

**MONITORING REPORT FORM (CDM-MR)**  
**Version 01****CONTENTS**

- A. General description of the project activity
  - A.1. Brief description of the project activity
  - A.2. Project participants
  - A.3. Location of the project activity
  - A.4. Technical description of the project
  - A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity
  - A.6. Registration date of the project activity
  - A.7. Crediting period of the project activity and related information
  - A.8. Name of responsible person(s)/entity(ies)
- B. Implementation of the project activity
  - B.1. Implementation status of the project activity
  - B.2. Revision of the monitoring plan
  - B.3. Request for deviation applied to this monitoring period
  - B.4. Notification or request of approval of changes
- C. Description of the monitoring system
- D. Data and parameters monitored
  - D.1. Data and parameters used to calculate baseline emissions
  - D.2. Data and parameters used to calculate project emissions
  - D.3. Data and parameters used to calculate leakage emissions
  - D.4. Other relevant data and parameters
- E. Emission reductions calculation
  - E.1. Baseline emissions calculation
  - E.2. Project emissions calculation
  - E.3. Leakage calculation
  - E.4. Emission reductions calculation
  - E.5. Comparison of actual emission reductions with estimates in the registered CDM-PDD
  - E.6. Remarks on difference from estimated value



**MONITORING REPORT**  
**Version 5.0 and Date 3/08/2011**  
**Title: Tungabhadra wind power project in Karnataka**  
**Project Reference No: 1268**  
**Monitoring Period - From 27/10/2008 to 30/11/2009 (including first and last day)**

**SECTION A. General description of the project activity**

**A.1. Brief description of the project activity: >>**

>>

The project activity includes development, design, engineering, procurement, finance, construction, operation and maintenance of Tungabhadra 22.8 MW wind power project (“Project”) in the Indian state of Karnataka to provide reliable, renewable power to the Karnataka state electricity grid which is part of the Southern regional electricity grid. The Project will lead to reduced greenhouse gas emissions because it displaces electricity from grid connected fossil fuel based electricity generation plants.

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 specifications of E-40 machine are given in section A.4 of the monitoring report.

The machines under the project activity were commissioned on 23 April 2007, 12 Sep 2007 & 31 Dec 2007. The expected operational lifetime of the project is for 20 years. The total emission reductions achieved under this monitoring period (27 October 2008 to 30 November 2009) is 53,951 tCO<sub>2</sub>.

**A.2. Project Participants**

>>

Enercon (India) Limited

**A.3. Location of the project activity:**

>>

The project area extends between latitude 15° 3’ 0.6’’ to 15° 5’ 58.1’’ – North and 75° 50’ 0.7’’ to 75° 52’ 58.9’’ – East.

The Project is connected to the KPTCL 110/33/11 kV substation at Bannikoppa village. The project activity is located at village Singatalur, Koralahalli and Hammigi at Mundargi in Gadag district in the state of Karnataka, India. The information in regard of the Wind Energy Generators i.e. unique identification number, location number, location details (Village, Taluk & District) & latitude & longitude are defined in the table as follows:

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



Unique Identification Number	Loc. No.	Latitude			Longitude		
		Degree	Minutes	Seconds	Degree	Minutes	Seconds
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

The project activity is located in the villages of Koralahalli, Singatalur and Hammagi. The PDD also clearly states that the project activity is located in the villages of Koralahalli, Singatalur and Hammagi in the district of Gadag.

The physical extent of the project activity given in the registered PDD is 13o 31' & 13o 45' North and longitude 76o 30' & 76o 44' East, whereas the actual physical extent extends between latitude 15°03'20.1'' & 15° 05'21.9'' North and longitude 75°50'5.3'' & 75°52'15.4'' east. This is a typological error and the correct latitude and longitude for each machine has been included in the MR. Commissioning certificates also reflect that the project activity has been implemented at the same location ie. Koralahalli, Singatalur and Hammagi villages in Mundargi taluka in the district of Gadag as described in the registered PDD. The clarification on the same has been asked from UNFCCC and UNFCCC has considered it as a typological error. Therefore EB 48, Annex 66 does not apply to the project activity as the project activity has been implemented as described in the registered PDD and no change in project activity has happened after that.

**A.4. Technical description of the project**

&gt;&gt;

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  $400\text{ V} \pm 12.5\%$ .

The other salient features of the state-of-art technology are:

- 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.

**A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:**

&gt;&gt;

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

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

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

**A.6. Registration date of the project activity:**

&gt;&gt;

27/10/2008

**A.7. Crediting period of the project activity and related information (start date and choice of crediting period):**

&gt;&gt;

Crediting period of the project activity as per registered PDD is from 27 October 2008 to 26 October 2018 (Fixed). However we have chosen the first monitoring period from 1 November 2008. This is because Joint Meter Reading is generated on 1st day of every month. Carving out generation details for 5 days i.e., from 27 October 2008 to 31 October 2008 is difficult. Hence, the project proponent wishes to forego the generation for those 5 days for the purpose of simplicity in the calculation of emission reductions during this monitoring period.

**A.8. Name of responsible person(s)/entity(ies):**

&gt;&gt;



Contact Information of Enercon (India) Limited is given in the table below:

Organization:	Enercon (India) Limited
Street/P.O.Box:	A-9, Veera Industrial Estate, Veera Desai Road, Andheri (West)
Building:	Enercon Towers
City:	Mumbai
State/Region:	Maharashtra
Postfix/ZIP:	400 053
Country:	India
Telephone:	+91-22-5522 7794
FAX:	+91-22-5692 1175
E-Mail:	<a href="mailto:a.raghavan@enerconindia.net">a.raghavan@enerconindia.net</a>
URL:	<a href="http://www.enerconindia.net">www.enerconindia.net</a>
Represented by:	
Title:	Associate Vice President
Salutation:	Mr.
Last Name:	Raghavan
Middle Name:	
First Name:	A
Department:	Corporate
Mobile:	+91-9820045724
Direct FAX:	+91-22-5692 1175
Direct tel:	+91-22-6692 4848 extn. 7169
Personal E-Mail:	<a href="mailto:a.raghavan@enerconindia.net">a.raghavan@enerconindia.net</a>

## SECTION B. Implementation of the project activity

### B.1. Implementation status of the project activity

>>

The first machine under the project activity was commissioned on 23 April 2007 and last machine under the project activity was commissioned on 31 December 2007. The project activity consists of 38 machines of Enercon make E-40. The commissioning date for all the machines include in the project activity is given in the table below.

Unique Identification Number	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



Unique Identification Number	Loc. No.	Date of Commissioning
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

Enercon operation and maintenance activities are ISO 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 machines that are included in the project activity.

**B.2. Revision of the monitoring plan**

&gt;&gt;

We have applied for the revision in monitoring plan. The same has been approved by EB on 18-Feb-2011.

**B.3. Request for deviation applied to this monitoring period**

&gt;&gt;

Not applicable

**B.4. Notification or request of approval of changes**

&gt;&gt;

Not Applicable

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

&gt;&gt;



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 33 kV 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 Enercon 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 Enercon 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:

$$Z = \frac{(X1+X2+X3...+Xn)-Y}{(X1+X2+X3...+Xn)} \times 100$$

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.

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

Here  $X_i$  represents  $X_1, X_2, X_3, \dots, X_n$  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  $X_i$  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 Enercon and the state utility.

Transmission Loss in Export ( $TE$ ) = Percentage Transmission Loss (Z) \* Energy Export at 33kV metering point ( $EG_{Export}$ )

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

Net Energy Export after adjustment of transmission loss =  $EG_{Export} - \text{Transmission Loss } (TE)$



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 Enercon 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 Enercon substation
4. Electricity supplied to the Grid [**EGexport-115%\*EGimport-TE**]

JMR is signed by the representatives of Enercon 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 Enercon substation
2. Transmission loss calculation endorsed / confirmed jointly by the representatives of Enercon 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 Enercon 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 Enercon 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 Enercon. 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 0.2% 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 0.2 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.

**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.

**Training imparted to the Personnel**

Enercon (India) Limited has been instrumental in imparting training to the persons it recruits to serve in the organisation. EIL has a separate training facility, called Enercon 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. Enercon 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:-

Meter description	Serial No.	Make	Accuracy class	Metering point	First Calibration Details	Second Calibration Details	Third Calibration Details
Main meter (Bulk Meter I)	06607369	L&T	0.2	Bannikoppa S/s 110 KV	5-Feb-2007	30-Mar-2009	25 May 2010
Check meter (Bulk Meter I)	06606801	L&T	0.2	Bannikoppa S/s 110 KV	5-Feb-2007	30-Mar-2009	25 May 2010
Main meter (Bulk Meter II)	06605135	L&T	0.2	Bannikoppa S/s 110 KV	5-Feb-2007	30-Mar-2009	25 May 2010
Check meter (Bulk Meter II)	06607373	L&T	0.2	Bannikoppa S/s 110 KV	5-Feb-2007	30-Mar-2009	25 May 2010
Main meter at 33 KV	06767626	L&T	0.2	Kapathgudd a South 33KV	11-Feb-2008	28-Feb-2009	8 Dec 2009
Check Meter at 33 KV	06767637	L&T	0.2	Kapathgudd a South 33KV	11-Feb-2008	28-Feb-2009	8 Dec 2009

- 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 each year. 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 & transmission loss and -0.2% for exports for the entire monitoring period. The correction



factor applied to meter reading can be validated from calculation of emission reductions provided in spreadsheet and section D.

- The calibration certificates for bulk main meters & check meters are not available for the year 2008 so considering Annex 60, EB 52, error factor has been applied. As per the calibration records of Bulk main meter & check meters dated 5-Feb-2007 and main meter & check meter connected at 33 kV dated 28-Feb-2009, errors were detected. So considering Annex 60, EB 52 error factor has been applied for the entire monitoring period.

The line diagrams showing all relevant monitoring points are attached as Appendix 1.

#### SECTION D. Data and parameters

>>

##### D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

<b>Data / Parameter:</b>	$EF_{OM,y}$		
Data unit:	tCO <sub>2</sub> e/MWh		
Description:	Operating Margin Emission Factor of Southern Regional Electricity Grid		
Source of data used:	<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>		
Value(s) :	2002 – 03	0.9970	
	2003 – 04	1.0094	
	2004 – 05	1.0038	
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline Emissions		
Additional comment:	None		

<b>Data / Parameter:</b>	$EF_{BM,y}$		
Data unit:	tCO <sub>2</sub> e/MWh		
Description:	Build Margin Emission Factor of Southern Regional Electricity Grid (year 2004-05)		
Source of data used:	<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>		
Value(s) :	0.7180		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline Emissions		



Additional comment:	None
---------------------	------

<b>Data / Parameter:</b>	<b><math>EF_{CM,y}</math></b>
Data unit:	tCO <sub>2</sub> e/MWh
Description:	Combined Margin Emission Factor of Southern Regional Electricity Grid (year 2004-05)
Source of data used:	“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) :	0.93204
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline Emissions
Additional comment:	None

**Data and parameters monitored:**

<b>Data / Parameter:</b>	<b>EG<sub>y</sub></b>
Data unit:	MWh (Mega-watt hour)
Description:	Net electricity supplied to the grid by the Project
Source of data to be used:	Electricity supplied to the grid as per Joint Meter Readings (Form B) taken at 33 kV metering point.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Annual electricity supplied to the grid by the Project = 57893.008 MWh
Description of measurement methods and procedures to be applied:	<p>Monitoring: The procedures for metering and meter reading will be as per the provisions of the power purchase agreement except or otherwise explicitly stated in the monitoring plan in section B.7.2 of the PDD. Metering system for the project activity consists of one main and check meter at 33 kV metering location. Both meters are <b>two-way tri-vector meters capable of recording import and export of electricity</b>.</p> <p>In addition to this there are two main and check meters (bulk meters) at 110 kV metering point at the Enercon (India) Limited (herein after referred as “Enercon”) 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 Enercon 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 Enercon substation at Bannikoppa. The transmission loss calculated by the state utility is endorsed /</p>



	<p>confirmed jointly by the representatives of Enercon 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>Frequency of recording data: Monthly</p> <p>Recording: The values of electricity supplied to the grid is sourced from JMR for 22.8 MW at 33 kV metering point.</p> <p>Responsibility: Joint responsibility of Enercon and state utility.</p>
QA/QC procedures to be applied:	QA/QC procedures will be as implemented by state utility pursuant to the provisions of the power purchase agreement except or otherwise explicitly stated in the PDD. The values of electricity supplied to the grid mentioned in the JMR for 22.8 MW for the project at 33kV metering point can be cross checked with values mentioned in the invoice raised on the state utility.
Any comment:	The data (electricity supplied to the grid) will be 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.

<b>Data / Parameter:</b>	<b>EG<sub>export</sub></b>
Data unit:	MWh (Mega-Watt hour)
Description:	Electricity Export recorded at meters (one main and one check) connecting 38 machines of the project activity.
Source of data to be used:	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 of data applied for the purpose of calculating expected emission reductions in section B.5	This value has been taken from the JMR (Form B) taken at 33kV metering point and has been applied directly. 59502.000 MWh
Description of measurement methods and procedures to be applied:	<p>Monitoring: Electricity export to the grid will be recorded by the meters (one main and one check) connecting 38 turbines at 33kV point.</p> <p>Frequency of recording data: Monthly</p> <p>Recording: The values electricity export to the grid is sourced from one JMR for 22.8 MW at 33 kV metering point.</p> <p>Responsibility: Joint responsibility of Enercon and state utility</p>
QA/QC procedures to be applied:	QA/QC procedures will be as implemented by state utility and the PP except or otherwise explicitly stated in the PDD.
Any comment:	The data will be 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.

<b>Data / Parameter:</b>	<b>EG<sub>import</sub></b>
Data unit:	MWh (Mega-Watt hour)
Description:	Electricity Import recorded at the meters (one main and one check)



	connecting 38 machines of the project activity.
Source of data to be used:	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 of data applied for the purpose of calculating expected emission reductions in section B.5	This value has been taken from the JMR (Form B) taken at 33 kV metering point and has been applied directly.  31.050 MWh
Description of measurement methods and procedures to be applied:	Monitoring: Electricity import from the grid will be recorded by meters (one main and one check) connected to the 38 machines at 33kV point.  Frequency of recording data: Monthly  Recording: The values electricity import to the grid is sourced from one JMR for 22.8 MW at 33 kV metering point.  Responsibility: Joint responsibility of Enercon and state utility
QA/QC procedures to be applied:	QA/QC procedures will be as implemented by state utility and the PP except or otherwise explicitly stated in the PDD.
Any comment:	The data will be 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.

<b>Data / Parameter:</b>	<b>T<sub>E</sub></b>
Data 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 Enercon substation.
Source of data to be used:	Transmission Loss for export have been sourced from the joint meter reading (Form B) issued by HESCOM, taken at 33kV metering point for the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This value is certified by the State utility in the JMR (Form B). This value will be directly sourced from the JMR (Form B).  1455.964 MWh
Description of measurement methods and procedures to be applied:	Monitoring: Transmission loss between metering location at 33 kV and the metering location at 110 kV at Enercon substation is applied to the meter reading taken at meters connected at 33 kV point for the project activity. Enercon 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 Enercon and the state utility.  Frequency of recording data: Monthly  Recording: The value of transmission loss is sourced from JMR for 22.8 MW at 33 kV metering point.  Responsibility: Joint responsibility of Enercon and state utility



QA/QC procedures to be applied:	QA/QC procedures will be as implemented by state utility and the PP.
Any comment:	The data will be stored in hard format and values will be taken from JMR.

The data will be stored in hard format and soft format by PP (Enercon) at the project site office. Joint meter reading is taken in the presence of the persons representing Enercon [Operation and Maintenance Contractor]. The archive will be kept for the period up to two years after the completion of the crediting period.

## SECTION E. Emission reductions calculation

### E.1. Baseline emissions calculation

>>

“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** 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 JMR (Form B) 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 (932.04 tCO<sub>2</sub>e/GWh fixed ex-ante)

Month	Export	Import	Transmission Loss	Error correction due to delayed calibration	Net Generation
	EG <sub>export</sub> [kWh]	EG <sub>import</sub> [kWh]	T <sub>E</sub> [kWh]		EG <sub>y</sub> [kWh]
Oct-08 (27-Oct-2008 to 31-Oct-2008)	0	0	0	0	0
Nov-08 (01-Nov-2008 to 30-Nov-2008)	3,267,000	0(zero)	72,728	0.20%	3,187,593
Dec-08 (01-Dec-2008 to 31-Dec-2008)	3,285,000	1,725	68,932	0.20%	3,207,632



Jan-09 (01-Jan-2009 to 31-Dec-2009)	3,490,500	1,725	73,424	0.20%	3,408,220
Feb-09 (01-Feb-2009 to 28-Feb-2009)	1,950,000	5,175	50,626	0.20%	1,890,187
Mar-09 (01-Mar-2009 to 31-Mar-2009)	1,695,000	5,175	49,005	0.20%	1,637,322
Apr-09 (01-Apr-2009 to 30-Apr-2009)	3,675,000	3,450	84,167	0.20%	3,579,858,
May-09 (01-May-2009 to 31-May-2009)	4,894,500	3,450	118,415	0.20%	4,762,602
Jun-09 (01-Jun-2009 to 30-Jun-2009)	7,362,000	0 (zero)	181,501	0.20%	7,165,412
Jul-09 (01-Jul-2009 to 31-Jul-2009)	12,034,500	1,725	339,670	0.20%	11,668,353
Aug-09 (01-Aug-2009 to 31-Aug-2009)	6,726,000	1,725	169,693	0.20%	6,540,787
Sep-09 (01-Sep-2009 to 30-Sep-2009)	4,150,500	1,725	97,810	0.20%	4,042,465
Oct-09 (01-Oct-2009 to 31-Oct-2009)	3,732,000	5,175	87,853	0.20%	3,631,322
Nov-09 (01-Nov-2009 to 30-Nov-2009)	3,240,000	0 (zero)	62,140	0.20%	3,171,256
<b>Total</b>					





					<b>57,893,008</b>
--	--	--	--	--	-------------------

**E.2. Project emissions calculation**

&gt;&gt;

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

**E.3. Leakage calculation**

&gt;&gt;

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

**E.4. Emission reductions calculation / table**

&gt;&gt;

The total emission reductions achieved during the monitoring period is 53,951 tCO<sub>2</sub>.

Total baseline emissions: 53,951 tCO<sub>2</sub>

Total project emissions: Zero

Total leakage: Zero

Emission reductions

$$\begin{aligned} \text{ER}_y &= \text{BE}_y - \text{PE}_y - \text{L}_y \\ &= 53,951 \text{ tCO}_2 \end{aligned}$$

Reading for Month	From	To	Baseline Emissions [tCO <sub>2</sub> e] BE <sub>y</sub>	Project Emissions [tCO <sub>2</sub> e] PE <sub>y</sub>	Emission Reductions [tCO <sub>2</sub> e] ER <sub>y</sub> = BE <sub>y</sub> – PE <sub>y</sub>
Oct-08	27/10/2008	31/10/2008	0	0	0
Nov-08	01/11/2008	01/12/2008	2,970	0	2,970
Dec-08	01/12/2008	01/01/2009	2,989	0	2,989
Jan-09	01/01/2009	01/02/2009	3,176	0	3,176
Feb-09	01/02/2009	01/03/2009	1,761	0	1,761
Mar-09	01/03/2009	01/04/2009	1,526	0	1,526
Apr-09	01/04/2009	01/05/2009	3,336	0	3,336
May-09	01/05/2009	01/06/2009	4,438	0	4,438
Jun-09	01/06/2009	01/07/2009	6,678	0	6,678
Jul-09	01/07/2009	01/08/2009	10,875	0	10,875
Aug-09	01/08/2009	01/09/2009	6,096	0	6,096
Sep-09	01/09/2009	01/10/2009	3,767	0	3,767
Oct-09	01/10/2009	01/11/2009	3,384	0	3,384
Nov-09	01/11/2009	01/12/2009	2,955	0	2,955
Total			53,951		53,951

Note: \* Joint Meter Reading is generated on 1<sup>st</sup> day of every month. Carving out generation details for 5 days i.e., from 27/10/2008 to 31/10/2008 is difficult. Hence, the project proponent wishes to forego the generation for those 5 days for the purpose of simplicity in the calculation of Emission reductions during this verification.



Total emissions reductions for the monitoring period are **53,951**.

**E.5. Comparison of actual emission reductions with estimates in the CDM-PDD**

&gt;&gt;

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO <sub>2</sub> e)	53,442 (13 months equivalent of annually 49,331 emission reductions estimated in the registered PDD)	53,951

**E.6. Remarks on difference from estimated value in the PDD**

&gt;&gt;

There is very minor change of 0.94% in the expected and annual emission reductions. The registered PDD also captures the change in PLF to the extent of +/-10% and therefore the change of 0.94% is within the range of sensitivity mentioned in the registered PDD.

-----

**History of the document**

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
<b>Decision Class:</b> Regulatory <b>Document Type:</b> Guideline, Form <b>Business Function:</b> Issuance		



## Appendix 1

