

# 21 MW WIND ENERGY FARM AT PALLADAM, TAMILNADU BY HZL

Document Prepared By

Hindustan Zinc Limited

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|                          |                                                                                                                                                                                                                                                                                                                             |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Title</b>     | 21 MW Wind energy farm at Palladam, TamilNadu by HZL                                                                                                                                                                                                                                                                        |
| <b>Version</b>           | 02.1                                                                                                                                                                                                                                                                                                                        |
| <b>Report ID</b>         | 1                                                                                                                                                                                                                                                                                                                           |
| <b>Date of Issue</b>     | 20-November -2013                                                                                                                                                                                                                                                                                                           |
| <b>Project ID</b>        | PL1137                                                                                                                                                                                                                                                                                                                      |
| <b>Monitoring Period</b> | 20/10/2011 to 30/11/2012 (both days included)                                                                                                                                                                                                                                                                               |
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## 1 PROJECT DETAILS

### 1.1 Summary Description of Project

Hindustan Zinc Ltd. (HZL), a vertically integrated natural resources enterprise, headquartered at Udaipur, Rajasthan having broad operations ranging from exploration, mining, ore processing to smelting of non-ferrous metals is the owner and project proponent of the proposed project activity.

The project activity primarily aims at reducing Green House Gas (GHG) emissions through utilization of renewable energy technology for generation of electrical energy. The Net electricity generated from the project activity during the monitoring period was 47,455 MWh and it displaced equivalent electricity generation in grid connected power plants. The project activity reduced the anthropogenic GHG emissions 43474 tCO<sub>2</sub>e during the monitoring period associated with the equivalent amount of electricity generation from the fossil fuel based grid connected power plants.

The project activity involves installation and operation of fourteen Suzlon make 1.5 MW Wind Turbine Generators (WTGs) by Hindustan Zinc Limited (HZL) in the state of Tamil Nadu. All the WEGs are commissioned in October 2011- February 2012. The cumulative capacity of the project activity is 21 MW. The electricity generated from the wind farm will be exported to regional Grid.

The technology employed by the project activity converts kinetic energy in wind to mechanical energy and mechanical energy to electrical energy using wind turbine generators (WEGs). In this process, there are no greenhouse gas emissions or burning of any fossil fuels. The electricity is generated through sustainable means without causing any negative effect to the environment and therefore the technology is environmentally safe and sound.

Wind turbines produce electricity by using the natural power of wind to drive a generator. Wind has considerable amount of kinetic energy when blowing at high speeds. When this kinetic energy passes through the blades of the wind turbines, it is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the connected generator also rotates, thereby producing electricity. The Project activity envisages installation of WEGs of S-82 Suzlon make (1500 kW WEGs). The WEGs generate 3-phase power at 400V, which is stepped up to 33 KV. The project can operate in the frequency range of 46–54 Hz and in the voltage range of 400 V  $\pm$  20%

Details of the commissioning of the project activity as follows;

| LOCATION No                       | Date of commissioning | Connected Load ( MW) |
|-----------------------------------|-----------------------|----------------------|
| U2176, U2177,U2178                | 20-10-2011            | 4.5 MW               |
| U2180                             | 26-12-2011            | 1.5 MW               |
| TZA-11,12,13,14,15,16,17,18,19,20 | 10-02-2012            | 15 MW                |

The total GHG emission reduction in this monitoring period 20 Oct 2011 to 30 Nov 2012 is 43,474 tCO<sub>2</sub>e.

### 1.2 Sectoral Scope and Project Type

Sectoral Scope – Energy Industries (renewable/non-renewable sources).

Project Type: Renewable Energy projects

Project activity is not a grouped project activity.

### 1.3 Project Proponent

|                   |                                                                                                 |
|-------------------|-------------------------------------------------------------------------------------------------|
| Organization name | Hindustan Zinc Limited                                                                          |
| Contact person    | Mr. Bhagwan Lal Ahuja                                                                           |
| Title             | AGM (CDM Cell)                                                                                  |
| Address           | CPP-CLZS<br>Chanderiya Lead Zinc Smelter<br>Putholi<br>Chittorgarh-312021<br>Rajasthan<br>INDIA |
| Telephone         | 91-1472-257950                                                                                  |
| Email             | <a href="mailto:Bhagwan.ahuja@vedanta.co.in">Bhagwan.ahuja@vedanta.co.in</a>                    |

## 1.4 Other Entities Involved in the Project

No other entities other than Hindustan Zinc Limited are involved

## 1.5 Project Start Date

20/10/2011, date of commissioning of first WTG

## 1.6 Project Crediting Period

Project activity has Renewable crediting period of 21 years for the CDM project.

Start date of crediting period for VCS verification: 20/10/2011 (Date of commissioning of first WTG)

End date of crediting period for VCS verification: 30/11/2012 (Date one day prior to the start date of crediting period of CDM project activity)

## 1.7 Project Location

The project activity consists of Fourteen 1.5 MW wind turbines in the district of Tiruppur in the state of Tamil Nadu, India

Details of the location of the project activity:

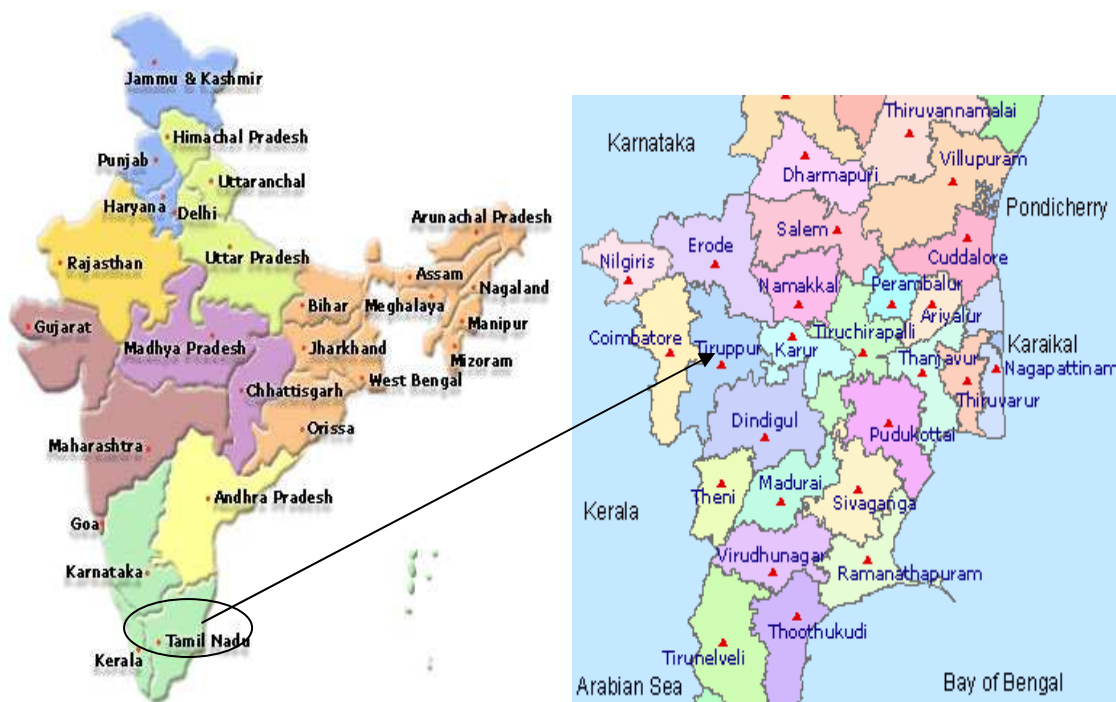
| Sr. No. | WTG. No. | Village         |
|---------|----------|-----------------|
| 1       | KD176    | Suriyanallur    |
| 2       | KDE80    | Suriyanallur    |
| 3       | TAY52    | Karukkanpalayam |
| 4       | TAY54    | Nelali          |
| 5       | KDE84    | Nelali          |
| 6       | TAY29    | Kozhumankuli    |

|    |        |                   |
|----|--------|-------------------|
| 7  | Q165   | Kundadam          |
| 8  | Q132   | Kundadam          |
| 9  | Q133   | Kundadam          |
| 10 | KDE92  | Uthiyur           |
| 11 | TAY46  | Nelali            |
| 12 | TAY48  | Nelali            |
| 13 | TAY47  | Nelali            |
| 14 | KD 112 | Nandavanampalayam |

The specific geographical coordinates of the individual WEGs are as follows:

| Sr. No. | WTG. No. | Latitude     | Longitude    |
|---------|----------|--------------|--------------|
| 1       | KD176    | N 10 52 02.9 | E 77 27 31.8 |
| 2       | KDE80    | N 10 54 07.8 | E 77 29 11.2 |
| 3       | TAY52    | N 10 56 12.0 | E 77 29 07.2 |
| 4       | TAY54    | N 10 55 34.0 | E 77 28 46.5 |
| 5       | KDE84    | N 10 54 35.0 | E 77 29 27.6 |
| 6       | TAY29    | N 10 52 26.0 | E 77 29 30.2 |
| 7       | Q165     | N 10 51 43.3 | E 77 25 52.6 |
| 8       | Q132     | N 10 52 57.4 | E 77 24 51.9 |
| 9       | Q133     | N 10 52 58.2 | E 77 25 11.3 |
| 10      | KDE92    | N 10 54 21.7 | E 77 30 22.5 |
| 11      | TAY46    | N 10 55 38.7 | E 77 29 38.1 |
| 12      | TAY48    | N 10 55 38.5 | E 77 29 59.3 |
| 13      | TAY47    | N 10 51 9.5  | E 77 23 57.6 |
| 14      | KD 112   | N 10 55 18.7 | E 77 30 2.1  |

The project activity location is delineated in the maps given below:



## 1.8 Title and Reference of Methodology

Title of the baseline methodology: “Consolidated Baseline Methodology for grid connected electricity generation from renewable sources”.

**Reference:** ACM0002, Version 12.3.0 (EB 66), Sectoral Scope: 01

The following tools and guidance’s have been followed (References):

1. Tool to calculate the emission factor for an electricity system (Version 02.2.1)
2. Tool for the demonstration and assessment of additionality (Version 06.0.0)

## 1.9 Other Programs

### 1.9.1 Emissions Trading Programs and Other Binding Limits

This project activity is voluntary initiative of HZL and it is not to meet any local laws or regulatory compliances. HZL has submitted an undertaking that they shall not claim for GHG emission reduction credits for the given period (20/10/11 – 30/11/12) under any other emission trading program.

### 1.9.2 Other Forms of Environmental Credit

The project activity generates Carbon Credits under Clean Development Mechanism (Ref.No:8198) from 01/12/2012 ; however the VCUs that are claimed are from the date of commissioning till 30 /11/2012 since, the project is registered on 16/11/2012 but the crediting period under CDM starts only on 01/12/2012. Project proponent has submitted an undertaking to the VVB that they shall not claim for GHG emission reduction credits for the given period under any other emission trading program.”

## 1.9.3 Participation under Other GHG Programs

The project activity under consideration here has already been registered under the Clean Development Mechanism of UNFCCC. The requisite details are provided below:

CDM Project Reference # - 8198

Project Title: **21 MW Wind energy farm at Palladam, TamilNadu by HZL**

Weblink: <http://cdm.unfccc.int/Projects/DB/DNV-CUK1352807242.64/view>

Project Proponent: Hindustan Zinc Limited

## 2 IMPLEMENTATION STATUS

### 2.1 Implementation Status of the Project Activity

Start date is 20/10/2011 (commissioning date of first WTG)

Details of the project activity are as follows;

| LOCATION No                       | Date of commissioning | Connected Load ( MW) |
|-----------------------------------|-----------------------|----------------------|
| U2176, U2177,U2178                | 20-10-2011            | 4.5 MW               |
| U2180                             | 26-12-2011            | 1.5 MW               |
| TZA-11,12,13,14,15,16,17,18,19,20 | 10-02-2012            | 15 MW                |

The project promoter signed operation and maintenance agreements with the O & M contractor of the wind turbines. The performance of the turbines, safety in operation and scheduled / breakdown maintenances is the responsibility of O & M contractor and are organized and monitored by them, hence the authority and responsibility of project management on site lies with the O & M contractor will maintains all the data / records for the project monitoring. Suzlon Energy Limited is the O&M contractor for the project activity.

During the monitoring period no such events or situations occurred which could impact on the actual operation of the project activity.

During the monitoring period (20/10/2011- 30/11/2012) the project activity was operated and monitored in accordance with the applicable baseline and monitoring methodology ACM0002, Version 12.3.0 and registered PDD.

All the WEGs are in operation and No abnormal circumstance occurred during this monitoring period. Suzlon operation and maintenance activities are ISO 9001:2008 certified and all the events are recorded in the log book available at the project site. As a part of regular maintenance the machines are stopped for mechanical and electrical maintenance.

As per the VCS guidelines 'if the energy generating equipment is transferred from another activity, leakage is to be considered'. In the project activity, there is no transfer of energy generating equipment and therefore the leakage from the project activity is considered as zero

There are no changes like project proponent or other entities during the monitoring period

## 2.2 Deviations

### 2.2.1 Methodology Deviations

There is no methodology deviation involved in the project activity.

### 2.2.2 Project Description Deviations

There is no deviation involved in the Project Description. .

## 2.3 Grouped Project

There is no grouping involved in the project activity.

## 3 DATA AND PARAMETERS

### 3.1 Data and Parameters Available at Validation

|                                                                                              |                                                                                                                                                                                                                                                                                                                                                   |        |
|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Data / Parameter                                                                             | EF <sub>grid,OM,y</sub>                                                                                                                                                                                                                                                                                                                           |        |
| Data unit                                                                                    | tCO2/MWh                                                                                                                                                                                                                                                                                                                                          |        |
| Description                                                                                  | Operating Margin emission factor for Southern grid                                                                                                                                                                                                                                                                                                |        |
| Source of data                                                                               | Referred from CO <sub>2</sub> Baseline Database for the Indian Power Sector prepared by Central Electricity Authority Version 6.0.                                                                                                                                                                                                                |        |
| Value applied:                                                                               | 0.9671 tCO <sub>2</sub> /MWh                                                                                                                                                                                                                                                                                                                      |        |
| Justification of choice of data or description of measurement methods and procedures applied | The operating margin emission factor has been published by CEA in accordance with the ‘Tool to calculate the emission factor for an electricity system.” The option of ex ante calculation based on Simple Operating Margin Method have been applied using a three year generation weighted average (2007-08, 2008-09 and 2009-10) as given below |        |
|                                                                                              | <b>Operating Margin Estimation for Southern Grid (tCO<sub>2</sub> / MWh)</b>                                                                                                                                                                                                                                                                      |        |
|                                                                                              | OM, 2007-08                                                                                                                                                                                                                                                                                                                                       | 0.9909 |
|                                                                                              | OM, 2008-09                                                                                                                                                                                                                                                                                                                                       | 0.9729 |
|                                                                                              | OM, 2009-10                                                                                                                                                                                                                                                                                                                                       | 0.9415 |
|                                                                                              | Net Electricity Generated (GWh), 2007-08                                                                                                                                                                                                                                                                                                          | 114634 |
|                                                                                              | Net Electricity Generated (GWh), 2008-09                                                                                                                                                                                                                                                                                                          | 121471 |
|                                                                                              | Net Electricity Generated                                                                                                                                                                                                                                                                                                                         | 134717 |

|                     |                                                                             |               |
|---------------------|-----------------------------------------------------------------------------|---------------|
|                     | (GWh), 2009-10                                                              |               |
|                     | <b>Average OM (<math>EF_{grid, OM,y}</math>)</b>                            | <b>0.9671</b> |
| Purpose of the data | Baseline calculations                                                       |               |
| Comments            | This value is determined ex-ante and will be fixed for the crediting period |               |

|                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                                             | $EF_{grid,BM,y}$                                                                                                                                                                                                                                                                                                                                                                                                      |
| Data unit                                                                                    | tCO <sub>2</sub> /MWh                                                                                                                                                                                                                                                                                                                                                                                                 |
| Description                                                                                  | Build Margin emission factor for Southern grid                                                                                                                                                                                                                                                                                                                                                                        |
| Source of data                                                                               | Referred from CO <sub>2</sub> Baseline Database for the Indian Power Sector prepared by Central Electricity Authority Version 6.0.                                                                                                                                                                                                                                                                                    |
| Value applied:                                                                               | 0.7634 tCO <sub>2</sub> /MWh                                                                                                                                                                                                                                                                                                                                                                                          |
| Justification of choice of data or description of measurement methods and procedures applied | The build margin emission factor has been published by CEA in accordance with the 'Tool to calculate the emission factor for an electricity system.' The build margin is calculated as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation. The build margin has been taken corresponding to the year 2009-10, the latest year for which data is available. |
| Purpose of the data                                                                          | Baseline calculations                                                                                                                                                                                                                                                                                                                                                                                                 |
| Comments                                                                                     | This value is determined ex-ante and will be fixed for the crediting period                                                                                                                                                                                                                                                                                                                                           |

| Data / Parameter                                                                             | $EF_{grid,CM,y}/EF_{CO_2,grid,y}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                      |  |                                        |               |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|--|----------------------------------------|---------------|
| Data unit                                                                                    | tCO <sub>2</sub> /MWh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                      |  |                                        |               |
| Description                                                                                  | Combined Margin CO <sub>2</sub> emission factor for Southern grid                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                      |  |                                        |               |
| Source of data                                                                               | Estimated figure based on 75% of OM and 25% of BM values                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                      |  |                                        |               |
| Value applied:                                                                               | 0.9161 tCO <sub>2</sub> /MWh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                      |  |                                        |               |
| Justification of choice of data or description of measurement methods and procedures applied | <p>The combined margin emission factor has been determined based on data published by the CEA, applying a 75% weightage for <math>EF_{grid, OM,y}</math> and 25% for <math>EF_{grid,BM,y}</math> in accordance with the 'Tool to calculate the emission factor for an electricity system.'</p> <table border="1"> <tr> <th colspan="2">Combined Margin Estimation for Southern Grid (tCO<sub>2</sub>/MWh)</th></tr> <tr> <td>Operating Margin (<math>EF_{grid, OM,y}</math>)</td><td><b>0.9671</b></td></tr> </table> | Combined Margin Estimation for Southern Grid (tCO <sub>2</sub> /MWh) |  | Operating Margin ( $EF_{grid, OM,y}$ ) | <b>0.9671</b> |
| Combined Margin Estimation for Southern Grid (tCO <sub>2</sub> /MWh)                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                      |  |                                        |               |
| Operating Margin ( $EF_{grid, OM,y}$ )                                                       | <b>0.9671</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                      |  |                                        |               |

|                     |                                                                             |               |
|---------------------|-----------------------------------------------------------------------------|---------------|
|                     | <b>Build Margin (<math>EF_{grid, BM, y}</math>)</b>                         | <b>0.7634</b> |
|                     | <b>Combined Margin (<math>EF_{CO2, grid, y}</math>)</b>                     | <b>0.9161</b> |
| Purpose of the data | Baseline calculations                                                       |               |
| Comments            | This value is determined ex-ante and will be fixed for the crediting period |               |

## 3.2 Data and Parameters Monitored

|                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                | $EG_{BL, y}$ ( <b><math>EG_{y \text{ export}} - EG_{y \text{ import}}</math></b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Data unit                                                       | MWh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Description                                                     | Net electricity exported to the southern grid by the project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Source of data                                                  | Statements issued by TANGEDCO earlier known as TNEB to the project proponent on electricity generation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Description of measurement methods and procedures to be applied | <p>Statements issued by TANGEDCO earlier known as TNEB to the project proponent on electricity generation will report the net electricity export, <math>EG_{BL, y}</math>.</p> <p>Energy meters of 0.2 accuracy class provided at each WTG continuously measure the export as well as the import from the turbine at the project site. The net electricity exported shall be calculated by subtracting import from the export values measured for each WTG. The total net electricity exported by the project activity will be calculated as the sum of the net electricity exported from each WTG.</p> <p>Meter readings will be taken monthly by the representative of the TANGEDCO earlier known as TNEB. The detailed monitoring plan and personnel responsible is described in section 3.3</p> |
| Frequency of monitoring/recording                               | <p>Measured: Continuously</p> <p>Reporting Frequency: Monthly (Calculated)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Value monitored:                                                | 47455.546 MWh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Monitoring equipment                                            | Energy meter installed on each WEG. Details of the meters mentioned in Annexure 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| QA/QC procedures to be applied                                  | The values can be cross checked with the invoice raised by the project proponent/supplier to TANGEDCO earlier known as TNEB for the electricity supplied to the southern grid.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Purpose of the data                                             | <i>Calculation of baseline emissions</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Calculation method                                              | The net electricity exported calculated by subtracting import from the export values measured for each WTG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Comments                                                        | The data will be kept for two years after the crediting period or from last issuance. The values are monitored ex-post and VERs are                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|  |                       |
|--|-----------------------|
|  | calculated at actual. |
|--|-----------------------|

|                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                | <b>EG<sub>y</sub> export</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Data unit                                                       | MWh                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Description                                                     | Electricity exported to the state electricity board by the project activity                                                                                                                                                                                                                                                                                                                                                                                                          |
| Source of data                                                  | Statements issued by TANGEDCO earlier known as TNEB to the project proponent on electricity generation                                                                                                                                                                                                                                                                                                                                                                               |
| Description of measurement methods and procedures to be applied | Statements issued by TANGEDCO earlier known as TNEB to the project proponent on electricity generation will report the electricity exported EG <sub>y</sub> export.<br><br>Energy meters of 0.2 accuracy class installed at each WTG will continuously measure the electricity exported by the WTG. TANGEDCO earlier known as TNEB officials will take down monthly reading of the energy meters. The detailed monitoring plan and personnel responsible is described in section 3.3 |
| Frequency of monitoring/recording                               | Continuous measurement and monthly recording                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Value monitored:                                                | <b>47745.144</b> MWh                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Monitoring equipment                                            | Energy meter installed on each WEG. Details of the meters mentioned in Annexure 1.                                                                                                                                                                                                                                                                                                                                                                                                   |
| QA/QC procedures to be applied                                  | In order to ensure the optimum accuracy levels the monitoring equipments used for measuring the parameter will be calibrated at least once in three years.                                                                                                                                                                                                                                                                                                                           |
| Purpose of the data                                             | <i>Calculation of baseline emissions</i>                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Calculation method                                              | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Comments                                                        | The data will be kept for two years after the crediting period or from last issuance.                                                                                                                                                                                                                                                                                                                                                                                                |

|                                                                 |                                                                                                                                                                      |
|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                | <b>EG<sub>y</sub> import</b>                                                                                                                                         |
| Data unit                                                       | MWh                                                                                                                                                                  |
| Description                                                     | Electricity imported from the southern grid. This is a monitored parameter.                                                                                          |
| Source of data                                                  | Statements issued by TANGEDCO earlier known as TNEB to the project proponent on electricity generation                                                               |
| Description of measurement methods and procedures to be applied | Statements issued by TANGEDCO earlier known as TNEB to the project proponent on electricity generation will report the electricity imported, EG <sub>y</sub> import. |

|                                   |                                                                                                                                                                                                                                                                                                        |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| applied                           | Energy meters of 0.2 accuracy class installed at each WTG will measure the electricity imported by WTG continuously. TANGEDCO earlier known as TNEB officials will take down monthly reading of the energy meters. The detailed monitoring plan and personnel responsible is described in section 3.3. |
| Frequency of monitoring/recording | Continuous measurement and monthly recording                                                                                                                                                                                                                                                           |
| Value monitored:                  | <b>289.598 MWh</b>                                                                                                                                                                                                                                                                                     |
| Monitoring equipment              | Energy meters installed on each WEG. Details of the meters mentioned in Annexure 1.                                                                                                                                                                                                                    |
| QA/QC procedures to be applied    | In order to ensure the optimum accuracy levels the monitoring equipments used for measuring the parameter will be calibrated at least once in three years.                                                                                                                                             |
| Purpose of the data               | <i>Calculation of baseline emissions</i>                                                                                                                                                                                                                                                               |
| Calculation method                | Not applicable                                                                                                                                                                                                                                                                                         |
| Comments                          | The data will be kept for two years after the crediting period or from last issuance.                                                                                                                                                                                                                  |

### 3.3 Description of the Monitoring Plan

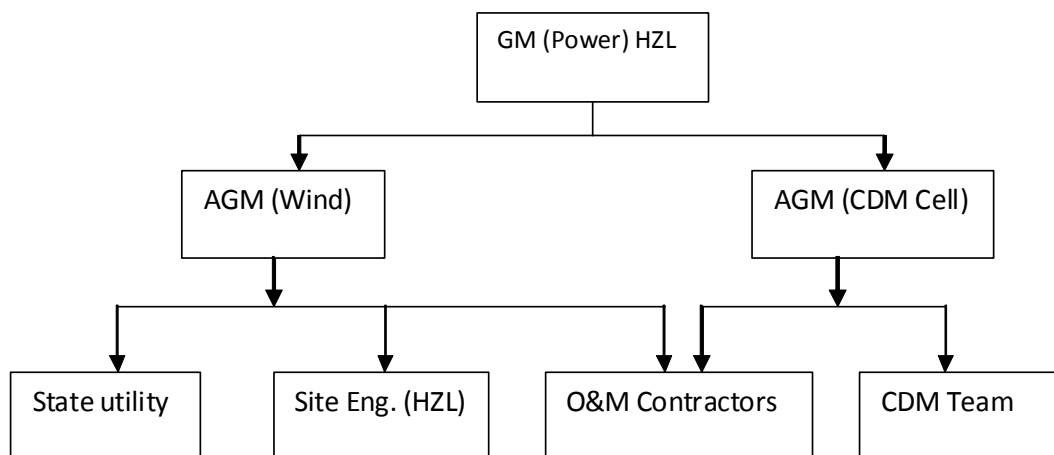
The purpose of the monitoring plan is to define the organizational structure of the monitoring team, monitoring practices, QA and QC procedures and archiving procedures. The monitoring plan will ensure that the emission reductions from the project activity are reported accurately and transparently.

#### Roles and Responsibilities of the Monitoring Team

The authority and responsibility of project management as well as registration, monitoring, measurement and reporting lies with HZL. The project proponent has formulated a Monitoring Team to ensure proper and continuous monitoring of the emission reductions as well as performance of turbines and generation of power.

To ensure trouble free operation of all the wind turbines, HZL has entered into a comprehensive Operation and Maintenance agreement with the manufactures of the turbines. The contractor, Suzlon Infrastructure Limited, would be responsible for the operation and maintenance of the WTGs. The O&M personnel are qualified engineers and are trained at the WEG manufacturing facility of Suzlon Infrastructure Limited.

The monitoring will interact with the O&M contractors as well as the State Utility officials for executing the monitoring plan. The structure of the Monitoring Team is as follows:



| Monitoring Team              | Roles & Responsibilities                                                                                                                                                                                       |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General Manager (Power), HZL | <ul style="list-style-type: none"> <li>Communication with CDM EB</li> <li>Communication with state utility</li> </ul>                                                                                          |
| AGM (CDM Cell), HZL          | <ul style="list-style-type: none"> <li>Overall coordination with monitoring team and DOE for verification activities</li> <li>Maintaining data records, documentation and archiving</li> </ul>                 |
| CDM Team                     | <ul style="list-style-type: none"> <li>Assisting the General Manager (Wind) with overall coordination and with maintaining data records, documentation, archiving etc.</li> </ul>                              |
| AGM (Wind) HZL               | <ul style="list-style-type: none"> <li>Coordinating with Site Engineer, O&amp;M operators, and State Utility</li> </ul>                                                                                        |
| Site Engineer, HZL           | <ul style="list-style-type: none"> <li>Overseeing monitoring, operation and maintenance activities at site</li> <li>Interacting with State Utility and O&amp;M contractors for JMRs and calibration</li> </ul> |
| O&M contractors              | <ul style="list-style-type: none"> <li>Carrying out operation &amp; maintenance of WTGs</li> <li>Carrying out joint meter readings with state utility</li> </ul>                                               |
| State Utility                | <ul style="list-style-type: none"> <li>Carrying out joint meter readings with representative of project proponent (O&amp;M contractors)</li> <li>Calibration of energy meters</li> </ul>                       |

#### Quality control and Quality Assurance procedures:

##### Calibration Procedures:

Energy meters are installed at each WTG for monitoring the energy exported and imported. The energy meters shall be tested for accuracy at least once in three years with reference to a portable standard meter. The meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.2 accuracy class. The data registered by the energy meter will be adopted for the purpose of emission reduction calculation as long as the error in the main meter is within permissible limits. If the energy meter is found to be beyond the permissible limits of error, TANGEDCO earlier known as TNEB officials shall be notified for rectification or replacement of the meter. The rectified / replaced energy meter would be calibrated.

##### Data collection and archiving

Monthly data is collected and maintained in hard copy (copies of TANGEDCO earlier known as TNEB statements). The project proponent shall keep complete and accurate records of all the data as a part of monitoring for at least a period of 2 years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

## 4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

### 4.1 Baseline Emissions

Baseline emissions (BE<sub>y</sub> in tCO<sub>2</sub>e) are the product of the baseline emissions factor (EF<sub>y</sub> in tCO<sub>2</sub>/MWh) times the electricity supplied by the project activity to the grid (EG<sub>y</sub> in MWh) as described in registered PDD.

$$BE_y = EF_y * EG_y$$

Where,

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

**EG<sub>y</sub>** Net Quantity of Electricity exported to TANGEDCO earlier known as TNEB facility

**EF<sub>y</sub>** grid emission factor, i.e. 0.9161 t CO<sub>2</sub>/MWh (it has been fixed ex-ante)

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

$$= 47745.144 - 289.598$$

$$= 47455.546 \text{ MWh}$$

| Month                      | Electricity exported to the state electricity board by the project activity EG <sub>y</sub> export | Electricity imported from the southern grid by the project activity EG <sub>y</sub> import | Net electricity exported to the southern grid by the project EGBL, y | Emission Factor | Baseline Emissions |
|----------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-----------------|--------------------|
|                            | kWh                                                                                                | kWh                                                                                        | MWh                                                                  |                 | tCO <sub>2</sub> e |
| 20-Oct-2011 to 31-Oct-2011 | 14620                                                                                              | 3760                                                                                       | <b>11</b>                                                            | 0.9161          | 10                 |
| 31-Oct-2011 to 08-Nov-2011 | 4140                                                                                               | 2400                                                                                       | <b>2</b>                                                             |                 | 2                  |
| 08-Nov-2011 to 08-Dec-2011 | 87440                                                                                              | 9080                                                                                       | <b>78</b>                                                            |                 | 72                 |
| 08-Dec-2011 to 08-Jan-2012 | 111020                                                                                             | 8620                                                                                       | <b>102</b>                                                           |                 | 94                 |
| 08-Jan-2012 to 08-Feb-2012 | 172800                                                                                             | 8360                                                                                       | <b>164</b>                                                           |                 | 151                |
| 08-Feb-2012 to 08-Mar-12   | 218840                                                                                             | 7920                                                                                       | <b>211</b>                                                           |                 | 193                |

|                            |             |        |              |          |
|----------------------------|-------------|--------|--------------|----------|
| 26-Dec-2011 to 27-Dec-2012 | 48          | 72     | <b>0</b>     | 0        |
| 27-Dec-2011 to 08-Jan-2012 | 20640       | 696    | <b>20</b>    | 18       |
| 08-Jan-2012 to 08-Feb-2012 | 45048       | 3384   | <b>42</b>    | 38       |
| 08-Feb-2012 to 08-Mar-2012 | 48528       | 2760   | <b>46</b>    | 42       |
| 10-Feb-2012 to 13-Feb-2012 | 42816       | 4104   | <b>39</b>    | 35       |
| 13-Feb-2012 to 08-Mar-2012 | 528720      | 19200  | <b>510</b>   | 467      |
| 08-Mar-2012 to 08-Apr-2012 | 890000      | 49632  | <b>840</b>   | 770      |
| 08-Apr-2012 to 08-May-2012 | 2101700     | 41676  | <b>2060</b>  | 1887     |
| 08-May-2012 to 08-Jun2012  | 7432944     | 13592  | <b>7419</b>  | 6797     |
| 08-Jun2012 to 08-Jul-2012  | 9846108     | 3396   | <b>9843</b>  | 9017     |
| 08-Jul-2012 to 08-Aug-2012 | 10102912    | 6148   | <b>10097</b> | 9250     |
| 08-Aug-2012 to 08-Sep-2012 | 9045324     | 6940   | <b>9038</b>  | 8280     |
| 08-Sep-2012 to 08-Oct-2012 | 5493504     | 19336  | <b>5474</b>  | 5015     |
| 08-Oct-2012 to 08-Nov-2012 | 1280536     | 45868  | <b>1235</b>  | 1131     |
| 08-Nov2012 to 30-Nov-2012  | 257455.7333 | 32654  | <b>225</b>   | 206      |
| Total                      | 47745144    | 289598 | 47456        | 43474.03 |

So,

$$BE_y = 47\,456.55 \times 0.9161$$

$$= 43\,474.03 \text{ tCO}_2$$

$$= 43\,474 \text{ tCO}_2 \text{ (Round down to nearest integer)}$$

## 4.2 Project Emissions

There are no Project emissions from the project activity

## 4.3 Leakage

There are no leakage emissions from the project activity

## 4.4 Summary of GHG Emission Reductions and Removals

$$BE_y = EF_y \times EG_y$$

= 47 455.546 \*0.9161

= 43 474 (Value is rounded down, please refer ER calculation sheet for the same)

According to the approved methodology ACM0002 (Version 12.3.0, EB 66, Annex 35) Emission Reductions are calculated as:-

**ER<sub>y</sub> = BE<sub>y</sub> – PE<sub>y</sub>**

= 43 474 – 0

**= 43 474 tCO<sub>2</sub>e**

| Year         | Baseline emissions or removals (tCO <sub>2</sub> e) | Project emissions or removals (tCO <sub>2</sub> e) | Leakage emissions (tCO <sub>2</sub> e) | Net GHG emission reductions or removals (tCO <sub>2</sub> e) |
|--------------|-----------------------------------------------------|----------------------------------------------------|----------------------------------------|--------------------------------------------------------------|
| Year 2011    | 233.97                                              | 0                                                  | 0                                      | 233.97                                                       |
| Year 2012    | 43240.05                                            | 0                                                  | 0                                      | 43240.05                                                     |
| <b>Total</b> | 43474                                               | 0                                                  | 0                                      | 43474                                                        |

## Appendix -1

### Meter details:-

| Sr. No. | Location | HTSC No. | Accuracy Class | Main meter | Check meter |
|---------|----------|----------|----------------|------------|-------------|
| 1       | TAY29    | TZA 11   | 0.2            | TN 901795  | TN 902631   |
| 2       | KDE 80   | TZA 12   | 0.2            | TN 901793  | TN 902632   |
| 3       | KD 176   | TZA 20   | 0.2            | HT 2110564 | TN 90633    |
| 4       | TAY 52   | TZA 18   | 0.2            | TN 901794  | TN 902630   |
| 5       | TAY 54   | TZA 19   | 0.2            | TN 901802  | TN 902641   |
| 6       | KDE 84   | TZA 13   | 0.2            | TN 901798  | TN 902634   |
| 7       | KDE 92   | TZA 14   | 0.2            | TN 901797  | TN 902629   |
| 8       | TAY46    | TZA 17   | 0.2            | TN 902614  | TN 902615   |
| 9       | TAY 48   | TZA 16   | 0.2            | TN 901801  | TN 902616   |
| 10      | TAY 47   | TZA 15   | 0.2            | TN 901803  | TN 902611   |
| 11      | Q132     | U2178    | 0.2            | HT 2110435 | HT2110707   |
| 12      | Q133     | U2177    | 0.2            | HT 2110438 | HT2110688   |
| 13      | Q165     | U2176    | 0.2            | HT 2110427 | HT2110686   |
| 14      | KD 112   | 2180     | 0.2            | HT 2110426 | TN902664    |