



Monitoring report form (Version 03.2)

Monitoring report

Title of the project activity	Tungabhadra wind power project in Karnataka
Reference number of the project activity	1268
Version number of the monitoring report	4.0
Completion date of the monitoring report	04/06/2014
Registration date of the project activity	27/10/2008
Monitoring period number and duration of this monitoring period	4 th Monitoring Period, 01/09/2012 to 31/10/2013 (first and last days included)
Project participant(s)	Wind World (India) Limited
Host Party(ies)	India
Sectoral scope(s) and applied methodology(ies)	1, Energy industries (renewable/ non-renewable sources) Consolidated methodology for grid-connected electricity generation from renewable sources, ACM0002, Version 6
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	Average value of CER/ year (or 365 days) as per registered PDD are 49,331. Current monitoring period (01/09/2012-31/10/2013) covers period of 426 days, hence ex-ante estimated of CER's as per registered PDD are 57,575 tCO _{2e} .
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	51,466 tCO _{2e}
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	13,523 tCO _{2e}
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	37,943 tCO _{2e}

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 51,466 tCO_{2e} 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 Southern 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 38-wind energy converters (WECs) of Enercon make (600 kW E-40) 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 ± 12.5%. The other salient features of the state-of-art-technology are referred in Appendix 2. 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 machines under the project activity were commissioned on 23/04/2007, 12/09/2007 & 31/12/2007. 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). The length of crediting period is from 27/10/2008 to 26/10/2018 (Fixed). In first CER verification, the monitoring period considered was the period from 27/10/2008 to 30/11/2009. The second monitoring period was from 01/12/2009 to 31/08/2011. The third monitoring period was from 01/09/2011 to 31/08/2012. The Fourth monitoring period has been considered for 01/09/2012 to 31/10/2013.

- (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 (01/09/2012 to 31/10/2013) is 51,466 tCO_{2e}.

A.2. Location of project activity

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- (a) Host Party(ies);

India

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

Southern Region/Karnataka State

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

The project activity is located at village Singatalur, Koralahalli and Hammigi at Mundargi in Gadag district in the state of Karnataka, India.

(d) Physical/ Geographical location.

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

Table 1:

Unique Identification Number	Loc. No.	Latitude			Longitude		
		Degree	Minutes	Seconds	Degree	Minutes	Seconds
EILKGS 1	1	15	3	27.4	75	52	4.0
EILKGS 2	2	15	3	30.0	75	52	2.0
EILKGS 3	3	15	3	29.9	75	51	57.9
EILKGS 4	4	15	3	32.4	75	51	51.3
EILKGS 5	5	15	3	36.1	75	51	43.0
EILKGS 6	6	15	3	37.3	75	51	39.6
EILKGS 7	7	15	3	38.3	75	51	34.1
EILKGS 8	8	15	3	45.3	75	51	40.0
EILKGS 9	9	15	3	49.2	75	51	39.1
EILKGS 10	10	15	3	52.2	75	51	36.7
EILKGS 11	11	15	3	54.1	75	51	32.7
EILKGS 12	12	15	3	54.3	75	51	16.4
EILKGS 13	13	15	3	58.1	75	51	15.3
EILKGS 14	14	15	4	4.2	75	51	17.2
EILKGS 15	15	15	4	7.5	75	51	14.4
EILKGS 16	16	15	4	5.7	75	51	4.8
EILKGS 17	17	15	4	9.5	75	51	1.6
EILKGS 18	18	15	4	20.9	75	51	0.7
EILKGS 19	19	15	4	23.2	75	50	58.1
EILKGS 20	20	15	4	27.2	75	50	54.0
EILKGS 21	21	15	4	34.3	75	51	5.4
EILKGS 22	22	15	4	36.7	75	50	58.9
EILKGS 23	23	15	4	38.9	75	50	51.6
EILKGS 24	24	15	4	38.1	75	50	40.6
EILKGS 25	25	15	4	37.1	75	50	30.2
EILKGS 26	26	15	4	42.4	75	50	38.5
EILKGS 27	27	15	4	45.6	75	50	35.0
EILKGS 28	28	15	4	48.0	75	50	30.7
EILKGS 29	29	15	4	51.0	75	50	26.8
EILKGS 30	30	15	4	54.5	75	50	22.4
EILKGS 31	31	15	4	57.0	75	50	19.9
EILKGS 32	32	15	5	0.6	75	50	16.6
EILKGS 33	33	15	4	16.5	75	51	3.5
EILKGS 34	34	15	5	4.8	75	50	33.7
EILKGS 35	35	15	5	8.0	75	50	30.8
EILKGS 36	36	15	5	11.5	75	50	26.1
EILKGS 37	37	15	5	12.7	75	50	19.3
EILKGS 38	38	15	5	15.5	75	50	16.3

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India	Wind World (India) Limited	No

A.4. Reference of applied methodology

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Methodology: "Consolidated methodology for grid-connected electricity generation from renewable sources", ACM0002 Version 6.

Baseline Methodology: Consolidated baseline methodology for grid-connected electricity generation from renewable sources, ACM0002, Version 6.

Monitoring Methodology: Consolidated monitoring methodology for zero- emissions grid-connected electricity generation from renewable sources, ACM0002, Version 6.

Methodology Reference:

<http://cdm.unfccc.int/methodologies/DB/MPY3HVJIMTKE5P0UNTYE827D6Q7EHB>

ACM0002 draws upon the following tools:

- Tool to calculate the emission factor for an electricity system (Version 1.0)
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf/history_view
- Tool for the demonstration and assessment of additionality (Version 3.0)
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf/history_view

A.5. Crediting period of project activity

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The crediting period start date is 27/10/2008 and length of crediting period is 10 years (Fixed).

SECTION B. Implementation of project activity**B.1. Description of implemented registered project activity**

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The Project involves 38-wind energy converters (WECs) of Enercon make (600 kW E-40) 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 2.

The starting date of operation of the project activity

The first WEC under the project activity was commissioned on 23/04/2007 and last WEC under the project activity was commissioned on 31/12/2007. The commissioning date for all the WECs included in the project activity is given in the table below.

Table 2:

Unique Number	Identification	Loc. No.	Date of Commissioning
EILKGS 1		1	31/12/2007
EILKGS 2		2	31/12/2007
EILKGS 3		3	31/12/2007
EILKGS 4		4	31/12/2007
EILKGS 5		5	31/12/2007
EILKGS 6		6	31/12/2007
EILKGS 7		7	31/12/2007
EILKGS 8		8	31/12/2007
EILKGS 9		9	31/12/2007
EILKGS 10		10	31/12/2007
EILKGS 11		11	31/12/2007
EILKGS 12		12	23/04/2007
EILKGS 13		13	23/04/2007
EILKGS 14		14	31/12/2007
EILKGS 15		15	31/12/2007
EILKGS 16		16	23/04/2007
EILKGS 17		17	23/04/2007
EILKGS 18		18	23/04/2007
EILKGS 19		19	23/04/2007
EILKGS 20		20	23/04/2007
EILKGS 21		21	12/09/2007
EILKGS 22		22	31/12/2007
EILKGS 23		23	31/12/2007
EILKGS 24		24	12/09/2007
EILKGS 25		25	12/09/2007
EILKGS 26		26	23/04/2007
EILKGS 27		27	23/04/2007
EILKGS 28		28	23/04/2007
EILKGS 29		29	31/12/2007
EILKGS 30		30	31/12/2007
EILKGS 31		31	31/12/2007
EILKGS 32		32	31/12/2007
EILKGS 33		33	12/09/2007
EILKGS 34		34	12/09/2007
EILKGS 35		35	12/09/2007
EILKGS 36		36	12/09/2007
EILKGS 37		37	12/09/2007
EILKGS 38		38	12/09/2007

The information regarding the actual operation of the project

State	KARNATAKA		Project Performance Report						Date:01/09/2012-31/10/2013		
	Generation		Lack Of Wind	Down Time				Machine Availability(%)	Capacity Factor(%)	Grid Availability(%)	
	Wec No.	KWh		Hrs	Machine		Grid				
					Fault	Shutdown	Fault				Shutdown
Site: KAPATHGUDDA SOUTH, KARNATAKA			ENERCON WINDFARM KAPATHGUDDA SOUTH PVT LTD							Total WEC : 38	
EILKGS-01	1,919,182	8863:00:00	1190:36:00	15:17	37:11:00	45:03:00	51:47:00	1391:46:00	99.49	31.29	98.55
EILKGS-02	1,855,397	8890:00:00	1162:29:00	23:10	65:53:00	45:03:00	51:47:00	1400:14:00	99.13	30.25	98.55
EILKGS-03	1,603,727	8637:00:00	1384:23:00	21:25	35:22:00	45:03:00	51:47:00	1589:52:00	99.44	26.14	98.55
EILKGS-04	1,298,309	8218:00:00	1779:43:00	9:52	53:56:00	45:03:00	51:47:00	1992:13:00	99.38	21.16	98.55
EILKGS-05	1,722,505	8676:00:00	1376:36:00	14:09	41:22:00	45:03:00	51:47:00	1575:35:00	99.46	28.08	98.6
EILKGS-06	1,708,254	8759:00:00	1284:46:00	52:32:00	30:18:00	45:03:00	51:47:00	1516:18:00	99.19	27.85	98.55
EILKGS-07	1,569,212	8672:00:00	1281:20:00	54:23:00	66:52:00	45:17:00	51:47:00	1551:31:00	98.81	25.58	98.54
EILKGS-08	1,846,970	8833:00:00	1224:04:00	6:55	41:29:00	45:03:00	51:47:00	1421:10:00	99.53	30.11	98.55
EILKGS-09	1,669,887	8766:00:00	1292:08:00	8:37	42:47:00	45:03:00	51:47:00	1492:14:00	99.5	27.22	98.55
EILKGS-10	1,657,152	8843:00:00	1200:47:00	22:01	37:21:00	45:03:00	51:47:00	1408:51:00	99.42	27.01	98.55
EILKGS-11	1,532,205	8475:00:00	1569:55:00	20:17	33:20:00	45:03:00	51:47:00	1772:14:00	99.48	24.98	98.55
EILKGS-12	1,839,360	8840:00:00	1208:03:00	11:45	53:38:00	42:30:00	51:47:00	1419:35:00	99.36	29.98	98.57
EILKGS-13	1,818,249	8764:00:00	1261:06:00	10:48	40:29:00	42:16:00	51:47:00	1458:18:00	99.5	29.64	98.57
EILKGS-14	1,795,628	8920:00:00	1137:21:00	7:33	41:33:00	42:16:00	50:47:00	1331:22:00	99.52	29.27	98.58
EILKGS-15	1,699,857	8876:00:00	1177:45:00	9:45	39:17:00	42:16:00	51:47:00	1372:42:00	99.52	27.71	98.57
EILKGS-16	1,522,621	8623:00:00	1338:16:00	82:04:00	53:32:00	42:16:00	51:47:00	1619:47:00	98.67	24.82	98.57
EILKGS-17	1,503,945	8684:00:00	1353:14:00	4:12	53:50:00	42:16:00	51:47:00	1557:11:00	99.43	24.52	98.57
EILKGS-18	1,949,203	8763:00:00	1293:23:00	16:49	24:32:00	42:16:00	51:47:00	1480:39:00	99.6	31.77	98.57
EILKGS-19	1,732,095	8708:00:00	1333:36:00	13:34	43:34:00	42:30:00	51:47:00	1536:53:00	99.44	28.24	98.57
EILKGS-20	1,313,243	8547:00:00	1472:18:00	25:57:00	48:10:00	42:16:00	51:47:00	1692:20:00	99.28	21.41	98.57
EILKGS-21	1,664,511	8758:00:00	1278:12:00	11:42	48:27:00	40:00:00	57:14:00	1488:54:00	99.41	27.13	98.53
EILKGS-22	1,642,702	8766:00:00	1283:17:00	20:30	24:53:00	40:00:00	57:14:00	1479:13:00	99.56	26.78	98.53
EILKGS-23	1,514,982	8705:00:00	1322:10:00	8:25	52:15:00	40:00:00	57:14:00	1533:23:00	99.41	24.7	98.53
EILKGS-24	1,412,231	8667:00:00	1297:54:00	42:24:00	58:16:00	40:00:00	57:14:00	1572:07:00	99.02	23.02	98.53
EILKGS-25	1,582,441	8626:00:00	1340:45:00	117:27:00	34:59:00	31:45:00	57:14:00	1635:29:00	98.51	25.8	98.61
EILKGS-26	1,719,199	8929:00:00	1111:30:00	14:08	34:21:00	40:00:00	57:14:00	1310:32:00	99.53	28.03	98.53
EILKGS-27	1,983,293	8864:00:00	1178:47:00	16:40	30:22:00	40:00:00	57:14:00	1376:22:00	99.54	32.33	98.53
EILKGS-28	1,978,298	8861:00:00	1141:29:00	40:34:00	54:34:00	40:00:00	57:14:00	1387:10:00	99.07	32.25	98.53
EILKGS-29	1,804,281	8795:00:00	1227:08:00	31:23:00	36:21:00	44:45:00	59:06:00	1452:02:00	99.34	29.41	98.46
EILKGS-30	1,804,671	8753:00:00	1236:18:00	25:36:00	45:09:00	47:53:00	57:15:00	1465:30:00	99.31	29.41	98.45
EILKGS-31	1,541,836	8714:00:00	1277:32:00	39:35:00	53:32:00	46:27:00	57:15:00	1527:40:00	99.09	25.13	98.46
EILKGS-32	1,635,274	8786:00:00	1238:00:00	14:41	46:25:00	46:27:00	57:15:00	1456:07:00	99.4	26.66	98.46
EILKGS-33	1,748,921	8715:00:00	1331:42:00	7:33	39:34:00	43:43:00	53:32:00	1529:23:00	99.54	28.51	98.53
EILKGS-34	1,670,444	8816:00:00	1212:16:00	18:09	42:48:00	46:27:00	57:15:00	1430:14:00	99.4	27.23	98.46
EILKGS-35	1,768,742	8716:00:00	1341:49:00	22:55	29:43:00	46:27:00	57:15:00	1549:28:00	99.49	28.83	98.48
EILKGS-36	1,728,024	8557:00:00	1337:41:00	91:17:00	57:01:00	46:27:00	57:15:00	1667:00:00	98.55	28.17	98.46
EILKGS-37	1,463,518	8512:00:00	1488:55:00	31:01:00	22:07	46:27:00	57:15:00	1699:04:00	99.48	23.86	98.46
EILKGS-38	1,344,111	8630:00:00	1406:32:00	20:49	26:19:00	46:41:00	57:15:00	1610:55:00	99.54	21.91	98.46
Total	63,564,480	331527:00	49373:46	1005:54:00	1621:32:00	1650:08:00	2063:10:00	57751:18	99.32	27.27	98.53

(Note: Down time and lack of wind are in hours)

Wind World (India) Limited (WWIL) is responsible for operation and maintenance activities for this project. Wind World (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 which may impact the applicability of applied methodology. As a part of regular maintenance the WECs are stopped for mechanical, electrical, grease and visual maintenance. Detailed maintenance procedures of the WECs are mentioned below:

Description of maintenance intervals:

There is a pre-defined maintenance schedule for annual maintenance for all the WECs at project site. There are four types of maintenance activity have been executed for all the WECs. During maintenance, WEC needs to stop for defined time period which are as follows:

Visual maintenance : Average 3 to 4 hr stoppage of WEC
 Grease maintenance : Average 3 to 4 hr stoppage of WEC
 Electrical maintenance : Average 16 to 20 hr stoppage of WEC
 Mechanical maintenance: Average 16 to 20 hr stop of WEC

Other than the above mentioned maintenance activity, WEC were generating electricity continuously without any technical fault. Hence no break down has been noted during the monitoring period.

B.2. Post registration changes**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

>> Not applicable

B.2.2. Corrections

>> A revised PDD (version 6.0, Date: 04/06/2014) is submitted with following corrections:

- Typographical error in the registered PDD regarding the latitude and longitude details of the turbines have been rectified in revised PDD (version 6.0). The issue regarding the geographical coordinates was raised, by the DOE (TUV NORD) during the first verification of this project activity, and has been discussed under CL R1 on page 21 of the verification report of the 1st monitoring period. The geographical coordinates were revised in the Monitoring report of the 1st monitoring period after seeking a clarification from the UN. During the current verification, the PP has incorporated the same revised coordinates in the revised PDD (version 6.0) in section A.2.4.
- Name change of project proponent from Enercon (India) Limited to Wind World (India) Limited is incorporated.

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

>> A revision in the monitoring plan has been approved by EB on 18-Feb-2011. Approved revision in monitoring plan has been incorporated in revised PDD (version 6.0).

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

>> Not applicable

B.2.5. Changes to start date of crediting period

>> Not applicable

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

>> Not applicable

SECTION C. Description of monitoring system

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Approved monitoring methodology ACM0002 / Version 06 Sectoral Scope: 1, "Consolidated methodology for grid-connected electricity generation from renewable sources", by CDM - Meth Panel to be 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. There is one main and check meter dedicated to project activity at 33kV metering point for the project activity. In addition to this there are two main and check meters (bulk meters) at 110 kV metering point at the Wind World (India) Limited substation and are connected to the machines of the project activity and the machines commissioned by the other project developers. Therefore in order to determine the electricity supplied to the grid by the project at 110 kV at the Bannikoppa substation, the state utility applies the transmission loss to the meter reading recorded at the 33 kV metering point. The transmission loss calculated by the state utility is endorsed / confirmed jointly by the representatives of Wind World (India) Limited and the state utility. The transmission loss applied to the project activity by the state utility is reflected in the JMR (Form B) recorded at 33kV metering point. Electricity supplied to the grid is calculated by applying transmission loss to the meter readings taken at 33 kV metering location of the project activity.

The procedure for calculation of transmission loss as given in the PPA is set-out below:

$$Z = (((X1+X2+X3.....+Xn)-Y)*100)/ (X1+X2+X3.....+Xn)$$

Z = Percentage transmission loss for export incurred in transmission line between the meter located at 33 kV metering point and the meters located at 110kV metering point (two bulk meters) high voltage side of receiving sub-station.

Xi = Energy Export Reading of energy meter installed at 33kV metering point

Here Xi represents X1, X2, X3,...Xn which are the meters that are installed at 33kV metering point and are connected to the receiving substation by internally connected lines to the receiving station.

Y = Energy Export Readings at bulk meters (two in number) installed at high voltage side of transformer of the receiving station at 110 kV.

The Export Reading Xi is adjusted for transmission loss that is determined by the state utility and is applied directly to the JMR (Form B) taken at 33 kV metering point. This can be checked from the JMR signed jointly by the representatives of Wind World (India) Limited and the state utility.

Transmission Loss in Export (TE) = Percentage Transmission Loss (Z) * Energy Export at 33kV metering point (EGExport)

Empirical Formula for Energy Export after adjustment of transmission loss (Equation 1)

Net Energy Export after adjustment of transmission loss = **EGExport– Transmission Loss (TE)**

The transmission loss in export is generally less than 5%. However in case of Energy Import, the state utility conservatively applies adjustment of 15% to the import values noted at 33 kV metering point.

Transmission Loss in Import (TI) = 15% * Energy Import at 33kV metering point (EGImport)

Empirical Formula for Energy Import after adjustment of transmission loss (Equation 2)

Net Energy Import after adjustment of transmission loss = **EGimport+15%*EGimport**
= 115%* EGimport

Therefore Energy Supplied to Grid after adjustment of transmission loss is difference of equation 1 and 2 as given in the JMR (Form B) signed jointly by Wind World (India) Limited and the state utility.

EGy = EGExport– 115%*EGimport– Transmission Loss (TE)

The Joint meter reading noted at 33 kV metering location contains the following data:-

1. Electricity Export (EGExport)
2. Electricity Import (EGImport)
3. Transmission Loss (TE) between 33 kV metering point and 110 kV metering point (two bulk meters) at Wind World (India) Limited substation
4. Electricity supplied to the Grid [EGExport-115%*EGImport-TE]

JMR is signed by the representatives of Wind World (India) Limited and the state utility. The meter readings (both export and import), transmission loss and electricity supplied to the grid are recorded in the JMR (33 kV metering point). Hence all these values have been reproduced from the JMR for calculation of emission reductions.

In addition to the JMR (Form B) at 33kV metering location for the project activity, the following documents will also be provided to the DoE for verification:

1. JMR (Form B) at 110kV metering point (two bulk meters) at Wind World (India) Limited substation

2. Transmission loss calculation endorsed / confirmed jointly by the representatives of Wind World (India) Limited and the state utility.

The electricity supplied to the grid can be cross checked from the invoices raised on the state utility for supply of electricity supplied to the grid.

Monitoring Information:

The reference of the monitoring information as described under this section has been taken from the PPA.

Metering: Electricity supplied to the grid is metered jointly by state utility and Wind World (India) Limited through one main and one check meter at 33 kV metering point connecting exclusively the machines of project activity.

In addition to this there are two main and check meters (Bulk meters) at 110 kV metering point at Wind World (India) Limited substation covering machines of the project activity and machines of other project developers. The schematic diagram indicating location of meters at 33 kV and 110 kV metering points for the project activity is attached as Appendix 1.

Metering Equipment: Metering system for the project activity consists of one main and one check meter of 0.2 percent accuracy class at 33kV metering point and two main and check meters at 110 kV metering point. All the meters are two-way Trivector meters capable of recording import and export of electricity. The meters installed are capable of recording and storing half hourly readings of all electrical parameters for a minimum period of 35 days with digital output.

Meter Readings: The electricity supplied to the grid is recorded by taking JMR for 22.8 MW at 33kV metering point in the presence of representatives of state utility and Wind World (India) Limited. The JMR at 33kV metering point contains the value of energy exported, energy imported, transmission loss and electricity supplied to the grid during the recording period. This JMR is certified by state utility. These certified readings are then used to prepare the invoices to be raised on Discom. Thus the electricity supplied to the grid as mentioned in the JMR can be crosschecked with the value mentioned in the invoices.

Inspection of Energy Meters: All main and check energy meters and all associated instruments, transformers installed at the Project are of 0.2s accuracy class. Each meter is jointly inspected and sealed on behalf of the Parties and is not to be interfered with by either Party except in the presence of the other Party or its authorized representatives.

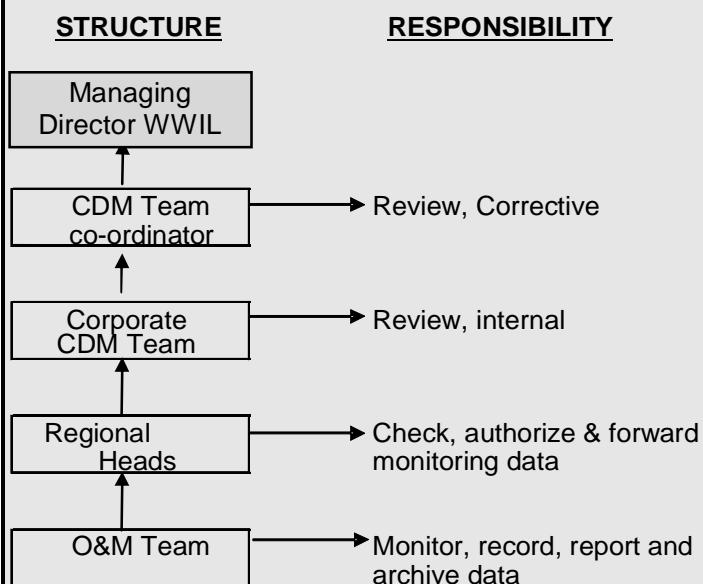
Meter Test Checking: All main and check meters are tested for accuracy with reference to a portable standard meter. The portable standard meter is owned by state utility. The main and check meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.2s accuracy class. The consumption registered by the main meters alone will hold good for the purpose of metering electricity supplied to the grid as long as the error in the main meters is within the permissible limits. All the meters will be tested / calibrated for accuracy annually. The steps taken in the event (not be applicable to current monitoring period) of following findings during meter test checking are described below.

If during the meter test checking,

- The main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the permissible limits, then the meter reading will be as per the main meter as usual. The check meter shall, however, be calibrated immediately.
- The main meter is found to be beyond permissible limits of error, but the corresponding check meter is found to be within permissible of error, then the meter reading for the month up to the date and time of such test shall be as per the check meter. There will be a revision in the meter reading for the period from the previous calibration test up to the current test based on the readings of the check meter. The main meter shall be calibrated immediately and meter reading for the period thereafter till the next monthly meter reading shall be as per the calibrated main meter.
- Both the main meters and the corresponding check meters are found to be beyond the permissible limits of error, both the main meters shall be immediately calibrated and the correction applied to the reading registered by the main meter to arrive the correct reading of energy supplied for metering electricity supplied to the grid for the period from the last month's meter reading up to the current test. Meter reading for the period thereafter till the next monthly reading shall be as per the calibrated main meter.

None of the above situations occurred during the current monitoring period.

Operational and Management structure implemented by Wind World (India) Limited:



The 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 or panel meters of all WECs is retrieved) at the project site. In case of data loss, the data can be archived from this online monitoring system.

The data (electricity supplied to the grid) are archived on electronic media as well as on paper. The archive will be kept for the period up to two years after the completion of the crediting period.

Training imparted to the Personnel

Wind World (India) Limited has been instrumental in imparting training to the persons it recruits to serve in the organisation. Wind World (India) Limited has a separate training facility, called Wind World (India) Limited Training Academy, which gives training to the persons who are to be deployed On-Site to take care of all the activities starting from project construction to operation to maintenance. The training facility is located at Daman and is fully functional and equipped with qualified trainers, training equipments, classrooms and hostel facilities. The training academy has a fixed schedule which is applicable to all those who reside in the training academy. The training schedule and the training period depend upon the role the trainee has to perform. The trainers are well equipped to judge the capabilities of the trainees. All trainees, who are to be associated to the technical side of project are given six to twelve months' rigorous training on all the aspects of wind turbine installation and maintenance depending upon the requirements. Wind World (India) Limited conducts periodical test to rate the trainees and thus they are deployed as per the outcomes of their performance during the training period.

Calibration Details

The metering equipments were inspected & calibrated by state utility. Meter details for the all the main and check meters are as follows:-

Table 3: Calibration Details

Meter description	Serial No., Make, Accuracy class	Metering point	Calibration (2011)	Calibration (2012)	Calibration (2013)	Validity of Calibration
Main meter (Bulk Meter I)	6607369 L&T, 0.2s	Bannikoppa S/s 110 KV	14/07/2011	22/10/2012	25/07/2013	24/07/2014
Check meter (Bulk Meter I)	6606801 L&T, 0.2s	Bannikoppa S/s 110 KV	14/07/2011	22/10/2012	25/07/2013	24/07/2014
Main meter (Bulk Meter II)	6605135 L&T, 0.2s	Bannikoppa S/s 110 KV	14/07/2011	25/09/2012	25/07/2013	24/07/2014
Check meter (Bulk Meter II)	6607373 L&T, 0.2s	Bannikoppa S/s 110 KV	14/07/2011	25/09/2012	25/07/2013	24/07/2014
Main meter at 33 KV	6767626 L&T, 0.2s	Kapathgudda South 33KV	26/11/2011	20/12/2012	-	19/12/2013
Check Meter at 33 KV	6767637 L&T, 0.2s	Kapathgudda South 33KV	26/11/2011	20/12/2012	-	19/12/2013

- 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 bulk meter annually on time. Therefore in accordance with Para 273 (a) of VVS version 6 where calibration is not carried out in line with the frequency mentioned in the revised monitoring plan 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 0.2s. In accordance with Para 273 (a) of VVS version 6, we have applied a correction factor of +0.2% for imports and -0.2% for exports for the delay period. The correction factor applied to meter reading can be validated from calculation of emission reductions provided in spreadsheet.
- In 2011, the Bulk main & check meters (substation) were calibrated on 14/07/2011. In 2012, the meters were calibration on 22/10/2012 & 25/09/2012. Hence correction factor has been applied conservatively to transmission losses for the months of September and October 2012 as the bulk meters are used for calculation of the transmission losses only.
- In 2011, the main & check meters (of project) were calibrated on 26/11/2011. In 2012, the meters were calibration on 20/12/2012. Hence correction factor has been applied conservatively to energy export and import values for the months of November and December 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 ₂ e/MWh								
Description:	Operating Margin Emission Factor of Southern Regional Electricity Grid								
Source of data:	<p>"CO₂ Baseline Database Version 1.1 for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India.</p> <p>The "CO₂ Baseline Database for Indian Power Sector" is available at http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm</p>								
Value(s) applied:	<table border="1"> <tr> <td>2002 – 03</td><td>0.9970</td></tr> <tr> <td>2003 – 04</td><td>1.0094</td></tr> <tr> <td>2004 – 05</td><td>1.0038</td></tr> <tr> <td>Average Operating Margin of last three years</td><td>1.0034</td></tr> </table>	2002 – 03	0.9970	2003 – 04	1.0094	2004 – 05	1.0038	Average Operating Margin of last three years	1.0034
2002 – 03	0.9970								
2003 – 04	1.0094								
2004 – 05	1.0038								
Average Operating Margin of last three years	1.0034								
Purpose of data:	Baseline Emissions								
Additional comment:	None								

Data / Parameter:	$EF_{BM,y}$
Unit:	tCO ₂ e/MWh
Description:	Build Margin Emission Factor of Southern Regional Electricity Grid (year 2004-05)
Source of data:	<p>"CO₂ Baseline Database Version 1.1 for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India.</p> <p>The "CO₂ Baseline Database for Indian Power Sector" is available at http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm</p>
Value(s) applied:	0.7180
Purpose of data:	Baseline Emissions
Additional comment:	None

Data / Parameter:	$EF_{CM,y}$
Unit:	tCO ₂ e/MWh
Description:	Combined Margin Emission Factor of Southern Regional Electricity Grid (year 2004-05)
Source of data:	<p>"CO₂ Baseline Database Version 1.1 for Indian Power Sector" published by the Central Electricity Authority, Ministry of Power, Government of India.</p> <p>The "CO₂ Baseline Database for Indian Power Sector" is available at http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm</p>
Value(s) applied:	0.93204

Purpose of data:	Baseline Emissions
Additional comment:	None

D.2. Data and parameters monitored

Data / Parameter:	EGy
Unit:	MWh (Mega-Watt hour)
Description:	Net electricity supplied to the grid by the Project
Measured/ Calculated / Default:	Calculated
Source of data:	Electricity supplied to the grid as per Joint Meter Readings (Form B) taken at 33kV metering point.
Value(s) of monitored parameter:	55,228.183
Monitoring equipment:	Calculated as per formulae better described under section C of monitoring report.
Measuring/ Reading/ Recording frequency:	Frequency of recording data: Monthly Recording: The values of electricity supplied to the grid is sourced from JMR for 22.8 MW at 33 kV metering point.
Calculation method (if applicable):	<p>Monitoring: The procedures for metering and meter reading are as per the provisions of the power purchase agreement except or otherwise explicitly stated in the revised monitoring plan in section B.7.3. of the revised PDD. Metering system for the project activity consists of one main and check meter at 33 kV metering location. Both meters are two-way tri-vector meters capable of recording import and export of electricity.</p> <p>In addition to this there are two main and check meters (bulk meters) at 110 kV metering point at the Wind World (India) Limited substation at Bannikoppa. The bulk meter is connected to the machines of the project activity and the machines commissioned by the other project developers. Therefore in order to determine the electricity supplied to the grid by the project activity at high voltage (110 kV) side of Wind World (India) Limited substation, the state utility (herein after referred to as "KPTCL/HESCOM") applies the transmission loss between 110 kV metering points (two in number) and meter reading recorded at the 33 kV metering points for all the machines that are connected to 110 kV bulk meters at Wind World (India) Limited substation at Bannikoppa. The transmission loss calculated by the state utility is endorsed / confirmed jointly by the representatives of Wind World (India) Limited and the state utility. The transmission loss applied to the project activity by the state utility is reflected in the JMR (Form B) recorded at 33kV metering point. Refer Appendix 1 for location of metering points at 33kV and 110 kV.</p> <p>Responsibility: Joint responsibility of Wind World (India) Limited and state utility.</p> <p>$EGy = EG_{\text{export}} - 115\% \cdot EG_{\text{import}} - \text{Transmission Loss (TE)}$</p>

QA/QC procedures:	Refer section C of monitoring report for an illustration of the provisions for QA/QC procedures.
Purpose of data:	Baseline Emissions calculations
Additional comment:	Not Applicable
Data / Parameter:	EGexport
Unit:	MWh (Mega-Watt hour)
Description:	Electricity Export recorded at meters (one main and one check meters) connecting 38 machines of the project activity
Measured/ Calculated / Default:	Measured
Source of data:	Electricity export to the grid as per joint meter reading (Form B) issued by HESCOM, taken at 33 kV metering point and can be sourced from JMR for 22.8 MW of the project activity.
Value(s) of monitored parameter:	56,757.408
Monitoring equipment:	Details of the metering equipment are mentioned in Section C of monitoring report
Measuring/ Reading/ Recording frequency:	Reading frequency: Half Hourly Frequency of recording data: Monthly Recording: The values of electricity exports to the grid are sourced from JMR for the project at 33 kV metering point.
Calculation method (if applicable):	NA
QA/QC procedures:	Refer section C of monitoring report for an illustration of the provisions for QA/QC procedures.
Purpose of data:	Baseline Emissions calculations
Additional comment:	Not Applicable
Data / Parameter:	EGimport
Unit:	MWh (Mega-Watt hour)
Description:	Electricity Import recorded at the meters (one main and one check) connecting 38 machines of the project activity.
Measured/ Calculated / Default:	Measured
Source of data:	Electricity import from the grid as per joint meter reading issued by HESCOM, taken at 33kV metering point and can be sourced from JMR for 22.8 MW of the project activity.
Value(s) of monitored parameter:	48.003
Monitoring equipment:	Details of the metering equipment are mentioned in Section C of monitoring report

Measuring/ Reading/ Recording frequency:	Reading frequency: Half Hourly Frequency of recording data: Monthly Recording: The values of electricity import sourced from JMR for the project at 33 kV metering point.
Calculation method (if applicable):	NA
QA/QC procedures:	Refer section C of monitoring report for an illustration of the provisions for QA/QC procedures
Purpose of data:	Baseline Emissions calculations
Additional comment:	Not Applicable

Data / Parameter:	T_E
Unit:	MWh (Mega-Watt hour)
Description:	Transmission loss for export between the metering location at 33 kV point and the metering location at 110 kV at the Wind World (India) Limited substation.
Measured/ Calculated / Default:	Calculated as per the procedure mentioned in the PPA. Refer section C of the MR.
Source of data:	Transmission Loss for export are sourced from the joint meter reading (Form B) issued by HESCOM, taken at 33kV metering point for the project activity.
Value(s) of monitored parameter:	1,474.021
Monitoring equipment:	Calculated as per formulas better described under section C of monitoring report.
Measuring/ Reading/ Recording frequency:	Frequency of recording data: Monthly Recording: The value of transmission loss is sourced from JMR for the project at 33 kV metering point.
Calculation method (if applicable):	Monitoring: Transmission loss between metering location at 33 kV and the metering location at 110 kV at Wind World (India) Limited substation is applied to the meter reading taken at meters connected at 33 kV point for the project activity. Wind World (India) Limited Substation is connected to the machines of the project activity and the machines commissioned by the other project owners. Therefore transmission loss is applied by the state utility as reflected in the JMR (Form B) taken at 33kV point. The JMR (Form B) is signed by the representatives of Wind World (India) Limited and the state utility. Responsibility: Joint responsibility of Wind World (India) Limited and state utility
QA/QC procedures:	Refer section C of monitoring report for an illustration of the provisions for QA/QC procedures.
Purpose of data:	Baseline Emissions calculations
Additional comment:	Not Applicable

The data are stored in hard format and soft format by Wind World (India) Limited at the project site office.

Joint meter reading is taken in the presence of the persons representing Wind World (India) Limited Operation and Maintenance Contractor. The archive will be kept for the period up to two years after the completion of the crediting period.

D.3. Implementation of sampling plan

>> Not applicable

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 CO₂e/kWh) calculated in a transparent and conservative manner as the weighted average emissions (in kg CO₂e/kWh) as described in registered PDD.

$$BE_y = EG_y * EF_y$$

Where,

BE_y is baseline emissions in year y, tCO₂e

EG_y is the net electricity supplied to the grid in year

EF_y is the CO₂ emission factor of the grid (0.932* tCO₂e/MWh fixed ex-ante)

(*A value up to three decimal point is applied to get conservative value of baseline emissions)

Emission reduction calculation for the period 01/09/2012 to 31/10/2013 :

$$\begin{aligned} \text{Baseline Emission (BE}_y) &= 55,228.183 \text{ (MWh)} * 0.932 \text{ (tCO}_2\text{e /MWh)} \\ &= 51,466 \text{ tCO}_2\text{e} \end{aligned}$$

*(Please note that baseline emission calculation of $EG_y * EF_y$ as mentioned above gives a result of 51,472 numbers (approx.), but actual baseline emission reduction achieved has been considered as 51,466 numbers as this was a conservative number arrived after round down the baseline emission calculation for each month against the application of above calculation on lump sum of net electricity supplied to the grid in complete monitoring period)*

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 (Version 6.0).

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

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	51,466	0	0	51,466

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 (t CO₂e)	57,575	51,466

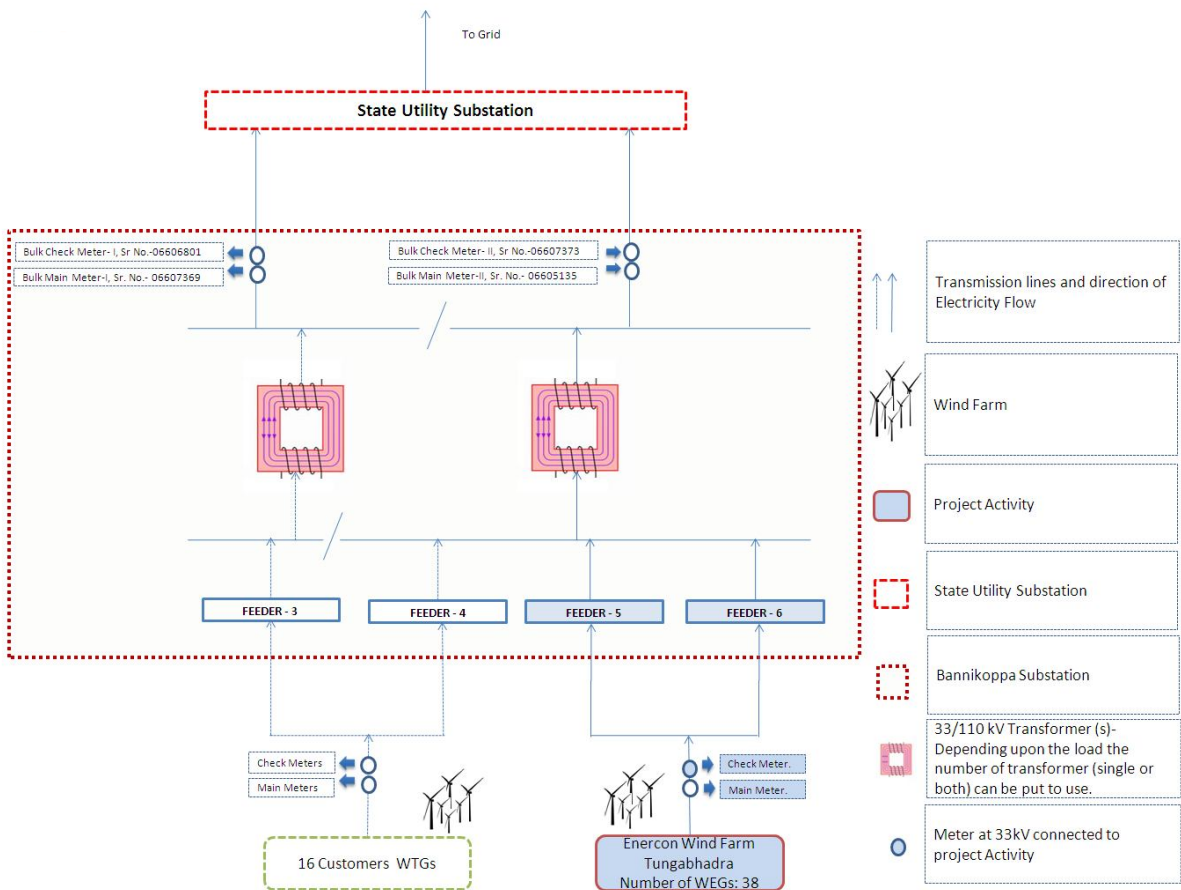
E.6. Remarks on difference from estimated value in registered PDD

>> Actual emission reductions are about 10.61% less than estimated emission reductions as per registered PDD. This is due to low plant load factor (23.69% against 26.5% as mentioned in PDD) observed and more number of days under low wind season.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO₂e)	13,523	37,943

Appendix 1: Line Diagram Showing Relevant Metering Points



Appendix 2: The other salient features of the state-of-art-technology

Wind World (India) Limited 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.

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
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