

52.50 MW WIND ENERGY FARM AT MOKLA RAJASTHAN BY HZL



Document Prepared By EKI Energy Services Limited

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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 primarily aims at reducing Green House Gas (GHG) emissions through utilization of renewable energy technology for generation of electrical energy. The electricity generated from the project activity (approximately 90,506 MWh annually) will displace equivalent electricity generation in grid connected power plants. The project activity will reduce the anthropogenic GHG emissions (approximately 85,863 tCO₂ annually) 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 twenty five Suzlon make 2.1 MW Wind Electric Generators (WTGs) by Hindustan Zinc Limited (HZL) in the state of Rajasthan. The cumulative capacity of the project activity is 52.5 MW. The electricity generated from the project activity 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 (WTGs). 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 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 ± 20%.

The technical specifications of the WTGs are as below:

WTG (S88, 2.1 MW, 50 Hz) TECHNICAL DATA

Rated capacity: 2100 kW

Rotor diameter: 88 m

Hub height: 80 m

Rotor with Pitch Control

Type: Upwind rotor with active pitch control

Number of blades: 3

Swept area: 6082 m²

Blade material: The rotor blades are made of high grade GRP and manufactured by using Resin Infusing Moldings (RIM) technology

Rotor speed: 15.47 rpm

Tip speed: 71 m/s

Generator: Type: Single fed Induction Generator with slip-rings, variable rotor resistance with SUZLON-FLEXI-SLIP control system.

Hub: Cast spherical hub

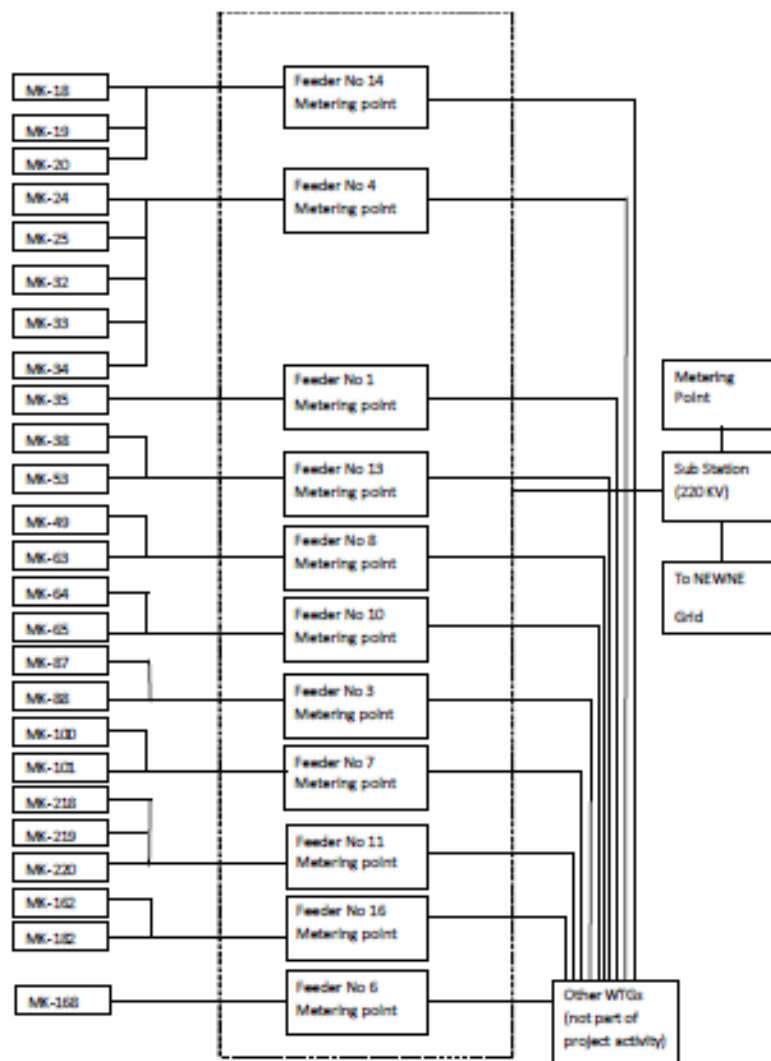
Bearings: High tensile double-row ball-bearing

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

Yaw Control: Active through adjustment gears, friction damping

Tower: Steel Tubular, 77.5 m height

The schematic diagram of project activity and its interconnection with state electricity board is depicted below:



The total GHG emission reduction in this monitoring period 1st Dec 2012 to 31st Dec 2016 (inclusive of both dates) is 284,783 tCO₂e.

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 Chanderiya Lead Zinc Smelter, Putholi

	Chittorgarh-312021, Rajasthan INDIA
Telephone	91-1472-257950
Email	v.jayaraman@vedanta.co.in

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, Vijay Nagar, Indore-452010 (M.P, India)
Telephone	+91 99 07 53 4900
Email	manish@enkingint.org

1.5 Project Start Date

15/02/2011, date of commissioning of first WTG

1.6 Project Crediting Period

This is the second monitoring under VCS and covers the activity from 01/12/2012 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 15/02/2011 to 14/02/2021 (first crediting period) and it will be renewed twice till end date of CDM crediting period.

Start date of crediting period for VCS verification: 15/02/2011 (Date of commissioning of first WTG)

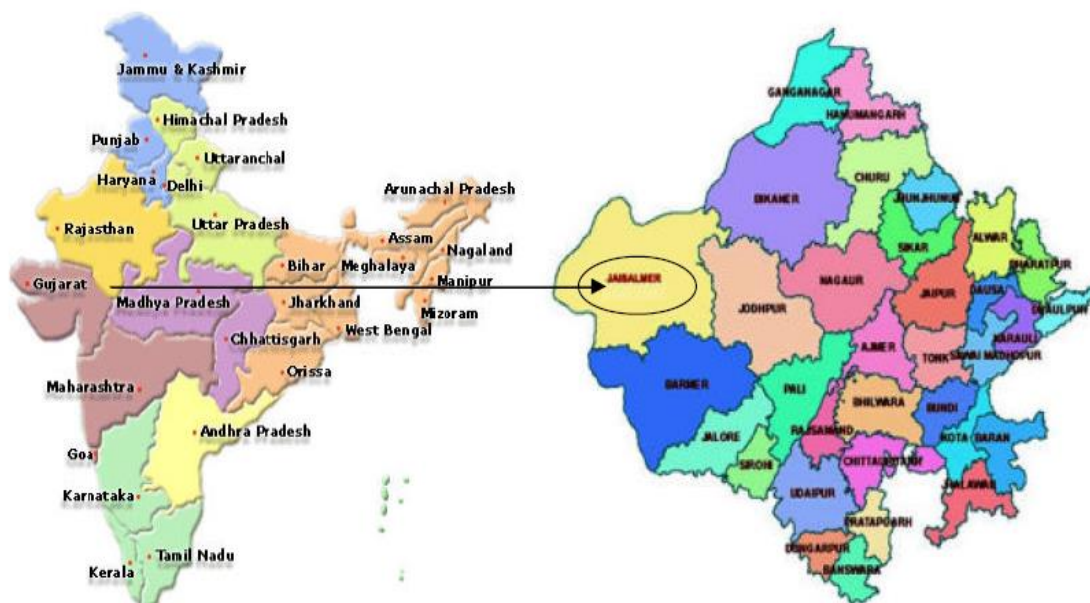
1.7 Project Location

The project activity consists of twenty five 2.1 MW wind turbines in the state of Rajasthan. Details of the location of the project activity:

Sr No.	Phase	WTG No.	Latitude	Longitude
1	Phase- I	MK018	N27°09'20.6"	E70°42'01.9"

2		MK019	N27°09'14.0"	E70°42'19.6"
3		MK020	N27°09'07.3"	E70°42'37.3"
4		MK038	N27°10'04.2"	E70°41'51.2"
5		MK053	N27°10'23.9"	E70°40'58.7"
6		MK049	N27°10'24.2"	E70°40'58.1"
7		MK063	N27°11'21.3"	E70°40'12.2"
8		MK064	N27°11'14.4"	E70°40'30.5"
9		MK065	N27°11'07.8"	E70°40'48.1"
10		MK087	N27°10'30.1"	E70°44'50.0"
11		MK088	N27°10'40.7"	E70°44'35.9"
12		MK100	N27°12'12.3"	E70°39'44.1"
13		MK101	N27°12'18.9"	E70°39'26.3"
14		MK168	N27°13'58.5"	E70°39'31.5"
15		MK218	N27°14'48.8"	E70°40'37.5"
16		MK219	N27°14'56.9"	E70°40'19.7"
17		MK220	N27°15'03.0"	E70°40'01.9"
18	Phase- II	MK024	N27°08'27.5"	E70°44'23.3"
19		MK025	N27°08'23.6"	E70°44'44.9"

20		MK032	N27°08'35.8"	E70°45'40.1"
21		MK033	N27°08'42.5"	E70°45'22.4"
22		MK034	N27°08'49.1"	E70°45'04.8"
23		MK035	N27°08'57.0"	E70°44'49.4"
24		MK162	N27°13'18.4"	E70°40'18.2"
25		MK019	N27°13'48.7"	E70°41'42.1"



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

The project has been registered with UNFCCC having registration number 7895¹. 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 India².

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 India³. 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.

¹ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1351252642.79/view>

² https://recregistryindia.nic.in/index.php/general/publics/accredited_regens_pdf

³ http://www.cdmindia.in/approval_process.php

Technological well being

- 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 15/02/2011 (commissioning date of first WTG)

Details of the project activity are as follows;

LOCATION No	Date of commissioning	Connected Load (MW)	Phase
MK-49,63,100,101,168	15/02/2011	10.5 MW	Ph I
MK-18,19,20,38,53,64,65,87,88, 218, 219, 220	13/03/2011	25.2 MW	Ph I
MK-162	16/08/2011	2.1 MW	Ph II
MK- 32,33,34,35	01/09/2011	8.4 MW	Ph II
MK 24,25	22/09/2011	4.2 MW	Ph II
MK 182	30/09/2011	2.1 MW	Ph II

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 is the O&M contractor for the project activity.

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. Suzlon 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

The Monitoring plan described in the CDM registered PDD includes parameters like X, Y, A and B. However, these parameters do not be utilised in the calculation of the emission reductions, as these are calculated from the JMR and break up energy sheet of $EG_{\text{export},y}$, $EG_{\text{import},y}$ and the difference between the two, viz., $EG_{\text{facility},y}$. So that these parameters has been removed from the data and parameters monitored. A monthly meter reading taken jointly by state utility and PP representative is recorded in the JMR. The net electricity exported to the grid is the difference of export and the import measured through the meter. The metered export and import of electricity in the JMR is apportioned among the various project developers based on the electricity generated at the WTG-Controller. The apportioned metered net electricity (export – import) corresponding to WTGs owned by a particular developer is then issued separately in a share certificate prepared by the O&M Service provider. 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.

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 notification⁴ 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 stakeholders and they were totally in support for setting up of these kinds of projects in the region. The PP also placed a

⁴ http://envfor.nic.in/sites/default/files/Latest_118_Final_Directions.pdf

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 _{grid,OM,y}																
Data unit	tCO ₂ /MWh																
Description	Operating Margin emission factor for NEWNE grid																
Source of data	Referred from CO ₂ Baseline Database Version 6.0 for the Indian Power Sector prepared by Central Electricity Authority.																
Value applied	0.9962																
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 three years vintage data (2007-08, 2008-09 and 2009-10) as given below: <table border="1"> <thead> <tr> <th colspan="2">Operating Margin Estimation for NEWNE Grid (tCO₂/MWh)</th></tr> </thead> <tbody> <tr> <td>OM 2007-08</td><td>0.9999</td></tr> <tr> <td>OM 2008-09</td><td>1.0066</td></tr> <tr> <td>OM 2009-10</td><td>0.9777</td></tr> <tr> <td>Net Electricity Generated (GWh), 2007-08</td><td>401642</td></tr> <tr> <td>Net Electricity Generated (GWh), 2008-09</td><td>421803</td></tr> <tr> <td>Net Electricity Generated (GWh), 2009-10</td><td>458043</td></tr> <tr> <td>Average OM (EF_{grid, OM,y})</td><td>0.9962</td></tr> </tbody> </table>	Operating Margin Estimation for NEWNE Grid (tCO ₂ /MWh)		OM 2007-08	0.9999	OM 2008-09	1.0066	OM 2009-10	0.9777	Net Electricity Generated (GWh), 2007-08	401642	Net Electricity Generated (GWh), 2008-09	421803	Net Electricity Generated (GWh), 2009-10	458043	Average OM (EF_{grid, OM,y})	0.9962
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Net Electricity Generated (GWh), 2008-09	421803																
Net Electricity Generated (GWh), 2009-10	458043																
Average OM (EF_{grid, OM,y})	0.9962																
Purpose of the data	For the calculation of the Baseline Emission																
Comments	This value is determined ex-ante and will be fixed for the crediting period																

Data / Parameter	EF _{grid,BM,y}
Data unit	tCO ₂ /MWh
Description	Build Margin emission Factor for NEWNE grid
Source of data	Referred from CO ₂ Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 6.0.
Value applied	0.8123
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	For the calculation of the Baseline Emission
Comments	This value is determined ex-ante and will be fixed for the crediting period

Data / Parameter	EF _{grid,CM,y} /EF _{CO₂,grid,y}	
Data unit	tCO ₂ /MWh	
Description	Combined Margin CO ₂ emission factor for NEWNE grid	
Source of data	Calculated based on values given in the CO ₂ Baseline Database Version 6.0 for the Indian Power Sector prepared by Central Electricity Authority	
Value applied	0.9487	
Justification of choice of data or description of measurement methods and procedures applied	The combined margin emission factor has been determined based on data published by the CEA, applying a 75% weightage for EF _{grid, OM,y} and 25% for EF _{grid,BM,y} in accordance with the 'Tool to calculate the emission factor for an electricity system.'	
	Combined Margin Estimation for NEWNE Grid (tCO₂/MWh)	
	Operating Margin (EF_{grid, OM,y})	0.9962
	Build Margin (EF_{grid, BM, y})	0.8123
	Combined Margin (EF_{CO₂,grid,y})	0.9487
Purpose of the data	For the calculation of the Baseline Emission	
Comments	This value is determined ex-ante and will be fixed for the crediting period	

3.2 Data and Parameters Monitored

Data / Parameter	EG _{PJ,y}
Data unit	MWh
Description	Net electricity supplied by the WTGs in the project activity to the grid.
Source of data	Statements on Break-up of Net Export Units prepared by the O&M Service provider
Description of measurement methods and procedures to be applied	Main meter installed at the substation of the state utility (RVPN / DISCOM) measure the power delivered to the grid continuously. A monthly meter reading taken jointly by state utility and PP representative is recorded in the JMR. The meter would be a bidirectional meter measuring both the export and the import. The net electricity exported to the grid would be the difference of export and the import measured through the meter. The metered export and import of electricity in the JMR is apportioned among the various project developers based on the electricity generated at the WTG-

	Controller (LCS readings). The apportioned metered net electricity (export – import) corresponding to WTGs owned by a particular developer is then issued separately in a share certificate which is further used for ER calculation.
Frequency of monitoring/recording	Measured: Continuously Reporting Frequency: Monthly (Calculated)
Value monitored	300,183.04
Monitoring equipment	Energy Meters of Accuracy class 0.2s. Please refer Annex 1 for detailed schedule of Calibration
QA/QC procedures to be applied	The quantity of net electricity supplied will be cross-verified from the invoices/sales receipts raised to the state utility. The conservative values of net electricity exported would be considered for emission reductions As per the registered monitoring plan, the energy meters has to be calibrated annually. It is to be noted here that due to delay in calibration, error factor has been applied on export and import values to retain conservativeness for the month of Dec 2013, Jan 2014 and from Dec 2015 to July 2016.
Purpose of the data	Calculation of Baseline emissions
Calculation method	Main meter installed at the substation of the state utility (RVPN / DISCOM) measure the power delivered to the grid continuously. A monthly meter reading taken jointly by state utility and PP representative is recorded in the JMR. The meter would be a bidirectional meter measuring both the export and the import. The net electricity exported to the grid would be the difference of export and the import measured through the meter. The metered export and import of electricity in the JMR is apportioned among the various project developers based on the electricity generated at the WTG-Controller (LCS readings). The apportioned metered net electricity (export – import) corresponding to WTGs owned by a particular developer is then issued separately in a share certificate which is further used for ER calculation. There is also a check meter installed at the substation to measure the power delivered to the grid continuously, in case of the failure of the main meter, the readings are monitored from the check meter in a similar way as that for the main meter. The energy meters will be electronic meters of 0.2s accuracy class. Net electricity supplied by the project activity to the grid will be calculated based on the values of export and import of electricity as follows: Net Electricity = Total electricity exported by project proponent - Total electricity imported by project proponent.
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.

Data / Parameter	EG _{y,export}
Data unit	MWh

Description	Sum of electricity exported by all 25 WTGs of project activity connected to substation of the state utility
Source of data	Statements on Break-up of Net Export Units prepared by the O&M Service provider
Description of measurement methods and procedures to be applied	Main meter installed at the substation measure the total electricity exported to the grid continuously. A monthly meter reading taken jointly by state utility and PP representative (O&M contractor). The meter is a bi-directional meter measuring both the export and the import. The metered export of electricity is apportioned among the various project developers based on the electricity generated at the WTG-Controller (LCS readings). The apportioned export electricity corresponding to WTGs owned by a particular developer is then issued separately in a share certificate. There is also a check meter installed at the substation to measure the total electricity exported to the grid continuously, in case of the failure of the main meter, the readings are monitored from the check meter in a similar way as that for the main meter.
Frequency of monitoring/recording	Continuous monitoring, hourly measurement and monthly recording
Value monitored	302,919.7
Monitoring equipment	Energy Meters of Accuracy class 0.2s. Please refer Annex 1 for detailed schedule of Calibration
QA/QC procedures to be applied	The quantity of net electricity imported will be cross-verified from the invoices/sales receipts raised to the state utility. The conservative values of net electricity exported would be considered for emission reductions. As per the registered monitoring plan, the energy meters has to be calibrated annually. It is to be noted here that due to delay in calibration, error factor has been applied on export values to retain conservativeness for the month of Dec 2013, Jan 2014 and from Dec 2015 to July 2016.
Purpose of the data	Calculation of Baseline emissions
Calculation method	-
Comments	The data will be kept for two years after the end of the crediting period

Data / Parameter	EG _{y,import}
Data unit	MWh
Description	Sum of electricity imported by all 25 WTGs of project activity connected to substation of the state utility
Source of data	Statements on Break-up of Net Export Units prepared by the O&M Service provider
Description of measurement methods and procedures to be applied	Main meter installed at the substation measure the total electricity imported from the grid continuously. A monthly meter reading taken jointly by state utility and PP representative (O&M contractor). The meter is a bi-directional meter measuring both the export and the import. The metered import of electricity is apportioned among the various project developers based on the electricity generated at the WTG-Controller (LCS readings). The apportioned import electricity

	corresponding to WTGs owned by a particular developer is then issued separately in a share certificate. There is also a check meter installed at the substation to measure the total electricity imported from the grid continuously, in case of the failure of the main meter, the readings are monitored from the check meter in a similar way as that for the main meter.
Frequency of monitoring/recording	Continuous monitoring, hourly measurement and monthly recording
Value monitored	2,736.66
Monitoring equipment	Energy Meters of Accuracy class 0.2s. Please refer Annex 1 for detailed schedule of Calibration
QA/QC procedures to be applied	The quantity of net electricity imported will be cross-verified from the invoices/sales receipts raised to the state utility. The conservative values of net electricity exported would be considered for emission reductions As per the registered monitoring plan, the energy meters has to be calibrated annually. It is to be noted here that due to delay in calibration, error factor has been applied on import values to retain conservativeness for the month of Dec 2013, Jan 2014 and from Dec 2015 to July 2016.
Purpose of the data	Calculation of Baseline emissions
Calculation method	-
Comments	The data will be kept for two years after the end of the crediting period

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 12.3.0

The methodology requires monitoring of the following parameters:

1. Electricity generation from the proposed project activity (EGY).
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 update 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.

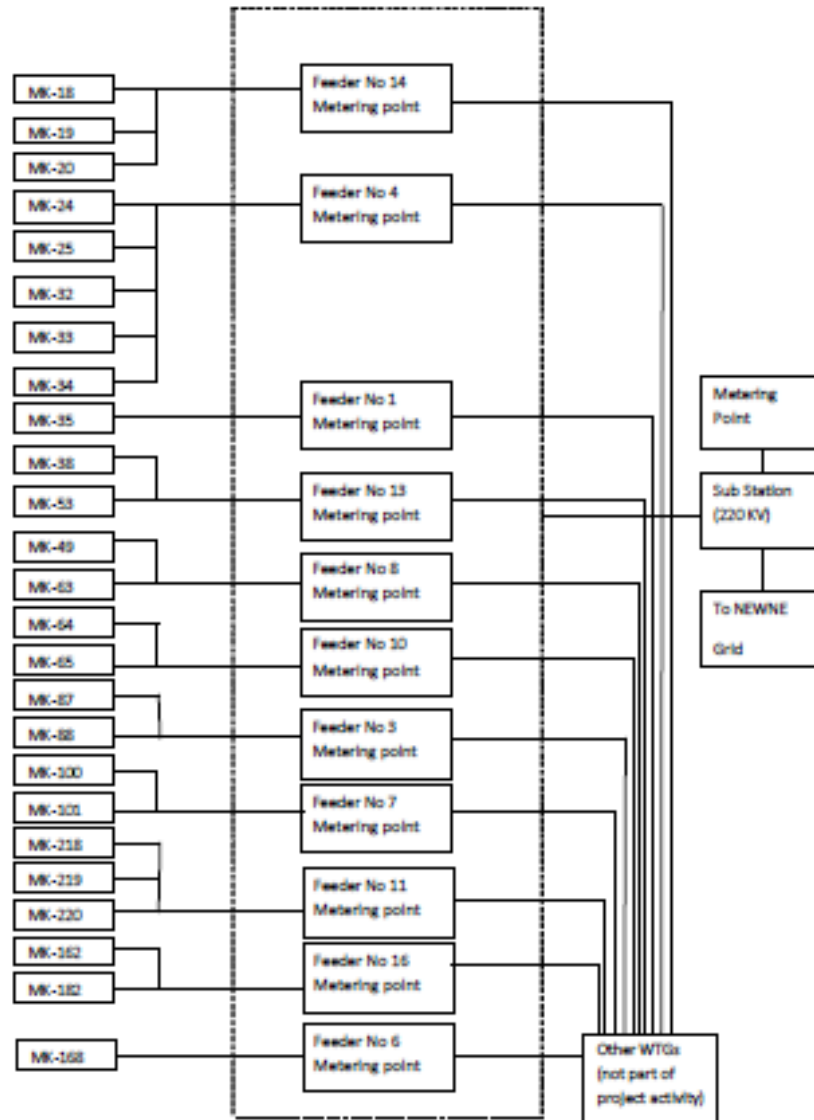
Reading and correction of meters:

The general conditions set out for metering, recording, meter readings, meter inspections, Test & Checking and communication shall be as per the PPA (power purchase agreement). The electricity is exported to the grid sub-station from the project WTGs. A set of main and check is installed at grid substation to monitor the electricity export and import from the project and non-project WTGs. In addition, a set of main and check meter is also installed at each feeder point of the pooling station maintained by the O&M service provider. The generation measured at WTG controller end is also recorded by the O&M service provider. Based on the measured and recorded energy at grid-substation level, feeder points at pooling station level and at WTG controller readings, O&M service provider calculates electricity export, import and net electricity supplied to the grid by the individual WTG using standard apportioning procedure accepted by the state electricity utility. A break-up sheet is prepared by the O&M service provider for each month & project owner in the wind farm. The Break up sheet is shared with the State Utility & project participant as well. On basis of this breakup sheet PP raises the invoices for payment against the net electricity supplied to grid. The break up sheet consists detail of the electricity exported, electricity imported and net electricity supplied to grid.

The Main and check meter of 0.2s accuracy class are also installed at the sub-station of the state utility (RVPN / DISCOM) and also at feeder points. On a monthly basis, a joint meter reading will be carried out in the presence of the state utility officials and representatives of the project promoters.

Sealing and maintenance of meters:

- i. The AVVNL meter sealed in the presence of representatives of HZL / Suzlon and AVVNL.
- ii. Any meter seal(s) broken only by the AVVNL representative in the presence of Suzlon/HZLs representative whenever the main metering system or the 33kV metering system is to be inspected, tested, adjusted, repaired or replaced.
- iii. The AVVNL meter at the substation calibrated yearly.



Note: Arrangement of HZL WTG's connected with different feeders and then 220 KV substation of AVVNL.

Records:

Suzlon 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:

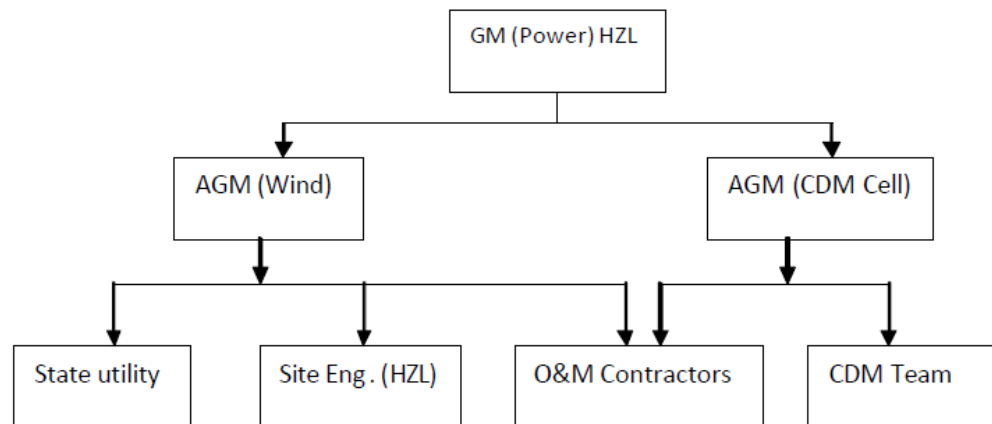
Training on the machine is an essential pre-requisite, to ensure necessary safety of man and machine. Further, in order to maximize the output from the Wind Energy Converters (WECs), it is extremely essential, that the engineers and technicians understand the machines and keep them in good health. In order to ensure, that Suzlon 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 Suzlon Training Academy provides need-based training to meet the training requirements of Suzlon 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 responsibility of project management as well as 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 WTG manufacturing facility of Suzlon Infrastructure Limited.

The monitoring team 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:



Net Electricity Exported = Total Electricity Exported - Total Electricity Imported

Baseline Emission Calculation:-

$$BE_y = EF_y \times EG_y$$

BE_y baseline emissions, tCO₂e

EG_y Net Quantity of Electricity supplied to AVVNL facility

EF_y grid emission factor, i.e. 0.9487 tCO₂/MWh (it has been fixed ex -ante)

Data collection and archiving

The daily data on electricity generation from WTGs at the site is collected in electronic form. Monthly JMR statements are collected and maintained in hard copy, and archived electronically. 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.

Emission Reduction Calculation:-

$$ER_y = BE_y - PE_y$$

ER_y Emission Reduction

BE_y baseline emissions

PE_y project emissions

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions (BE_y in tCO₂e) are the product of the baseline emissions factor (EF_y in tCO₂/MWh) times the electricity supplied by the project activity to the grid (EG_y in MWh) as described in registered PD.

$$BE_y = EF_{CO_2, grid, y} \times EG_{BL, y}$$

Where,

BE_y baseline emissions, tCO₂e

$EG_{BL, y}$ Net Quantity of Electricity exported to the facility

$EF_{CO_2, grid, y}$ grid emission factor, i.e. 0.9487 t CO₂/MWh (it has been fixed ex-ante)

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

$$BE_y = 300,183.04 \times 0.9487 = 284,783 \text{ tCO}_2\text{e}$$

4.2 Project Emissions

There are no Project emissions from the project activity

4.3 Leakage

Leakage emission is neglected as per the requirement of the methodology

4.4 Net GHG Emission Reductions and Removals

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

$$ER_y = BE_y - PE_y$$

Where,

ER_y = Emission Reduction in tCO₂/year

BE_y = Baseline emission in tCO₂/year

PE_y = Project emissions in tCO₂/year

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2012	3,215	0	3,215
2013	70,048	0	70,048
2014	73,338	0	73,338
2015	73,697	0	73,697
2016	64,485	0	64,485
Total	284,783	0	284,783

It is to be noted here that as per the registered PD, the emission reductions during the current monitoring period was estimated to be 350,980 tCO₂e, whereas actual emission reductions achieved are 284,783 tCO₂e, 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 Details	Meter Sr. No.	Calibration in Previous MP	Calibration Done	Validity	Calibration done	Validity	Calibration Done	Validity	Calibration Done	Validity
220 KV Line 1 Main	9166170	13-03-2012	12-12-2012	11-12-2013	21-01-2014	20-01-2015	28-12-2014	27-12-2015	20-07-2016	19-07-2017
220 KV Line 1 Back Up	9166172	13-03-2012	12-12-2012	11-12-2013	21-01-2014	20-01-2015	28-12-2014	27-12-2015	20-07-2016	19-07-2017
220 KV Line 2 Main	MSB 60428	13-03-2012	17-12-2012	16-12-2013	21-01-2014	20-01-2015	28-12-2014	27-12-2015	20-07-2016	19-07-2017
220 KV Line 2 Back Up	MSB 60429	13-03-2012	17-12-2012	16-12-2013	21-01-2014	20-01-2015	28-12-2014	27-12-2015	20-07-2016	19-07-2017
SEL 74 (main)	RJB69748	16-03-2012	16-12-2012	15-12-2013	21-01-2014	20-01-2015	28-12-2014	27-12-2015	20-07-2016	19-07-2017

SEL 74 (back)	RJB69747	16-03-2012	16-12-2012	15-12-2013	21-01-2014	20-01-2015	28-12-2014	27-12-2015	20-07-2016	19-07-2017
SEL 75 Main	MSB10288	16-03-2012	15-12-2012	14-12-2013	21-01-2014	20-01-2015	28-12-2014	27-12-2015	19-07-2016	18-07-2017
SEL 75 Back	MSB10287	16-03-2012	15-12-2012	14-12-2013	21-01-2014	20-01-2015	28-12-2014	27-12-2015	19-07-2016	18-07-2017
SEL 86 Main	MSB10290	16-03-2012	15-12-2012	14-12-2013	21-01-2014	20-01-2015	28-12-2014	27-12-2015	19-07-2016	18-07-2017
SEL 86 Back	MSB10291	16-03-2012	15-12-2012	14-12-2013	21-01-2014	20-01-2015	28-12-2014	27-12-2015	19-07-2016	18-07-2017
SEL 90 Main	RJB69756	16-03-2012	15-12-2012	14-12-2013	22-01-2014	21-01-2015	27-12-2014	26-12-2015	20-07-2016	19-07-2017
SEL90 backup	RJB69757	16-03-2012	15-12-2012	14-12-2013	22-01-2014	21-01-2015	27-12-2014	26-12-2015	20-07-2016	19-07-2017
SEL91 Main	RJB69759	16-03-2012	15-12-2012	14-12-2013	23-01-2014	22-01-2015	27-12-2014	26-12-2015	20-07-2016	19-07-2017
SEL91 Backup	RJB69760	16-03-2012	15-12-2012	14-12-2013	23-01-2014	22-01-2015	27-12-2014	26-12-2015	20-07-2016	19-07-2017
SEL 92 Main	RJB69751	16-03-2012	15-12-2012	14-12-2013	23-01-2014	22-01-2015	29-12-2014	28-12-2015	19-07-2016	19-07-2017
SEL 92 Back up	RJB 69753	16-03-2012	15-12-2012	14-12-2013	23-01-2014	22-01-2015	29-12-2014	28-12-2015	19-07-2016	19-07-2017
SEL 99 Main	RJB69754	16-03-2012	15-12-2012	14-12-2013	22-01-2014	21-01-2015	29-12-2014	28-12-2015	20-07-2016	19-07-2017
SEL 99 backup	RJB 69755	16-03-2012	15-12-2012	14-12-2013	22-01-2014	21-01-2015	29-12-2014	28-12-2015	20-07-2016	19-07-2017
SEL 103 Main	RJB 72832	16-03-2012	15-12-2012	14-12-2013	21-01-2014	20-01-2015	29-12-2014	28-12-2015	20-07-2016	19-07-2017
SEL 103 backup	RJB 72831	16-03-2012	15-12-2012	14-12-2013	21-01-2014	20-01-2015	29-12-2014	28-12-2015	20-07-2016	19-07-2017
SEL 104 Main	RJB 72833	16-03-2012	15-12-2012	14-12-2013	23-01-2014	22-01-2015	29-12-2014	28-12-2015	19-07-2016	18-07-2017
SEL 104 backup	RJB 72834	16-03-2012	15-12-2012	14-12-2013	23-01-2014	22-01-2015	29-12-2014	28-12-2015	19-07-2016	18-07-2017
SEL 105 Main	RJB 72524	16-03-2012	15-12-2012	14-12-2013	21-01-2014	20-01-2015	29-12-2014	28-12-2015	19-07-2016	18-07-2017

SEL 105 Backup	RJB 72525	16-03-2012	15-12-2012	14-12-2013	21-01-2014	20-01-2015	29-12-2014	28-12-2015	19-07-2016	18-07-2017
SEL 113 Main	RJB 73569	16-03-2012	15-12-2012	14-12-2013	22-01-2014	21-01-2015	29-12-2014	28-12-2015	19-07-2016	18-07-2017
SEL 113 back up	RJB73570	16-03-2012	15-12-2012	14-12-2013	22-01-2014	21-01-2015	29-12-2014	28-12-2015	19-07-2016	18-07-2017
SEL 114 Main	RJB 73571	16-03-2012	15-12-2012	14-12-2013	22-01-2014	21-01-2015	29-12-2014	28-12-2015	19-07-2016	18-07-2017
SEL 114 Backup	RJB 73572	16-03-2012	15-12-2012	14-12-2013	22-01-2014	21-01-2015	29-12-2014	28-12-2015	19-07-2016	18-07-2017

It is to be noted here that due to delay in calibration, error factor has been applied on export and import values to retain conservativeness for the month of Dec 2013, Jan 2014 and from Dec 2015 to July 2016.

APPENDIX 2: BREAKDOWN DETAILS FOR THE CURRENT MONITORING PERIOD

Gen. Date	MW	Loc. No.	Breakdown Remark	Breakdown Hrs.
01-Apr-2014	2.10	MK218	Preventive Check	0.20
01-Apr-2014	2.10	MK100	Elec SafetyChainStop	0.20
01-Apr-2014	2.10	MK221	Pitch BatterySurveillance2	12.30
01-Apr-2014	2.10	MK219	Preventive Check	0.40
01-Apr-2014	2.10	MK035	Line Breakdown due to Earthfault	0.10
01-Apr-2014	2.10	MK029	Line Breakdown due to Earthfault	0.10
02-Apr-2014	2.10	MK216	Elec FB YawCW Error	6.40
02-Apr-2014	2.10	MK221	Pitch Akku1Voltage LowStop	6.00
02-Apr-2014	2.10	MK049	Elec FB GeneratorFan	0.10
03-Apr-2014	2.10	MK044	Preventive Check	0.10
07-Apr-2014	2.10	MK025	Rep Pitch FreqConvPitch2 ErrStop	0.70
07-Apr-2014	2.10	MK218	Rep Pitch CANComFail	0.60
07-Apr-2014	2.10	MK024	Elec UPSBattChange	3.40
11-Apr-2014	2.10	MK035	Rep Pitch CANComFail	6.90
11-Apr-2014	2.10	MK018	IDRV Audit	1.10
12-Apr-2014	2.10	MK029	Theft	3.70
02-May-2014	2.10	MK088	Shut Down Taken By EB	24.00

02-May-2014	2.10	MK179	Shut Down Taken By EB	24.00
02-May-2014	2.10	MK029	Shut Down Taken By EB	24.00
02-May-2014	2.10	MK031	Shut Down Taken By EB	24.00
02-May-2014	2.10	MK168	Shut Down Taken By EB	10.30
02-May-2014	2.10	MK219	Shut Down Taken By EB	24.00
02-May-2014	2.10	MK044	Shut Down Taken By EB	24.00
02-May-2014	2.10	MK038	Shut Down Taken By EB	24.00