

# BUNDLED WIND POWER PROJECT IN JAMNAGAR, GUJARAT



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<b>Project Title</b>	Bundled wind power project in Jamnagar, Gujarat
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## 1 PROJECT DETAILS

### 1.1 Summary Description of Project

The purpose of the project activity is to utilize renewable wind energy for generation of electricity. The project activity replaces anthropogenic emissions of greenhouse gases (GHG's) into the atmosphere, which is estimated to be approximately 13,123 tCO<sub>2</sub>e for current monitoring period, by displacing the equivalent amount of electricity generation through the operation of existing fuel mix in the grid comprising mainly fossil fuel based power plants and future capacity expansions connected to the grid.

The proposed project is a bundled project activity which involves commissioning and operation of 12 Wind Turbine Generators (WTGs) of 0.8 MW capacities with a total installed capacity of 9.6 MW. The machines are Enercon E-53 make. The project activity will assist the sustainable growth of the region by providing clean and green electricity to the state electricity grid. The bundled project activity consists of 12 WTGs:

Name	No. of WTGs
Vish Wind Infrastructure LLP	8
J. N. Investment & Trading Co. Private Limited	4

### 1.2 Sectoral Scope and Project Type

Sectoral scope: 1 Energy Industries (renewable -/ non renewable sources)

Project Type: I, Renewable energy projects.

The project is not a grouped project.

### 1.3 Project Proponent

Vish Wind Infrastructure LLP

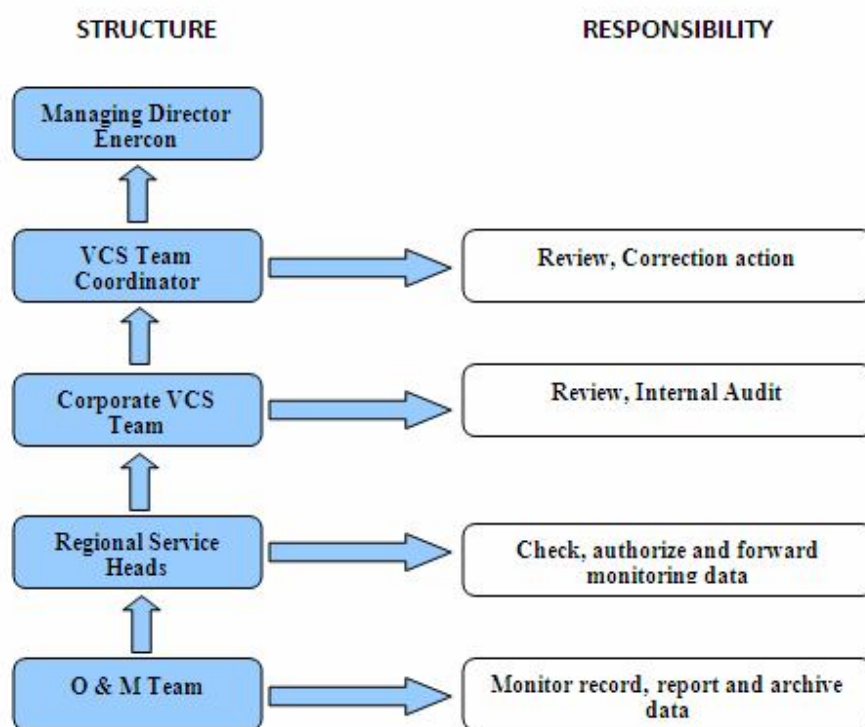
Organization:	Vish Wind Infrastructure LLP
Street/P.O.Box:	Veera Industrial Estate, Veera Desai Road, Andheri West
Building:	Enercon Tower, A-9
City:	Mumbai
State/Region:	Maharashtra
Postfix/ZIP:	400053
Country:	India
Telephone:	+91-22- 66924848
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URL:	
Represented by:	
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J. N. Investments & Trading Co. Pvt. Ltd.

Organization:	J. N. Investments & Trading Co. Pvt. Ltd.
Street/P.O.Box:	L.B.S Marg, Vikhroli (West)
Building:	Kaysons No.1, Mehra Estate,
City:	Mumbai
State/Region:	Maharashtra
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URL:	
Represented by:	
Title:	Director
Salutation:	Mrs
Last Name:	Mehra
Middle Name:	
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#### Roles & Responsibility



**1.4 Other Entities Involved in the Project**

There are no other entities involved in this project activity.

**1.5 Project Start Date**

27<sup>th</sup> September 2010

**1.6 Project Crediting Period**

The crediting period for the project activity is considered from 27<sup>th</sup> September 2010 to 26<sup>th</sup> September 2020, for 10 years & 0 days.

**1.7 Project Location**

The Project is spread across villages of Jamnagar district in the state of Gujarat. Nearest airport and railway station are at Jamnagar city which is located at a distance of approximately 60 kms from the project activity site. The longitude and latitude details of WTGs are given below:

Sr. No.	Project Owner	Unique WTG ID No.	Latitude			Longitude		
			Deg.	Min.	Sec.	Deg.	Min.	Sec.
1	J. N. Investment & Trading Co. Private Limited	EIL/800/10-11/1822	21	59	20.8	70	13	19
2		EIL/800/10-11/1823	21	59	12.7	70	13	19.7
3		EIL/800/10-11/1824	21	58	42.7	70	13	11.1
4		EIL/800/10-11/1825	21	56	1.8	70	11	4.1
5	Vish Wind Infrastructure	EIL/800/10-11/1887	21	56	13.4	70	11	11.5

6	LLP	EIL/800/10-11/1888	21	56	19.1	70	11	3
7		EIL/800/10-11/1889	21	59	23.7	70	6	53.3
8		EIL/800/10-11/1890	21	59	48.6	70	6	17.5
9		EIL/800/10-11/1891	21	58	57.6	70	10	21.9
10		EIL/800/10-11/1892	21	59	6.3	70	10	19.9
11		EIL/800/10-11/1893	21	59	23.3	70	10	14.4
12		EIL/800/10-11/1894	21	59	29.8	70	10	8.6

### 1.8 Title and Reference of Methodology

Title: "Grid connected renewable electricity generation".

Reference: AMS-I.D, EB 54 Version 16

[http://cdm.unfccc.int/filestorage/S/JI/SJ152M6QXGKFNOZABTHDYPU789EV3C/EB54\\_repan07\\_AMS-I.D\\_ver16.pdf?t=Smh8bW5hbGRfDDA6SjPzK0wTcaDPXgFqxv](http://cdm.unfccc.int/filestorage/S/JI/SJ152M6QXGKFNOZABTHDYPU789EV3C/EB54_repan07_AMS-I.D_ver16.pdf?t=Smh8bW5hbGRfDDA6SjPzK0wTcaDPXgFqxv)

## 2 IMPLEMENTATION STATUS

### 2.1 Implementation Status of the Project Activity

The first machine under the project activity was commissioned on 27/09/2010 and last machine under the project activity was commissioned on 30/09/2010. The project activity consists of 12 machines (800 kWh) of Enercon make E-53 totaling to a capacity of 9.6 MW.

The commissioning date for all the WTGs included in the project activity is given in the table below:

Sr. No.	Project Owner	Unique Identification No.	Commissioning Date
1	J. N. Investment & Trading Co. Private Limited	EIL/800/10-11/1822	27/09/2010
2		EIL/800/10-11/1823	27/09/2010
3		EIL/800/10-11/1824	27/09/2010
4		EIL/800/10-11/1825	27/09/2010
5	Vish Wind Infrastructure LLP	EIL/800/10-11/1887	29/09/2010
6		EIL/800/10-11/1888	29/09/2010
7		EIL/800/10-11/1889	29/09/2010
8		EIL/800/10-11/1890	29/09/2010
9		EIL/800/10-11/1891	30/09/2010
10		EIL/800/10-11/1892	30/09/2010
11		EIL/800/10-11/1893	30/09/2010
12		EIL/800/10-11/1894	30/09/2010

The project activity involves 12-Wind Turbine Generators (WTGs) of Enercon make (800 kW E-53) with internal electrical lines connecting the project activity with local evacuation facility. The WTGs generates 3-phase power at 400V, which is stepped up to 33 KV. The project activity can operate in the frequency range of 47.5–51.5 Hz and in the voltage range of 400 V ± 12.5%. The

average life time of the WTG is around 20 years as per information provided by the supplier. The other salient features of the state-of art technology are:

Turbine Model	Enercon E-53
Rated Power	800 kW
Rotor Diameter	53 m
Hub Height	75 m
Turbine Type	Gearless horizontal axis wind turbine with variable rotor speed
Power Regulation	Independent electromechanical pitch system for each blade
Cut in wind speed	2.5 m/s
Rated wind speed	12 m/s
Cut out wind speed	28-34 m/s
Extreme Wind Speed	59.5 m/s
Rated rotation speed	32 rpm
Operating range rot. Speed	12-29 rpm
Orientation	Upwind
No. Of Blades	3
Blade Material	Fibre Glass Epoxy reinforced with integral lightning protection
Gear box type	Gearless
Generator type	Synchronous generator
Braking	Aerodynamic
Output Voltage	400 V
Yaw System	Active yawing with 4 electric yaw drives with brake motor & friction bearing
Tower	74 m concrete

The project has supplied 14235.58 MWh of electricity to the grid in the monitoring period, which indicates that the project has performed reasonably well during the monitoring period.

Enercon operation and maintenance activities are ISO 9001:2008 certified and all the events are recorded at the project site. Referring to the data available, it can be inferred that there has not been any major event for any machines that are included in the project activity. As a part of regular maintenance, the machines are stopped for mechanical and electrical maintenance for 17 to 19 hours annually and for visual inspection for 7 to 8 hours quarterly which is 14 hours for mechanical and electrical maintenance and 10 hours for visual inspection for the current monitoring period.

During the current monitoring period, there has not been any event that may impact the applicability of the methodology or the GHG emission reductions.

### 2.2 Project Description Deviations

There is no deviation in the monitoring plan.

### 2.3 Grouped Project

The project activity is an individual project & not a group project.

## 3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	EF <sub>grid,OM,y</sub>
Data unit:	tCO <sub>2</sub> / MWh
Description:	Operating Margin Emission Factor of NEWNE Electricity Grid
Source of data:	Calculated from operating and built margin, using 75%-25% weights used (Source: CEA database Version 5 <a href="http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm">http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm</a> )
Value applied:	1.00497
Purpose of the data:	To calculate Baseline Emissions.
Any comment:	The value is calculated on ex-ante basis and it will remain same throughout the crediting period.

Data Unit / Parameter:	EF <sub>grid,BM,y</sub>
Data unit:	tCO <sub>2</sub> / MWh
Description:	Build Margin Emission Factor of NEWNE Electricity Grid
Source of data:	Calculated from CEA database Version 5 <a href="http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm">http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm</a>
Value applied:	0.67518
Purpose of the data:	To calculate Baseline Emissions.
Any comment:	The value is calculated on ex-ante basis and it will remain same throughout the crediting period.

Data Unit / Parameter:	EF <sub>CM,y</sub>
Data unit:	tCO <sub>2</sub> / MWh
Description:	Combined Margin Emission Factor of NEWNE Electricity Grid.
Source of data:	Calculated from operating and built margin, using 75%-25% weights used (Source: CEA database Version 5 <a href="http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm">http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm</a> )
Value applied:	0.92252
Purpose of the data:	To calculate Baseline Emissions.
Any comment:	This value is calculated on ex-ante basis and will remain fixed for the entire crediting period.

3.2 Data and Parameters Monitored

Data Unit / Parameter:	EG <sub>BL,y</sub>
Data unit:	MWh (Mega-watt hour)
Description:	Net Quantity of Electricity exported to the grid.
Source of data:	Share certificate issued by GETCO.
Description of measurement methods and procedures to be applied:	<p>The procedure for metering is as per the provisions of the power purchase agreement. The WTGs of a single customer (VWILLP in this case) are divided into clusters and each cluster has dedicated metering system. Different clusters are connected to different Vacuum Circuit Breaker metering yards (VCB) which ultimately lead to the shared main GETCO meter (also known as revenue meter) at the Sadodar substation maintained by Enercon (India) Limited. Data monitoring takes place at the cluster metering points and GETCO main meter at the EIL substation.</p> <p>The net electricity supplied to the grid by the wind farm is calculated by GEDA on the basis of GETCO main meter reading and the meter readings taken at individual cluster meters after adjusting transmission loss. For adjustment of transmission loss, the electricity metered at the GETCO meter is proportionally divided by GEDA among the customers connected to the GETCO meter/revenue meter on the basis of the pro rata readings taken at the cluster meters. . The meter reading is taken jointly by the representatives of Enercon and GEDA/GETCO in the form of JMR on monthly basis. The meter reading recorded at cluster meters are sent to GEDA every day.</p> <p>The net electricity exported by the project activity is taken directly from the share certificate issued by GETCO on monthly basis. The apportioning procedure is performed by GEDA personnel based on the data received from LCS meters &amp; clusters meters on daily basis and the PP has no role.</p>
Frequency of monitoring/recording:	<p>The recording frequency is on monthly basis. The monitoring of the data parameters is on continuous basis.</p> <p>The O&amp;M site-in-charge is responsible for the regular recording of data.</p>
Value monitored:	14235.58 MWh

Monitoring equipment:	Details are provided in Section 5.
QA/QC procedures to be applied:	Annual calibration of 220 kV Sadodar Substation meters has been undertaken. The Net Quantity of Electricity exported to the grid as per Share certificate issued by GETCO is cross verified by the sale invoice.  The further details of calibration have been given in Section 5.
Calculation method:	Description provided in Section 3.3.
Any comment:	The data will be archived for crediting period + 2 years.

### 3.3 Description of the Monitoring Plan

Approved monitoring methodology AMS-I.D. Version 16 (Para 22) Sectoral Scope: 1, by CDM – Meth Panel is proposed to be used to monitor the emission reductions.

Enercon (India) Limited is the O&M contractor for the project activity. Enercon (India) Limited will be responsible for maintaining all the monitoring data on behalf of PP in respect of the project activity. Enercon (India) Limited has implemented the management structure for managing the monitored data.

The project activity will have various clusters and each cluster has exclusive metering arrangement and the meter readings taken at these metering points will be provided by the representatives of Enercon to GEDA. These energy meters will be sealed by GEDA and will also be calibrated once in three year.

Enercon Substation at Sadodar has main meter(s) also known as revenue meter which is connected to wind turbines installed by the project proponent and wind turbines installed by other project owners. Gujarat Electricity Development Authority (GEDA) apportions the net electricity supplied to the grid at the Enercon substation to all the project owners after adjusting transmission loss from GETCO meters at Sadodar Substation to the meter readings taken at dedicated cluster meters of different project owners.

The meter reading is taken jointly by the representatives of Enercon and GEDA/GETCO in the form of JMR. The electricity from Enercon’s substation is finally supplied to the utility’s substation at Moti Paneli.

The net electricity generated by the project owners is provided by GETCO in the share certificate of electricity generated. The value of the net electricity generated by the project activity will be taken directly by the project proponent from the share certificate provided by GETCO for calculation of emission reductions.

If during meter testing the main meter at the Enercon substation is found beyond the permissible limit of error, the meter reading will be taken from the main meter located at the utility (GETCO) substation at Moti Panelli after addition of average historical transmission losses.

If during meter testing the cluster meters found beyond the permissible limit of error, the sum of panel meter (LCS meter) readings located at each wind turbine of the project activity will be provided to GEDA for purpose of apportioning net electricity supplied to the grid. The LCS meters do not require calibration as the energy readings of electricity generated at the LCS meter is cross verified by the energy calculated by inverting system installed in the WTGs. In case there is any mismatch in the energy values recorded by the LCS meter and the energy values calculated by the inverting system; the machine will stop working and generate the error report.

The apportioning procedure performed by GEDA personnel for the project activity is explained below:-

$EG_{GETCO, Export}$  = Electricity exported, as recorded by the main meter at Enercon substation

$EG_{GETCO, Import}$  = Electricity imported, as recorded by the main meter at Enercon substation

$EG_{Cluster, Export}$  = Electricity exported by the project activity, as measured at Cluster Meter

$EG_{Cluster, Import}$  = Electricity imported by the project activity, as measured at Cluster Meter

$EG_{Cluster, WF, Export}$  = Electricity exported by all the project owners connected to Enercon substation, as measured at Cluster Meter

$EG_{Cluster, WF, Import}$  = Electricity imported by all the project owners connected to Enercon substation, as measured at Cluster Meter

$EG_{BL, export, y}$  = Electricity exported by the project activity to the grid, calculated

$EG_{BL, import, y}$  = Electricity imported from the project activity to the grid, calculated

$EG_{BL, y}$  = Net Electricity exported by the project activity to the grid, calculated

Electricity Exported to the Grid by the project activity

$EG_{BL, export, y} = EG_{GETCO, Export} \times EG_{Cluster, Export} / EG_{Cluster, WF, Export}$

Electricity Imported from the Grid by the project activity

$EG_{BL, import, y} = EG_{GETCO, Import} \times EG_{Cluster, Import} / EG_{Cluster, WF, Import}$

Net Electricity Exported to the grid by the project activity

$EG_{BL, y} = EG_{BL, Export, y} - EG_{BL, Import, y}$

The apportioning procedure for the project activity is done based on the meters that are connected to the cluster meter of various project owners connected to substation of Enercon based on meter reading noted at Enercon substation connecting all the machines of the project activity and other project developers. The meter reading at cluster meter and the Enercon substation are directly monitored and measured on continuous basis and hence the apportioning of the electricity is based on the meter reading that are directly measured. The meter recording at cluster meters of the project activity are done on monthly basis. The panel meter (LCS meter) reading is recorded continuously by the online monitoring system.

The apportioning procedure is performed by GEDA personnel based on the data received from LCS meters & clusters meters on daily basis.

The Project is operated by Enercon (O&M contractor for the project activity) and managed by the PP.

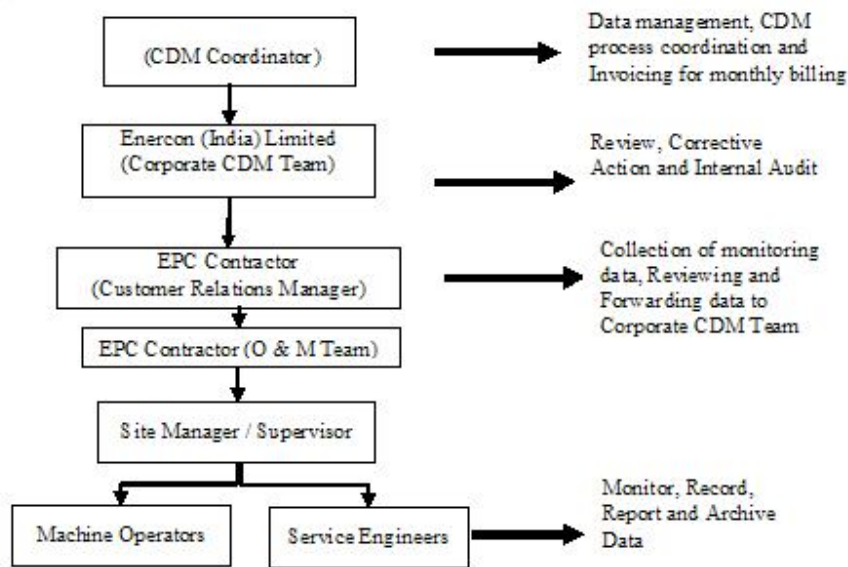
The operational and maintenance contract for the project is with Enercon. Enercon is an ISO 9001:2000 certified Quality Management system from Germanischer Lloyd. Enercon follows the documentation practices to ensure the reliability and availability of the data for all the activities as required from 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 of the metering equipment once each year.

The detail of calibration of meters is given in Section 5.

**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 Wind Turbine Generators (WTGs), it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that Enercon’s service staff 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. The Enercon Training Academy provides need-based training to meet the training requirements of Enercon projects. The training is contemporary, which results in imparting focused knowledge leading to value addition to the attitude and skills of all trainees. This ultimately leads to creativity in problem solving.



The detailed monitoring plan is described below:

**Meter Reading**

- The net electricity supplied to the grid will be taken directly from the share certificate for net electricity generated provided by GETCO.
- The meter reading is taken jointly at GETCO meters by representatives of Enercon and GEDA/GETCO located at Enercon substation. The GETCO meters are connected to the wind turbines of the project activity and the wind turbines of the other project owners. Therefore GETCO provides the share certificate that apportions the net electricity generated by the project owners.

- The Cluster meters are provided exclusively to all the project owners having installed wind turbines at the wind farm. The meter readings from these meters are used by GEDA for purpose of apportioning.

**Meter Testing**

- The main meter at Enercon Substation will be jointly tested & calibrated once in a year.
- If during meter testing the main meter at the Enercon substation is found beyond the permissible limit of error, the meter reading will be taken from the main meter located at the utility (GETCO) substation at Moti Panelli after addition of average historical transmission losses for last quarter (03 months).
- The main meter at utility substation will also be calibrated once in each year.
- All cluster meters which are connected to the Enercon substation will be sealed by GEDA and will also be calibrated once in three year.
- If during meter testing any cluster meter is found beyond the permissible limit of error, the sum of LCS meter reading located at each wind turbine of that cluster will be provided to GEDA for purpose of apportioning net electricity supplied to the grid.
- The LCS meters do not require calibration as the energy readings of electricity generated at the LCS meter is cross verified by the energy calculated by inverting system installed in the WTGs. In case there is any mismatch in the energy values recorded by the LCS meter and the energy values calculated by the inverting system; the machine will stop working and generate the error report.

**Data recording**

- The meter recording at the main meter at Enercon substation and the cluster meters of the project activity will be done each month.
- The panel meter (LCS meter) reading is recorded continuously by the online monitoring system.
- All the monitored data will be recorded and filed electronically and in hard format for 2 years beyond the crediting period i.e. 10+2 years.

**4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS**

**4.1 Baseline Emissions**

The baseline emissions are to be calculated as follows:

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where:

BE<sub>y</sub> = Baseline emissions in year y (tCO<sub>2</sub>)

EG<sub>BLy</sub> = Net electricity supplied to the grid in year y and is applied directly from JMR certified by state utility. This value can also be cross checked from the invoice. (MWh)

EF<sub>,CO<sub>2</sub>,grid,y</sub> = CO<sub>2</sub> emission factor of the grid

Baseline emission factor (Combined Margin) (EFCO<sub>2 grid, y</sub>)

= 0.92252 tCO<sub>2</sub>e/MWh

Electricity supplied to the grid by the Project (EG<sub>BL,y</sub>) for this monitoring period (27/09/2010 to 14/07/2011)(inclusive of both the dates):

= 14235.58 MWh

Baseline Emissions Reduction:

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

= 14235.58 MWh X 0.92252 tCO<sub>2</sub>e/MWh

= 13,123 tCO<sub>2</sub>e

As per approved methodology AMS I.D (Version 16)

$$ER_y = BE_y - PE_y - LE_y$$

ER<sub>y</sub> = 13,123 – 0 - 0

= 13,123

Emission reductions from the project activity are equal to the baseline emissions as project emissions and leakage are nil.

## 4.2 Project Emissions

The project activity is a renewable energy project which generates electricity using wind power and hence does not result in project emissions.

## 4.3 Leakage

No leakage is considered from the project activity as per approved methodology AMS I. D (Version 16)

## 4.4 Summary of GHG Emission Reductions and Removals

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO <sub>2</sub> e)	Project emissions or actual net GHG removals by sinks (tCO <sub>2</sub> e)	Leakage (tCO <sub>2</sub> e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO <sub>2</sub> e)
27/09/2010 – 31/12/2010	2,918	0	0	2,918
01/01/2011 – 14/07/2011	10,205	0	0	10,205
<b>Total</b>	<b>13,123</b>	<b>0</b>	<b>0</b>	<b>13,123</b>

## 5 ADDITIONAL INFORMATION

### Metering system details:

The details of meters installed at the substation are provided below:

Name of Substation	Main Meter/GETCO Meter	Accuracy Class	Type	Calibration Frequency	Calibration	
					2010	2012
Sadodar	GJB 01470	0.2s	EM021	Annually	22/01/2010	17/01/2012
	GJU 04175	0.2s	EM021	Annually	22/01/2010	17/01/2012
	GJU 04176	0.2s	EM021	Annually	22/01/2010	17/01/2012
	KAB11082	0.2s	EM021	Annually	29/05/2010	17/01/2012

Unique Identification No.	Cluster Meter	Installation Date <sup>1</sup>	Accuracy Class	Make	Calibration Frequency
EIL/800/10-11/1822	GJU60941	27/09/2010	0.2s	Secure Meter	Once in 3 year
EIL/800/10-11/1823			0.2s	Secure Meter	Once in 3 year
EIL/800/10-11/1824			0.2s	Secure Meter	Once in 3 year
EIL/800/10-11/1825	GJU60942	27/09/2010	0.2s	Secure Meter	Once in 3 year
EIL/800/10-11/1887	GJU60940	29/09/2010	0.2s	Secure Meter	Once in 3 year
EIL/800/10-11/1888			0.2s	Secure Meter	Once in 3 year
EIL/800/10-11/1889	10058384	29/09/2010	0.2s	L&T	Once in 3 year
EIL/800/10-11/1890	10059202	30/09/2010	0.2s	L&T	Once in 3 year
EIL/800/10-11/1891	GJU60945	30/09/2010	0.2s	Secure Meter	Once in 3 year
EIL/800/10-11/1892			0.2s	Secure Meter	Once in 3 year
EIL/800/10-11/1893			0.2s	Secure Meter	Once in 3 year
EIL/800/10-11/1894			0.2s	Secure Meter	Once in 3 year

As per the Monitoring plan, the Main meters installed at Sadodar Substation shall be tested for accuracy once annually. However it can be seen from above table that the consecutive calibrations for the year

<sup>1</sup> The meter was installed on the date mentioned in the table, however the meter was tested on: GJU60941, GJU60942, GJU60945 tested on 03/09/2010  
10058384 and 10059202 tested on 20/03/2010

2011 are not done for the main meter installed at Sadodar Sub-station annually on time. Therefore, as per Guidelines for assessing compliance with the calibration frequency requirements, (VVS Version 3.3 para 238 (a)) states that: "Applying the maximum permissible error of the instrument to the measured values, if the results of the delayed calibration do not show any errors in the measuring equipment, or if the error is smaller than the maximum permissible error;" the calibration is not carried out in line with the frequency mentioned in the PD. Hence as a conservative approach, the net energy export values (as mentioned in the JMR) can be considered after applying the maximum possible value of error of the instrument to the measured values.

Since the latest test certificate shows that meters are operating within their accuracy class 0.2s. In accordance with VVS Version 3.3 paragraph 238 (a) we have applied a correction factor of +0.2% for the year 2011 for the WTGs connected to Sadodar Substation, which can be verified from calculation of emission reductions provided in spreadsheet.

### **Line Diagram of the project Activity**

