

**MONITORING REPORT FORM (F-CDM-MR)**  
**Version 02.0**

**MONITORING REPORT**

<b>Title of the project activity</b>	Enercon Wind Farm (Hindustan) Ltd in Rajasthan
<b>Reference number of the project activity</b>	1168
<b>Version number of the monitoring report</b>	2
<b>Completion date of the monitoring report</b>	01/08/2012
<b>Registration date of the project activity</b>	15/03/2010
<b>Monitoring period number and duration of this monitoring period</b>	3 <sup>rd</sup> Verification, 01/09/2011 to 30/06/2012
<b>Project participant(s)</b>	Enercon (India) Ltd
<b>Host Party(ies)</b>	India
<b>Sectoral scope(s) and applied methodology(ies)</b>	Energy industries (renewable/ non-renewable sources). <i>Consolidated methodology for grid-connected electricity generation from renewable sources, ACM0002, Version 6</i>
<b>Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD</b>	84,205 tCO <sub>2</sub>
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period</b>	59,272 tCO <sub>2</sub>

## **SECTION A. Description of project activity**

### **A.1. Purpose and general description of project activity**

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- (a) *Purpose of the project activity and the measures taken for GHG emission reductions or net anthropogenic GHG removals by sinks;*

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 59,272 tCO<sub>2</sub>e for this 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. In the absence of the project activity the equivalent amount of electricity would have been generated from the connected/ new power plants in the NEWNE grid, which are/ will be predominantly based on fossil fuels. Whereas the electricity generation from operation of Wind Energy Convertors (WEC's) is emission free.

- (b) *Brief description of the installed technology and equipments;*

The Project involves 75-wind energy converters (WECs) of Enercon make (800 kW E-48) with internal electrical lines connecting the Project with local evacuation facility. The WECs generates 3-phase power at 400V, which is stepped up to 33 KV. The Project can operate in the frequency range of 47.5–51.5 Hz and in the voltage range of 400 V  $\pm$  12.5%. The other salient features of the state-of-art-technology are referred in Appendix 4. The line diagram of wind farm including metering points and substations is attached as Appendix 1.

- (c) *Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.);*

The first WEC under the project activity was commissioned on 26 November 2006 and the last WEC under the project activity was commissioned on 25 December 2006. The expected operational lifetime of the project is for 20 years. The length of the Crediting period of the project activity as per registered PDD is 10 years (Fixed). As per the Registered PDD, the Crediting period Start Date is estimated 01 November 2007. However, since the Project was registered on 15 March 2010, the length of crediting period is from 15 Mar 2010 to 14 Mar 2020. In first CER verification, the monitoring period considered was the period from 15 Mar 2010 to 30 Sep 2010. The second monitoring period was from 01 Oct 2010 to 31 August 2011. The third monitoring period considered is from 01 Sep 2011 to 30 Jun 2012.

- (d) *Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period.*

The total emission reductions achieved under this monitoring period (01 Sep 2011 to 30 Jun 2012) is 59,272 tCO<sub>2</sub>.

### **A.2. Location of project activity**

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- (a) *Host Party(ies);*

India

- (b) *Region/State/Province, etc.;*

Northern Region/Rajasthan State

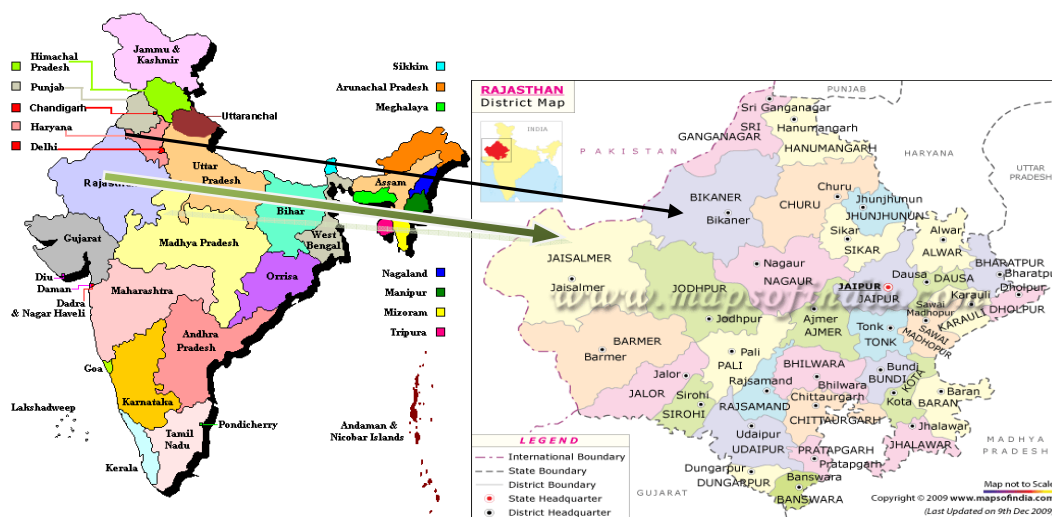
- (c) *City/Town/Community, etc.;*

The Project is located at Kita and Pithodai Ki Dhani village, in Jaisalmer District of Rajasthan state in India.

- (d) *Physical/ Geographical location.*

The project area extends between latitude 26° 40' 47.5'' & 26° 45' 48.3'' North and longitude 70° 58' 19.3'' & 71° 3' 32.5'' East. The Project is connected to 33/132/220 kV Akal RRVPN substation. The

sites are located at a distance of 25 km from Jaisalmer by road. The nearest railway station is at Jaisalmer.



Individual WEG location numbers and coordinates are detailed out in below Table 1: -

S. No	EWHPL UNIQUE ID	Loc No	Latitude			Longitude		
			Deg.	Minute	Second	Deg.	Minute	Second
1	EWHPL 01	322	26	40	47.5	70	58	58.2
2	EWHPL 02	323	26	40	55.3	70	58	54.6
3	EWHPL 03	145	26	41	2.5	70	58	49.5
4	EWHPL 04	146	26	41	7.7	70	58	43.9
5	EWHPL 05	147	26	41	12.8	70	58	38.4
6	EWHPL 06	148	26	41	18	70	58	32.8
7	EWHPL 07	150	26	41	27	70	58	48.3
8	EWHPL 08	151	26	41	32.1	70	58	42.7
9	EWHPL 09	152	26	41	37.3	70	58	37.2
10	EWHPL 10	153	26	41	38.5	70	59	8.6
11	EWHPL 11	154	26	41	43.6	70	59	3.1
12	EWHPL 12	155	26	41	48	70	58	57.5
13	EWHPL 13	156	26	41	54.1	70	58	52.1
14	EWHPL 14	157	26	41	56.6	70	58	41.5
15	EWHPL 15	307	26	42	12	70	58	24.8

16	EWHPL16	306	26	42	17.2	70	58	19.3
17	EWHPL 17	300	26	42	47.4	70	58	24.4
18	EWHPL 18	301	26	42	43.9	70	58	30.7
19	EWHPL 19	304	26	42	26.8	70	58	46.6
20	EWHPL 20	305	26	42	21.7	70	58	52.2
21	EWHPL 21	161	26	42	16.5	70	58	57.7
22	EWHPL 22	160	26	42	9	70	59	2.2
23	EWHPL 23	159	26	42	1.3	70	59	6.7
24	EWHPL 24	324	26	42	5.7	70	59	23.9
25	EWHPL 25	167	26	42	38.3	70	59	0.2
26	EWHPL 26	168	26	42	42.9	70	58	56.3
27	EWHPL 27	169	26	42	49.6	70	58	54.4
28	EWHPL 28	170	26	42	56.5	70	58	52.7
29	EWHPL 29	326	26	43	22.4	70	58	50.2
30	EWHPL 30	177	26	42	54.5	70	59	29.3
31	EWHPL 31	178	26	42	49.4	70	59	34.9
32	EWHPL 32	179	26	42	44.2	70	59	40.5
33	EWHPL 33	181	26	42	32.2	70	59	50.9
34	EWHPL 34	183	26	42	59	70	59	50.6
35	EWHPL 35	184	26	43	5.8	70	59	45.8
36	EWHPL 36	186	26	43	17.8	70	59	35.4
37	EWHPL 37	190	26	43	25.1	70	59	50.1
38	EWHPL 38	191	26	43	18.3	70	59	54.9
39	EWHPL 39	192	26	43	13.2	71	0	0.5
40	EWHPL 40	193	26	43	8	71	0	6.1
41	EWHPL 41	194	26	43	2.9	71	0	11.6
42	EWHPL 43	218	26	45	31.3	71	0	32
43	EWHPL 42	219	26	45	17.2	71	0	23.1
44	EWHPL 44	220	26	44	52.6	71	0	38.2

45	EWHPL 45	221	26	44	52.5	71	0	47.2
46	EWHPL 46	222	26	44	45.9	71	0	55.9
47	EWHPL 47	223	26	44	56.1	71	1	5.4
48	EWHPL 48	224	26	45	1.9	71	1	16.3
49	EWHPL 49	225	26	44	43.9	71	1	23
50	EWHPL 50	226	26	44	38.8	71	1	35.9
51	EWHPL 51	230	26	44	24.9	71	1	55.5
52	EWHPL 52	232	26	44	19.9	71	2	1.7
53	EWHPL 53	233	26	44	14.1	71	2	7.3
54	EWHPL 54	329	26	44	30.1	71	2	16
55	EWHPL 55	234	26	44	20.5	71	2	27.9
56	EWHPL 56	236	26	43	57.4	71	2	22.2
57	EWHPL 57	237	26	43	55.8	71	2	30.9
58	EWHPL 58	238	26	43	56.9	71	2	39.7
59	EWHPL 59	328	26	44	8.9	71	2	56.5
60	EWHPL 60	241	26	43	58.7	71	2	59.9
61	EWHPL 61	242	26	43	51.8	71	3	5.1
62	EWHPL 62	245	26	44	30.5	71	3	32.5
63	EWHPL 63	246	26	44	32.5	71	3	22.5
64	EWHPL 64	249	26	45	9.4	71	3	14.1
65	EWHP 65	302	26	44	51.4	71	2	56.1
66	EWHPL 66	250	26	44	58.1	71	2	52.3
67	EWHPL 67	251	26	45	0.4	71	2	44.6
68	EWHPL 68	252	26	45	0.8	71	2	32.4
69	EWHPL 69	253	26	45	4.3	71	2	25.6
70	EWHPL 70	254	26	45	14.2	71	2	15.9
71	EWHPL 71	256	26	45	23.8	71	2	25.8
72	EWHPL 72	257	26	45	39.3	71	2	47.5
73	EWHPL 73	258	26	45	42.8	71	2	37.2
74	EWHPL 74	259	26	45	46.6	71	2	26.5
75	EWHPL 75	260	26	45	48.3	71	2	18.7

### A.3. Parties and project participant(s)

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India (Host)	Enercon (India) Ltd	No
Government of United Kingdom of Great Britain and Northern	Coöperatieve Centrale Raiffeisen-Boerenleenbank B.A.	No

Ireland (Annex 1)		
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#### A.4. Reference of applied methodology

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*Consolidated methodology for grid-connected electricity generation from renewable sources, ACM0002, Version 6*

Further information with regards to the methodology / tools can be obtained at

<http://cdm.unfccc.int/methodologies/DB/UB3431UT9I5KN2MUL2FGZXZ6CV71LT>

#### A.5. Crediting period of project activity

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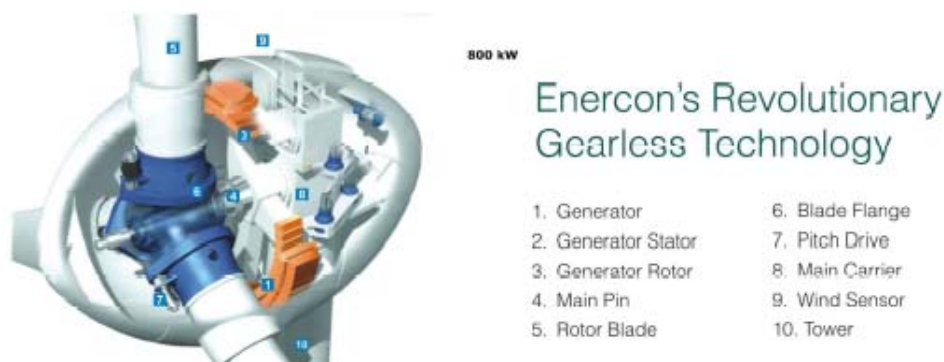
The length of the Crediting period of the project activity as per registered PDD is 10 years (Fixed). The crediting period start date is 15 Mar 2010 and length of crediting period is 10 years (from 15 Mar 2010 to 14 Mar 2020).

### SECTION B. Implementation of project activity

#### B.1. Description of implemented registered project activity

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The Project involves 75-wind energy converters (WECs) of Enercon make (800 kW E-48) with internal electrical lines connecting the Project with local evacuation facility. The WECs generates 3-phase power at 400V, which is stepped up to 33 KV. The Project can operate in the frequency range of 47.5–51.5 Hz and in the voltage range of 400 V  $\pm$  12.5%. The other salient features of the state-of-art-technology are referred in Appendix 4.



For project activities that consist of more than one site, the report shall clearly describe the status of implementation and starting date of operation for each site. For CDM project activities with phased implementation, the report shall indicate the progress of the proposed CDM project activity achieved in each phase.

#### The starting date of operation of the project activity

The first WEC under the project activity was commissioned on 26<sup>th</sup> November 2006 and last WEC under the project activity was commissioned on 25<sup>th</sup> December 2006. The commissioning date for all the WECs included in the project activity is given in the table below.

Table 2:

S.No	EWHPL UNIQUE ID	Loc No	Commissioning date
1	EWHPL 01	322	20-Dec-06

2	EWHPL 02	323	20-Dec-06
3	EWHPL 03	145	20-Dec-06
4	EWHPL 04	146	20-Dec-06
5	EWHPL 05	147	20-Dec-06
6	EWHPL 06	148	20-Dec-06
7	EWHPL 07	150	20-Dec-06
8	EWHPL 08	151	20-Dec-06
9	EWHPL 09	152	20-Dec-06
10	EWHPL 10	153	20-Dec-06
11	EWHPL 11	154	20-Dec-06
12	EWHPL 12	155	20-Dec-06
13	EWHPL 13	156	20-Dec-06
14	EWHPL 14	157	20-Dec-06
15	EWHPL 15	307	21-Dec-06
16	EWHPL 16	306	21-Dec-06
17	EWHPL 17	300	20-Dec-06
18	EWHPL 18	301	20-Dec-06
19	EWHPL 19	304	21-Dec-06
20	EWHPL 20	305	21-Dec-06
21	EWHPL 21	161	20-Dec-06
22	EWHPL 22	160	20-Dec-06
23	EWHPL 23	159	20-Dec-06
24	EWHPL 24	324	21-Dec-06
25	EWHPL 25	167	20-Dec-06
26	EWHPL 26	168	26-Nov-06
27	EWHPL 27	169	26-Nov-06
28	EWHPL 28	170	26-Nov-06
29	EWHPL 29	326	21-Dec-06
30	EWHPL 30	177	25-Dec-06
31	EWHPL 31	178	25-Dec-06
32	EWHPL 32	179	25-Dec-06
33	EWHPL 33	181	25-Dec-06
34	EWHPL 34	183	25-Dec-06
35	EWHPL 35	184	25-Dec-06
36	EWHPL 36	186	25-Dec-06
37	EWHPL 37	190	25-Dec-06
38	EWHPL 38	191	25-Dec-06
39	EWHPL 39	192	25-Dec-06
40	EWHPL 40	193	25-Dec-06
41	EWHPL 41	194	25-Dec-06
42	EWHPL 43	218	21-Dec-06
43	EWHPL 42	219	21-Dec-06
44	EWHPL 44	220	25-Dec-06

45	EWHPL 45	221	25-Dec-06
46	EWHPL 46	222	25-Dec-06
47	EWHPL 47	223	21-Dec-06
48	EWHPL 48	224	21-Dec-06
49	EWHPL 49	225	21-Dec-06
50	EWHPL 50	226	21-Dec-06
51	EWHPL 51	230	21-Dec-06
52	EWHPL 52	232	21-Dec-06
53	EWHPL 53	233	21-Dec-06
54	EWHPL 54	329	21-Dec-06
55	EWHPL 55	234	21-Dec-06
56	EWHPL 56	236	21-Dec-06
57	EWHPL 57	237	21-Dec-06
58	EWHPL 58	238	20-Dec-06
59	EWHPL 59	328	20-Dec-06
60	EWHPL 60	241	20-Dec-06
61	EWHPL 61	242	20-Dec-06
62	EWHPL 62	245	20-Dec-06
63	EWHPL 63	246	26-Nov-06
64	EWHPL 64	249	26-Nov-06
65	EWHP 65	302	21-Dec-06
66	EWHPL 66	250	26-Nov-06
67	EWHPL 67	251	21-Dec-06
68	EWHPL 68	252	21-Dec-06
69	EWHPL 69	253	21-Dec-06
70	EWHPL 70	254	26-Nov-06
71	EWHPL 71	256	26-Nov-06
72	EWHPL 72	257	26-Nov-06
73	EWHPL 73	258	26-Nov-06
74	EWHPL 74	259	21-Dec-06
75	EWHPL 75	260	21-Dec-06

**The information regarding the actual operation of the project**

The project activity consists of 75 WECs (800 kW) of Enercon make E-48 totaling to a capacity of 60 MW. During the monitoring period, the WECs were operating normally. Hence no major breakdown was found during this period.

**A brief description of: (i) events or situations that occurred during the monitoring period (ii) how the issues resulting from these events or situations are being addressed.**

Enercon Wind Farms (Hindustan) Pvt. Ltd. has appointed Enercon (India) Limited as their operation & maintenance contractor. Hence Enercon (India) limited is responsible for operation and maintenance activities for Enercon Wind Farms (Hindustan) Pvt. Ltd. Enercon (India) limited operation and maintenance activities are ISO 9001:2008 certified and all the events are recorded in the log book



available at the project site. Referring to the data available it can be inferred that there have not been any major special events for any of the WECs that are included in the project activity. As a part of regular maintenance the WECs are stopped for mechanical and electrical maintenance for 16 to 18 hours annually and for visual inspection for 6 to 7 hours quarterly.

## **B.2. Post registration changes**

### **B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

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Not Applicable

### **B.2.2. Corrections**

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Not Applicable

### **B.2.3. Permanent changes from registered monitoring plan or applied methodology**

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Revision in the monitoring plan was requested. The same has been approved by UNFCCC on 3<sup>rd</sup> Aug 2011.

### **B.2.4. Changes to project design of registered project activity**

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1. Notification with regards to change of village name and change of DISCOM name was sent to UNFCCC. The same was accepted on 3 Aug 2011 by UNFCCC.
2. Notification with regard to the change in the substation from Amarsagar substation to Akal substation was sent to UNFCCC. The same has been accepted on 1 Mar 2012 by UNFCCC.

### **B.2.5. Changes to start date of crediting period**

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Not Applicable

### **B.2.6. Types of changes specific to afforestation or reforestation project activity**

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Not Applicable

## **SECTION C. Description of monitoring system**

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Approved monitoring methodology ACM0002 / Version 06 Sectoral Scope: 1, "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources.", by CDM - Meth Panel has been used to monitor the emission reductions.

This approved monitoring methodology requires monitoring of the following:

- Electricity generation from the project activity; and
- Operating margin emission factor and build margin emission factor of the grid, where *ex post* determination of grid emission factor has been chosen

Since the baseline methodology is based on *ex ante* determination of the baseline, the monitoring of operating margin emission factor and build margin emission factor is not required.

Enercon (India) Ltd. is managing the project operation.

EG<sub>y</sub> for the project activity is being derived as follows:-

The electricity generated from the project activity is transmitting to Bhu substation through 4 feeders. The WECs of the project activity and WECs of other power producers are connected to Bhu Substation which is further connected to Akal substation. In addition to the project activity, the WECs located at

Kita, Jodha, Pithoda Ki Dhani are connected to Bhu substation which are further connected to the Akal substation.

An Energy meter at 220 kV (accuracy Class-0.2) at Bhu Substation is termed 'Back up meter' and Energy meter at 220 kV (accuracy Class-0.2) at Akal substation is termed as 'Main Meter'. Net Electricity supplied by the WECs is being metered at a common metering/delivery point. The common metering/delivery point comprises of one main meter that is installed at 220 kV metering point at the Akal substation and one backup meter installed at 220kV at Bhu substation. Consequently, the main meter reading reflects the aggregate electricity supplied by all these WECs, including the project activity. The net electricity supplied by individual WEC is being determined by following a process of allocating the total electricity recorded at the main meter to the individual WEC in proportion of the electricity generation recorded by the LCS meters at the individual WEC. The apportioning for electricity export and import is done by Enercon based on which invoices are raised for individual customers. These invoices can be cross verified by cheque copies by the DOE.

**The procedure for allocation is detailed below:**

$B_{JMRExport}$  = Gross Electricity exported, as recorded by the main meter at the substation. This data represents the total gross electricity exported by all the WECs (project and non project) at substation point.

$B_{JMRImport}$  = Gross Electricity imported, as recorded by the main meter at the substation. This data represents the total gross electricity imported by all the WECs (project and non project) at substation point.

$B_{ControllerExport_i}$  = Gross Electricity exported (at WEC point at the site) by a WEC (project or non project), as measured at the LCS meter. Each WEC has exclusive LCS meter that records gross electricity export from the WEC (project or non project). This gross electricity exported by the WEC (at WEC point at the site)

$B_{ControllerExport_i}$  and  $B_{ControllerExport_k}$  are subsets of  $B_{ControllerExport_j}$

where i is any value between 1 to j+k

j represents WECs of the project activity (1 to 75) connected to main meter at Akal substation and backup meter at Bhu substation.

k represents WECs of the non project (76 to 290) connected to main meter at Akal substation and backup meter at Bhu substation.

$\sum B_{ControllerExport_i}$  = Summation of gross electricity exported (at WEC point at the site) by all the WECs (project and non project) connected to the main meter at the substation, measured at the LCS meter of each WEC. This is summation of gross electricity exported by the WECs (at WEC point at the site) including WECs of the project and non project.

$B_{WECExport_i}$  = Gross Electricity exported (at substation point) by an individual WEC of the project to the grid that is connected to main meter. Thus this data can be used to compute electricity export (at substation point) for individual WEC.

$B_{WECImport_i}$  = Gross Electricity imported (at substation point) by an individual WEC of the project from the grid that is connected to main meter. Thus this data can be used to compute electricity import (at substation point) for individual WEC.

$\sum_{Project} E_{WEC,Export,i}$  = Summation of gross electricity exported (at substation point) by all the WECs of the project activity.

$\sum_{Project} E_{WEC,Import,i}$  = Summation of gross electricity imported (at substation point) by all the WECs of the project activity.

Gross Electricity exported by each WEC is apportioned on the basis of gross electricity export recorded at the LCS meter of each WEC and the gross electricity export recorded at the main meter mentioned in the JMR. The export multiplication factor is calculated as follows-

$$\text{Export Multiplication factor} = \frac{E_{JMR,Export}}{\sum E_{Controller,Export,i}} \dots\dots\dots(1)$$

Thus the energy exported by an individual WEC of the project activity to the grid is given by the equation-

$$E_{WEC,Export,i} = \text{Export Multiplication factor} \times E_{Controller,Export,i} \dots\dots\dots(2)$$

As the LCS meter doesn't record import, the apportioning of energy import by each WEC is also done on the basis of electricity export recorded at the LCS meter of each WEC and the electricity import recorded at the main meter and mentioned in the JMR. The import multiplication factor is calculated as follows-

$$\text{Import Multiplication factor} = \frac{E_{JMR,Import}}{\sum E_{Controller,Export,i}} \dots\dots\dots(3)$$

Thus the energy imported by an individual WEC of the project activity to the grid is given by the equation-

$$E_{WEC,Import,i} = \text{Import Multiplication factor} \times E_{Controller,Export,i} \dots\dots\dots(4)$$

The net electricity supplied by the WECs of the project is given by the equation-

$$EG_y = \sum_{Project} E_{WEC,Export,i} - \sum_{Project} E_{WEC,Import,i} \dots\dots\dots(5)$$

The summation is done on the WECs belonging to the project activity.

The apportioning for electricity export and import is done by Enercon based on which invoices are raised for individual customers. These invoices can be cross verified by the cheque copies by the DOE.

Joint Meter Reading is generated on 1st day of every month. Representatives of RRVN/Ajmer & Jaipur DISCOM and Enercon jointly take the main reading and sign the meter reading on the first day of every month. Simultaneously, the joint meter reading at the 220 kV level of the backup metering system at Bhu substation is also being taken by representatives of RRVN/Ajmer & Jaipur DISCOM and Enercon.

#### Metering system details:

The details of meters installed at the site for measuring export and import by project activity are provided below in Table 3:

Meter Type	Meter Sr. number	Sub-station	Accuracy class	Make	Last Calibration done as per Second Verification period In 2011	Calibration in 2012	Calibration due date(As per the PPA & PDD frequency of the calibration of main & back up meters are annual)
Main Meter	11068579	Akal	0.2	L & T	04 Mar 2011	20 Mar 2012	19 Mar 2013
Backu p Meter	11068580	BHU	0.2	L & T	04 Mar 2011	20 Mar 2012	19 Mar 2013

- As per revised Monitoring plan, the meters shall be tested for accuracy once annually. However it can be seen from above table that the consecutive calibrations are not done for the Main meter and Backup Meter annually on time. Therefore in accordance with “Guidelines For Assessing Compliance With The Calibration Frequency Requirements”–Annex 60 to EB 52, Paragraph 4(a) where calibration is not carried out in line with the frequency mentioned in the registered PDD, as a conservative approach, the energy export and import 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 0.2%. In accordance with Annex 60, EB 52 we have applied a correction factor of +0.2% for imports and -0.2% for exports for the March 2012. The correction factor applied to meter reading can be validated from calculation of emission reductions provided in spreadsheet and section D.
- In 2011, the Main meter & Back up meter were calibrated on 04 Mar 2011 and the next calibration was due in 03 Mar 2012. In 2012, the Main & Backup meters were calibrated on 20 Mar 2012. Here the gap in calibration was for 17 days in the month of Mar 2012. Therefore, as a conservative approach, we have applied the error factor for the complete month in March 2012.

## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter	$EF_{OM,y}$		
Unit	tCO <sub>2</sub> e/MWh		
Description	Simple Operating Margin Emission Factor of Northern Regional Electricity Grid version 1.1 dated 21 <sup>st</sup> December 2006.		
Source of data	“CO <sub>2</sub> Baseline Database for Indian Power Sector” published by the Central Electricity Authority, Ministry of Power, Government of India.  The “CO <sub>2</sub> Baseline Database for Indian Power Sector” is available at <a href="http://www.cea.nic.in">www.cea.nic.in</a>		
Value(s) applied	2002 – 03	0.9993	
	2003 – 04	0.9869	
	2004 – 05	0.9756	

	Average Operating Margin of last three years	0.9873	
<b>Purpose of data</b>	Baseline Emission Calculations		
<b>Additional comment</b>	None		

<b>Data / Parameter</b>	$EF_{BM,y}$
<b>Unit</b>	tCO <sub>2</sub> e/MWh
<b>Description</b>	Build Margin Emission Factor of Northern Regional Electricity Grid
<b>Source of data</b>	<p>“CO<sub>2</sub> Baseline Database for Indian Power Sector” published by the Central Electricity Authority, Ministry of Power, Government of India.</p> <p>The “CO<sub>2</sub> Baseline Database for Indian Power Sector” is available at <a href="http://www.cea.nic.in">www.cea.nic.in</a></p>
<b>Value(s) applied</b>	0.5335
<b>Purpose of data</b>	Baseline Emission Calculations
<b>Additional comment</b>	None

<b>Data / Parameter</b>	$EF_{CM,y}$
<b>Unit</b>	tCO <sub>2</sub> e/MWh
<b>Description</b>	Combined Margin Emission Factor of Northern Regional Electricity Grid version 1.1 dated 21 <sup>st</sup> December 2006.
<b>Source of data</b>	<p>“CO<sub>2</sub> Baseline Database for Indian Power Sector” published by the Central Electricity Authority, Ministry of Power, Government of India.</p> <p>The “CO<sub>2</sub> Baseline Database for Indian Power Sector” is available at <a href="http://www.cea.nic.in">www.cea.nic.in</a></p>
<b>Value(s) applied</b>	0.87387
<b>Purpose of data</b>	Baseline Emission Calculations
<b>Additional comment</b>	None

## D.2. Data and parameters monitored

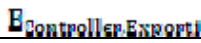
<b>Data / Parameter</b>	<b>EG<sub>y</sub></b>
<b>Unit</b>	MWh (Mega-Watt hour)
<b>Description</b>	Net electricity supplied to the grid by the Project
<b>Measured /Calculated /Default</b>	Calculated by applying apportioning procedure better described in C.
<b>Source of data</b>	Electricity supplied to the grid as per the tariff invoices raised on RRVPNL/Ajmer & Jaipur DISCOM (State Utility). These invoices can be cross verified by cheque copies.
<b>Value(s) of monitored parameter</b>	Annual electricity supplied to the grid by the Project 67,827.495 MWh
<b>Monitoring equipment</b>	Calculated as per formulae better described under section C.
<b>Measuring/ Reading/ Recording frequency</b>	Monthly: The apportioning is done as per the procedure described in section C.
<b>Calculation method (if applicable)</b>	The WECs of the project activity and WECs of other power producers are connected to Bhu Substation which is further connected to Akal substation. In addition to the project activity, the WECs located at Kita, Jodha, Pithoda ki Dhani are also connected to Bhu substation which are further connected to the Akal substation. Net Electricity supplied by all these WECs is metered at a common metering/delivery point. The common metering/delivery point comprises one main meter that is installed at 220 kV metering/delivery point at the Akal substation.


	Consequently, the main meter reading reflects the aggregate electricity supplied by all these WECs, including the project activity. The net electricity supplied by individual WEC is determined by a process of allocating the total electricity recorded at the main meter to the individual WEC in proportion to the electricity generation recorded by the LCS meters at the individual WEC. Allocation plan for calculating net electricity supplied to the grid is explained in section C above.
<b>QA/QC procedures</b>	Meters are found to be under the permissible limit as the result of annual calibration. Therefore no correction factor has been applied.
<b>Purpose of data</b>	Baseline Emissions calculations
<b>Additional comment</b>	Not Applicable

<b>Data / Parameter:</b>	<b>E<sub>MR Export</sub></b>
<b>Unit</b>	MWh (Mega-Watt hour)
<b>Description</b>	Gross Electricity exported (at substation point), as recorded by the main meter at the Akal substation. This data represents the total gross electricity exported by all the WECs (project and non project) at substation point.
<b>Measured /Calculated /Default</b>	Measured: The Export reading is jointly noted from the main meter installed at the Akal substation.
<b>Source of data</b>	Export value from Joint meter reading taken at Akal Substation in the presence of representatives of Enercon and state utility.
<b>Value(s) of monitored parameter</b>	Please refer Appendix 3 for month wise details.
<b>Monitoring equipment</b>	Please refer section C & Table 3
<b>Measuring/ Reading/ Recording frequency:</b>	Monthly: The reading is jointly noted by the representatives of state utility and Enercon.
<b>Calculation method (if applicable):</b>	NA
<b>QA/QC procedures</b>	Meters are found to be under the permissible limit as the result of annual calibration. Therefore no correction factor has been applied.
<b>Purpose of data</b>	Baseline Emissions calculations
<b>Additional comment</b>	Not Applicable

<b>Data / Parameter</b>	<b>E<sub>MR Import</sub></b>
<b>Unit</b>	MWh (Mega-Watt hour)
<b>Description</b>	Gross Electricity imported (at substation point), as recorded by the main meter at the Akal Substation. This data represents the total gross electricity imported by all the WECs (project and non project) at substation point
<b>Measured /Calculated /Default</b>	Measured: The import reading is jointly noted from the main meter installed at the Akal substation.
<b>Source of data</b>	Import value from Joint meter reading taken at Akal Substation in the presence of representatives of Enercon and state utility
<b>Value(s) of monitored parameter:</b>	Please refer Appendix 3 for month wise detail.
<b>Monitoring equipment</b>	Please refer section C & Table 3
<b>Measuring/ Reading/ Recording frequency</b>	Monthly: The reading is jointly noted by the representatives of state utility and Enercon.
<b>Calculation method (if applicable)</b>	NA
<b>QA/QC procedures</b>	Meters are found to be under the permissible limit as the result of

	annual calibration. Therefore no correction factor has been applied.
<b>Purpose of data</b>	Baseline Emissions calculations
<b>Additional comment</b>	Not Applicable

<b>Data / Parameter</b>	
<b>Unit</b>	MWh (Mega-Watt hour)
<b>Description</b>	<p>Gross Electricity export (at WEC point at the site) by a WEC (project or non project), as measured at the LCS meter. Each WEC has exclusive LCS meter that records gross electricity export from the WEC (project or non project). This represents gross electricity export by individual WEC (at WEC point at the site)</p> <p>where i is any WEC between 1 to j+k</p> <p>j is any WEC between 1 to 75 of the project activity connected to main meter at Akal substation and backup meter at Bhu substation.</p> <p>k is any WEC between 76 to 290 of the non project connected to main meter at Akal substation and backup meter at Bhu substation.</p>
<b>Measured /Calculated /Default</b>	Measured: The value is recorded continuously by the online monitoring station. This value can also be checked from the electronic panel installed inside the WEC tower.
<b>Source of data</b>	This reading is monitored continuously by the online monitoring station (online monitoring station is located at the project site where all the data [historical and instantaneous] from the LCS meters of all WECs is retrieved) at the project site.
<b>Value(s) of monitored parameter</b>	Please refer ER sheet for the individual WEC panel generation
<b>Monitoring equipment</b>	<p>Meter Type: NZR</p> <p>Meter Serial No: Refer Appendix 2</p> <p>The LCS meters are 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 WECs. 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 WEC will stop working and generate the error report.</p>
<b>Measuring/ Reading/ Recording frequency:</b>	Monthly: The value is recorded continuously by the online monitoring station. This value can also be checked from the electronic panel installed inside the WEC tower.
<b>Calculation method (if applicable)</b>	NA
<b>QA/QC procedures</b>	During the monitoring period there is no mismatch found in the electricity generated at the LCS meter & the inverting system. Therefore there is no data uncertainty.
<b>Purpose of data</b>	Baseline Emissions calculations
<b>Additional comment</b>	Not Applicable

<b>Data / Parameter</b>	
<b>Unit</b>	MWh (Mega-Watt hour)
<b>Description</b>	<p>Summation of gross electricity exported (at WEC point at the site) by all the WECs (project and non project) connected to the main meter at the substation, measured at the LCS meter of each WEC. This is summation of gross electricity exported by the WECs (at WEC point at the site) including WECs of the project and non project.</p> <p>where i is any WEC between 1 to j+k</p>



	j is any WEC between 1 to 75 of the project activity connected to main meter at Akal substation and backup meter at Bhu substation.  k is any WEC between 76 to 290 of the non project connected to main meter at Akal substation and backup meter at Bhu substation.
<b>Measured /Calculated /Default</b>	Measured: The value is recorded continuously by the online monitoring station. This value can also be checked from the electronic panel installed inside the WEC tower.
<b>Source of data</b>	This reading is monitored continuously by the online monitoring station (online monitoring station is located at the project site where all the data [historical and instantaneous] from the LCS meters of all WECs is retrieved) at the project site.
<b>Value(s) of monitored parameter</b>	310969.394 MWh
<b>Monitoring equipment</b>	Meter Type: NZR Meter Serial No: Refer Appendix 2 The LCS meters are 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 WECs. 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 WEC will stop working and generate the error report.
<b>Measuring/ Reading/ Recording frequency</b>	Monthly: The value is recorded continuously by the online monitoring station. This value can also be checked from the electronic panel
<b>Calculation method (if applicable)</b>	NA
<b>QA/QC procedures</b>	During the monitoring period there is no mismatch found in the electricity generated at the LCS meter & the inverting system. Therefore there is no data uncertainty.
<b>Purpose of data</b>	Baseline Emissions calculations
<b>Additional comment</b>	Not Applicable

<b>Data / Parameter</b>	<b>E<sub>WEC Export</sub></b>
<b>Unit</b>	MWh (Mega-Watt hour)
<b>Description</b>	Gross Electricity exported (at substation point) by an individual WEC (j of the project activity) to the grid that is connected to main meter at Akal substation.  Where j is any WEC between 1 to 75 of the project activity connected to main meter at Akal substation and backup meter at Bhu substation.
<b>Measured /Calculated /Default</b>	<b>E<sub>WEC Export</sub></b> denotes the electricity exported by individual WEC of the project activity to the grid. The value is calculated based on the formula mentioned in Section C
<b>Source of data</b>	Calculated using formula mentioned in Section C
<b>Value(s) of monitored parameter</b>	Please refer ER sheet for the individual WEC export value.
<b>Monitoring equipment</b>	Calculated using the formulae better described under section C. Please refer equation 2 under section C of the MR.
<b>Measuring/ Reading/ Recording frequency</b>	Calculated using the formulae better described under section C.
<b>Calculation method (if applicable)</b>	Refer to Section C for details and description of the above variables.
<b>QA/QC procedures</b>	Meters are found to be under the permissible limit as the result of annual calibration. Therefore no correction factor has been applied.
<b>Purpose of data</b>	Baseline Emissions calculations
<b>Additional comment</b>	Not Applicable



<b>Data / Parameter</b>	$E_{WEC\text{Import},j}$
<b>Unit</b>	MWh (Mega-Watt hour)
<b>Description</b>	Gross Electricity imported (at substation point) by an individual WEC of the project activity to the grid that is connected to main meter at Akal substation.  Where j is any WEC between 1 to 75 of the project activity connected to main meter at Akal substation and backup meter at Bhu substation.
<b>Measured /Calculated /Default</b>	$E_{WEC\text{Import},j}$ denotes the gross electricity imported by individual WEC of the project activity from the grid. The value is calculated based on the formula mentioned in section C.
<b>Source of data</b>	Calculated using formula mentioned in Section C.
<b>Value(s) of monitored parameter</b>	Please refer ER sheet for the individual WEC import value.
<b>Monitoring equipment</b>	Calculated using the formulae better described under section C. Please refer equation 4 under section C of the MR.
<b>Measuring/ Reading/ Recording frequency</b>	Calculated using the formulae better described under section C.
<b>Calculation method (if applicable)</b>	Refer to Section C for details and description of the above variables.
<b>QA/QC procedures</b>	Meters are found to be under the permissible limit as the result of annual calibration. Therefore no correction factor has been applied.
<b>Purpose of data</b>	Baseline Emissions calculations
<b>Additional comment</b>	Not Applicable

<b>Data / Parameter:</b>	$\sum_{Project} E_{WEC\text{Import},j}$
<b>Unit</b>	MWh (Mega-Watt hour)
<b>Description</b>	Summation of gross electricity exported (at substation point) by all the WECs of the project activity.  Where j is any WEC between 1 to 75 of the project activity connected to main meter at Akal substation and backup meter at Bhu substation.
<b>Measured /Calculated /Default</b>	$\sum_{Project} E_{WEC\text{Import},j}$ denotes summation of the gross electricity exported (at substation point) to the grid by a WECs included in the project activity. The value is calculated based on the formula mentioned in section C.
<b>Source of data</b>	Summation of data values of $E_{WEC\text{Import},j}$ for all the WECs included in the project activity.
<b>Value(s) of monitored parameter</b>	67920.357 MWh
<b>Monitoring equipment</b>	Calculated using the formulae better described under section C.
<b>Measuring/ Reading/ Recording frequency</b>	Monthly: Calculated using the formulae better described under section C.
<b>Calculation method (if applicable)</b>	$\sum_{Project} E_{WEC\text{Import},j}$ denotes summation of the gross electricity exported (at substation point) to the grid by a WECs included in the project activity. Refer to Section C for details and description.
<b>QA/QC procedures</b>	The value is calculated and can be cross checked from the invoices raised on the state utility.
<b>Purpose of data</b>	Baseline Emissions calculations
<b>Additional comment</b>	Not Applicable

<b>Data / Parameter:</b>	$\sum_{Project} E_{WEC\text{Import},j}$
--------------------------	---

<b>Unit</b>	MWh (Mega-Watt hour)
<b>Description</b>	Summation of electricity imported (at substation point) by all the WECs of the project activity.  Where, j is any value between 1 to 75 representing WECs of the project activity connected to main meter at Akal substation and backup meter at Bhu substation.
<b>Measured /Calculated /Default</b>	$\sum_{Project} E_{WEC,Import,j}$ denotes summation of the gross electricity imported (at substation point) to the grid by a WECs included in the project activity. The value is calculated based on the formula mentioned in section C.
<b>Source of data</b>	Summation of data values of $E_{WEC,Import,j}$ for all the WECs included in the project activity.
<b>Value(s) of monitored parameter</b>	800.54 MWh
<b>Monitoring equipment</b>	Calculated using the formulae better described under section C.
<b>Measuring/ Reading/ Recording frequency</b>	Monthly: Calculated using the formulae better described under section C.
<b>Calculation method (if applicable)</b>	$\sum_{Project} E_{WEC,Import,j}$ denotes summation of the gross electricity imported (at substation point) to the grid by a WECs included in the project activity. Refer to Section C for details and description.
<b>QA/QC procedures</b>	The value is calculated and can be cross checked from the invoices raised on the state utility.
<b>Purpose of data</b>	Baseline Emissions calculations
<b>Additional comment</b>	Not Applicable

### D.3. Implementation of sampling plan

>>

No sampling plan is followed by PP.

## SECTION E. Calculation of emission reductions or GHG removals by sinks

### E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO<sub>2</sub>e/kWh) calculated in a transparent and conservative manner as the weighted average emissions (in kg CO<sub>2</sub>e/kWh) as described in registered PDD.

$$BE_y = EG_y * EF_y$$

Where,

**BE<sub>y</sub>** is baseline emissions in year y, tCO<sub>2</sub>e

**EG<sub>y</sub>** is the net electricity supplied to the grid in year y and is applied directly from the invoice certified by state utility. This value can also be cross checked from the invoice.

**EF<sub>y</sub>** is the CO<sub>2</sub> emission factor of the grid (0.87387 tCO<sub>2</sub>e/MWh fixed ex-ante).

Emission reduction calculation for the period 01 Sep 2011 to 30 June 2012:

$$\begin{aligned}
 \text{Emission Reductions (ER)} &= 67827.495 \text{ (MWh)} * 0.87387 \text{ (tCO}_2\text{e /MWh)} \\
 &= \mathbf{59,272 \text{ tCO}_2\text{e}}
 \end{aligned}$$

## E.2. Calculation of project emissions or actual net GHG removals by sinks

>>

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

## E.3. Calculation of leakage

>>

No leakage is considered from the project activity as per approved methodology ACM0002.

## E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

The total emission reductions achieved during the monitoring period is **59, 272** tCO<sub>2</sub>e.

Total baseline emissions: **59, 272** tCO<sub>2</sub>e

Total project emissions: Zero

Total leakage: Zero

Total Emission reductions, ER = BE<sub>y</sub> – PE<sub>y</sub> - LE<sub>y</sub>  
= **59, 272** tCO<sub>2</sub>e

## E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO <sub>2</sub> e)	84,205	59,272

## E.6. Remarks on difference from estimated value in registered PDD

>>

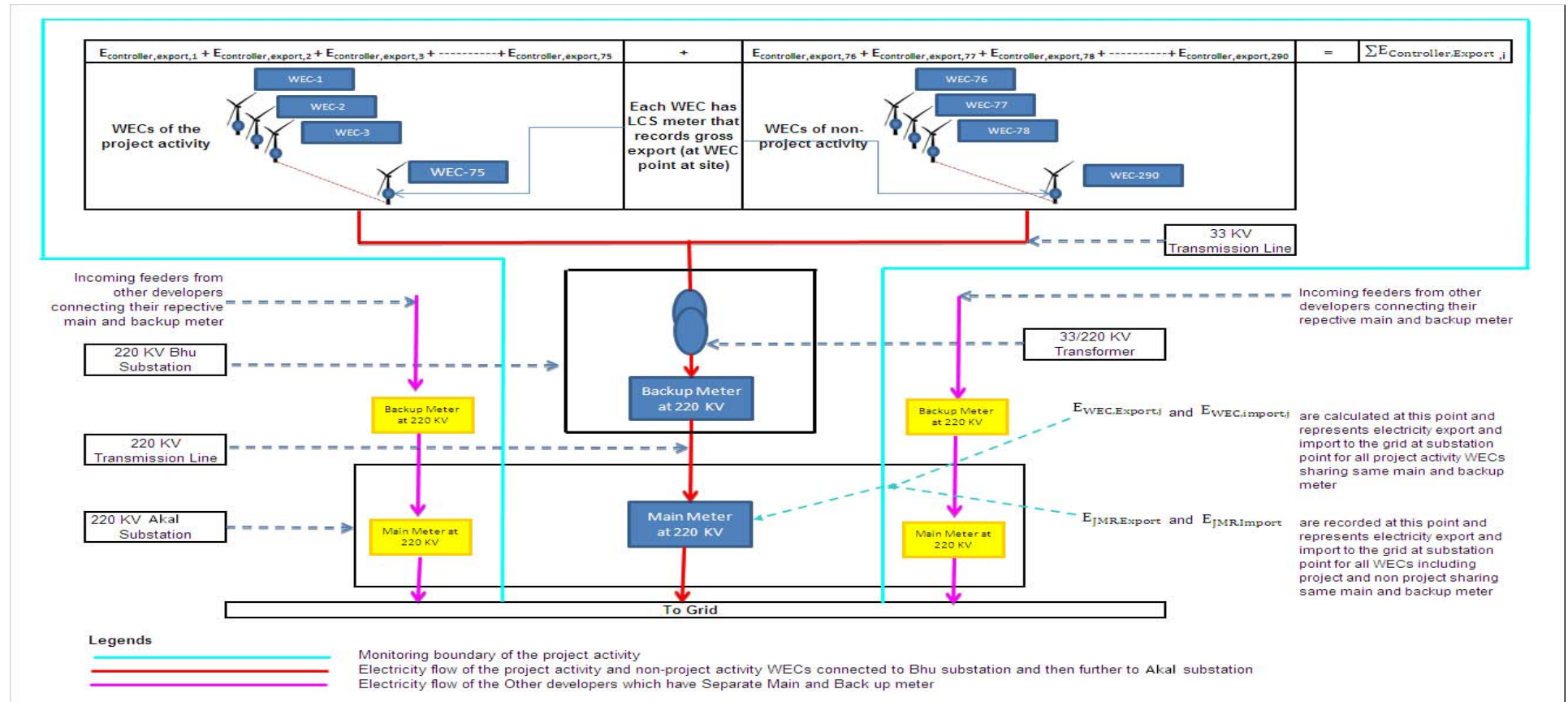
There is change of 29.61% in the expected and annual emission reductions. The difference in the total CERs is due to low wind availability leading to low plant load factor.

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### History of the document

Version	Date	Nature of revision
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	EB 54, Annex 34 28 May 2010	Initial adoption.
<b>Decision Class:</b> Regulatory <b>Document Type:</b> Form <b>Business Function:</b> Issuance		

## Appendix 1: Line Diagram Showing Relevant Metering Points



## Appendix 2: Controller Meter Details

Equipment Name	Meter Number
EWHLPLD-01	475500
EWHLPLD-02	475330
EWHLPLD-03	475293
EWHLPLD-04	475488
EWHLPLD-05	475077
EWHLPLD-06	475557
EWHLPLD-07	1215614
EWHLPLD-08	475490
EWHLPLD-09	475512
EWHLPLD-10	475703
EWHLPLD-11	475725
EWHLPLD-12	475548
EWHLPLD-13	475483
EWHLPLD-14	475498
EWHLPLD-15	475075
EWHLPLD-16	475550
EWHLPLD-17	475292
EWHLPLD-18	475112
EWHLPLD-19	475356
EWHLPLD-20	475102
EWHLPLD-21	474937
EWHLPLD-22	475682
EWHLPLD-23	475735
EWHLPLD-24	475358
EWHLPLD-25	475024
EWHLPLD-26	474943
EWHLPLD-27	474951
EWHLPLD-28	466271
EWHLPLD-29	475099
EWHLPLD-30	475511
EWHLPLD-31	475086
EWHLPLD-32	475495
EWHLPLD-33	475496
EWHLPLD-34	475492
EWHLPLD-35	475479
EWHLPLD-36	475503
EWHLPLD-37	475738
EWHLPLD-38	475486
EWHLPLD-39	466298
EWHLPLD-40	466256
EWHLPLD-41	475513
EWHLPLD-42	475510
EWHLPLD-43	475113
EWHLPLD-44	475497
EWHLPLD-45	475518
EWHLPLD-46	475350
EWHLPLD-47	475485
EWHLPLD-48	475061

Equipment Name	Meter Number
EWHLPLD-49	475114
EWHLPLD-50	475059
EWHLPLD-51	475290
EWHLPLD-52	475329
EWHLPLD-53	475502
EWHLPLD-54	475076
EWHLPLD-55	475296
EWHLPLD-56	475332
EWHLPLD-57	475347
EWHLPLD-58	475326
EWHLPLD-59	475501
EWHLPLD-60	475593
EWHLPLD-61	475070
EWHLPLD-62	475651
EWHLPLD-63	475091
EWHLPLD-64	475621
EWHLPLD-65	475517
EWHLPLD-66	475100
EWHLPLD-67	475335
EWHLPLD-68	475064
EWHLPLD-69	475062
EWHLPLD-70	475087
EWHLPLD-71	475289
EWHLPLD-72	475321
EWHLPLD-73	475499
EWHLPLD-74	475352
EWHLPLD-75	475481



## Appendix 3: Net Electricity Exported to Grid (EGy)

Month	Export Multiplication Factor	Import Multiplication Factor	$E_{\text{Controller, Export},i}$ (kWh)	$E_{\text{WEG, Export},j}$ (kWh)	$E_{\text{WEG, Import},j}$ (kWh)	$E_{\text{JMR, Export}}$ (kWh)	$E_{\text{JMR, Import}}$ (kWh)	$\sum_{\text{Project}} E_{\text{WEG, Export},j}$ (kWh)	$\sum_{\text{Project}} E_{\text{WEG, Import},j}$ (kWh)	EGy in kWh
Sep-11	0.9716	0.0004	7169154	6965402	2715	27370650	10667	6965402	2715	6962687
Oct-11	0.9753	0.0039	4276716	4170876	16513	16165323	64000	4170876	16513	4154363
Nov-11	0.9601	0.0082	2079441	1996426	17063	8111995	69333	1996426	17063	1979363
Dec-11	0.9730	0.0034	3363999	3273290	11292	13914658	48000	3273290	11292	3261998
Jan-12	0.9691	0.0021	3430843	3324983	7365	14447991	32000	3324983	7365	3317618



<b>Feb-12</b>	0.9715	0.0011	4620939	4489027	5298	18074655	21333	4489027	5298	4483729
<b>Mar-12</b>	0.9661	0.0010	6621350	6397164	6817	25023984	26666	6397164	6817	6390347
<b>Apr-12</b>	0.9747	0.0008	6197144	6040622	5065	25439984	21333	6040622	5065	6035557
<b>May-12</b>	0.9811	0.0005	10659008	10457156	5440	41002641	21333	10457156	5440	1045171 6
<b>Jun-12</b>	0.9657	0.0001	21544492	20805411	2486	89242611	10667	20805411	2486	2080292 5

**Appendix 4:**

Enercon (India) Ltd has secured and facilitated the technology transfer for wind based renewable energy generation from Enercon GmbH and has established a manufacturing plant at Daman in India where, along with other components the "Synchronous Generators" using "Vacuum Impregnation" technology are manufactured. The other salient features of the state-of-art-technology are as follows:

- Gearless Construction - Rotor & Generator Mounted on same shaft eliminating the Gearbox.
- Variable speed function – has the speed range of 18 to 33 RPM thereby ensuring optimum efficiency at all times.
- Variable Pitch functions ensuring maximum energy capture.
- Near Unity Power Factor at all times.
- Minimum drawl (less than 1% of kWh generated) of Reactive Power from the grid.
- No voltage peaks at any time.
- Operating range of the WEC with voltage fluctuation of -20 to +20%.
- Less Wear & Tear since the system eliminates mechanical brake, which are not needed due to low speed generator, which runs at maximum speed of 33 rpm and uses Air Brakes.
- Three Independent Braking System.
- Generator achieving rated output at only 33 rpm.
- Incorporates lightning protection system, which includes blades.
- Starts Generation of power at wind speed of 3 m/s.