW (45 WTGs in number) is implemented in different phases and are in operation.

Thus, out of the proposed 63 WTGs only 45 WTGs has been commissioned and further 18 WTGs referring to the project is still under the implementation stage.

Brief description of the installed technology and equipment:

The project activity involves WTG supplied by GE. The WTGs are GE XLE 1.6 MW machines. The WTGs implemented in this project have been supplied by GE as complete unit without any technology transfer.

The technical details of the WTG are as follows

Rotor:	
Diameters	82.5 m
Number of Blades	3
Swept area	5346m²
Rotor speed range	9-18 rpm
Rotational direction	Clockwise looking downwind
Maximum tip speed	77.2 m/s
Orientation	Upwind
Speed regulation	Pitch control
Aerodynamic brakes	Full feathering
Pitch System:	
Principle	Independent blade pitch control
Actuation	Individual electric drive
Yaw System:	
Yaw rate	0.5 degree/s

Relevant dates for the project activity:

Project got registered under CDM on 05/12/2012, and the CDM crediting period is from 05/12/2012 to 04/12/2022. For VCS project activity, the VCS crediting period will be considered same as CDM crediting period. PP will ensure that there is no any double accounting of emission reductions. The VCS crediting period start date is 05/12/2012 and the details for the date of commissioning for the WTGs commissioned are given below:-

WTG ID	Date of commissioning
Location No. - 9,10,11,12,13	22-Feb-2013
Location No. - 8	22-Apr-2013
Location No. – 31	13-Jun-2013
Location No. - 45,47,48	13-Jun-2013
Location No. - 16,20,38,43	22-Apr-2013
Location No. - 4, 49	1-Jan-2014
Location No. – 42	7-Jul-2013
Location No. - 50,51	13-Feb-2014
Location No. - 5,6	2-Jul-2013
Location No. – 7	2-Jul-2013
Location No. - 14,17,26	10-May-2013
Location No. - 41,46	28-May-2013
Location No. - 22,23,34	28-May-2013
Location No. - 18,37,55,63	28-May-2013
Location No. – 40	13-Feb-2014
Location No. - 52,56,62	1-Jan-2014
Location No. – 61	7-Jul-2013
Location No. – 32	26-Oct-2013
Location No. - 15,19,25,27,28	6-Mar-2013

Total emission reductions achieved in this monitoring period:

The net power generation is 130,576.50 MWh from the implemented project of 72 MW and the emission reduction achieved by the operation of implemented WTGs is 123,864 tCO_2e.

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

Project Category : ACM0002: Grid-connected electricity generation from renewable sources - Version 12.3.0[1]

The project is not a grouped project activity.

1.3 Project Proponent

Organization name	Panama Wind Energy Private Limited
Contact person	Mr. Dinesh Jagdale
Title	Director & Chief Operating Officer
Address	Viman Nagar 1st Floor, Lunkad Towers,Pune Maharashtra 411 014

[1] http://cdm.unfccc.int/methodologies/DB/UB3431UT9I5KN2MUL2FGZXZ6CV71LT

Telephone	+91 20 26125060
Email	djagdale@panama-group.com

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the Project	Project Consultant
Contact person	Mr. Prakash Sahu
Title	Project Manager
Address	Office No 201, Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore 452010, India
Telephone	+91-9589899649
Email	prakash@enkingint.org

1.5 Project Start Date

Project Start Date: 22-February-2013
The project start date is the date on which first WTG was commissioned under the Project activity. The commissioning details are mentioned in section 1.1 of MR.

1.6 Project Crediting Period

The VCS Project crediting period will be same as CDM crediting period i.e. 05/12/2012 to 04/12/2022. The PP has taken CDM benefits from period 05/12/2012 to 01/04/2016. PP is availing VCU benefits under current monitoring period i.e. 01-April-2019 to 29-February-2020.
Crediting Period Start date: 05-December-2012
Crediting Period End date: 04-December-2022
The project activity adopts fixed crediting period of 10 years period in line with CDM registered PDD.

1.7 Project Location

The project location details are as below

Fig 1: Map of India indicating the location of state of Maharashtra

Project Sky is located in the state of Maharashtra, within the Satara district, about 350 kms to the south of Mumbai. Approach roads are available from Bangalore-Pune National Highway no 4, from Pune 165 km to Karad and a further 45 km up to the project site at Sahayadri via the Karad – Patan state highway. The precise geo-coordinates of the WTGs are as follows

The latitude and longitude of project activity is as below

Sr. No	Location No	Coordinate in Lat/Long		Date of Commissioning
		Latitude	Longitude	
1	Location No 1	N17 17 42.4	E73 46 33.3	
2	Location No 2	N17 17 51.2	E73 46 32.5	
3	Location No 3	N17 17 59.8	E73 46 32.3	
4	Location No 21	N17 18 19.7	E73 47 02.1	
5	Location No 24	N17 18 36.8	E73 46 59.5	
6	Location No 29	N17 19 08.7	E73 47 31.3	
7	Location No 30	N17 19 09.1	E73 47 48.7	

8	Location No 33	N17 19 18.1	E73 47 27.0	Yet to Commission
9	Location No 35	N17 18 59.5	E73 47 54.8	
10	Location No 36	N17 19 06.7	E73 48 09.0	
11	Location No 44	N17 19 00.2	E73 48 37.4	
12	Location No 53	N17 18 40.9	E73 48 53.1	
13	Location No 54	N17 18 48.5	E73 48 57.0	
14	Location No 59	N17 18 32.6	E73 49 17.6	
15	Location No 60	N17 18 40.6	E73 49 20.4	
16	Location No 39	N17 19 50.4	E73 48 40.3	
17	Location No 57	N17 19 12.7	E73 49 08.7	
18	Location No 58	N17 19 22.7	E73 49 15.5	
19	Location No 4	N17 18 18.2	E73 47 19.8	01/01/2014
20	Location No 5	N17 19 52.2	E73 48 58.8	02/07/2013
21	Location No 6	N17 19 37.4	E73 48 50.2	02/07/2013
22	Location No 7	N17 18 56.2	E73 49 19.9	02/07/2013
23	Location No 8	N17 18 43.3	E73 46 48.0	22/04/2013
24	Location No 9	N17 18 49.6	E73 46 37.0	22/02/2013
25	Location No 10	N17 18 56.3	E73 46 42.8	22/02/2013
26	Location No 11	N17 19 02.3	E73 46 49.5	22/02/2013
27	Location No 12	N17 19 09.8	E73 46 53.0	22/02/2013
28	Location No 13	N17 19 16.1	E73 46 59.4	22/02/2013
29	Location No 14	N17 19 22.5	E73 47 05.5	10/05/2013
30	Location No 15	N17 19 28.6	E73 47 12.8	06/03/2013
31	Location No 16	N17 19 34.8	E73 47 19.5	22/04/2013
32	Location No 17	N17 19 39.8	E73 47 28.0	10/05/2013
33	Location No 18	N17 19 00.7	E73 49 33.5	28/05/2013
34	Location No 19	N17 19 30.8	E73 47 35.6	06/03/2013
35	Location No 20	N17 19 36.6	E73 47 45.0	22/04/2013
36	Location No 22	N17 18 26.1	E73 47 14.7	28/05/2013
37	Location No 23	N17 18 27.7	E73 47 27.0	28/05/2013
38	Location No 25	N17 18 45.3	E73 47 00.6	06/03/2013
39	Location No 26	N17 18 53.0	E73 47 04.7	10/05/2013
40	Location No 27	N17 18 59.8	E73 47 10.7	06/03/2013
41	Location No 28	N17 19 06.7	E73 47 18.1	06/03/2013
42	Location No 31	N17 18 56.4	E73 50 01.9	13/06/2013
43	Location No 32	N17 18 33.6	E73 48 31.8	26/10/2013
44	Location No 34	N17 18 10.1	E73 47 24.3	28/05/2013
45	Location No 37	N17 18 41.0	E73 48 37.3	28/05/2013
46	Location No 38	N17 19 44.8	E73 47 37.7	22/04/2013
47	Location No 40	N17 19 39.7	E73 48 33.6	13/02/2014
48	Location No 41	N17 19 44.9	E73 48 56.0	28/05/2013
49	Location No 42	N17 19 31.8	E73 49 09.3	07/07/2013
50	Location No 43	N17 18 54.7	E73 47 25.7	22/04/2013
51	Location No 45	N17 19 08.6	E73 48 40.5	13/06/2013
52	Location No 46	N17 19 16.4	E73 48 43.0	28/05/2013
53	Location No 47	N17 19 19.9	E73 48 52.8	13/06/2013

54	Location No 48	N17 19 27.6	E73 48 59.3	13/06/2013
55	Location No 49	N17 18 50.6	E73 47 56.6	01/01/2014
56	Location No 50	N17 18 20.0	E73 48 54.6	13/02/2014
57	Location No 51	N17 18 25.2	E73 48 47.2	13/02/2014
58	Location No 52	N17 18 31.6	E73 48 53.1	01/01/2014
59	Location No 55	N17 18 57.1	E73 49 02.3	28/05/2013
60	Location No 56	N17 19 04.4	E73 49 07.2	01/01/2014
61	Location No 61	N17 18 48.5	E73 49 22.2	07/07/2013
62	Location No 62	N17 18 49.0	E73 49 40.0	01/01/2014
63	Location No 63	N17 18 52.9	E73 49 51.8	28/05/2013

1.8 Title and Reference of Methodology

Methodology: ACM0002: Grid-connected electricity generation from renewable sources --- Version 12.3.0, Sectoral Scope: 01, EB 66[2]

The following tools have been used for the project activity under consideration –

- Tool to calculate emission factor for an electricity system
  Reference: Version 02.2.1/EB – 63, Annex 19[3]
- Tool for the demonstration and assessment of additionality
  Reference: Version 06.0.0, EB- 65, Annex 21[4]

1.9 Participation under other GHG Programs

The Project has applied for the CDM under the Kyoto protocol and registered with CDM having UNFCCC ref number as UN8524.

https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1354531234.95/view

The project activity will avail GHG emissions reductions for only one program and there will not be any double accounting for the same.

1.10 Other Forms of Credit

The project activity is not availing any REC benefits and the same can be confirmed from publically available link of REC generators.

[2] https://cdm.unfccc.int/methodologies/DB/8W400U6E7LFHHYH2C4JR1RJWWO4PVN

[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

Web-link: https://www.recregistryindia.nic.in/index.php/general/publics/registered_regens PP has also submitted undertaking for not availing other forms of environmental credit for the same crediting period under consideration.

1.11 Sustainable Development

Contribution to sustainable development:

The National CDM Authority (NCDMA), which is the Designated National Authority (DNA) for the Government of India (GOI) under the Ministry of Environment, Forests and Climate Change (MoEFCC), has mentioned four indicators for the sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM) projects from India . Thus the project's contribution towards sustainable development has been addressed based on the following sustainable development aspects:

- **Social well-being:** The project would help in generating employment opportunities during the construction and operation phases. The project activity will lead to development in infrastructure in the region like development of roads and also may promote business with improved power generation.
- **Economic well-being:** The project is a clean technology investment in the region, which would not have been taken place in the absence of the VCS benefits the project activity will also help to reduce the demand supply gap in the state. The project activity will generate power using zero emissions wind based power generation which helps to reduce GHG emissions and specific pollutants like SO_x, NO_x, and SPM associated with the conventional thermal power generation facilities.
- **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:** Wind 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 SAFEGUARDS

2.1 No Net Harm

The project activity does not involve any major construction activity. It primarily requires the installation of the WTGs, interfacing the generators with the State Electricity Board by setting up HT transmission lines and installation of other accessories.

The report on "Developmental Impacts and Sustainable Governance Aspects of Renewable Energy Projects" prepared by MNRE dated September 2013. This report clearly mentioned that wind power project activity operations do not result in direct air pollution, noise pollution. Please refer below web link for the same[5].

Thus there are no any significant impacts due to implementation of project activity on air, water, soil quality and ambience are envisaged due to the project activity.

2.2 Local Stakeholder Consultation

As per VCS Guidelines, this section is not mandatory as the project is already registered.

As a part of continuous feedback from stakeholders, there were no other major comments or protest raised by the stakeholders and they were totally in support for setting up of these kinds of projects in the region. 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.

However no any grievances received during the current monitoring period. Since no any grievances received during the current monitoring period, there are no any issues (negative feedback) received from stakeholders, hence no any mitigation measures are required.

2.3 AFOLU-Specific Safeguards

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

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The purpose of the project activity is to generate power using renewable energy source (wind) and sell the power generated to the state grid. The proposed 100.8 MW wind power project is also known as Project Sky. The project activity uses Wind Turbine Generators (WTGs) manufactured by General Electric (GE). The project activity generates electricity using wind potential and converts it into kinetic energy using Wind turbines, which drives the alternators to generate energy. The generated electricity is exported to the regional grid system which is under the purview of the NEWNE grid of India. The project initially aimed to install 100.8 MW by March 2012, however, till now only 72 MW (45 WTGs in number) is implemented in different phases and are in operation. The project implementation schedule is given as below:

[5] http://mnre.gov.in/file-manager/UserFiles/report-on-developmental-impacts-of-RE.pdf

WTG ID	Connecting Feeder	No. of WTGs	Date of commissioning
Location No. - 9,10,11,12,13	Feeder -1	5	22-Feb-2013
Location No. - 8	Feeder -1	1	22-Apr-2013
Location No. – 31	Feeder - 4	1	13-Jun-2013
Location No. - 45,47,48	Feeder - 3	3	13-Jun-2013
Location No. - 16,20,38,43	Feeder - 2	4	22-Apr-2013
Location No. - 4, 49	Feeder -1	2	1-Jan-2014
Location No. – 42	Feeder - 3	1	7-Jul-2013
Location No. - 50,51	Feeder - 4	2	13-Feb-2014
Location No. - 5,6	Feeder - 3	2	2-Jul-2013
Location No. – 7	Feeder - 4	1	2-Jul-2013
Location No. - 14,17,26	Feeder - 2	3	10-May-2013
Location No. - 41,46	Feeder - 3	2	28-May-2013
Location No. - 22,23,34	Feeder - 2	3	28-May-2013
Location No. - 18,37,55,63	Feeder - 4	4	28-May-2013
Location No. – 40	Feeder - 3	1	13-Feb-2014
Location No. - 52,56,62	Feeder - 4	3	1-Jan-2014
Location No. – 61	Feeder - 4	1	7-Jul-2013
Location No. – 32	Feeder - 3	1	26-Oct-2013
Location No. - 15,19,25,27,28	Feeder - 2	5	6-Mar-2013

Thus, out of the proposed 63 WTGs only 45 WTGs has been commissioned and further 18 WTGs referring to the project is still under the implementation stage.

Brief description of the installed technology and equipment:

The project activity involves WTG supplied by GE. The WTGs are GE XLE 1.6 MW machines. The WTGs implemented in this project have been supplied by GE as complete unit without any technology transfer.

The technical details of the WTG are as follows

Rotor:	
Diameters	82.5 m
Number of Blades	3
Swept area	5346m²
Rotor speed range	9-18 rpm
Rotational direction	Clockwise looking downwind
Maximum tip speed	77.2 m/s
Orientation	Upwind
Speed regulation	Pitch control
Aerodynamic brakes	Full feathering

Pitch System:	
Principle	Independent blade pitch control
Actuation	Individual electric drive
Yaw System:	
Yaw rate	0.5 degree/s

Emission Reductions from anthropogenic sources:

The wind power generated from the Project will be displacing the electricity generated from grid connected power plants. Since, the wind power is Green House Gas (GHG) emissions free, the power generated will prevent the anthropogenic GHG emissions generated by grid connected power plants comprising coal, diesel, furnace oil and gas. The estimation of GHG reductions by this project is limited to carbon dioxide (CO_2) only. Also, the WTG ID number 49 is not operating due to technical reasons since 2014.

3.2 Deviations

2.3.1 Methodology Deviations

No methodology deviation is applied during the monitoring period.

2.3.2 Project Description Deviations

Deviation 1:

The project initially aimed to install 100.8 MW by March 2012, however, till now only 72 MW (45 WTGs in number) is implemented in different phases and are in operation. The rest are behind due the delay in signing of PPA for all wind farm by state government.

Thus, out of the proposed 63 WTGs only 45 WTGs has been commissioned and further 18 WTGs referring to the project is still under the implementation stage.

3.3 Grouped Projects

The project is not a grouped project thus this is not applicable.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO2/MWh

Description	Operating margin CO_2 emission factor for NEWNE grid in the year y
Source of data	"Baseline Carbon Dioxide Emission Database Version 6.0" published by the Central Electricity Authority, Ministry of Power, Government of India.
Value applied	0.9941
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per ACM0002 with 3 years vintages (2007-08,2008-09,2009 10) data obtained from "CO2 Baseline Database for Indian Power Sector" version 6 published by the CEA, MoP, GoI, which is based on " tool to calculate emission factor for an electricity system, version 2.2.1".
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO2/MWh
Description	This is the build margin for the NEWNE grid of India
Source of data	"CO2 Baseline Database for Indian Power Sector" version 6 published by the CEA, MoP, GoI. Weblink: www.cea.nic.in
Value applied	0.8123
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per ACM0002 with year 2009-10 data obtained from "CO_2 Baseline Database for Indian Power Sector" version 6 published by the CEA, MoP, GoI. Which is based on "tool to calculate emission factor for an electricity system, version 2.2.1".
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO2/MWh
Description	This is the combined margin for the NEWNE grid of India
Source of data	CEA database version 6
Value applied	0.9486
Justification of choice of data or description of measurement methods	Combined margin emission factor has been calculated by the Central Electricity Authority in accordance with CDM methodology: ACM0002 and tool to calculate the emission factor

and procedures applied	for an electricity system
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{facility,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid during this monitoring period
Source of data	Credit note/ reports generated by MSEDCL
Description of measurement methods and procedures to be applied	The value of net electricity generation supplied to the grid as per Joint Meter Reading Report forms the basis for calculation of the emission reductions; which can be cross checked from the invoice raised to DISCOM. Net electricity supplied to grid will be calculated as the difference of the measured values of "export" and "import" of electricity through the dedicated SEB energy meter installed at the delivery point (i.e. the connected substation). Net electricity generated and supplied by the project (Wind) plant/unit to the grid = Electricity Export to the grid – Electricity Import from the grid. Monthly meter readings are taken from the main and check meter installed at the substation and certified by the representatives of SEB Officials and the representatives of the project proponent.
Frequency of monitoring/recording	Continuous monitoring, hourly measurement and at least monthly recording.
Value monitored	130,576.50
Monitoring equipment	Monitoring: Tri vector meter will be used Data type: Measured Type of meter: Static type meter (Main & Check). Both are Bidirectional meters. Class of meter: 0.2s
QA/QC procedures to be applied	The main and check meters is of accuracy class 0.2S and shall be calibrated at least once in three years. The records are cross-checked with the records of sold electricity

	to MSEDCL.
Purpose of the data	Calculation of Baseline emissions
Calculation method	Accuracy Class: 0.2s Archiving Policy: Paper & Electronic For measuring the energy delivered by the project activity, one set of main meters (part of interconnection facilities) and check meters is provided at each of the 4 feeders by the project proponent and respective electricity distribution company (MSEDCL). Monthly joint meter readings of the main meters and check meters located at 4 feeders (sub-station) is taken by the designated officials of the company and MSEDCL. The summation of all 4 feeder meters reading is be used for billing and emission reduction calculation purpose. Monthly joint meter readings are taken by the designated officials of the two parties on the synchronisation date of each unit as well as once during the monthly cycle.
Comments	The readings of each of the main meters located at 4 feeders are used for emission reduction calculation purpose. These 4 feeders are connected to the WTGs covered in the project activity only.

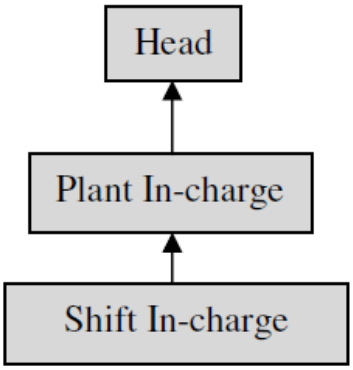
4.3 Monitoring Plan

Roles & Responsibility Structure:

The monitoring plan is developed in accordance with the modalities and procedures for CDM project activities and is proposed for grid-connected wind power project being implemented in Maharashtra, India. The monitoring plan, which is implemented by the project proponent describes about the monitoring organisation, parameters to be monitored, monitoring practices, quality assurance, quality control procedures, data storage and archiving.

The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the project proponent. PP proposed the following structure for data monitoring, collection, data archiving and calibration of equipment's for this project activity. The team comprises of the following members:-

Organisational Structure for Monitoring



PP has assigned the responsibility of operation and maintenance of WTGs to GE India Industrial private limited.

Responsibilities of Head: Overall functioning and maintenance of the project activity.

Responsibilities of Plant In-charge: Responsibility for Maintains the data records, ensures completeness of data, and reliability of data (calibration of equipment's).

Responsibilities of Shift In-charge: Responsibility for day to day data collection and maintains day to day log book for monitored data.

QA/QC procedures:
The energy meters at the feeders are maintained and owned by MSEB. Neither the project proponent nor the site personnel have any control over it. The records are cross-checked with the records of sold electricity to MSEDCL. The meters are calibrated by MSEB at-least once in three years.

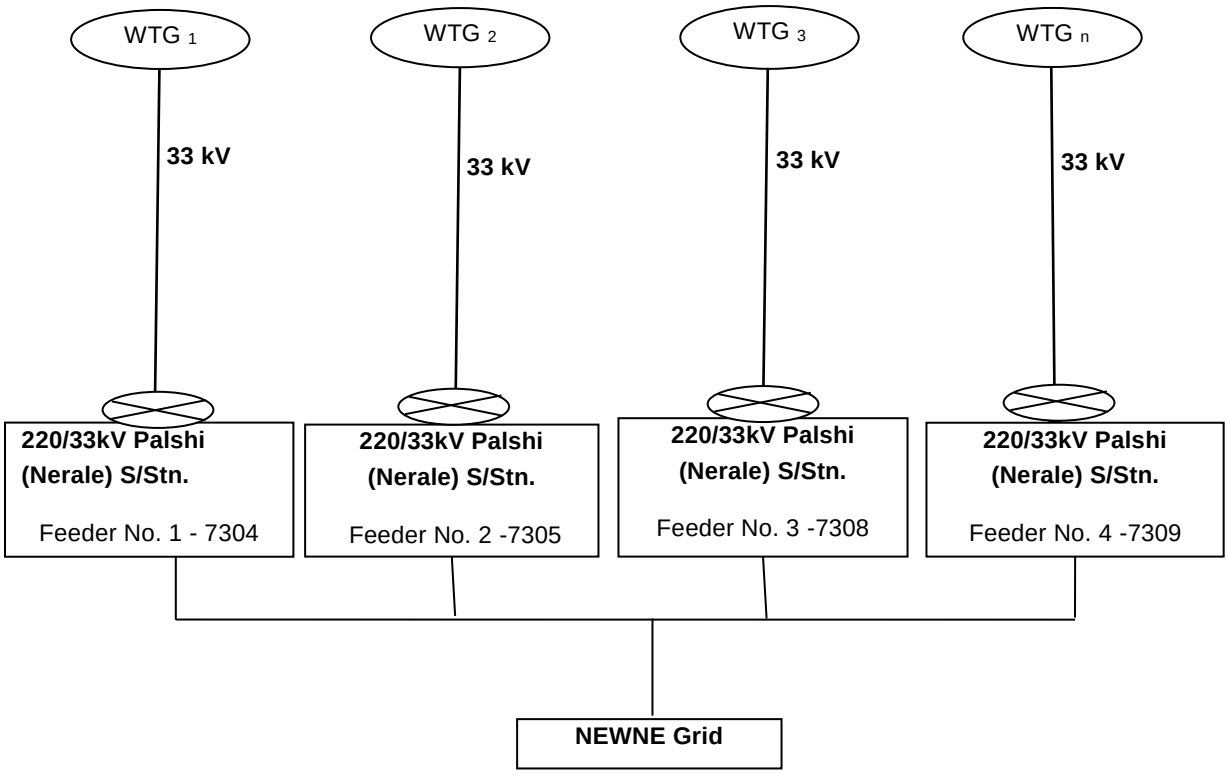
Data Archiving:
Monthly data shall be archived electronically and in paper form and stored for the entire crediting period and two years thereafter.

Training and maintenance requirements:
Training on the machine is an essential pre-requisite, to ensure necessary safety of man and machine. Further, in order to maximize the output from the WTGs, it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that O&M team is deft at handling technical snags on top of the turbine, the necessity of ensuring that they are capable of climbing the tower with absolute ease and comfort has been established. Each and every site personnel is provided with proper training to meet the

requirements of the Operations and maintenance. This ultimately leads to creativity in problem solving.

The below mentioned diagram represents the monitoring systems, voltage levels and metering arrangements at the Project site. The power generated by the WTGs implemented under the project are connected to feeder meters located at substation. There are 4 feeders dedicated for WTGs covered under this project activity only. Pair of check meters and main meters is provided at each of the four feeders. The main meter reading at the 4 feeders at sub-station is jointly undertaken by MSEDCL and project proponent representatives.

Power generated by the WTGs is collected at 33 kV and fed to pooling (sub) station near Nerale Village (8 kms away), where it is stepped up to 220 kV (national grid). The pooling station itself is then connected to existing 2X220 kV single circuit lines (750m away) from Koyana (Pophali) to Karad and Pedambe to Karad.
Line Diagram to show the monitoring system with appropriate voltage levels is given below



5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As per the approved methodology: ACM0002 "Consolidated baseline methodology for grid connected electricity generation from renewable sources. (Version 12.3.0)" baseline emissions for the project activity are calculated by multiplying the net quantity of electricity supplied by this project activity (EGBL, y) with the CO2 baseline emission factor for the electricity displaced due to the project ($EFCO_2$) as follows:

$BEy = EF_{CO2, grid, y} * EG_{BL, y}$

Where,

$EF_{CO2,grid,y}$	=	Baseline emission factor
	=	0.9486 tCO_2e/MWh
$EG_{BL,y}$	=	Net electricity supplied to the NEWNE regional grid (MWh)
	=	130,576.50 MWh
BE_y	=	130,576.50 x 0.9486
	=	123,864 tCO_2e (round down values)

5.2 Project Emissions

$PE_{FF,y} = 0$, As per ACM0002 version 12.3.0,"For all renewable energy power generation project activities, emissions due to the use of fossil fuels for the backup generator can be neglected"

$PR_{FF, y} = 0$

5.3 Leakage

As per ACM0002 version 12.3.0, No leakage emissions need to considered for the project activity.

5.4 Net GHG Emission Reductions and Removals

The Formula used to calculate the net emission reduction for the project activity is

$ER_Y = BE_y – PE_y – LE_y$

Where,

ER_y = Emission Reduction in tCO_2/year
BE_y = Baseline emission in tCO_2/year
PE_y = Project emissions in tCO_2/year
LE_y = Leakage Emissions in tCO_2/year

For the project activity during the current monitoring period, as per section 5.1

$BE_y = 123,864\ tCO_2e$

PE_y = 0 tCO_2e

LE_y = 0 tCO_2e

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
01-April-2019 to 31-December-2019	116,745	0	0	116,745
01-January-2020 to 29-February-2020	7,119	0	0	7,119
Total	**123,864**	**0**	**0**	**123,864**

The achieved GHG emission is 1.43 % is higher than the estimated value. This is due to more number of high power generating month during this monitoring period.

APPENDIX 1: CALIBRATION RECORDS

Calibration Details of the WTGs installed in the project activity have been provided below:

Details	Calibration details of the meters at Feeder No. 1					
Type of meter	Main Meter			Check Meter		
Location	220/33kV Palshi (Nerale) S/Stn. Feeder No. 1 - 7304					
WTG Connected	Location no: 4, 8-13, 49					
Accuracy class	0.2 s			0.2 s		
Meter Make	Elster			Elster		
Meter Sr. No.	16595568			13813597		
Calibration Details	Year 2016	Year 2017	Year 2018	Year 2016	Year 2017	Year 2018
Date of calibration	03/06/2016	08/06/2017	06/06/2018	03/06/2016	08/06/2017	06/06/2018
Calibration delay[6]	No delay			No delay		
Due date of Calibration	05/06/2021			05/06/2021		

Details	Calibration details of the meters at Feeder No. 2					
Type of meter	Main Meter			Check Meter		
Location	220/33kV Palshi (Nerale) S/Stn. Feeder No. 2 - 7305					
WTG Connected	Location no: 14-17, 19-20, 22-23, 25-28, 34,38,43					
Accuracy class	0.2 s			0.2 s		
Meter Make	Elster			Elster		
Meter Sr. No.	16595569			13813601		
Calibration Details	Year 2016	Year 2017	Year 2018	Year 2016	Year 2017	Year 2018
Date of calibration	03/06/2016	08/06/2017	06/06/2018	03/06/2016	08/06/2017	06/06/2018
Calibration delay	No delay			No delay		
Due date of Calibration	05/06/2021			05/06/2021		

Details	Calibration details of the meters at Feeder No. 3	
Type of meter	Main Meter	Check Meter
Location	220/33kV Palshi (Nerale) S/Stn. Feeder No. 3 – 7308	

[6] As per the registered PDD meters are calibrated at least once in three years.

WTG Connected	Location no: 5-6, 32, 40-42, 45-48					
Accuracy class	0.2 s			0.2 s		
Meter Make	Elster			Elster		
Meter Sr. No.	13813600 till 23/06/2016 and 13813599 from 23/06/2016 onwards			13132610		
Calibration Details	Year 2016	Year 2017	Year 2018	Year 2016	Year 2017	Year 2018
Date of calibration	23/06/2016	08/06/2017	06/06/2018	03/06/2016	08/06/2017	06/06/2018
Calibration delay	No delay			No delay		
Due date of Calibration	05/06/2021			05/06/2021		

Details	**Calibration details of the meters at Feeder No. 4**					
Type of meter	Main Meter			Check Meter		
Location	220/33kV Palshi (Nerale) S/Stn. Feeder No. 4 - 7309					
WTG Connected	Location no: 7,18,31,37,50-52,55-56,61-63					
Accuracy class	0.2 s			0.2 s		
Meter Make	Elster			Elster		
Meter Sr. No.	13132640			13813602		
Calibration Details	Year 2016	Year 2017	Year 2018	Year 2016	Year 2017	Year 2018
Date of calibration	03/06/2016	08/06/2017	06/06/2018	03/06/2016	08/06/2017	06/06/2018
Calibration delay	No delay			No delay		
Due date of Calibration	05/06/2021			05/06/2021		

APPENDIX 2: MAJOR BREAKDOWN DETAILS

Date	Turbine No	Total	Comment
14-Apr-19	PWEPL-01	9:01	WTG restoration after grid outage (12:20 to 12:25)
14-Apr-19	PWEPL-02	9:01	WTG restoration after grid outage (12:20 to 12:25)
14-Apr-19	PWEPL-03	9:01	WTG restoration after grid outage (12:20 to 12:30), Line CCU Collective fault (13:40 to 14:33)
14-Apr-19	PWEPL-07	9:01	WTG restoration after grid outage (12:20 to 12:25)
14-Apr-19	PWEPL-18	9:01	WTG restoration after grid outage (12:20 to 12:25)
14-Apr-19	PWEPL-31	9:01	WTG restoration after grid outage (12:20 to 12:25)
14-Apr-19	PWEPL-32	9:01	WTG restoration after grid outage (12:20 to 12:25)
14-Apr-19	PWEPL-37	9:01	WTG restoration after grid outage (12:20 to 12:25)
14-Apr-19	PWEPL-50	9:01	WTG restoration after grid outage (12:20 to 12:25)
01-May-19	PWEPL-03	10:05	WTG restoration after grid outage(10:58 to 11:06), Topbox motor protection MCB tripped (11:06 to 16:16)
01-May-19	PWEPL-07	10:05	WTG restoration after grid outage (10:58 to 11:06), Topbox motor protection MCB tripped (11:06 to 15:38)
01-May-19	PWEPL-18	10:05	WTG restoration after grid outage (10:58 to 11:06), Topbox motor protection MCB tripped (11:06 to 16:02)
01-May-19	PWEPL-31	10:05	WTG restoration after grid outage(10:58 to 11:07)
01-May-19	PWEPL-32	10:05	WTG restoration after grid outage (10:58 to 11:06), Topbox motor protection MCB tripped (11:06 to 15:08)
01-May-19	PWEPL-37	10:05	WTG restoration after grid outage (10:58 to 11:06), Topbox motor protection MCB tripped (11:06 to 15:08) Gearbox oil over tempearture (00:012 to 00:20) (15:28 to 23:59)
01-May-19	PWEPL-50	10:05	WTG restoration after grid outage (10:58 to 11:06), Topbox motor protection MCB tripped (11:06 to 14:47)
01-May-19	PWEPL-51	10:05	WTG restoration after grid outage (10:58 to 11:06), Topbox motor protection MCB tripped (11:06 to 15:38)
01-May-19	PWEPL-52	10:05	WTG restoration after grid outage(10:58 to 11:09)
01-May-19	PWEPL-55	10:05	WTG restoration after grid outage(10:58 to 11:09)
01-May-19	PWEPL-56	10:05	WTG restoration after grid outage(10:58 to 11:07)
12-May-19	PWEPL-05	7:53	Internal grid failure (05:16 to 07:55) WTG restoration after grid outage (7:55 to 08:20)
12-May-19	PWEPL-06	7:53	Internal grid failure (05:16 to 07:55) WTG restoration after grid outage (7:55 to 08:20)
06-Jun-19	PWEPL-01	4:00	Feeder Tripped (00:00 to 4:00); WTG Restoration after grid resume (4:00 to 4:02)
06-Jun-19	PWEPL-02	4:00	Feeder Tripped (00:00 to 4:00); WTG Restoration after grid resume (4:00 to 4:02)
06-Jun-19	PWEPL-03	4:00	Feeder Tripped (00:00 to 4:00); WTG Restoration after grid resume (4:00 to 4:02)

06-Jun-19	PWEPL-07	4:00	Feeder Tripped (00:00 to 4:00); WTG restoration after grid resume (4:00 to 4:01)
06-Jun-19	PWEPL-18	4:00	Feeder Tripped (00:00 to 4:00); WTG Restoration after grid resume (4:00 to 4:02); Annual Maintenance (8:03 to 15:35)
06-Jun-19	PWEPL-31	4:00	Feeder Tripped (00:00 to 4:00); WTG Restoration after grid resume (4:00 to 4:03)
06-Jun-19	PWEPL-56	4:00	Feeder Tripped (00:00 to 4:00); WTG Restoration after grid resume (4:00 to 4:07)
04-Aug-19	PWEPL-01	3:26	Internal Grid shutdown (13:01 to 14:06)
04-Aug-19	PWEPL-02	3:26	Internal Grid shutdown (13:01 to 14:06)
04-Aug-19	PWEPL-03	3:26	Internal Grid shutdown (13:01 to 14:06)
04-Aug-19	PWEPL-07	3:26	Internal Grid shutdown (13:01 to 14:06)
04-Aug-19	PWEPL-18	3:26	Internal Grid shutdown (13:01 to 14:06)
04-Aug-19	PWEPL-31	3:26	Internal Grid shutdown (13:01 to 14:06)
04-Aug-19	PWEPL-56	3:26	Internal Grid shutdown (13:01 to 14:06)
06-Aug-19	PWEPL-05	4:05	Internal Shutdown (4:33 to 4:51)
06-Aug-19	PWEPL-06	4:05	Internal Shutdown (4:33 to 4:51)
06-Aug-19	PWEPL-40	4:05	Internal Shutdown (4:33 to 4:51)
06-Aug-19	PWEPL-41	4:05	Internal Shutdown (4:33 to 4:51)
06-Aug-19	PWEPL-42	3:35	Internal Shutdown (4:33 to 4:44); Main Circuit breaker open(4:44 to 12:20)
06-Aug-19	PWEPL-45	3:35	Internal Shutdown (4:33 to 4:44)
06-Aug-19	PWEPL-46	3:35	Internal Shutdown (4:33 to 4:44)
06-Aug-19	PWEPL-47	3:35	Internal Shutdown (4:33 to 4:44)
06-Aug-19	PWEPL-48	3:35	Internal Shutdown (4:33 to 4:44)
08-Aug-19	PWEPL-09	6:25	Increasing speed with falling blade angle (03:44 to 04:20)
08-Aug-19	PWEPL-10	6:25	Generator overspeed (00:28 to 00:59)
08-Aug-19	PWEPL-14	6:23	Gearbox Over temperature from thermal swich (00:00 to 00:25)
08-Aug-19	PWEPL-20	6:23	Main circuit breaker tripped (16:35 to 16:58, 17:27 to 17:57)
08-Aug-19	PWEPL-52	9:59	Pitch control deviation Axis 3 (06:25 to 07:10)
11-Aug-19	PWEPL-01	5:18	Topbox fuse or motor protection alarm (14:33 to 15:13)
11-Aug-19	PWEPL-02	5:18	Topbox fuse or motor protection alarm (14:33 to 16:43)
11-Aug-19	PWEPL-03	5:18	Topbox fuse or motor protection alarm (14:33 to 18:36) & Communication fault(18:36 to 24:00)
11-Aug-19	PWEPL-04	5:29	Pitch communication fault(09:01 to 09:14)
11-Aug-19	PWEPL-07	5:18	Topbox fuse or motor protection alarm (14:33 to 16:46)
11-Aug-19	PWEPL-12	5:29	Pitch controller communication fault axis 3(06:50 to 8:29) &(12:04 to 14:58) Grid failure(18:31 to 24:00)
11-Aug-19	PWEPL-13	5:29	Grid failure(18:31 to 24:00)
11-Aug-19	PWEPL-14	5:29	Pitch communication fault(09:01 to 09:09)
12-Aug-19	PWEPL-20	3:16	Internal Grid shutdown (01:07 to 03:17)&Line side CCU collective faults (03:27 to 04:30)

04-Sep-19	PWEPL-01	4:22	Wtg restoration after grid resume (4:21 to 4:27)
04-Sep-19	PWEPL-02	4:22	Wtg restoration after grid resume (4:21 to 6:25)
04-Sep-19	PWEPL-03	4:22	Wtg restoration after grid resume (4:21 to 6:46)
04-Sep-19	PWEPL-07	4:22	Wtg restoration after grid resume(4:21 to 4:41)
04-Sep-19	PWEPL-18	4:22	Wtg restoration after grid resume(4:21 to 4:41)
04-Sep-19	PWEPL-31	4:22	Wtg restoration after grid resume(4:21 to 4:41); Wind measurement serial communication fault (9:00 to 11:00)
26-Sep-19	PWEPL-52	3:38	IO Card 28v power supply failed (17:11 to 19:00)
27-Sep-19	PWEPL-05	4:56	Feeder tripped (7:41 to 9:30)
27-Sep-19	PWEPL-06	4:56	Feeder tripped (7:41 to 9:30)
27-Sep-19	PWEPL-40	4:56	Feeder tripped (7:41 to 9:30)
27-Sep-19	PWEPL-41	4:56	Feeder tripped (7:41 to 9:30)
27-Sep-19	PWEPL-45	3:33	Customer shutdown (13:40 to 14:06)
27-Sep-19	PWEPL-46	3:34	Customer shutdown (11:08 to 11:35)
02-Jan-20	PWEPL-14	3:06	Shutdown taken by customer (9:36 to 12:42). Turbine restoration after grid Failure (12:42 to 13:05)
04-Jan-20	PWEPL-19	3:11	Shutdown taken by customer (9:44 to 12:55)
15-Jan-20	PWEPL-26	3:42	Shutdown taken by customer for USS maintenance (10:10 to 12:52)
20-Jan-20	PWEPL-01	4:41	Battery voltage not ok axis 1 (03:12 to 04:45)
20-Jan-20	PWEPL-18	4:41	Line CCU collective fault (05:37 to 12:09, 16:50 to 19:30)
28-Jan-20	PWEPL-02	3:15	Anemometer failure (6:53 to 9:15)
28-Jan-20	PWEPL-37	3:15	Blade cleaning activity (0:00 to 13:15);(16:30 to 0:00)
09-Feb-20	PWEPL-08	3:09	Abnormal grid condition because of VCB tripping (11:28 to 14:37)