

# Wind Power Project by HZL in Gujarat



Document Prepared By EKI Energy Services Limited

|                          |                                                                                                                                                                                                                                                                                                                   |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Title</b>     | Wind Power Project by HZL in Gujarat                                                                                                                                                                                                                                                                              |
| <b>Version</b>           | 02                                                                                                                                                                                                                                                                                                                |
| <b>Report ID</b>         | -                                                                                                                                                                                                                                                                                                                 |
| <b>Date of Issue</b>     | 19-10-2018                                                                                                                                                                                                                                                                                                        |
| <b>Project ID</b>        | PL 344                                                                                                                                                                                                                                                                                                            |
| <b>Monitoring Period</b> | 01-Nov-2013 to 31-Dec-2016 (inclusive of both days)                                                                                                                                                                                                                                                               |
| <b>Prepared By</b>       | Mr. Bhaskar Dutta                                                                                                                                                                                                                                                                                                 |
| <b>Contact</b>           | Manager Operations – GHG Services<br>EKI Energy Services Limited<br>Email ID : bhaskar@enkingint.org<br>T +91 731 42 89 086, M +91 9109916710<br>Address: Office no. 201, Plot 48, Scheme 78 part 2, Vijay Nagar<br>Indore - 452010 (M.P, India) Website <a href="http://www.enkingint.org">www.enkingint.org</a> |

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## 1 PROJECT DETAILS

### 1.1 Summary Description of the Implementation Status of the 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 envisages implementation of an 88.8 MW wind power project consisting of 111 WTGs of individual capacity 0.8 MW at Samana Site in Gujarat, India. The project activity is in line with the sustainable development priority of the country. The electricity generated from the wind farm will be exported to the regional electricity grid and sold to the state electricity utility thereby marginally contributing to reducing the energy demand supply gap in the state of Gujarat.

Enercon India Limited has supplied the wind energy technology to HZL. WTG is ingeniously devised to convert kinetic energy from the "air in motion" directly into electricity without using conventional sources like coal, oil or natural gas for power generation. The project activity implements gearless Enercon E-48 and E48SL WTGs with synchronous generator, pitch regulation, low cut-in speed and aerodynamic braking system.

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 111 WTGs of E-48 and E-48 SL Enercon make (800 kW WTGs). The WTGs 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%.

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

WTGs installed in the project activity are as follows:

| LOCATION   | Date of commissioning | Connected Load (MW) | Phase |
|------------|-----------------------|---------------------|-------|
| Sadodar-I  | 13/03/2007            | 3.2                 | Ph I  |
| Sadodar-II | 21/03/2007            | 0.8                 | Ph I  |
| Fulnath    | 13/03/2007            | 7.2                 | Ph I  |

|              |            |     |        |
|--------------|------------|-----|--------|
| Methan-1     | 24/03/2007 | 4   | Ph I   |
| Methan-2(A)  | 24/03/2007 | 6.4 | Ph I   |
| Methan-2(B)  | 24/03/2007 | 9.6 | Ph I   |
| Mevasa       | 21/03/2007 | 7.2 | Ph I   |
| Sadodar-I    | 13/09/2007 | 2.4 | Ph II  |
| Sadodar-II   | 01/09/2007 | 0.8 | Ph II  |
| Sadodar-III  | 01/09/2007 | 4.8 | Ph II  |
| Fulnath-I    | 28/09/2007 | 2.4 | Ph II  |
| Methan-2(A)  | 01/09/2007 | 4.8 | Ph II  |
| Dhun-Dhoraji | 28/09/2007 | 6.4 | Ph II  |
| Narmana      | 30/09/2007 | 12  | Ph II  |
| Jamwadi-01   | 16/02/2008 | 2.4 | Ph III |
| Jamwadi-02   | 16/02/2008 | 1.6 | Ph III |
| Jamwadi-03   | 16/02/2008 | 4.8 | Ph III |
| Narmana-02   | 16/02/2008 | 4   | Ph III |
| Laloi        | 29/03/2008 | 4   | Ph III |

Technical specifications of the project activity are as follows:

**E-48 and E-48 SL TECHNICAL DATA**

Rated capacity: 800 kW

Rotor diameter: E-48 - 48 m

E-48SL – 52.9 m

Hub height: E-48 - 56.85m

E-48 SL – 75 m

**Rotor with Pitch Control**

Type: Upwind rotor with active pitch control

Direction of rotation: Clockwise

Number of blades: 3

Swept area: E-48 - 1810 m<sup>2</sup>

E-48 SL – 2198 m<sup>2</sup>

Blade material: Fiberglass (reinforced epoxy) with integral lightning protection

Rotor speed: Variable, 16-31.5 rpm

Tip speed: E-48 - 41 - 78 m/s

E-48 SL – 33-80 m/s

Pitch control: Continuous variable pitching mechanism

**Generator: Synchronous - Type**

This is a multi-pole variable speed generator. Due to this and Power electronics the Gear Box which steps up the speed to meet the speed of Induction Generator is eliminated resulting in reduced transmission losses, and elimination of wear and tear of the Gear Box and oil leakage associated with it.

Hub: Casted Steel

Bearings: Tapered roller bearings

Grid Feeding: AC-DC-AC through Convertor - Invertor

Braking System: 3 independent Aero Brakes with power back up supply.

Yaw Control: Active through adjustment gears, friction damping

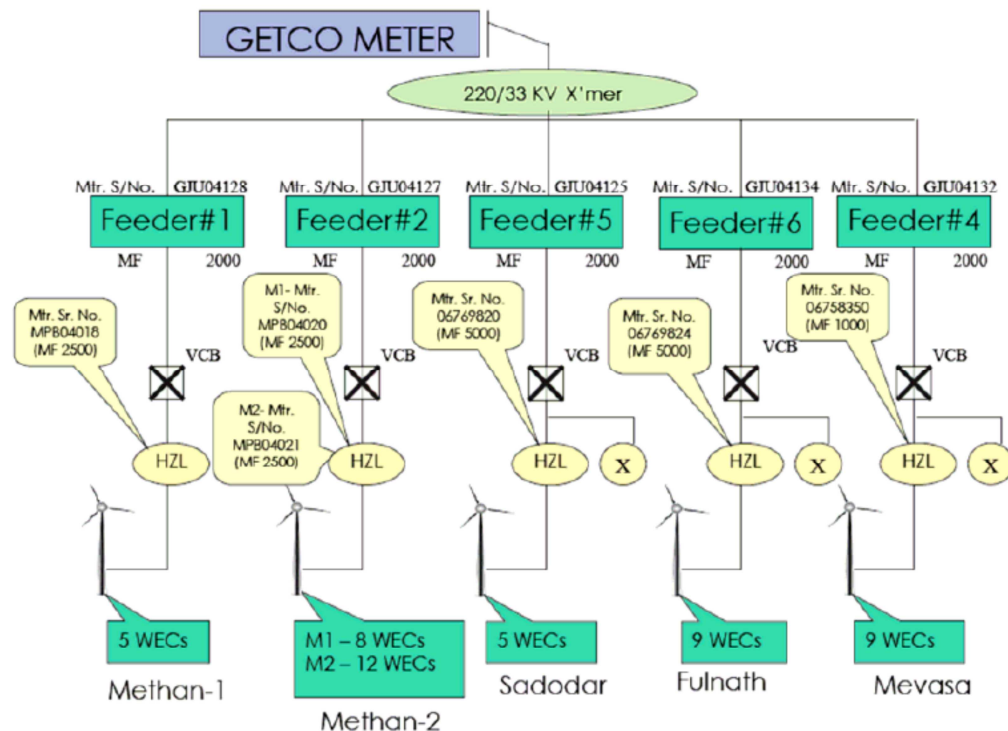
Cut-in Wind Speed: 3 m/s

Rated Wind Speed: 12 m/s

Tower: E-48 - Steel Tubular, 56 m height

E-48 SL – Concrete, 74 m height

The electricity metered at the GETCO meter is proportionally divided among the customers connected to the meter on the basis of the prorata readings taken at the VCB end. The emission reduction calculations are done on the basis of the GETCO Main meter reading (net electricity exported to the grid) after deducting imports from the grid as mentioned in the share certificate issued by GEDA on monthly basis. The following figure illustrates the metering arrangement for the HZL project activity. The figure is illustrative of the metering arrangement and does not depict total wind farm size.



The total GHG emission reduction in this monitoring period 1<sup>st</sup> Nov 2013 to 31<sup>st</sup> Dec 2016 (inclusive of both dates) is 404,826 tCO<sub>2</sub>e.

## 1.2 Sectoral Scope and Project Type

**Sectoral Scope 01:** Energy Industries (renewable/non-renewable).

**Project Type:** I- Renewable Energy Projects

### 1.3 Project Proponent

|                   |                                                                                             |
|-------------------|---------------------------------------------------------------------------------------------|
| Organization name | Hindustan Zinc Limited                                                                      |
| Contact person    | Mr. V. Jayaraman                                                                            |
| Title             | VP & Head (EOHS)                                                                            |
| Address           | CPP-CLZS<br>Chanderiya Lead Zinc Smelter, Putholi<br>Chittorgarh-312021, Rajasthan<br>INDIA |
| Telephone         | 91-1472-257950                                                                              |
| Email             | <a href="mailto:v.jayaraman@vedanta.co.in">v.jayaraman@vedanta.co.in</a>                    |

### 1.4 Other Entities Involved in the Project

|                     |                                                                                                       |
|---------------------|-------------------------------------------------------------------------------------------------------|
| Organization name   | EKI Energy Services Limited                                                                           |
| Role in the project | Project Consultant                                                                                    |
| Contact person      | Mr. Manish Dabkara                                                                                    |
| Title               | MD & CEO                                                                                              |
| Address             | Enking Embassy, Office no. 201, Plot 48, Scheme 78 part 2,<br>Vijay Nagar, Indore-452010 (M.P, India) |
| Telephone           | +91 99 07 53 4900                                                                                     |
| Email               | <a href="mailto:manish@enkingint.org">manish@enkingint.org</a>                                        |

### 1.5 Project Start Date

13/03/2007 date of commissioning of first WTG

### 1.6 Project Crediting Period

This is the second monitoring under VCS and covers the activity from 01/11/2013 to 31/12/2016 (inclusive of both dates).

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

VCS crediting period is 13/03/2007 to 12/03/2017 (first crediting period) and it will be renewed twice till end date of CDM crediting period.

Start date of crediting period for VCS verification: 13/03/2007 (Date of commissioning of first WTG)

## 1.7 Project Location

Host Party India

District Jamnagar

Taluk – Kalavad Jamjodhpur

Site Samana

Village Methan, DhunDhoraji, Sadodar, Laloi, Narmana, Hariparmvasa, Bagadhara and Jamwadhi

The nearest airport and railway station is at Jamnagar city which is located at a distance of approximately 60kms from the project activity site

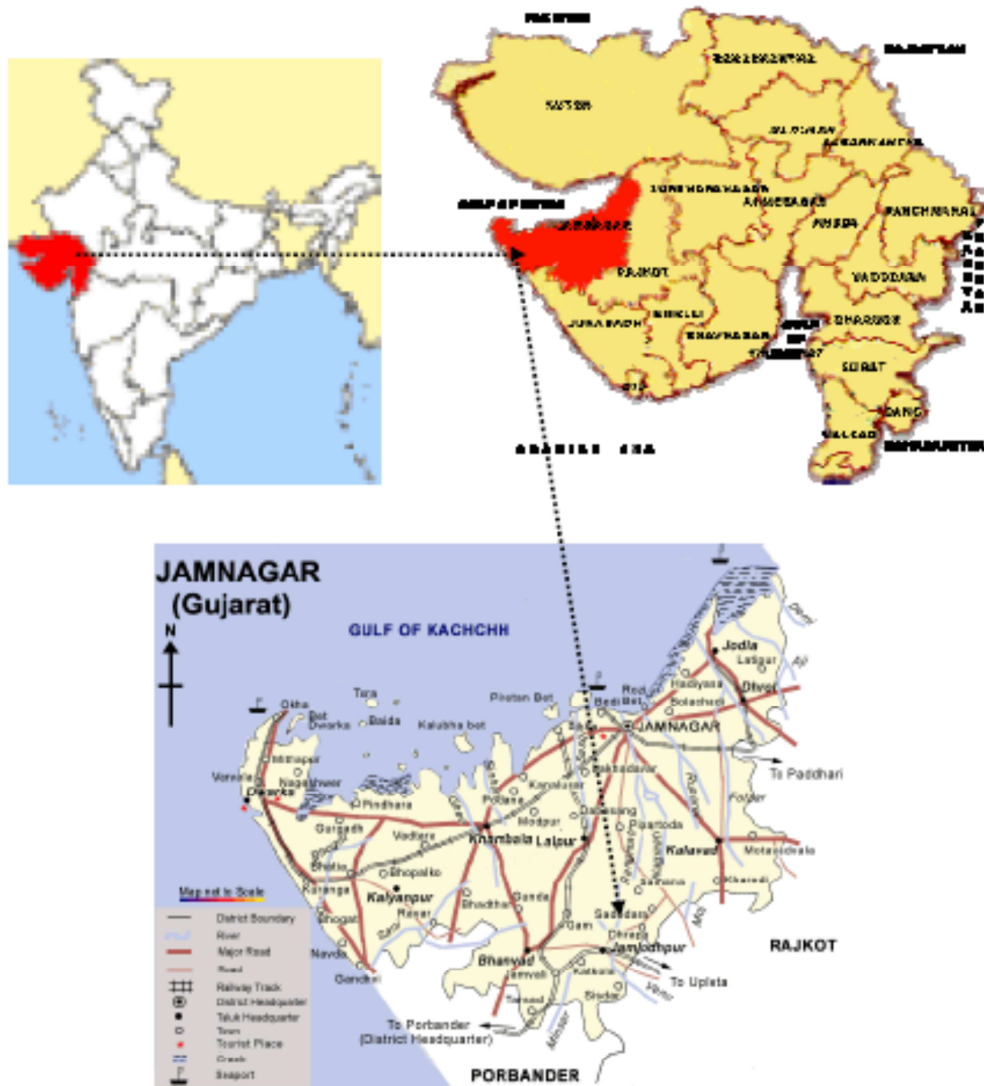
The following table illustrates the WTG wise details of location:

| S.N o. | Loc. | Latitude (N) | Longitude (E) | Taluka      | Village | Land Survey | Control Cabinet Nos. |
|--------|------|--------------|---------------|-------------|---------|-------------|----------------------|
| 1      | 160  | 22°01'59.9"  | 70°14'36.2"   | Jam-Jodhpur | Sadodar | 410         | 1773                 |
| 2      | 161  | 22°02'06.9"  | 70°14'33.5"   |             |         | 410         | 1797                 |
| 3      | 162  | 22°02'13.1"  | 70°14'31.3"   |             |         | 410         | 1749                 |
| 4      | 163  | 22°02'18.9"  | 70°14'28.5"   |             |         | 410         | 1794                 |
| 5      | 164  | 22°03'08.8"  | 70°13'51.2"   |             |         | 410         | 1821                 |
| 6      | 165  | 22°03'02.1"  | 70°13'55.7"   |             |         | 410         | 1747                 |
| 7      | 166  | 22°02'57.1"  | 70°13'58.5"   |             |         | 410         | 1757                 |
| 8      | 167  | 22°02'49.9"  | 70°14'01.3"   |             |         | 410         | 1774                 |
| 9      | 174  | 22°02'01.5"  | 70°14'15.7"   |             |         | 410         | 1739                 |
| 10     | 175  | 22°01'56.4"  | 70°14'11.8"   |             |         | 410         | 1763                 |
| 11     | 176  | 22°01'50.6"  | 70°14'06.3"   |             |         | 410         | 1787                 |
| 12     | 205  | 22°03'03.0"  | 70°13'02.6"   |             |         | 410         | 1884                 |
| 13     | 209  | 22°02'17.3"  | 70°12'24.8"   |             |         | 410         | 1916                 |
| 14     | 210  | 22°02'09.6"  | 70°12'28.3"   |             |         | 410         | 1718                 |
| 15     | 216  | 22°01'11.4"  | 70°12'44.7"   | Jam-Jodhpur | Methan  | 284         | 2050                 |
| 16     | 217  | 22°01'04.8"  | 70°12'42.7"   |             |         | 284         | 1894                 |
| 17     | 218  | 22°00'58.2"  | 70°12'43.5"   |             |         | 284         | 1809                 |
| 18     | 219  | 22°00'25.3"  | 70°12'36.8"   |             |         | 284         | 1717                 |
| 19     | 220  | 22°00'19.2"  | 70°12'41.0"   |             |         | 284         | 1706                 |
| 20     | 177  | 22°01'44.3"  | 70°14'05.8"   |             |         | 284         | 1827                 |
| 21     | 178  | 22°01'37.5"  | 70°14'04.2"   |             |         | 284         | 1826                 |
| 22     | 181  | 21°59'59.8"  | 70°13'49.8"   |             |         | 284         | 1832                 |
| 23     | 182  | 22°00'06.1"  | 70°13'41.2"   |             |         | 284         | 1813                 |
| 24     | 183  | 22°00'13.0"  | 70°13'34.0"   |             |         | 284         | 1803                 |
| 25     | 185  | 22°00'19.5"  | 70°13'27.9"   |             |         | 284         | 1792                 |

|    |     |             |             |             |              |     |      |
|----|-----|-------------|-------------|-------------|--------------|-----|------|
| 26 | 190 | 22°00'51.6" | 70°13'16.8" |             |              | 284 | 1780 |
| 27 | 191 | 22°00'58.0" | 70°13'11.6" |             |              | 284 | 1788 |
| 28 | 230 | 22°00'51.4" | 70°11'26.4" |             |              | 284 | 1991 |
| 29 | 231 | 22°00'55.7" | 70°11'25.5" |             |              | 284 | 1708 |
| 30 | 232 | 22°01'04.3" | 70°11'26.9" |             |              | 284 | 1790 |
| 31 | 233 | 22°01'11.3" | 70°11'29.7" |             |              | 284 | 1804 |
| 32 | 234 | 22°01'25.2" | 70°11'32.4" |             |              | 284 | 1786 |
| 33 | 179 | 21°59'40.8" | 70°14'06.7" | Jam-Jodhpur | Baghdara     | 441 | 1811 |
| 34 | 180 | 21°59'46.5" | 70°14'01.3" |             |              | 441 | 1791 |
| 35 | 184 | 22°00'06.3" | 70°13'17.6" |             |              | 441 | 1807 |
| 36 | 186 | 22°00'25.2" | 70°13'21.7" |             |              | 441 | 1801 |
| 37 | 187 | 22°00'32.9" | 70°13'16.5" |             |              | 441 | 1765 |
| 38 | 188 | 22°00'37.7" | 70°13'12.2" |             |              | 441 | 1685 |
| 39 | 901 | 22°00'14.5" | 70°12'45.8" |             |              | 441 | 1727 |
| 40 | 142 | 22°01'01.5" | 70°15'32.5" | Kalawad     | Mevasa       | 137 | 1972 |
| 41 | 143 | 22°00'56.2" | 70°15'38.0" |             |              | 137 | 1963 |
| 42 | 144 | 22°00'49.7" | 70°15'39.1" |             |              | 137 | 1969 |
| 43 | 145 | 22°0'43.0"  | 70°15'41.5" |             |              | 137 | 1994 |
| 44 | 147 | 22°00'40.1" | 70°15'20.5" |             |              | 137 | 1985 |
| 45 | 149 | 22°00'59.1" | 70°15'19.1" |             |              | 137 | 1964 |
| 46 | 150 | 22°00'48.5" | 70°15'05.9" |             |              | 137 | 1987 |
| 47 | 151 | 22°00'56.5" | 70°15'03.6" |             |              | 137 | 1770 |
| 48 | 902 | 22°01'01.3" | 70°14'57.5" |             |              | 137 | 1874 |
| 49 | 133 | 22°03'55.8" | 70°14'54.0" | Kalawad     | Dhun-Dhoraji | 220 | 2185 |
| 50 | 134 | 22°04'03.7" | 70°14'53.9" |             |              | 220 | 2190 |
| 51 | 135 | 22°04'09.5" | 70°14'46.2" |             |              | 220 | 2194 |
| 52 | 136 | 22°04'15.9" | 70°14'42.6" |             |              | 220 | 2210 |
| 53 | 137 | 22°04'23.2" | 70°14'35.6" |             |              | 220 | 2201 |
| 54 | 139 | 22°04'13.6" | 70°14'25.4" |             |              | 220 | 2196 |
| 55 | 140 | 22°04'07.3" | 70°14'30.0" |             |              | 220 | 2207 |
| 56 | 141 | 22°04'01.3" | 70°14'36.4" |             |              | 220 | 2204 |
| 57 | 157 | 22°01'27.8" | 70°14'20.5" | Jam-Jodhpur | Methan       | 284 | 2179 |
| 58 | 158 | 22°01'34.0" | 70°14'24.3" |             |              | 284 | 2192 |
| 59 | 159 | 22°01'38.7" | 70°14'24.7" |             |              | 284 | 2195 |
| 60 | 192 | 22°01'35.4" | 70°13'18.1" |             |              | 284 | 2041 |
| 61 | 193 | 22°01'43.7" | 70°13'17.4" |             |              | 284 | 2127 |
| 62 | 194 | 22°01'50.5" | 70°13'16.6" |             |              | 284 | 2130 |
| 63 | 212 | 22°01'39.2" | 70°12'18.3" |             |              | 284 | 2188 |
| 64 | 213 | 22°01'32.4" | 70°12'20.2" |             |              | 284 | 2356 |
| 65 | 214 | 22°01'24.1" | 70°12'25.3" |             |              | 284 | 2174 |
| 66 | 215 | 22°01'17.9" | 70°12'28.4" |             |              | 284 | 2169 |

|     |     |             |             |             |         |            |      |
|-----|-----|-------------|-------------|-------------|---------|------------|------|
| 67  | 168 | 22°02'41.8" | 70°14'04.3" | Jam-Jodhpur | Sadodar | 410        | 2193 |
| 68  | 169 | 22°02'35.2" | 70°14'03.5" |             |         | 410        | 2186 |
| 69  | 170 | 22°02'29.8" | 70°14'06.2" |             |         | 410        | 2200 |
| 70  | 195 | 22°01'57.7" | 70°13'21.5" |             |         | 410        | 2139 |
| 71  | 196 | 22°02'04.6" | 70°13'20.5" |             |         | 410        | 2129 |
| 72  | 197 | 22°02'12.1" | 70°13'18.0" |             |         | 410        | 2172 |
| 73  | 206 | 22°03'10.3" | 70°13'06.1" |             |         | 410        | 2121 |
| 74  | 207 | 22°02'30.2" | 70°12'20.4" |             |         | 410        | 2171 |
| 75  | 208 | 22°02'23.7" | 70°12'21.4" |             |         | 410        | 2136 |
| 76  | 235 | 22°04'10.1" | 70°11'28.4" |             |         | 410        | 2155 |
| 77  | 236 | 22°04'17.3" | 70°11'24.2" |             |         | 410        | 2161 |
| 78  | 237 | 22°04'23.1" | 70°11'18.4" |             |         | 410        | 2154 |
| 79  | 238 | 22°04'27.5" | 70°11'12.8" |             |         | 410        | 2161 |
| 80  | 240 | 22°04'33.1" | 70°10'25.9" | Jam-Jodhpur | Narmana | 20 and 190 | 2257 |
| 81  | 241 | 22°04'27.3" | 70°10'27.4" |             |         | 20 and 190 | 2213 |
| 82  | 243 | 22°04'14.1" | 70°10'21.2" |             |         | 20 and 190 | 2249 |
| 83  | 244 | 22°04'06.2" | 70°10'14.7" |             |         | 20 and 190 | 2316 |
| 84  | 245 | 22°04'28.8" | 70°10'11.2" |             |         | 20 and 190 | 2247 |
| 85  | 246 | 22°04'39.0" | 70°10'13.0" |             |         | 20 and 190 | 2225 |
| 86  | 247 | 22°04'33.7" | 70°09'53.9" |             |         | 20 and 190 | 2282 |
| 87  | 248 | 22°04'26.9" | 70°09'38.4" |             |         | 20 and 190 | 2220 |
| 88  | 249 | 22°04'20.6" | 70°09'37.0" |             |         | 20 and 190 | 2222 |
| 89  | 250 | 22°04'13.9" | 70°09'35.6" |             |         | 20 and 190 | 2208 |
| 90  | 251 | 22°04'07.5" | 70°09'35.6" |             |         | 20 and 190 | 2223 |
| 91  | 257 | 22°04'41.4" | 70°08'44.9" |             |         | 20 and 190 | 2288 |
| 92  | 258 | 22°04'47.1" | 70°08'47.8" |             |         | 20 and 190 | 2304 |
| 93  | 259 | 22°04'53.7" | 70°08'45.6" |             |         | 20 and 190 | 2352 |
| 94  | 260 | 22°05'05.0" | 70°08'48.0" |             |         | 20 and 190 | 2365 |
| 95  | 261 | 22°05'09.4" | 70°08'46.0" |             |         | 20 and 190 | 2344 |
| 96  | 266 | 22°04'58.3" | 70°06'06.6" | Jam-Jodhpur | Laloi   | 139        | 2348 |
| 97  | 268 | 22°05'18.7" | 70°05'55.0" |             |         | 139        | 2376 |
| 98  | 269 | 22°05'14.6" | 70°06'10.7" |             |         | 139        | 2390 |
| 99  | 270 | 22°05'22.4" | 70°06'07.9" |             |         | 139        | 2399 |
| 100 | 271 | 22°05'41.6" | 70°06'01.4" |             |         | 139        | 2353 |
| 101 | 32  | 22°08'29.2" | 70°18'55.7" | Kalawad     | Jamwadi | 164        | 2285 |
| 102 | 33  | 22°08'37.1" | 70°18'56.9" |             |         | 164        | 2224 |
| 103 | 34  | 22°08'43.5" | 70°18'54.3" |             |         | 164        | 2273 |
| 104 | 41  | 22°08'21.4" | 70°17'53.3" |             |         | 164        | 2277 |
| 105 | 42  | 22°08'15.2" | 70°18'04.0" |             |         | 164        | 2281 |
| 106 | 44  | 22°07'37.9" | 70°17'56.1" |             |         | 164        | 2227 |
| 107 | 45  | 22°07'32.0" | 70°17'55.6" |             |         | 164        | 2340 |

|     |    |             |             |  |  |     |      |
|-----|----|-------------|-------------|--|--|-----|------|
| 108 | 46 | 22°07'27.4" | 70°17'56.9" |  |  | 164 | 2357 |
| 109 | 47 | 22°07'52.7" | 70°17'40.7" |  |  | 164 | 2231 |
| 110 | 48 | 22°07'58.2" | 70°17'34.6" |  |  | 164 | 2221 |
| 111 | 49 | 22°08'04.0" | 70°17'23.5" |  |  | 164 | 2252 |



## 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 06 (19th May, 2006), Sectoral scope: 1. It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC CDM website (<http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>). Tool: Tool for the demonstration and assessment of additionality (Version 04)

## 1.9 Other Programs

The project has been registered with UNFCCC having registration number 1856<sup>1</sup>. However the project will avail either CDM or VCS revenues for any monitoring period to avoid any double accounting. Also it can be crosschecked that PP is not claiming REC benefits, the same can be verified with the REC accreditation body of India<sup>2</sup>.

## 1.10 Sustainable Development

The National CDM Authority (NCDMA), which is the Designated National Authority (DNA) for the Government of India (GOI) under the Ministry of Environment and Forests (MoEF), has mentioned four indicators for the sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM) projects from India<sup>3</sup>. Thus the project's contribution towards sustainable development has been addressed based on the following sustainable development aspects:

### Social well being

- Contribution to the development of an otherwise underdeveloped area.
- Generation of employment opportunities for local people during various phases of the project activity.

### Economical well being

- Since, the project uses renewable wind resources for power generation it does not lead to any emissions in the environment.
- Avoiding further depletion of the already over-exploited, limited non-renewable sources like coal, oil, etc.

### Environmental well-being:

- The project activity generates clean and green power thus causing negligible emissions of greenhouse gases. In the absence of the project activity, equivalent power would have been generated based on the fossil fuels resulting in more Green House Gas emissions into the atmosphere.
- The project activity has reduced the dependence on fossil fuels for power generation thus conserving the natural reserves. The project has led to greenhouse gas emission reduction and hence contributed in mitigating climate change.

### Technological well being

---

<sup>1</sup><http://cdm.unfccc.int/Projects/DB/BVQI1211956663.14/view>

<sup>2</sup>[https://recregistryindia.nic.in/index.php/general/publics/accredited\\_regens\\_pdf](https://recregistryindia.nic.in/index.php/general/publics/accredited_regens_pdf)

<sup>3</sup>[http://www.cdmindia.in/approval\\_process.php](http://www.cdmindia.in/approval_process.php)

- The technology selected for the power project would use well established Horizontal Pelton type turbines and the project activity would promote the use of such technology.

## 2 IMPLEMENTATION STATUS

### 2.1 Implementation Status of the Project Activity

Start date is 13/03/2007 (commissioning date of first WTG)

Details of the project activity are as follows:

| LOCATION     | Date of commissioning | Connected Load (MW) | Phase |
|--------------|-----------------------|---------------------|-------|
| Sadodar-I    | 13/03/2007            | 3.2                 | Ph I  |
| Sadodar-II   | 21/03/2007            | 0.8                 | Ph I  |
| Fulnath      | 13/03/2007            | 7.2                 | Ph I  |
| Methan-1     | 24/03/2007            | 4                   | Ph I  |
| Methan-2(A)  | 24/03/2007            | 6.4                 | Ph I  |
| Methan-2(B)  | 24/03/2007            | 9.6                 | Ph I  |
| Mevasa       | 21/03/2007            | 7.2                 | Ph I  |
| Sadodar-I    | 13/09/2007            | 2.4                 | Ph II |
| Sadodar-II   | 01/09/2007            | 0.8                 | Ph II |
| Sadodar-III  | 01/09/2007            | 4.8                 | Ph II |
| Fulnath-I    | 28/09/2007            | 2.4                 | Ph II |
| Methan-2(A)  | 01/09/2007            | 4.8                 | Ph II |
| Dhun-Dhoraji | 28/09/2007            | 6.4                 | Ph II |

|            |            |     |        |
|------------|------------|-----|--------|
| Narmana    | 30/09/2007 | 12  | Ph II  |
| Jamwadi-01 | 16/02/2008 | 2.4 | Ph III |
| Jamwadi-02 | 16/02/2008 | 1.6 | Ph III |
| Jamwadi-03 | 16/02/2008 | 4.8 | Ph III |
| Narmana-02 | 16/02/2008 | 4   | Ph III |
| Laloi      | 29/03/2008 | 4   | Ph III |

To ensure trouble free operations and efficient generations through all the wind turbines, HZL has entered into a comprehensive Operation and Maintenance agreement with the manufactures of the turbines. The contractor EIL, under the O&M contract with HZL would be responsible for the operation and maintenance of the project activity for the entire crediting period.

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

All the WTGs are in operation and No abnormal circumstance occurred during this monitoring period. EIL operation and maintenance activities are ISO 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

No methodology deviation is applied during the monitoring period.

### 2.2.2 Project Description Deviations

According to point 2 of paragraph 3.6.1 of the VCS Standard Version 3.4, 'Where the deviation does not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario, and the project remains in compliance with the applied methodology, the

deviation shall be described and justified in the monitoring report. This shall include a description of when the changes occurred and the reasons for the changes.'

The Monitoring plan described in the CDM registered PDD includes parameters like  $EG_{y,Export}$ ,  $EG_{y,Import}$ ,  $EG_{WEG}$  and  $EG_{VCB}$ . However, these parameters do not be utilized in the calculation of the emission reductions, as emission reductions has been claimed against the net electricity supplied to the State Electricity Grid and are calculated from the Share Certificates issued by GETCO. So these parameters has been removed from the data and parameters monitored, since these does not have direct impact upon the project activity emission reductions. A monthly meter reading taken jointly by state utility and PP representative is recorded in the Share Certificate issued by GETCO (State Electricity Board). The net electricity exported to the grid is the difference of export and the import measured through the main meter, however the Share Certificate issued by GETCO only provides the value of net electricity feed to the State Grid. The invoices rise on the basis of Share Certificates and after cross verification the payment issued by DISCOM. These values are used in ER calculation which can be cross verified from invoices.

Also as per the registered monitoring plan, the meters has to be tested annually, however as per the State Electricity Board norms, (vide Ref no. GUVNL/Com/CFM(IPP)/GETCO:290 dated 10/02/2010) all the energy meters has to be calibrated once in 3 years, and the same practice is being followed at site. However, as per 3.6.1.2 of VCS standard 3.4, this deviation is not impacting the applicability of the methodology, additionality or the appropriateness of the baseline scenario, and the project remains in compliance with the applied methodology.

## 2.3 Grouped Project

Not applicable as the project is not a group project.

## 2.4 Safeguards

### 2.4.1 No Net Harm

The project activity does not cause any harm to the local ecology. It primarily requires the installation of the wind power project, interfacing the generators with the State Electricity Board by setting up HT transmission lines and installation of other accessories.

Also as per the Central Pollution Control Board of India notification<sup>4</sup> wind project falls under White Category and are practically non-polluting.

However, there are no negative impacts on air, water, soil quality and ambience are envisaged due to the project activity.

### 2.4.2 Local Stakeholder Consultation

The project proponents organized stakeholders meeting in order to take into account the concerns of the nearby villagers regarding the project implementation. As a part of continuous feedback from stakeholders, there were no other major comments or protest raised by the

<sup>4</sup> [http://envfor.nic.in/sites/default/files/Latest\\_118\\_Final\\_Directions.pdf](http://envfor.nic.in/sites/default/files/Latest_118_Final_Directions.pdf)

stakeholders and they were totally in support for setting up of these kinds of projects in the region. The PP also placed a grievance register onsite in where the stakeholder can put down his/her complain and the same if found genuine will be addressed immediately.

### 3 DATA AND PARAMETERS

#### 3.1 Data and Parameters Available at Validation

|                                                                                              |                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                                             | EF <sub>OM,y</sub>                                                                                                                                                                                             |
| Data unit                                                                                    | tCO <sub>2</sub> /MWh                                                                                                                                                                                          |
| Description                                                                                  | Operating Margin emission factor for western regional grid                                                                                                                                                     |
| Source of data                                                                               | Referred from CO <sub>2</sub> Baseline Database Version 3.0 for the Indian Power Sector prepared by Central Electricity Authority.                                                                             |
| Value applied                                                                                | 1.003                                                                                                                                                                                                          |
| Justification of choice of data or description of measurement methods and procedures applied | CEA has Calculated it as per ACM0002 with 3 years vintage data (2004-05, 2005-06 and 2006-07) and option of ex ante calculation based on Simple Operating Margin Method. Computed once during PD finalization. |
| Purpose of the data                                                                          | For the calculation of the Baseline Emission                                                                                                                                                                   |
| Comments                                                                                     | The data will be archived for two years beyond the crediting period.                                                                                                                                           |

|                                                                                              |                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                                             | EF <sub>BM,y</sub>                                                                                                                                                                                                                                                                                   |
| Data unit                                                                                    | tCO <sub>2</sub> /MWh                                                                                                                                                                                                                                                                                |
| Description                                                                                  | Build Margin emission Factor for western regional grid                                                                                                                                                                                                                                               |
| Source of data                                                                               | Referred from CO <sub>2</sub> Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 3.0.                                                                                                                                                                  |
| Value applied                                                                                | 0.59                                                                                                                                                                                                                                                                                                 |
| Justification of choice of data or description of measurement methods and procedures applied | CEA has Calculated it as per ACM0002 for the year 2006-07. The build margin is calculated in this database as the average emissions intensity of the 20% most recent capacity additions in the grid based on net generation and option of ex ante calculation. Computed once during PD finalization. |
| Purpose of the data                                                                          | For the calculation of the Baseline Emission                                                                                                                                                                                                                                                         |
| Comments                                                                                     | The data will be archived for two years beyond the crediting period.                                                                                                                                                                                                                                 |

|                  |                                                                             |
|------------------|-----------------------------------------------------------------------------|
| Data / Parameter | EF <sub>y</sub>                                                             |
| Data unit        | tCO <sub>2</sub> /MWh                                                       |
| Description      | Combined Margin CO <sub>2</sub> emission factor for western regional grid   |
| Source of data   | Estimated figure based on 75% of OM and 25% of BM values, CEA, Version 3.0. |

|                                                                                              |                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Value applied                                                                                | 0.9011                                                                                                                                                                                    |
| Justification of choice of data or description of measurement methods and procedures applied | CEA has calculated it as per ACM0002 with 3 years vintage data and option of ex ante calculation based on "75% of OM and 25% of BM values approach. Computed once during PD finalization. |
| Purpose of the data                                                                          | For the calculation of the Baseline Emission                                                                                                                                              |
| Comments                                                                                     | The data will be archived for two years beyond the crediting period.                                                                                                                      |

### 3.2 Data and Parameters Monitored

|                                                                 |                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data / Parameter                                                | EG <sub>y</sub>                                                                                                                                                                                                                                                           |
| Data unit                                                       | MWh                                                                                                                                                                                                                                                                       |
| Description                                                     | Net quantity of electricity exported to GUVNL facility                                                                                                                                                                                                                    |
| Source of data                                                  | Share certificate issued by GETCO monitored from the main meter                                                                                                                                                                                                           |
| Description of measurement methods and procedures to be applied | Electricity exported to GUVNL will be measured at the main meter connected to the incoming feeder of GUVNL. The procedures for metering will be as per the provisions of the power purchase agreement.                                                                    |
| Frequency of monitoring/recording                               | Measured: Continuously<br>Reporting Frequency: Monthly (Calculated)                                                                                                                                                                                                       |
| Value monitored                                                 | 449,258.61                                                                                                                                                                                                                                                                |
| Monitoring equipment                                            | Energy Meters of Accuracy class 0.2. Please refer Annex 1 for detailed schedule of Calibration                                                                                                                                                                            |
| QA/QC procedures to be applied                                  | Regular calibration of all the meters undertaken yearly and faulty meters replaced immediately.<br>It is to be noted here that due to delay in calibration, error factor has been applied on net electricity values to retain conservativeness for the month of Sep 2016. |
| Purpose of the data                                             | Calculation of Baseline emissions                                                                                                                                                                                                                                         |
| Calculation method                                              | Net electricity exported = Total electricity exported – Total electricity imported. However the Share Certificate only mentions the value of net electricity supplied to the Grid                                                                                         |
| Comments                                                        | The data will be kept for two years after the end of the crediting period or from last issuance. The values shall be monitored ex-post and CERs will be calculated at actual.                                                                                             |

### 3.3 Monitoring Plan

The monitoring plan has been devised as per approved consolidated monitoring methodology ACM0002 - "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources" version.6.

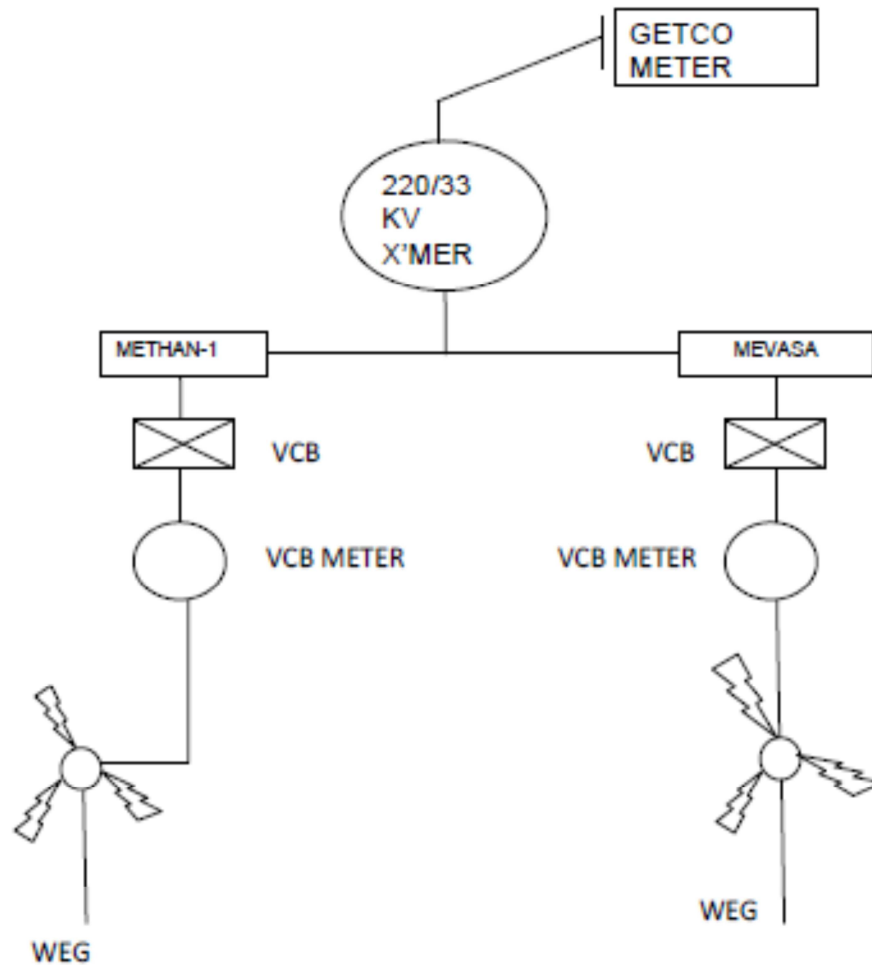
The methodology requires monitoring of the following parameters:

1. Electricity generation from the proposed project activity ( $EG_v$ )
2. Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (ACM0002);
3. Data needed to recalculate the build margin emission factor, if needed, consistent with “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”(ACM0002);

For the project activity to establish its creditable emission reduction, it has to record the actual electricity generation, which would displace equivalent units of electricity at the operating and build margin of the grid. Since, the simple OM emission factor is calculated based on a 3 year average, based on the most recent statistics available at the time of PD preparation, its updating based on ex post monitoring is not required. For BM calculation, option 1 (refer ACM 0002) has been chosen, which is calculated ex ante based on the most recent information, hence its monitoring is also not required. Hence, under the monitoring protocol for the project it is required to monitor and record the electricity generated and exported by the wind farm to the regional grid.

#### **Reading and correction of meters:**

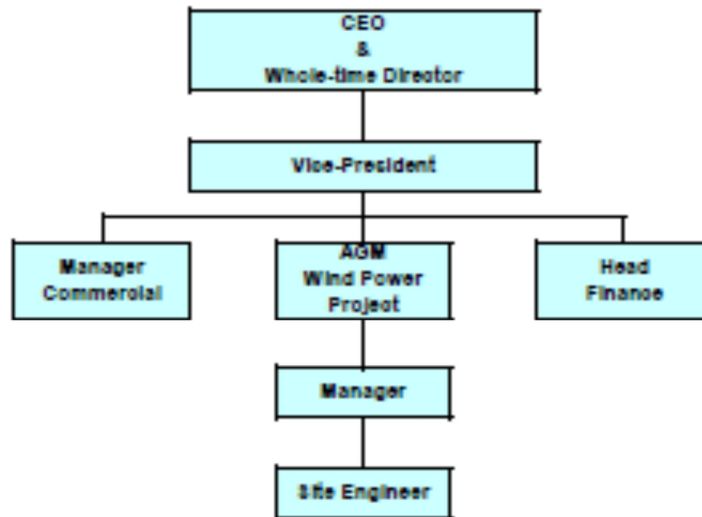
- a. As the WTGs are owned by more than one investor at the site, the ABT compliant meter at the pooling sub-station installed by GETCO on 33/220 KV side. A tri vector meter installed in each of the VCB metering yard. At the end of the month, GETCO give in respect of HZL, a statement of active energy injection and reactive energy drawl of their WTGs. This statement is the final measurement of the energy supplied to the GUVNL/DISCOM by the company for the preceding month for the purpose of payment.
- b. The WTGs of a single customer (HZL in this case) at a particular site are connected to a Vacuum Circuit Breaker metering yard (VCB) which in turn connects to a feeder that ultimately leads to the shared main GETCO meter at the substation maintained by WWIL. Data monitoring takes place at the VCB metering yard and WTG (through the SCADA system). The electricity metered at the GETCO meter is proportionally divided among the customers connected to the meter on the basis of the prorata readings taken at the VCB end. The emission reduction calculations are done on the basis of the GETCO Main meter reading (net electricity exported to the grid) after deducting imports from the grid.
- c. In case of conspicuous failures like burning of meter and erratic display of metered parameters and when the error found in testing of meter is beyond the permissible limit of error provided in the relevant standard, the meter immediately replaced with a correct meter.



Note: Arrangement of two VCBs connected with main line is shown. Other VCBs are connected similarly. Total 111 WEGs are connected to 16 VCB feeders and VCB's are connected to 5 Main meters of GETCO.

Sealing and maintenance of meters: I. The GETCO meter sealed in the presence of representatives of HZL / WWIL and GETCO. II. Any meter seal(s) broken only by the GETCO representative in the presence of WWIL/HZLs representative whenever the main metering system or the 33kV metering system is to be inspected, tested, adjusted, repaired or replaced. III. The GETCO meter at the substation will be calibrated yearly. Records: WWIL maintain an accurate and up-to-date operating log at the project site with records of: I. 24 Hours logs of Main meter and other meter readings and any other data mutually agreed. II. Any unusual conditions found during operation/inspections III. All the records preserved for 2 years beyond the crediting period. Training and maintenance: Training on the machine is an essential pre-requisite, to ensure necessary safety of man and machine. Further, in order to maximize the output from the Wind Energy Converters (WECs), it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that WWIL service staff is deft at handling technical snags on top of the turbine, the necessity of ensuring that they are capable of climbing the tower with absolute ease and comfort has been established. The WWIL Training Academy provides need-based training to meet the training requirements of WWIL projects. The training is contemporary, which results in imparting focused knowledge leading to value addition to the attitude and skills of all trainees.

This ultimately leads to creativity in problem solving. Authority and Responsibility The authority and responsibility of project management as well as registration, monitoring, measurement and reporting lies with Hindustan Zinc Limited. HZL has formulated a Project Team to ensure proper and continuous monitoring of the performance of turbines and generation of power. The same has been outlined as follows:



**Net Electricity Exported** = Total Electricity Exported - Total Electricity Imported

**Baseline Emission Calculation:**  $BE_y = EF_y \times EG_y$

$BE_y$  baseline emissions, tCO<sub>2</sub>e

$EG_y$  Net Quantity of Electricity supplied to GUVNL facility

$EF_y$  grid emission factor, i.e. 0.9011 tCO<sub>2</sub>/MWh (it has been fixed ex-ante)

**Emission Reduction Calculation:-**

$ER_y = BE_y - PE_y - L_y$

$ER_y$  Emission Reduction

$BE_y$  baseline emissions

$PE_y$  project emissions

$L_y$  leakage emissions

## 4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

### 4.1 Baseline Emissions

Baseline emissions ( $BE_y$  in tCO<sub>2</sub>e) are the product of the baseline emissions factor ( $EF_y$  in tCO<sub>2</sub>/MWh) times the electricity supplied by the project activity to the grid ( $EG_y$  in MWh) as described in registered PD.

$$BE_y = EF_y \times EG_y$$

Where,

$BE_y$  baseline emissions, tCO<sub>2</sub>e

$EG_y$  Net Quantity of Electricity exported to GUVNL facility

$EF_y$  grid emission factor, i.e. 0.9011 t CO<sub>2</sub>/MWh (it has been fixed ex-ante)

$$= 449,258.61 \times 0.9011 = 404,826 \text{ tCO}_{2e}$$

## 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 Net GHG Emission Reductions and Removals

Formula used to calculate the net emission reduction for the project activity is

$$ER_y = BE_y - PE_y - L_y$$

Where,

$ER_y$  = Emission Reduction in tCO<sub>2</sub>/year

$BE_y$  = Baseline emission in tCO<sub>2</sub>/year

$PE_y$  = Project emissions in tCO<sub>2</sub>/year

$L_y$  = Leakage Emissions in tCO<sub>2</sub>/year

| 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) |
|--------------|-----------------------------------------------------|----------------------------------------------------|----------------------------------------|--------------------------------------------------------------|
| 2013         | 17,905                                              | 0                                                  | 0                                      | 17,905                                                       |
| 2014         | 126,821                                             | 0                                                  | 0                                      | 126,821                                                      |
| 2015         | 133,381                                             | 0                                                  | 0                                      | 133,381                                                      |
| 2016         | 126,719                                             | 0                                                  | 0                                      | 126,719                                                      |
| <b>Total</b> | <b>404,826</b>                                      | <b>0</b>                                           | <b>0</b>                               | <b>404,826</b>                                               |

It is to be noted here that as per the registered PD, the emission reductions during the current monitoring period was estimated to be 501,241 tCO<sub>2</sub>e, whereas actual emission reductions achieved are 404,826 tCO<sub>2</sub>e, which is approximately 19% lower than the estimated emission reductions. The generation of electricity depends upon the wind flow, which is influenced by natural phenomena and not within the control of the project participant.

## APPENDIX 1: METER CALIBRATION DETAILS

|                  | Meter 1    | Meter 2    | Meter 3    | Meter 4    | Meter 5    |
|------------------|------------|------------|------------|------------|------------|
| Serial No.       | GJU 04175  | GJU 04176  | GJU 01470  | KAB 11082  | GJU 67589  |
| Type             | E3M021     | E3M021     | E3M021     | E3M021     | E3M021     |
| Make             | Secure     | Secure     | Secure     | Secure     | Secure     |
| Accuracy Class   | 0.2 s      | 0.2 s      | 0.2 s      | 0.2 s      | 0.2 s      |
| Calibration Date | 06/09/2013 | 06/09/2013 | 06/09/2013 | 06/09/2013 | 06/09/2013 |
| Validity         | 05/09/2016 | 05/09/2016 | 05/09/2016 | 05/09/2016 | 05/09/2016 |
| Calibration Date | 30/09/2016 | 30/09/2016 | 30/09/2016 | 30/09/2016 | 30/09/2016 |
| Validity         | 29/09/2019 | 29/09/2019 | 29/09/2019 | 29/09/2019 | 29/09/2019 |

It is to be noted here that due to delay in calibration, error factor has been applied on net electricity values to retain conservativeness for the month of Sep 2016.

## APPENDIX 2: BREAKDOWN DETAILS FOR THE CURRENT MONITORING PERIOD

| Gen. Date   | Breakdown Remark                 | Breakdown Hrs. |
|-------------|----------------------------------|----------------|
| 01-Apr-2014 | Preventive Check                 | 0.50           |
| 01-Apr-2014 | Elec SafetyChainStop             | 0.30           |
| 01-Apr-2014 | Pitch BatterySurveillance2       | 2.30           |
| 01-Apr-2014 | Preventive Check                 | 0.40           |
| 01-Apr-2014 | Line Breakdown due to Earthfault | 0.10           |
| 01-Apr-2014 | Line Breakdown due to Earthfault | 0.10           |
| 02-Apr-2014 | Elec FB YawCW Error              | 6.40           |
| 02-Apr-2014 | Pitch Akku1Voltage LowStop       | 6.00           |
| 02-Apr-2014 | Elec FB GeneratorFan             | 0.10           |
| 03-Apr-2014 | Preventive Check                 | 0.10           |
| 07-Apr-2014 | Rep Pitch FreqConvPitch2 ErrStop | 0.70           |
| 07-Apr-2014 | Rep Pitch CANComFail             | 0.60           |
| 07-Apr-2014 | Elec UPSBattChange               | 3.40           |
| 11-Apr-2014 | Rep Pitch CANComFail             | 6.90           |
| 11-Apr-2014 | IDRV Audit                       | 1.10           |
| 12-Apr-2014 | Theft                            | 3.70           |
| 02-May-2014 | Shut Down Taken By EB            | 24.00          |
| 02-May-2014 | Shut Down Taken By EB            | 24.00          |
| 02-May-2014 | Shut Down Taken By EB            | 24.00          |
| 02-May-2014 | Shut Down Taken By EB            | 24.00          |
| 02-May-2014 | Shut Down Taken By EB            | 10.30          |
| 02-May-2014 | Shut Down Taken By EB            | 24.00          |
| 02-May-2014 | Shut Down Taken By EB            | 24.00          |
| 02-May-2014 | Shut Down Taken By EB            | 24.00          |