GRID-CONNECTED WIND ELECTRICITY GENERATION PROJECT IN TAMIL NADU, INDIA

Document Prepared by EKI Energy Services Limited

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Project Title	Grid- Connected wind Electricity Generation Project in Tamil Nadu, India
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity under consideration has been promoted by National Enterprises, referred to as the project proponent throughout this document. The project activity involves the setting up of two numbers of WTGs of cumulative capacity of 3.3 MW (2 X 1.65 MW). The envisaged net electricity generation quantum from the project to the tune of 7938 MWh on an annual basis exported to the nearest grid substation of Tamil Nadu Electricity Board, a part of Indian Regional Electricity Grid of India. The basic purpose of the initiative is to generate clean energy through renewable energy source and supply the power to the grid. The power generated by the project displaces an equivalent quantity of power generated by grid by a majority of fossil fuel combustion, thus contributing to the cause of conservation of the conventional sources of energy.

The amount of emission reductions achieved during this Verification period i.e. from 01-January-2010 to 31-December-2015 is 29,626 tCO_2e.

Sl. No.	Capacity (MW)	WTG Supplier	HTSC Number	Date of Commissioning	WTG Location
1	1.65	Vestas	2570	30/03/2008	Samugarangapuram Village
2	1.65		2595	31/03/2008	

1.2 Sectoral Scope and Project Type

- As per the Voluntary Carbon Standard, Methodologies for baseline estimation and formulation of monitoring plan include methodologies specified by the :
- Clean Development Mechanism (CDM) of United Nations Framework Convention on Climate Change (UNFCCC)
- California Climate Action Registry

For the GHG abatement project activity under consideration, the project proponent chooses to apply an appropriate methodology as specified by Appendix B to the simplified modalities and procedures for small scale CDM project activities . The project activity under consideration fits into the following type and category:

- Sectoral Scope: 1 - Energy industries (renewable- /non-renewable sources).
- Type: Type I – Renewable Energy Projects
- Category: I.D. 'Grid Connected Renewable Energy Generation'

The project activity is not a grouped project activity

1.3 Project Proponent

Organization name	National Enterprises
Contact person	Mr. Charanjit Singh Grewal
Title	Proprietor
Address	National Enterprises P.O.-Box No.44 Barabil, Keonjhar Orissa Pin-758035
Telephone	06767-275521
Email	gapl_sponge@yahoo.co.in

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the Project	Project Consultant
Contact person	Sumant Saurabh
Title	Executive
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1.5 Project Start Date

The first project WTG under the project was commissioned and power generation stared on 30-03-2008 (Considered as the date of commissioning of the WTG's). Therefore project start date 30-03-2008.

1.6 Project Crediting Period

As per relevant guidelines of Verified Carbon Standard Version 3.2."crediting period start date" is defined as:

The date on which the project began generating GHG emission reductions or removals"

For the GHG abatement project activity under consideration, the crediting period start date, i.e., the date on which the project began generating GHG emission reductions or removals is considered to be the earliest of the dates of the commissioning of the WTGs by the TNEB, which is 30-March-2008. The crediting period starts from 01/01/2010 onwards, hence the crediting period for the project activity is given below,

Crediting Period Start date: 01-January-2010

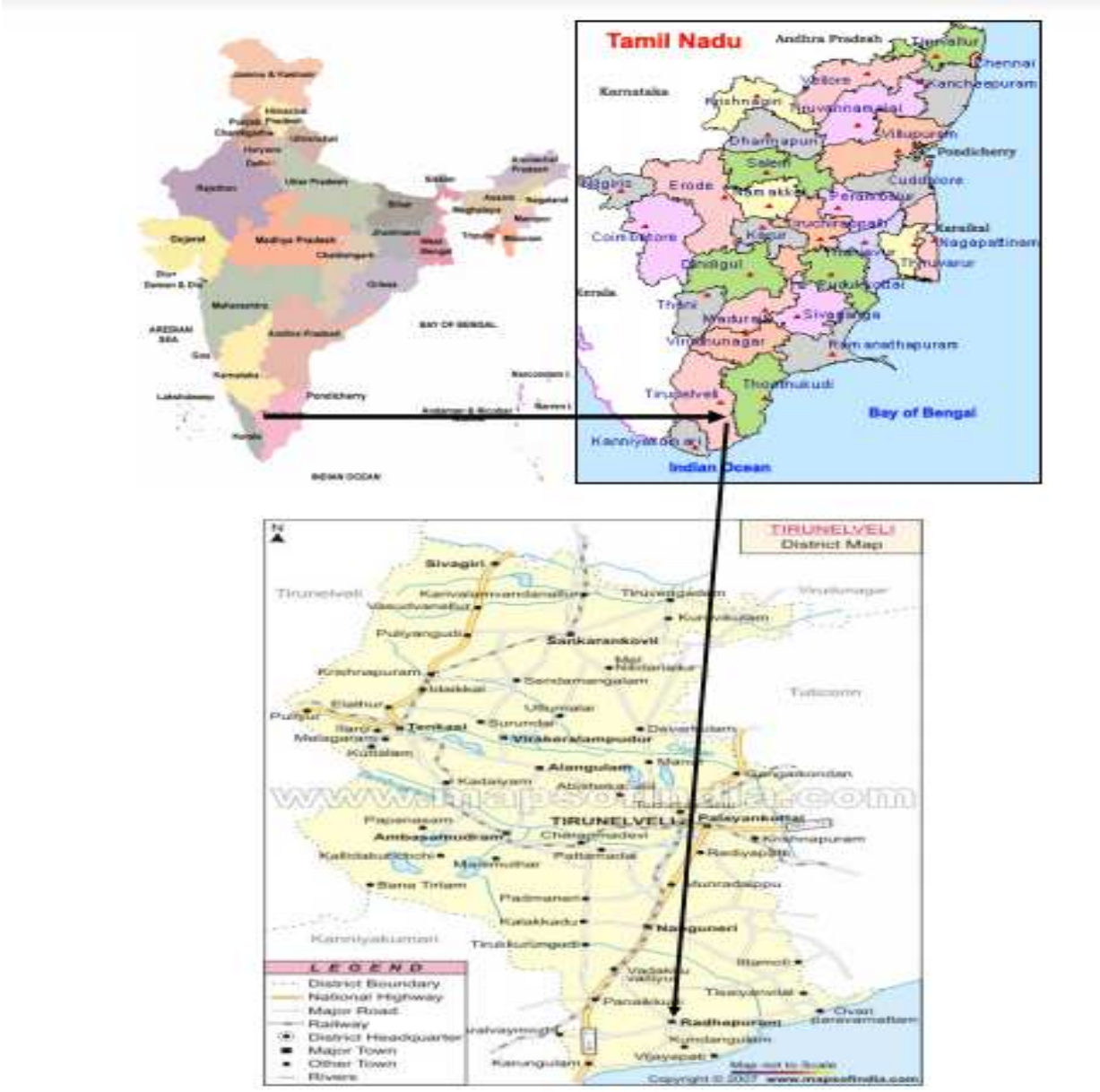
Crediting Period End date: 31-December-2019

The project activity adopts renewable crediting period of 10 years period which can be renewed for maximum 2 times. PP has taken deviation for the change of the start date of crediting period from VERRA for this current monitoring period As instructed by VERRA for VCS ID 1088 (the other project from same PP) the deviation forms the part of this monitoring report.

1.7 Project Location

The details pertaining to the location of each individual WTG installed under the project activity has been provided in the following table:

District	Site	HTSC No.	Latitude	Longitude	Local grid sub station
Tirunelveli	Samugarangapuram Village	2570	N 8°19'32.7"	E 77°40'59.2"	TNEB 33 KV (Tirunelveli)
		2595	N 8°19'59.4"	E 77°19'27.4"	



1.8 Title and Reference of Methodology

Approved Baseline Methodology: 'Grid Connected Renewable Electricity Generation'

Reference: Category I.D - Renewable Energy Projects: Approved Small Scale Methodology AMS – I.D. / Version 15[1] of the Appendix B of Simplified Modalities and Procedures (M & P) of Small Scale CDM Project Activities

[1] https://cdm.unfccc.int/filestorage/7/Q/X/7QXAZ5036WN8BEYKUDFRPJGL21V4I9/EB50_repan29_AMS-I.D_ver15.pdf?t=TzJ8cXZ1dXJrfDAY8s7oZsQG38kVPKNRrcej

1.9 Participation under other GHG Programs

The WTGs installed under the project activity are eligible to apply for environmental credit like CDM and VCS. The details of the progress of the individual WTGs in the CDM route (if applicable) are presented below:

Project Promoting Company	HTSC No	Other GHG Programs	Application Status
National Enterprises	25702595	https://cdm.unfccc.int/Projects/DB/BVQI1356857977.65/view	WTG has been commissioned.

1.10 Other Forms of Credit

It is to be noted that for each of the WTGs under consideration that the GHG abatement benefits (CERs/VCUs) for any particular duration of time can be claimed only under one GHG abatement scheme (CDM/VCS). Hence, the VCUs accumulated for the project activity from the date of crediting period is claimed under the VCS mechanism. Project is registered under CDM mechanism, the details of the same is provided in section 1.9 above. Project participant provided declaration dated 13-April-2021 that project will not claim any other GHG credit for the concerned monitoring period other than VCS.

1.11 Sustainable Development

The purpose of the wind-mills set up by the project activity is as follows:

- Clean power generation by harnessing a renewable natural resource i.e., wind power
- Abatement of GHG emissions for power generation from combustion of nonrenewable sources of energy
- Increased proportion of renewable energy directly in the regional electricity grid and indirectly in the national electricity grid
- Contribution to the causes of fossil-fuel conservation, climate change mitigation and energy security

Contribution of the Project Activity to Sustainable Development:

The contribution of the project activity to the sustainable development can be substantiated as follows:

1. **Social Well Being:**
    - Harnessing renewable energy by means of a clean power generation technology
    - No requirement of relocation or rehabilitation as there is no human displacement attributable to the project activity

- Provision of employment and business opportunities for local populace during installation, commissioning and operational phases
- Development of road network, transportation facilities and other infrastructure development initiatives

2. **Economic Well Being:**
   - Contribution towards grid stability and abridging the demand-supply gap in the Indian Electricity Grid
   - Creation of business opportunities for local stakeholders
3. **Technological Well Being:**
   - Employment of clean power generation technology by harnessing wind energy potential
   - Reduction in transmission and distribution losses from power plants in the grid to remote areas
4. **Environmental Well Being:**
   - GHG abatement by displacement of electricity generated by the fossil fuel dominated grid-mix
   - Contribution to causes of mitigation of climate change and global warming
   - No environmental disturbance or ecological imbalance caused to the surroundings, over total project lifetime
   - Contribution towards reduction in the levels of SOx, NOx, and SPM associated with combustion of fossil fuels for power generation.

2 SAFEGUARDS

2.1 No Net Harm

The project activity does not involve any major construction activity. It primarily requires the installation of the wind power project, 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 project activity operations do not result in direct air pollution, noise pollution. Please refer below web link for the same[2].

[2] http://164.100.94.214/sites/default/files/uploads/report-on-developmental-impacts-of-RE.pdf

Thus, there is no any significant impact 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 a part of continual improvement process, feedback from the associated stakeholders is vital, therefore a dedicated Visitor register cum grievance register has been placed at the project site which is accessible to stakeholders to provide their feedback on the project. It is appropriate publicly *accessible* location at which local stakeholders can provide their feedback on the project. This location is also conducive to continuous and regular checks for stakeholder comments.
At the time of project registration, Stakeholder meeting was organized in order to identify the major challenges around the area, *stakeholders* are invited well in advance through printed invitation, calls, meeting and a notice is placed around the local common areas. No any negative comments received during stakeholder meeting.

The stakeholders are also requested to share their experiences and grievances on continuous basis. Registers is used to records the *grievances* and feedback. Grievance register is placed at the main gate of site office and is accessible to everyone. During the current monitoring period, positive feedbacks had been received regarding site operation. No any grievances received during the current monitoring period, therefore, no any mitigation measures were required. In case of grievances, the nature of probable resolution is discussed with the plant head office and implemented by the site in-charge.

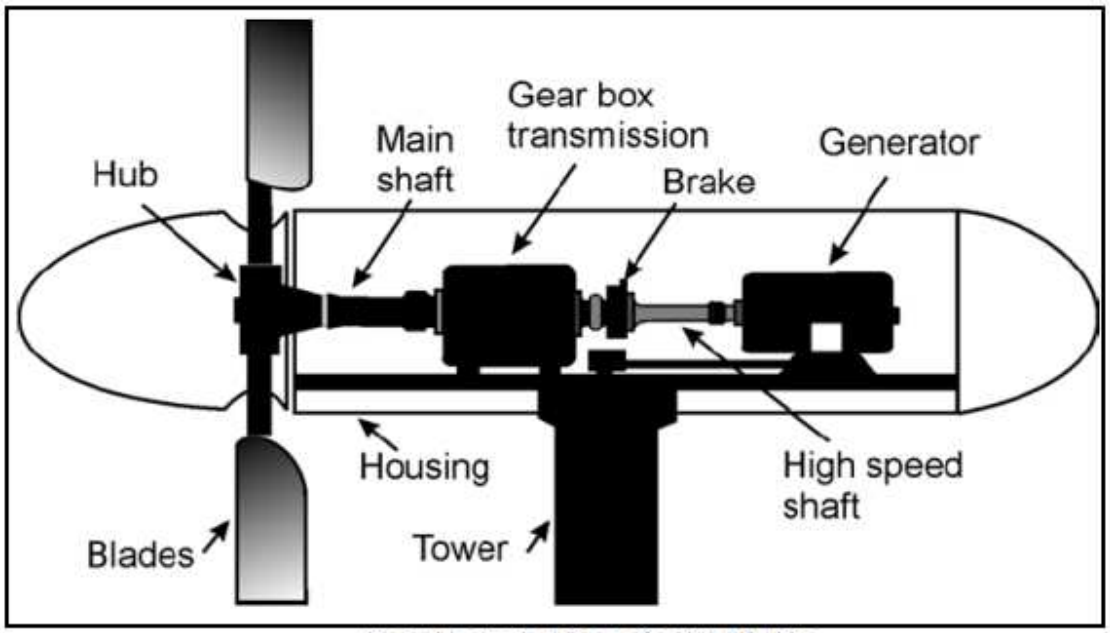
2.3 AFOLU-Specific Safeguards

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

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

In wind energy generation, kinetic energy of wind is converted into mechanical energy and subsequently into electrical energy. Wind has considerable amount of kinetic energy when blowing at high speeds. This kinetic energy when passes through the blades of the wind turbines, it is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the connected generator also rotates, thereby producing electricity.



Major Mechanical Parts of a Wind Turbine

Technical specification of the Wind Turbines Generator (V 82 – 1650 kW) used in the project activity has been detailed below:

Features of WTG		
Sr.No.	**Particulars**	**Specifications**
Main Specifications		
1.	Rotor diameter	82 m
2.	Number of blades	3
3.	Power Control	Active Stall
4.	Rotational Speed (Synchronous)	14.4 rpm
5.	Rotor position	Upwind
6.	Nominal Power	1650 KW
7.	Hub height	78 m
Rotor		
8.	Rotor Diameter	82 m
9.	Tilt Angle	5^0
10.	Swept Area	5281 m^2
Blade		
11.	Material	Fibre/Epoxy/Wood
12.	Blade Length	40 m
13.	Blade Profile	FFA – W3, NACA 63.4
14.	Air Brake	Full Blade

Hub		
14.	Type	Spherical
15.	Material	EN-GJS-400-18U-LT
Main Shaft		
16.	Type	Forged shaft and flange
17.	Material	34 CrNiMo6
Main Bearings		
18.	Front Bearings	Spherical roller bearings
Main Gear box		
19.	Gear Ratio	1:70.2
20.	Mechanical Power	1800 kW
Couplings		
21.	Gearbox/Generator	Flexible
Generator		
22.	Nominal Power	1650 kW
23.	Rotational Speed (Synchronous)	1012 rpm at rated power
24.	Insulation class	F/B
25.	Protection class (IEC529)	IP 54
Machine Frame		
26.	Type	Casted front end
27.	Material	EN-GJS-400-18U-LT
Yawing System		
28.	Yaw bearing	Ball bearing, internal gearing
29.	Yaw Motor	6 Nos.
30.	Yaw gear	6 pcs
31.	Gearing ratio	1:1666
32.	Yaw brake	Hydraulic disc brakes, 6 pcs
Tower		
33.	Type	Conical tubular
34.	Height	75.5 m
35.	Corrosion Protection	Acc. To ISO 12944:C5 I
Control System		
36.	Manufacturer	Vestas Control systems
37.	Type	Microprocessor based

The expected level of performance in terms of electricity generation from the project activity, along with the GHG abatement by the project activity is provided below:

- Installed power generation capacity: 3.3 MW
- Plant Load Factor (PLF) 27.46 %

- Net electricity export to the grid per annum: 7938 MWh
- GHG abatement potential per annum: 7,402 tCO_2e

The commissioning details of the project activity is mentioned in section 1.1 of this monitoring report. The project has been under operation since commissioning, without any major breakdowns. The plant is running smoothly since commissioning with scheduled maintenance. No events or situations happened expect the normal breakdowns for the reported monitoring period that can alter the applicability of the applied methodology.

3.2 Deviations

3.2.1 Methodology Deviations

The project activity has been implemented as described in the VCS-PD and there was no methodological deviation applied during the monitoring plan.

3.2.2 Project Description Deviations

Deviation 1:

The registered VCS PD mentioned about 10 years of crediting period but not mentioned about renewable type and VCS Validation report mentioned about10 years crediting period renewal twice as per Verified Carbon Standard Version 3.2.

Hence a project description deviation is seek for 10 years crediting period with renewal twice, as per VCS standard v 3.2, The same is mentioned in the section 1.6.

Deviation 2:

The registered VCS PD mentioned start date of crediting period as 30-March-2008. PP wants to start VCS verification period from 01-January- 2010 onwards,

Hence a project description deviation is requested to change in the start date of crediting period from 30-March-2008 to 01-Jan-2010.

Deviation 3:

For the entire monitoring period main Meter is used for billing purpose for this monitoring practice check meter is not installed at the site, since the meters are under the custody of state electricity board PP has no role in it. Hence, PP has requested deviation in this regard.

The above-mentioned deviations are of permanent nature and does not have any impact on the project applicability, baseline scenario and additionality.

3.3 Grouped Projects

Not applicable as the project is non-grouped.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	Operating margin emission factor (inclusive of imports) - $EF_{grid,OM,y}$
Data unit	tCO_2/ MWh
Description	Operating Margin CO_2 emission factor of the grid
Source of data	CO_2 Baseline Database for the Indian Power Sector, User Guide (Version 5, Date: November, 2009)
Value applied	0.97 (Value pertaining to the year 2008-2009)
Justification of choice of data or description of measurement methods and procedures applied	Information available from authorised government agencies – National standard value has been calculated by Central Electricity Authority (CEA) as per guidelines of the 'Tool to calculate the emission factor for an electricity system
Purpose of Data	To calculate Baseline Emission
Comments	The parameter has been calculated ex-ante and are remain fixed for the entire duration of the crediting period of the project activity. The relevant data are recorded in electronic form and the same can be archived for two years beyond the crediting period.

Data / Parameter	Build margin emission factor - $EF_{grid,BM,y}$
Data unit	tCO_2/ MWh
Description	Build Margin CO_2 emission factor of the grid
Source of data	CO_2 Baseline Database for the Indian Power Sector, User Guide (Version 5, Date: November, 2009)
Value applied	0.82 (Value pertaining to the year 2008-2009)
Justification of choice of data or description of measurement methods and procedures applied	Information available from authorised government agencies – National standard value has been calculated by Central Electricity Authority (CEA) as per guidelines Tool to calculate the emission factor for an electricity system'
Purpose of Data	To calculate Baseline Emission
Comments	The parameter has been calculated ex-ante and remains fixed for the entire duration of the crediting period of the project activity. The relevant data are recorded in electronic form and the same can be archived for two years beyond the crediting period.

Data / Parameter	Combined Margin Emission Factor - $EF_{grid,CM,y}$
Data unit	tCO_2/ MWh
Description	Combined Margin CO_2 emission factor of the Southern regional Grid of India
Source of data	CO_2 Baseline Database
Value applied	0.93
Justification of choice of data or description of measurement methods and procedures applied	Information available from authorised government agencies – National standard value has been calculated by Central Electricity Authority (CEA) as per guidelines Tool to calculate the emission factor for an electricity system'
Purpose of Data	To calculate Baseline Emission
Comments	The parameter has been calculated ex-ante and remains fixed for the entire duration of the crediting period of the project activity. The relevant data are recorded in electronic form and the same can be archived for two years beyond the crediting period.

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{BL,y}$
Data unit	MWh/Year
Description	Net Electricity Exported by the two WTGs to the Southern Regional Electricity Grid in the year y
Source of data	Monthly Electricity Export Invoices raised to regional electricity utility company for the two WTGs
Description of measurement methods and procedures to be applied	The data is calculated using certain measured and estimated parameters. (Measured parameters viz. import of electricity from the grid, export of electricity to the grid and the reactive power generated and estimated parameters viz. transmission losses) in a way as described in section 3.4 of PD. The Energy Meters (Tri vector meter of accuracy class 0.5) installed at the substation and the WTG switch yard measures the variable on a continuous basis. These are two-way meters. Utility officials take the readings (joint meter reading) on these meters on monthly basis and the same reading is used to determine the net power exported to the grid and determine the extent of mitigation of GHG over a period of time. A detail on metering and measurement methods is given in section 3.4 of the PD. **Metering equipment:** Tri vector Energy Meter **Accuracy Class: 0.5 Data type: Estimated (using meter readings)** **Archiving:** Electronic **Recording Frequency**: Monthly

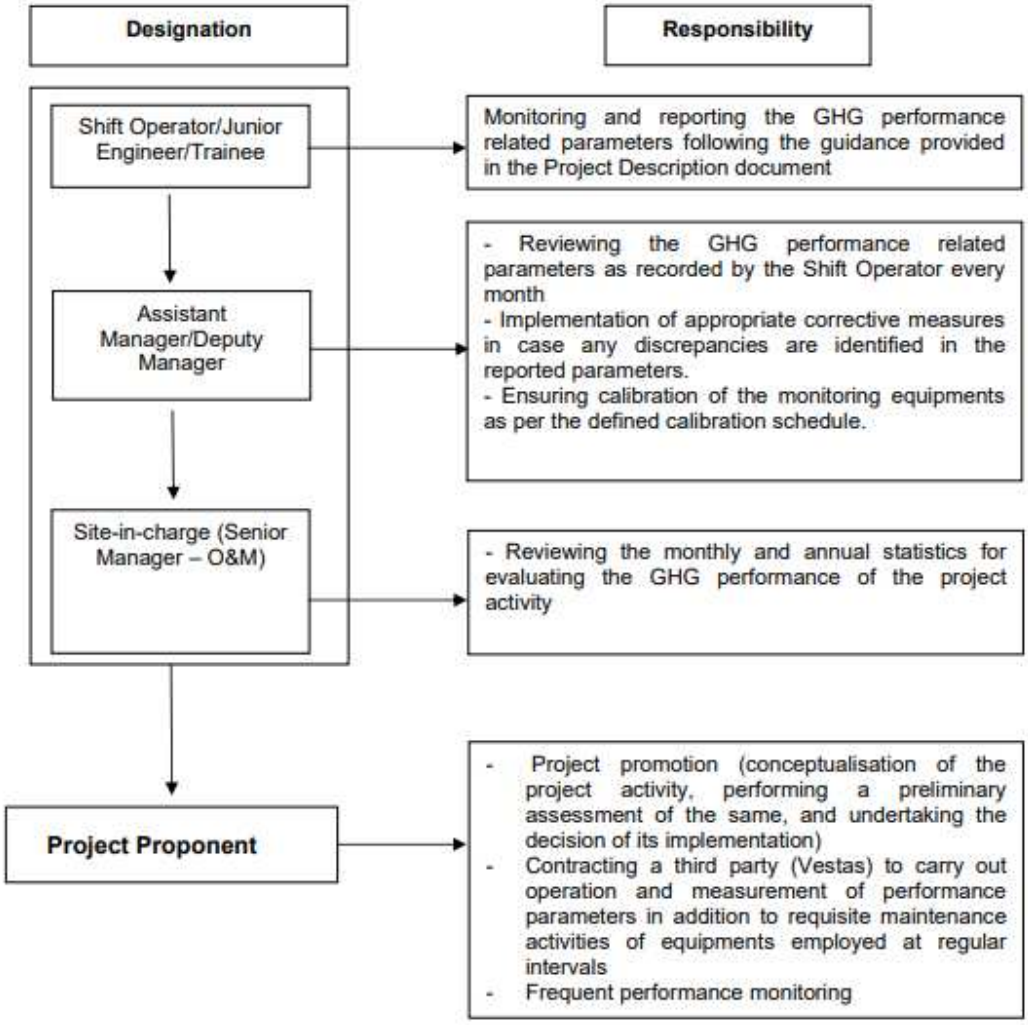
	Responsibility: The O&M operator is responsible for the regular recording of data. **Calibration Frequency:** As per the registered PD the meter calibration is annual. However, the calibration is not done for the entire Monitoring period. PP have the latest calibration report dated 16/March/ 2016 which shows that calibrated meter is under the error limit. Therefore, the accuracy class of the meter is applied for the entire monitoring period which is conservative.
Frequency of monitoring/recording	Monthly & Continuously.
Value monitored	32,825 (Rounded value)
Monitoring equipment	Tri vector Energy Meter
QA/QC procedures to be applied	The project activity emission reductions are based on the net electricity supplied ($EG_{BL,y)}$ by the individual WTG. $EG_{BL,y}$ is referred from the monthly invoice raised by the PP to State Utility Department based on the monthly JMR Report issued by State Electricity Department to the Project Proponent. The main meter at the sending end of the sub-station are sealed by and are in the custody of State Electricity Department. The main meter is used for the monitoring purpose of the said parameter and the same is in line with the State electricity regulatory commission guideline. .
Purpose of the data	To calculate Emission Reduction
Calculation method	NA
Comments	The relevant data are recorded in electronic form and the same along with the electricity bills can be archived for two years beyond the crediting period.

4.3 Monitoring Plan

The project activity falls in the technology measure as described in the paragraph 1 of the Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories. The applicable simplified baseline and monitoring methodology for selected small scale CDM project activities AMS I.D. version 15 requires monitoring of the following.

- Metering the electricity generated by the renewable technology
- Wind based electricity generation is not associated with any kind of leakages. Hence, the sole parameter for monitoring is the electricity supplied to the grid. The Project is operated and managed by Vestas. They follow the documentation practices to ensure the reliability and availability of the data for all the activities as required from the identification of the site, wind resource assessment, logistics, finance, construction, commissioning and operation of the wind power project. The accuracy of monitoring parameter is ensured by adhering to the calibration and testing procedure as set in the power purchase agreement. The project adheres to all the

mandatory regulatory and statutory requirements at the state as well as national level. The operational and management structure implemented by National Enterprises along with Vestas is as follows



The daily generation report is sent to National Enterprises by Vestas. The daily generation report contains data on grid availability, machine availability and generation of electricity. National Enterprises reviews the machine availability from the generation report The monitored data is maintained both as soft and hard copies in the form of photo copies of generation report, issued by TNEB every month showing export and import of energy. The copies of such TNEB generation report are primary document relating to actual number of units fed to the grid and are maintained for 10 + 2 (crediting + 2 years) years. Daily generation reports from Vestas are compiled into monthly reports and saved electronically for 10+2 years (crediting + 2 years).

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline emissions are calculated using the following formula:

$BE_y = EG_{BL,y} \times EFCO_2$

Where:

BE_y=Baseline Emissions.

$EG_{BL,y}$= Quantity of net electricity supplied to the grid as a result of the implementation of the VCS project activity in year y (MWh)

$EFCO_2$= CO_2 Emission Factor in year y; t CO_2e/MWh

Therefore,

$BE_y = 32,825 * 0.93$

BE_y=29,626 t CO_2e (Rounded Value)

5.2 Project Emissions

As the project activity is a wind power project, there are no anthropogenic emissions by sources of GHGs within the project boundary as a result of the project activity. Hence there are no project emissions to be considered. $PE_y = 0$

5.3 Leakage

There are no anthropogenic emissions identified by sources outside the project boundary due to the project activity. Furthermore, the equipments (WTGs) used by the project activity are newly procured and hence not transferred from another project. Thus, there are no leakage emissions attributable to the project activity. Hence,$LE_y = 0$

5.4 Net GHG Emission Reductions and Removals

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)
01-01-2010 to	5,707	0	0	5,707

20-12-2010				
20-12-2010 to 20-12-2011	5,687	0	0	5,687
20-12-2011 to 20-12-2012	5,829	0	0	5,829
20-12-2012 to 15-12-2013	4,852	0	0	4,852
15-12-2013 to 15-12-2014	4,161	0	0	4,161
15-12-2014 to 31-12-2015	3,390	0	0	3,390
Total	29,626	0	0	29,626

It is to be noted here that as per the estimated emission reduction to be achieved from the project activity for the current monitoring period are 44,412 tCO_2e, whereas actual emission reductions achieved are 29,626 tCO_2e, which is approximately 33% lower than the estimated emission reductions. This is due to low PLF achieved during the current monitoring period as compared to the PLF in the registered project description

APPENDIX 1 CALIBRATION DETAILS

HTSC No.	Meter Type	Accuracy Class	Date of Calibration
2595	Main Meter	0.5s	16-March-2016
2570	Main Meter	0.5s	16-March-2016

As per the registered PD the meter calibration is annual. However the calibration is not done for the entire Monitoring period. PP have the latest calibration report dated 16/March/ 2016 which shows that calibrated meter is under the error limit. Therefore the accuracy class of the meter is applied for the entire monitoring period which is conservative.

Breakdown Details-

DGR for Jan 2010

Date	**Export Kwh**
20-12-2009	3755.48
21-12-2009	6614.95
22-12-2009	8281.11
23-12-2009	8741.80
24-12-2009	27453.44
25-12-2009	8954.07
26-12-2009	8687.79
27-12-2009	20448.57
28-12-2009	4648.51
29-12-2009	19577.17
30-12-2009	31509.97
31-12-2009	28259.56
01-01-2010	12775.43
02-01-2010	911.68
03-01-2010	3943.83
04-01-2010	810.18
05-01-2010	20901.53
06-01-2010	29371.17
07-01-2010	31206.10
08-01-2010	17690.22
09-01-2010	2424.79
10-01-2010	4885.16
11-01-2010	2736.79
12-01-2010	14126.82
13-01-2010	21059.06
14-01-2010	10665.30
15-01-2010	20450.37
16-01-2010	27051.76
17-01-2010	17385.78
18-01-2010	6177.69
19-01-2010	7434.37
20-01-2010	17656.38
Total	**446596.78**

Controller data from 20/12/2009 to 20/01/2010 in MWh	446.5968
Controller data from 01/01/2010 to 20/01/2010in MWh	269.6644
Generation Ratio	0.603821

DGR for Jan 2016

Date	Export Kwh
15-12-2015	3298.01
16-12-2015	17429.69
17-12-2015	15577.28
18-12-2015	11111.34
19-12-2015	5845.97
20-12-2015	17848.00
21-12-2015	10539.51
22-12-2015	14474.21
23-12-2015	16829.28
24-12-2015	15074.91
25-12-2015	5077.53
26-12-2015	9081.36
27-12-2015	1749.64
28-12-2015	10067.76
29-12-2015	3064.29
30-12-2015	8577.34
31-12-2015	3277.30
01-01-2016	18129.43
02-01-2016	11366.43
03-01-2016	16053.23
04-01-2016	9881.71
05-01-2016	2526.80
06-01-2016	2773.95
07-01-2016	790.80
08-01-2016	16938.48
09-01-2016	12098.18
10-01-2016	4146.46
11-01-2016	17109.64
12-01-2016	10324.31
13-01-2016	17479.35
14-01-2016	930.57
15-01-2016	930.57
Total	**10403.37**

Controller data from 15/12/2015 to 15/01/2016 in MWh	310.4
Controller data from 01/01/206 to 15/01/2016 in MWh	141.5
Generation Ratio	0.455794