2.45 MW WIND POWER PROJECT IN RAJASTHAN, INDIA BY YAMUNA POWER AND INFRASTRUCTURE LTD.

Document Prepared by EKI Energy Services Limited

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Prepared By	Anant Ladukar Senior Manager - Operations EKI Energy Services Limited
Contact	EnKing Embassy, Office No. 201, Plot 48, Scheme 78, Part 2 Vijay Nagar, Near Brilliant Convention Centre, Indore- 452010 Madhya Pradesh, India Website: www.enkingint.org Email ID: anant@enkingint.org; registry@enkingint.org M: +91 9770900205

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity is a wind based power generation project of capacity 2.45 MW. It consists of a three Wind Turbine Generators (WTGs), 2 X 600 KW and 1 X 1250 KW belonging to Yamuna Power & Infrastructure Ltd. All the three WTGs are located in the state of Rajasthan. Suzlon Energy Ltd and Enercon India Ltd. are the equipment suppliers and the operations and maintenance contractors for the Project.

The generated electricity is being supplied to Indian grid of India under a long-term power purchase agreement (PPA) signed with Rajasthan Rajya Vidyut Prasaran Nigam Limited (RVPNL). Thereby the electricity exported from the project to the Indian grid has replaces an equivalent amount of power generation at the grid connected power plants which are predominantly fossil fuel based. Therefore the project activity results in an equivalent amount of CO_2 emission reduction which otherwise have resulted equivalent to the carbon intensity (Grid Emission Factor in tCO_2e/MWh) of the Indian grid.

Brief description of the installed technology and equipment:

The project installs one Suzlon make (S-66) and two Enercon Make (E-40) WEGs of individual capacity 1.25 MW and 0.6 MW respectively. The specification of the various WTG models S-66 and E-40 employed by the project activity are provided in **"Appendix II:<Technical Specification>"**.

The relevant implementation dates

Project Proponent	WTG No.	Installed Capacity	Location	Commissioning Date
Yamuna Power & Infrastructure Ltd.	YGCL-01	0.6 MW	Rajasthan	03-March-2004
Yamuna Power & Infrastructure Ltd.	YGCL-02	0.6 MW	Rajasthan	03-March-2004
Yamuna Power & Infrastructure Ltd.	J-215	1.25 MW	Rajasthan	14-March-2004

The WTGs are running smoothly since commissioning with scheduled maintenance. No events or situations happened for the reported monitoring period that can alter the applicability of the applied methodology.

The total GHG emission reductions or removals generated in this monitoring period.

The total emission reductions achieved in this monitoring period i.e. from 02-August-2009 to 27-March-2016 (First and last days included) is 17,450 tCO_2 e.

1.2 Sectoral Scope and Project Type

Project Type: I – Renewable Energy Projects

Sectoral Scope: 1 Energy industries (renewable - / non-renewable sources)
Project Category: I.D. Grid-connected renewable electricity generation

Project is not grouped project activity as per VCS guidelines.

1.3 Project Proponent

Organization name	Yamuna Power & Infrastructure Ltd. (Formerly Yamuna Gases and Chemicals Ltd.)
Contact person	Mr G. S. Chawla
Title	Advisory Head
Address	23 Barakhamba Road, 909 Naram Manzil, New Delhi, Delhi, India
Telephone	+919810530109
Email	gschawla@Yamunapower.com

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the Project	Project Consultant
Contact person	Anant Ladukar
Title	Senior Manager
Address	Office No 201, Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore 452010, India
Telephone	9770900205
Email	anant@enkingint.org / registry@enkingint.org

1.5 Project Start Date

Project Start Date: 03-March-2004 commissioning date for the WTG YGCL-01 & YGCL-02

1.6 Project Crediting Period

Project Crediting Period Start date: 28-March-2006
Project Crediting Period End date: 27-March-2016
Total Crediting Period: 10 Years

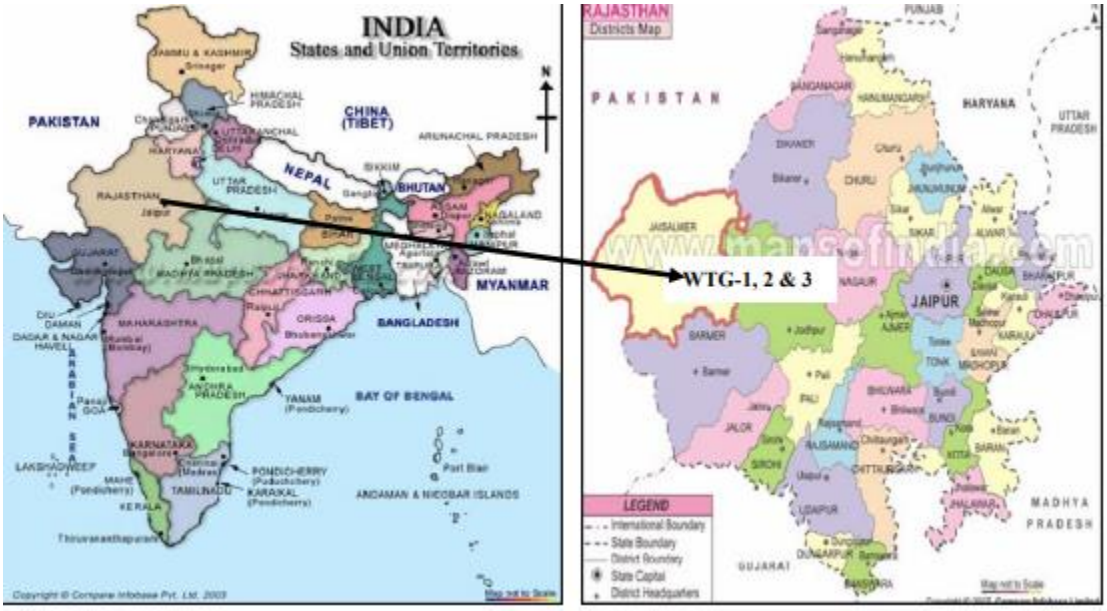
1.7 Project Location

Project location including geographic and physical information are as follows

S. No.	WEG No.	Capacity (MW)	Technology	Location			Site Coordinates
				Village	District	State	
1	YGCL-01	0.6	Enercon	Gorera	Jaisalmer	Rajasthan	26°44'37"N 70°51'41" E
2	YGCL-02	0.6	Enercon	Gorera	Jaisalmer	Rajasthan	26°45'03"N 70°51'54"E

3	J-215	1.25	Suzlon	Soda Mada	Jaisalmer	Rajasthan	26° 41'15.0" N 70° 53' 23.6" E

Maps depicting the districts and states in which Wind Projects are located are placed below.



1.8 Title and Reference of Methodology

Project Category: AMS I.D. – Grid connected renewable electricity generation (Version 14, EB 48)

According to the categorization of Appendix B to the simplified modalities and procedures for small scale Clean Development Mechanism (CDM) project activities

1.9 Participation under other GHG Programs

The project has neither been registered nor seeking registration under any other GHG programs. The project is seeking registration only in VCS program.

PP has provided undertaking that in current monitoring period, it has not claim GHG emission reduction credits in any GHG program other than that in VERRA. There is no double counting of GHG emission reductions

1.10 Other Forms of Credit

Emission Trading Programs and Other Binding Limits: The project proponent is not participating in any other emission trading program and other binding limits.

The project activity is not availing any REC benefits and the same can be confirmed from publically available link of REC generators.
https://www.recregistryindia.nic.in/index.php/publics/registered_regens

Other Forms of Environmental Credit: The project activity neither has nor intends to generate any other form of GHG related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

1.11 Sustainable Development

The contribution of the project activity to the sustainable development of the host country 'India' is evident from the following:

Social well being:

Activities such as site preparation, construction, building, operation and maintenance etc required a significant amount of skilled and unskilled manpower. This has (and still is) resulted in significant employment generation. Furthermore, as the locations of some of the WTGs incorporated in the project activity are in the remotest areas, it is a great opportunity for people in the interiors to come face to face with modern technologies. This is surely leads to capacity building in terms of technical knowledge and long-term skills.

Economic well being:

The renewable energy project has supplied electricity to the grid thereby not only reducing the load on an already deficit electricity grid but also result in an indirect saving of nonrenewable fossil fuels such as coal that are consumed by thermal power stations. In addition, the generation of employment opportunities also promotes the Economic well-being of the region. Lastly, the development of infrastructure of the region is imminent as such WTGs, riding on their success has invited more investments for the region.

Technological well being

This project activity incorporates WTGs that have rated outputs ranging from 600 KW to 1.25 MW. Moreover, although the technology for each of them is more or less similar, these WTGs are placed in different locations. Since, the parameters such as Wind densities, wind speeds and 'swept-areas' of rotors are different in each case, the project activity has also yield very useful data in terms of plant load factors (PLFs) achieved in each case. These data is very useful to technology providers, project participants, developers, wind power enthusiasts and students etc., the analysis of which may help in bringing about further improvements in technology.

Environmental well being

This is the fundamental intent behind the project activity. All the participants of the project activity had desired to produce electrical power, by using renewable resources, the utilization or consumption of which has not create environmental pollution. As such, not only does the project avoid any GHG emissions, but also avoids any form of pollution.

2 SAFEGUARDS

2.1 No Net Harm

As per Ministry of Environment, Forest and Climate Change, Government of India Notification dated 27th January 1994 (Para 3) followed by its amendment dated 13th June 2002 (clause ii), the implementation of the wind farm does not require an environmental impact assessment. Also, as per Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India the amended notification dated September 14, 2006[1] regarding the requirement of Environment Impact Assessment (EIA) studies as per the Environment Protection Rule, 1986 (Published in the Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii) Ministry of Environment and Forests) states that any project developer in India needs to file an application to MoEF (including a public hearing and an EIA) in case the proposed industry or project is listed in a predefined list. The wind farms are not included in this list. Therefore the project activity does not require an EIA study to be carried out.

The project activity does not involve any major construction activity. It primarily requires the installation of the Wind Electric Generators, interfacing the generators with the State Electricity Board by setting up HT transmission lines and installation of other accessories. However, there are no negative impacts on air, water; soil quality and ambience are envisaged due to the project activity

2.2 Local Stakeholder Consultation

The stakeholder meeting was conducted on during registration of the project activity. PP took due care of the comments received during LSC.

The process of local stakeholder consultation is continuous. During the current monitoring period, the project proponent has kept grievance register in plant site office and sought comments/grievances/suggestions from local stakeholders including local community, government agencies and NGOs. However, no comments/grievances/suggestions have been received from the aforementioned stakeholders during the current monitoring period.

2.3 AFOLU-Specific Safeguards

The project activity deals with generation of electricity using wind energy by Wind Turbine Generator (WTG) and not from AFOLU projects. Hence not applicable

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

Start Date of project activity is 03-March-2004 i.e. commissioning date for the WTG YGCL-01 & YGCL-02

The project activity involves the installation of three Wind Turbine Generators (WTGs), 2 X 600 KW and 1 X 1250 KW. The project activity has been commissioned and the monitoring equipments were installed to monitor the parameters as described in the registered Project

[1] http://environmentclearance.nic.in/writereaddata/EIA_notifications/2006_09_14_EIA.pdf

Description (PD). All the WTGs involved in the project activity are already commissioned and operational. The commissioning details of the project are as follows

Project Proponent	WTG No.	Installed Capacity	Location	Commissioning Date
Yamuna Power & Infrastructure Ltd.	YGCL-01	0.6 MW	Rajasthan	03-March-2004
Yamuna Power & Infrastructure Ltd.	YGCL-02	0.6 MW	Rajasthan	03-March-2004
Yamuna Power & Infrastructure Ltd.	J-215	1.25 MW	Rajasthan	14-March-2004

All the WTGs are running satisfactorily during the reported monitoring period. There are no special events occur during the reported monitoring period. Hence, no impact occurs on the GHG emission reduction from the project activity.

3.2 Deviations

2.3.1 Methodology Deviations

No methodology deviation is applied during the monitoring period.

2.3.2 Project Description Deviations

The deviation in project activity is provided below:

As per registered PDD, the site co-ordinates mention is typo error for WEG no. YGCL-01 and YGCL-02. This is now revised in the current MR based on actual site co-ordinates in section 1.7 of this monitoring report. This change having no impact on project applicability, baseline scenario, additionality etc. The nature of change is permanent.

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	tCO_2/GWh
Description	Operating margin CO_2 emission factor in year y
Source of data	CEA Database Version 04
Value applied	1009 (0.1009 tCO_2/MWh)
Justification of choice of data or description of	As per the "Tool to calculate the emission factor for an electricity system" (Version 01.1, EB 35), the calculation of

measurement methods and procedures applied	OM are done ex ante based on the most recent 3 years for which data is available at the time of PD submission.
Purpose of Data	Calculation of baseline emission
Comments	--

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/GWh
Description	Build margin CO_2 emission factor in year y
Source of data	CEA Database Version 04
Value applied	598 (0.598 tCO_2/MWh)
Justification of choice of data or description of measurement methods and procedures applied	BM value are taken from CO_2 baseline database for the Indian Power Sector, Version 04, October 2008. CO_2 Baseline Database for the Indian Power Sector is published by Central Electricity Authority, Ministry of Power, Govt. of India.
Purpose of Data	Calculation of baseline emission
Comments	--

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/GWh
Description	Combined margin CO_2 emission factor in year y
Source of data	CEA Database Version 04
Value applied	906 tCO_2/GWh (0.906 tCO_2/MWh)
Justification of choice of data or description of measurement methods and procedures applied	The combined margin emission factor is calculated as follows $EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM}$ For wind power generation project activities W_{OM} = 0.75 and W_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting period.
Purpose of Data	Calculation of baseline emission
Comments	The emission factor ($EF_{grid,CM,y}$) are calculated Ex ante and therefore need not to be monitored during crediting period

4.2 Data and Parameters Monitored

Data / Parameter	EG_y
Data unit	MWh /Year
Description	Net electricity supplied by individual WTGs included in the project activity.
Source of data	Metered net electricity supplied by the project activity as

	reported in the monthly joint meter reading issued by RVNPL.
Description of measurement methods and procedures to be applied	The data is calculated using the Joint Energy Meters (Tri vector meter of accuracy class 0.2) installed at the substation, together with controller meter reading at the WTGs. The joint energy meter (Main Meters and check meters) are two-way meters where RVNPL officials take the readings (joint meter reading) on monthly basis. The joint energy metering reading report is issued by RVNPL together with the O & M personnel. This reading is used to estimate the net power exported to the grid. The energy generated from individual WTGs is monitored continuously through SCS/LCS Controller. The net electricity exported to the grid by individual WTGs is calculated based on the appropriation of electricity as mentioned in section 4.3
Frequency of monitoring/recording	Monthly
Value monitored	19,265.65
Monitoring equipment	Energy Meters. Please refer Appendix I for more details
QA/QC procedures to be applied	The main energy meters and the check meter are calibrated once in a year to maintain the accuracy. In case of failure of main meters, check meters installed with the main meter used to record the generation. The WTG SCS/LCS Controller is micro-processor based. The measurement accuracy of the controller is 0.5% and these readings are highly accurate and reliable.
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	The relevant data is recorded in electronic form and the same along with the electricity bills are archived for two years beyond the crediting period.

4.3 Monitoring Plan

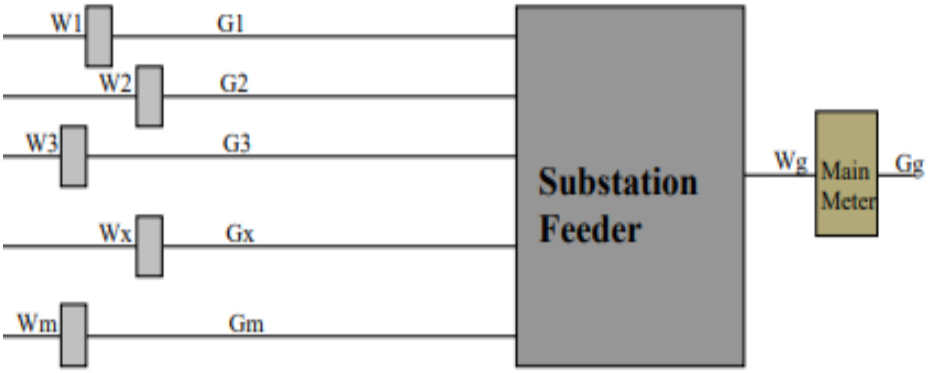
Purpose of monitoring:

The project activity is operated and managed by the project proponent with the help of site in-charge (personal from the project proponent) and site O & M contractor (personal from the wind turbine manufacturer). The purpose of monitoring is accurate measurement of the net electricity exported to the grid from the project activity and subsequently data interpretation techniques for monitoring and verification of GHG emissions with specific focus on technical / efficiency / performance parameters. The project activity essentially involves generation of electricity from wind energy and therefore the electricity generation measurements are required by the utility and the investors to assess electricity sales revenue.

Monitoring, including estimation, modelling, measurement or calculation approaches

The mechanism of billing calculation form each of the WTGs is carried out based on the net energy exported to the grid as reflected in the main energy installed as substation and the individual SCS/LCS Controller (attached to the individual wind mill) by apportioning of electricity, as described below:

Each substation is connected to numbers of wind turbines. The generation reading is collectively displayed by the main energy meter. The net electricity generation of each of the wind turbines is then calculated in the following manner:



In the figure G1, G2, G3, Gx ….Gm are the generation from individual machines (WTGs) and W1,W2,W3, Wx …. Wm are the WTGs installed at the site connected to one substation feeder.

The sum of generation of all the wind turbines connected to a particular substation feeder is Gg
i.e. (G1+G2+G3+Gx+…+Gm) = Gn

The reading at the substation is considered as net generation exported to Grid, i.e. Gg > Gn as some transmission loss takes place on the way to the substation.

Thus difference is, Gg-Gn >0

The total proportional transmission loss for all the turbines is

$$\frac{Gg - Gn}{Gg} = X \text{ (say)}$$

This transmission loss is distributed amongst the entire wind turbine in proportion to their generation as shown below:

G1 x (1- X) = B1 (say)

Here B1 is the actual bill amount raised by WEG 1 after consideration of the transmission losses.

Similarly the bill amount generation is calculated for all the WEG attached to the single substation.

The bill (invoice) amount of electricity is the most conservative of the net electricity generated by a wind mill and therefore this value has been considered for the calculation of Baseline Emissions for each WTG.

Monitoring roles and responsibilities

The project participant has signed an operation and maintenance agreement with the supplier of the wind turbines i.e. Suzlon and Enercon respectively. The performance of the turbines, safety in operation and scheduled /breakdown maintenances is responsibility of the respective facility provider and are organized and monitored by these companies.

Various activities carried out by the Operations and Maintenance team is as follows:

i. Project Monitoring:

- Data logging in for gross power generation, grid availability, machine availability.
- Taking monthly meter reading jointly with RVPN for the WTGs in Rajasthan, of power generated at the wind plant and supplied to the Grid from the meter/s maintained by RVPN for the purpose and coordinate to obtain necessary power credit report/ certificate.
- Preparation and submission of monthly performance report in agreed format.
- Sending the detailed daily and monthly reports for power generation to all the individual project proponent.
- Storage of recorded data and making it available until two years after the last issuance of credits for the Project

ii. Routine & Breakdown Maintenance:

The O & M contractor (Suzlon / Enercon) is responsible for periodic preventive maintenance and upkeeping the equipment including periodic replacement of consumables. The repairs and maintenance of the Equipment to be performed in the event of any breakdown or suspected breakdown due to operational reasons in the Equipment or any part thereof. The breakdown is being attended as soon as possible to put the Equipment back into operation.

iii. Technical Services:

- Visual inspection of the WTG and all parts thereof.
- Technical Assistance including checking of various technical, safety and operational parameters of the Equipment, trouble shooting and relevant technical services.
- Calibration of Meters on regular basis.

iv. Security Services:

This service includes watch and ward and Security of the Wind Farm and the Equipment.
The project promoter has assigned responsibilities to the respective personnel for overall supervision of the project performance

The assigned person are taken care of the overall supervision of the project performance including the following:

- Performance review of the WEG installations
- Monitoring & liaison with the state electricity utility
- Arranging for annual verification of the installations for issuance of CERs

Managing data quality

Measures to ensure the Accuracy of Results

Main meter: The calibration of the meters (and the check meter) is carried out by RVPNL once in a year. a check meter is also provided along with the main meter. The reading of both the meters is matched every month to ensure accuracy of the meters. In the event of mal function of main meter, check meter reading is used during the period.

WEG Controller/SCS (LCS) Controller: It is a micro-processor based intelligent controller which has been specially designed for control of wind turbines. It uses a Woodward Multifunction Relay that has three current inputs from CT and three direct voltage inputs (690 Volts). The analog values of current/voltage are converted into digital signal internally using A/D Converters at very high sampling rate. A software program reads these values and displays instantaneous parameters such as voltage, current, power factor, kVAh, kVArh and kWh. These instantaneous values are then time integrated and displayed/stored.

Roles and responsibilities for Monitoring

Designation	Responsibility
Shift Operator/Junior Engineer/Trainee (O&M Team)	Monitoring and reporting electricity generation and WTG performance following the guidance provided in the WTG operation manual.
Assistant Manager/Deputy Manager (O&M Team)	- Reviewing the data measured and recorded on net electricity exported to grid - Implementation of appropriate corrective measures in case any discrepancies are identified in the reported parameters. - Calculations of T & D Losses - Ensuring calibration of the monitoring equipments as per the defined calibration schedule. - Emergency preparedness plan in case of failure of the monitoring equipments
Site-in-charge (Senior Manager – O&M Team)	- Reviewing the monthly and annual electricity generation statistics. - Reviewing operation and Maintenance logbook. - Evaluating performance of the project activity. - Sending electricity generation reports to PP
Yamuna Power & Infrastructure Ltd. (Project Proponent)	- Reviewing the monthly and annual electricity generation statistics. - Calculation of GHG emission reductions based on the net electricity exported and the grid emission factor (GEF) - Keeping records for data related to for GHG emission calculation till 2 years beyond the crediting period

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As per the applicable methodology, AMS ID, Version 14, the baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in kWh of electricity produced by the renewable generating unit multiplied by an emission factor

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

BE_y = kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh)

EG_y = Net quantity of electricity supplied to the manufacturing facility by the project during the year y in MWh

$EF_{grid,CM,y}$ = Grid emission coefficient for the electricity displaced due to the project activity during the year y (tCO_2/MWh)

Year	EG_y	$EF_{grid,CM,y}$	BE_y
02-August-2009 to 31-December-2009	1320.04	0.906	1,195
01-January-2010 to 31-December-2010	3,042.60	0.906	2,756
01-January-2011 to 31-December-2011	3,192.14	0.906	2,892
01-January-2012 to 31-December-2012	2,973.31	0.906	2,693
01-January-2013 to 31-December-2013	2,977.40	0.906	2,697
01-January-2014 to 31-December-2014	3,044.35	0.906	2,758
01-January-2015 to 31-December-2015	2,313.04	0.906	2,095
01-January-2016 to 27-March-2016	402.78	0.906	3,64
Total			17,450

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.

$L_y = 0$

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)

02-August-2009 to 31-December-2009	1,195	0	0	1,195
01-January-2010 to 31-December-2010	2,756	0	0	2,756
01-January-2011 to 31-December-2011	2,892	0	0	2,892
01-January-2012 to 31-December-2012	2,693	0	0	2,693
01-January-2013 to 31-December-2013	2,697	0	0	2,697
01-January-2014 to 31-December-2014	2,758	0	0	2,758
01-January-2015 to 31-December-2015	2,095	0	0	2,095
01-January-2016 to 27-March-2016	364	0	0	364
Total	**17,450**	**0**	**0**	**17,450**

Remarks on increase in achieved emission reductions

During the current monitoring period, actual emission reductions achieved are 17,450 tCO_2e whereas estimated emission reductions was 27,516 tCO_2e.

The actual emission reduction achieved is 36.58% less than the estimated in the registered PD. This is due to lower PLF achieved during the current monitoring period as compared to the estimated PLF in the registered PD.

APPENDIX I: <CALIBRATION DETAILS>

Suzlon Energy Limited 220 KV Sub-Station SODA MADA, Jaisalmer (WTG No. J 215)					
	Transformer 1	Transformer 2	Transformer 3	Date of Calibration	Due Date of Calibration
Main Meter	RJB00316	TNU00956	TNU00957	19-January-2014	18-January-2015
Make	Secure	Secure	Secure	22-February-2016	21-February-2017
Accuracy Class	0.2	0.2	0.2		

220 KV GSS Amarsagar, Enercon Feeder-1 and Feeder-2					
Enercon (India) Ltd. Wind Farms at Temedarai, Soda Bandhan & Korwan					
Meter	Sr. No.	Make	Accuracy Class	Date of Calibration	Due Date of Calibration
Main Meter -1	TNU 00946	Secure	0.2	29-Jan-2009	29-Jan-2010
				30-March-2010	30-March-2011
				26-March-2011	26-March-2012
				19-March-2012	19-March-2013
				26-Dec-2012	26-Dec-2013
				13-Feb-2015	13-Feb-2016
				09-April-2016	08-April-2017
Main Meter -2	TNU 00945	Secure	0.2	29-Jan-2009	29-Jan-2010
				30-March-2010	30-March-2011
				26-March-2011	26-March-2012
				19-March-2012	19-March-2013
				26-Dec-2012	26-Dec-2013
				13-Feb-2015	13-Feb-2016
				09-Apri-2016	08-April-2017

Note: Considering the monitoring period as 02-August-2009 to 27-March-2016, there has been delay in calibration of meters – hence conservative error factor 0.2% has been applied to the values of both electricity export and electricity import on respective months.

APPENDIX II: <TECHNICAL SPECIFICATION>

Technical Specification for Suzlon make (1250 KW and 600 KW) WTGs.

S/No	Particulars	Suzlon S-66 WTG
	Rotor	
1	Rotor diameter	66 m
2	Hub Height	65 m
3	Installed electrical output	1250 kW
4	Rotor swept area	3421.19 m2
5	Rotational speed	13.9 / 20.8 rpm
6	Rotor material	GRP (Glass Reinforced Epoxy)
7	Regulation	Pitch
	Operational Data	
8	Cut-in wind speed	3.0 m/s
9	Rated wind speed	13.0 m/s
10	Cut-out wind speed	25.0 m/s
	Generator	
11	Type	Asynchronous Generator
12	Poles	4/6 poles
13	Rated output	250/1250 kW
14	Rotational speed	1010/1515 rpm
15	Operating voltage	690 V
16	Frequency	50 Hz
17	Insulation class	Class H
18	Protection	IP 56
19	Cooling system	Air cooled
	Gear Box	
20	Type	Integrated 3-stage gearbox
21	Gear Types	1 planetary & 2 helical.
22	Manufacturer	Flender
23	Gear ratio	1.74.917
24	Nominal load	1390 kW
25	Type of cooling	Oil cooling system
	Yaw Drive	
26	Motor	4 Active Electrical Yaw Motors
27	Yaw bearing	Polyamide slide bearing
	Safety System	
28	Aerodynamic Brake	3 Independent systems with blade Pitching
29	Mechanical Brake	Spring Powered Disc Brake, Hydraulically Released
	Tower	
30	Type	Free Standing; Lattice tower; Hot dip galvanised
31	Erection	With Crane
32	Design Standard	GL Special Class

Technical Specification for Enercon make (600 KW) WTG.

S/No	Particulars	Enercon E-40 WTG
1.	Rated Power	600 KW
2.	Rotor Diameter	44 m
3.	Hub Height	56.85 m
4.	Turbine Type	Gearless horizontal axis wind turbine with variable rotor speed
5.	Power Regulation	Independent electromechanical pitch system for each blade
6.	Design Lifetime	20 years
7.	Cut-in Wind Speed	3.0 m/s
8.	Rated Wind Speed	11.6 m/s
9.	Cut-out Wind Speed	25.0 m/s
10.	Extreme Wind Speed	57.6 m/s
11.	Rated Rotational Speed	32.5 rpm
12.	Operating Range Rotational Speed	18.0-33.0 rpm
13.	Orientation	Upwind
14.	No. of Blades	3
15.	Blade Material	Glass Fibre Reinforced Epoxy
16.	Gear box Type	Gear less
17.	Generator Type	Synchronous Generator
18.	Braking	Aero dynamical
19.	Output Voltage	400 V
20.	Yaw System	Active yawing with 4 electrical yaw drives with brake motor and friction bearing.
21.	Tower	56 m in 5 Sections.