

15 MW Wind Energy Farm at Gopalpura, Karnataka by HZL



Document Prepared By EKI Energy Services Limited

Project Title	15 MW Wind Energy Farm at Gopalpura, Karnataka by HZL
Version	02
Report ID	-
Date of Issue	30-10-2018
Project ID	PL1139
Monitoring Period	01-Dec-2012 to 31-Dec-2016 (inclusive of both days)
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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 34,821 MWh annually) will displace equivalent electricity generation in grid connected power plants. The project activity will reduce the anthropogenic GHG emissions (approximately 31,875 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 ten Suzlon make 1.5 MW Wind Electric Generators (WEGs) by Hindustan Zinc Limited (HZL) in the state of Karnataka. All the WTGs are commissioned on 31st March 2011 and 21May 2011. The cumulative capacity of the project activity is 15 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 (WEGs). In this process, there are no greenhouse gas emissions or burning of any fossil fuels. The electricity is generated through sustainable means without causing any negative effect to the environment and therefore the technology is environmentally safe and sound.

Wind turbines produce electricity by using the natural power of wind to drive a generator. Wind has considerable amount of kinetic energy when blowing at high speeds. When this kinetic energy passes through the blades of the wind turbines, it is converted into mechanical energy and rotates the wind blades. When the wind blades rotate, the connected generator also rotates, thereby producing electricity. The Project activity envisages installation of WEGs of S-80 Suzlon make (1500 kW WEGs). The WEGs generate 3-phase power at 400V, which is stepped up to 33 KV. The project can operate in the frequency range of 46–54 Hz and in the voltage range of 400 V $\pm$ 20%.

The technical specifications of the WTGs are as below:

WTG (S82 ,1.5 MW, 50 Hz) TECHNICAL DATA

Rated capacity: 1500 kW

Rotor diameter: 82 m

Hub height: 78.5 m

Rotor with Pitch Control

Type: Upwind rotor with active pitch control

Number of blades: 3

Swept area: 5281 m²

Blade material: The rotor blades are made epoxy bonded fibre glass

Rotor speed: 16.30 rpm

Tip speed: 70 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, 76 m height

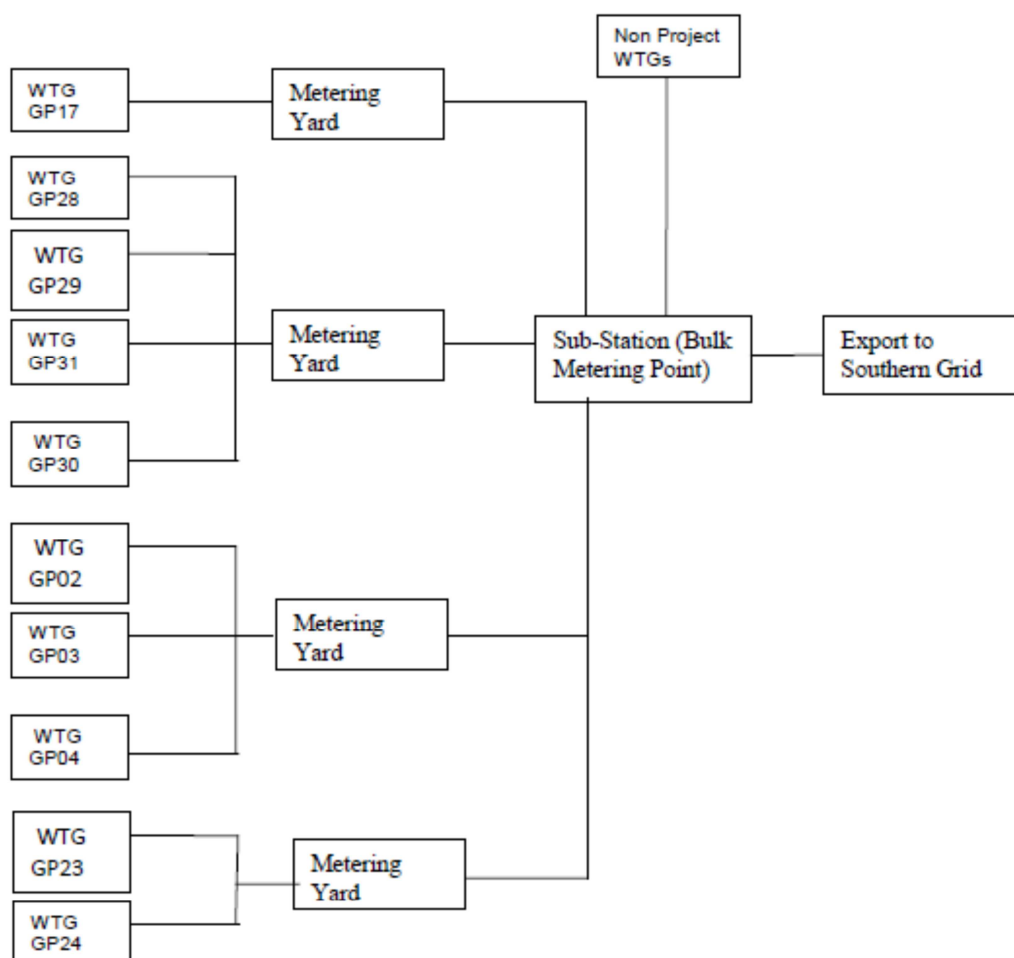
The timeline followed towards implementation of the project activity are as follows:

Sr No.	Particulars	Date
1.	Note for approval of project activity	10/10/2010
2.	Equipment supply Agreement	20/12/2010
3.	Start Date of Construction	29/12/2010
4.	Prior Intimation to NCDMA and UNFCCC	07/03/2011

Details of the project activity are as follows;

LOCATION No	Date of commissioning	Connected Load (MW)
GP 2,3,4,17,23,24,28,31	31/03/2011	12 MW
GP 29, 30	21/05/2011	3 MW

The project is being connected to the state electricity grid at 33/220 KV Substation (Gangapur feeder) at Doddakunchevu through 33 KV Double Circuit line and schematic diagram is being depicted via the following diagram:



The total GHG emission reduction in this monitoring period 1st Dec 2012 to 31st Dec 2016 (inclusive of both dates) is 87,833 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

31/03/2011, 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 31/03/2011 to 30/03/2021 (first crediting period) and it will be renewed twice till end date of CDM crediting period.

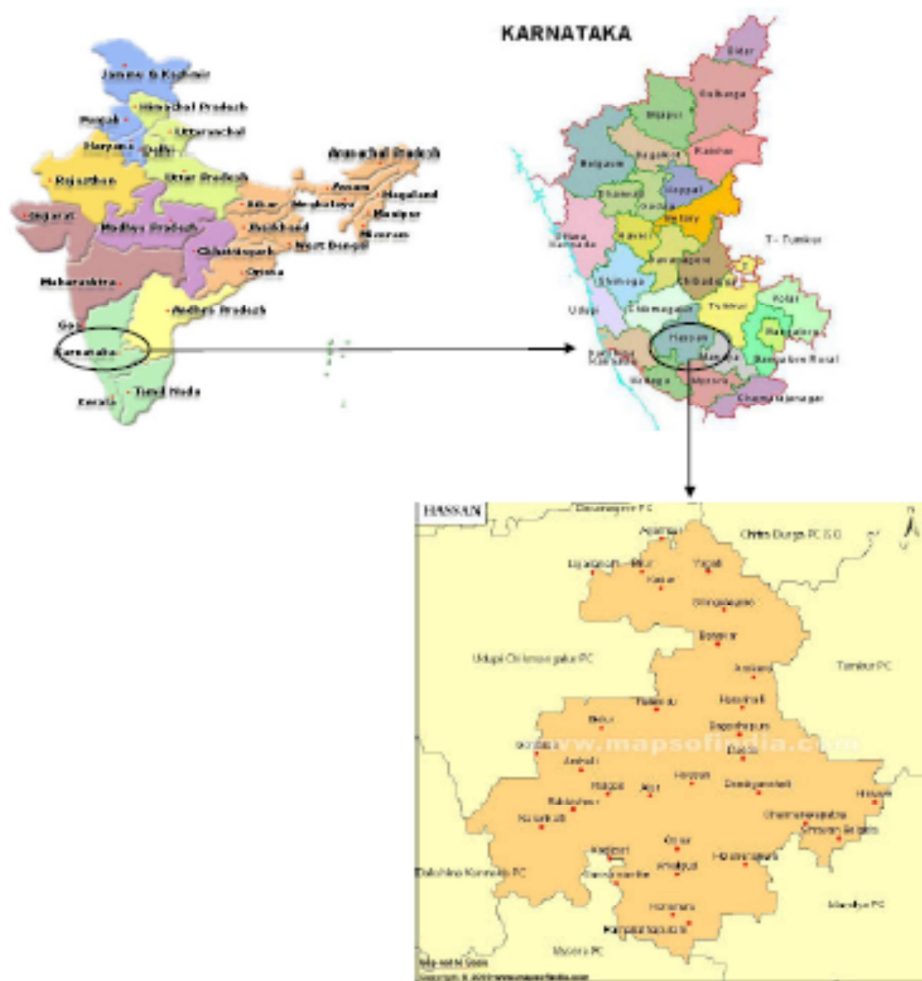
Start date of crediting period for VCS verification: 31/03/2011 (Date of commissioning of first WTG)

1.7 Project Location

The project activity consists of Ten 1.5 MW wind turbines in the state of Karnataka. Details of the location of the project activity:

Sr No.	WEG No.	Latitude	Longitude
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1	GP-02	N12°57'25.1"	E76°17'29.0"
2	GP-03	N12°57'10.2"	E76°17'28.5"
3	GP-04	N12°57'02.4"	E76°17'26.4"
4	GP-17	N12°55'11.6"	E76°17'13.6"
5	GP-23	N12°54'15.6"	E76°16'49.0"
6	GP-24	N12°54'07.5"	E76°16'48.7"
7	GP-28	N12°53'35.1"	E76°16'47.0"
8	GP-29	N12°53'27.1"	E76°16'47.0"
9	GP-30	N12°53'19.2"	E76°16'46.4"
10	GP-31	N12°53'11.1"	E76°16'46.0"



1.8 Title and Reference of Methodology

Title: "Grid connected renewable electricity generation".

Reference: AMS I D, Version 17, EB 61

The approved methodology uses the "Tool to calculate the emission factor for an electricity system" Version 02.2.0 for determination of the baseline scenario and also draws upon Appendix B of the simplified modalities and procedures for small-scale CDM project activities "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories".

1.9 Other Programs

The project has been registered with UNFCCC having registration number 8303¹. However the project will avail either CDM or VCS revenues for any monitoring period to avoid any double

¹ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1353404982.34/view>

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

- The project activity will lead to additional business for equipment suppliers, O&M contractors, civil work contractors etc.
- It will lead to additional investment for the development of infrastructure in the region like roads, power infrastructures, transmission lines 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

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

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

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

Start date is 31/03/2011 (commissioning date of first WTG)

Details of the project activity are as follows;

LOCATION No	Date of commissioning	Connected Load (MW)
GP 2,3,4,17,23,24,28,31	31/03/2011	12 MW
GP 29, 30	21/05/2011	3 MW

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

Not Applicable

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 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	0.9661
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)
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

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

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	0.7634
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	0.9154
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.'
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	$EG_{BL,y}$
Data unit	MWh
Description	Net electricity supplied to the grid by the project activity in year y.
Source of data	Joint Meter Reading statements
Description of measurement methods and procedures to be applied	For measurement of electricity exported and imported, electronic trivector energy meters of accuracy class 0.2 has been installed. The details metering measurement are also elaborated in Annexure 1. Calibration frequency: Yearly

Frequency of monitoring/recording	Measured: Continuously Reporting Frequency: Monthly (Calculated)
Value monitored	95,950.7
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 supplied will be cross-verified from the invoices/sales receipts raised to the state utility. Further, cross-checking will be carried out using meters located at transformer yards. 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 and transmission losses values to retain conservativeness for the month of Dec 2012 and July 2014 to May 2015.
Purpose of the data	Calculation of Baseline emissions
Calculation method	The net electricity supplied to the grid calculated as: $EG_{BL,y} = EG_{EXP,y} - (1+15\%) EG_{IMP,y} - EG_{TL,y}$ The WTGs generate 3-phase power at 690V, which is stepped up to 33 KV. On a monthly basis, joint meter readings (JMRs) of the energy meters at 33kV metering points taken by representatives of the project promoters and the KPTCL/CESC. Transmission losses computed by KPTCL and reported in the JMR statements. WTG controller data may also be used for proportioning of electricity generation data if billing cycles do not match with the monitoring period
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	$EG_{EXP,y}$
Data unit	MWh
Description	Electricity exported from the project activity in year y.
Source of data	Joint Meter Readings and Bills/receipts (statements on payment towards power purchased)
Description of measurement methods and procedures to be applied	Electronic trivector energy meters of accuracy class 0.2s will be used for measurement of electricity exported from the project activity. On a monthly basis, joint meter readings (JMRs) of the energy meters at metering points would be taken by representatives of the project promoters and KPTCL/CESC.
Frequency of monitoring/recording	Continuous monitoring, hourly measurement and monthly recording
Value monitored	98,251.96
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 as per accuracy class of meters to retain conservativeness for the month of Dec 2012 and July 2014 to May 2015.
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 _{IMP,y}
Data unit	MWh
Description	Electricity imported by the project activity in year y
Source of data	Joint Meter Readings and Bills/receipts (statements on payment towards power purchased)
Description of measurement methods and procedures to be applied	Electricity imported is monitored using trivector energy meters of 0.2s accuracy class at the sub-station of the state electricity board. Joint meter readings of the energy meters will be carried out by representatives of the project promoter and representatives of the state electricity board on a monthly basis. The import readings will be apportioned based on the electricity generation from the individual WTGs connected to the substation.
Frequency of monitoring/recording	Continuous monitoring, hourly measurement and monthly recording
Value monitored	745.61
Monitoring equipment	Energy Meters of Accuracy class 0.2s. Please refer Appendix 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. 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 as per accuracy class of meters to retain conservativeness for the month of Dec 2012 and July 2014 to May 2015.
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 _{TL,y}
Data unit	MWh
Description	Transmission losses in year y

Source of data	Joint Meter Reading statements
Description of measurement methods and procedures to be applied	The value of transmission losses would be calculated by KPTCL/CESC officials as per the equations described in the PPA and official notifications. The value would be determined from the bulk meter readings at the substation (from where electricity is exported to grid) and from all metering points connected to the substation. The value would be reported in the JMR statements.
Frequency of monitoring/recording	Continuous monitoring, hourly measurement and monthly recording
Value monitored	1,443.81
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. As per the registered monitoring plan, the energy meters have to be calibrated annually. It is to be noted here that due to delay in calibration, error factor has been applied on transmission values as per accuracy class of meters to retain conservativeness for the month of Dec 2012 and July 2014 to May 2015.
Purpose of the data	Calculation of Baseline emissions
Calculation method	The transmission loss percentage is computed by KPTCL/CESC in accordance with equations specified in the PPAs and official KPTCL /CESC circulars as follows: $Z = \left\{ \frac{(X_1 + X_2 + X_3 + X_4 + \dots) - Y}{(X_1 + X_2 + X_3 + X_4 + \dots)} \right\} \times 100$ Where: Z = % of Transmission Loss (X1+ X2+ X3+X4+.....) = Sum of electricity export from energy meter connected to the receiving substation Y = electricity export from bulk energy meter installed at the receiving substation
Comments	The data will be kept for two years after the end of the crediting period

3.3 Monitoring Plan

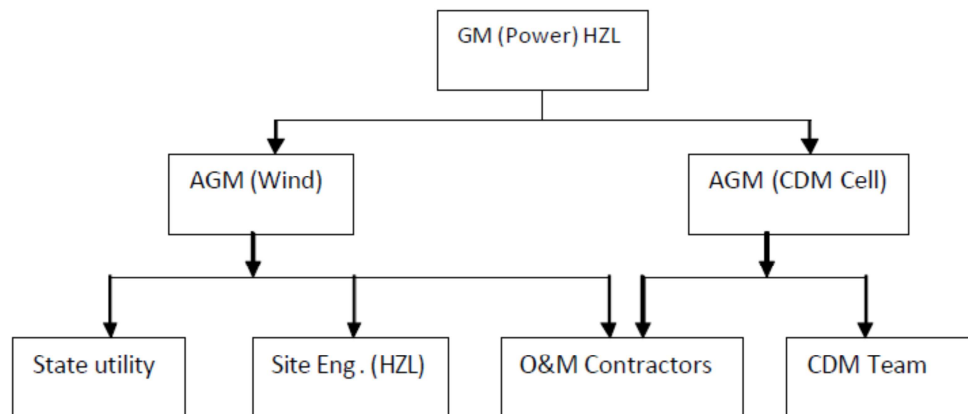
The purpose of the monitoring plan is to define the organizational structure of the monitoring team, monitoring practices, QA / QC procedures and archiving procedures. The monitoring plan aims to ensure that the emission reductions from the project activity are reported accurately and transparently.

Roles and Responsibilities of the Monitoring Team

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

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

The monitoring 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:



Monitoring Team	Roles & Responsibilities
General Manager (Power), HZL	- Communication with CDM EB - Communication with state utility
AGM (CDM Cell), HZL	- Overall coordination with monitoring team and DOE for verification activities - Maintaining data records, documentation and archiving
CDM Team	Assisting the General Manager (Wind) with overall coordination and with maintaining data records, documentation, archiving etc.
AGM (Wind) HZL	Coordinating with Site Engineer, O&M operators, and State Utility
Site Engineer, HZL	- Overseeing monitoring, operation and maintenance activities at site - Interacting with State Utility and O&M contractors for JMRs and calibration
O&M contractors	

	- Carrying out operation & maintenance of WTGs - Carrying out joint meter readings with state utility
State Utility	- Carrying out joint meter readings with representative of project proponent (O&M contractors) - Calibration of energy meters

Metering Arrangements and Procedures

HZL have 10 WTGs of 1.5 MW capacity each, all the WTGs are connected to four feeders. The WTGs generate 3-phase power at 690V, which is stepped up to 33 kV, For power evacuation GP-02,03,04 are connected to feeder 1, GP-17 connected to Feeder 2, GP-23,24 are connected to Feeder 3 and GP 28,29, 30,31 are connected to Feeder 4 as shown in the metering diagram above.

The electricity exported and imported from the sub-station metered using electronic trivector meters. A main and check meter is installed at every metering point/feeder for the project activity. There are four metering points/feeders for the project activity, the details of which as tabulated below:

Metering Point	Connected WTG	Total Capacity	Type of Meter	Accuracy Class
GP 04	GP02,GP03 & GP04	3 X 1.5 = 4.5MW	ER 300P	0.2 S
GP 17	GP17	1 X 1.5 = 1.5MW		
GP 23	GP23 & GP24	2 X 1.5 = 3MW		
GP 31	GP28,GP29,GP30 & GP31	4 X 1.5 = 6MW		

All the four feeders are connected to Gopalpura substation, where the power is stepped up to 220kV level and feeded to Grid. A bulk meter installed at Gopalpura substation, which is used for calculation of the transmission loss.

On a monthly basis, a joint meter reading carried out in the presence of the KPTCL/CESC officials and representatives of the project promoters. Each of the metering points connected to the nearest KPTCL/CESC sub-station from where electricity will be exported to the grid. For the purpose of calculating transmission losses, KPTCL/CESC will monitor electricity export from the sub-station through the sub-station bulk meter, and also electricity export from all metering points connected to the substation.

The transmission loss percentage is computed by KPTCL/CESC in accordance with equations specified in the PPAs and official KPTCL /CESC circulars as follows:

$$Z = \left\{ \frac{(X_1 + X_2 + X_3 + X_4 + \dots) - Y}{(X_1 + X_2 + X_3 + X_4 + \dots)} \right\} \times 100$$

Where:

Z = % of Transmission Loss

(X1+ X2+ X3+X4+.....) = Sum of electricity export from energy meter connected to the receiving substation

Y = electricity export from bulk energy meter installed at the receiving substation

For each metering point, transmission losses are computed each month as the product of the electricity export from the metering point (eg. X1) and the transmission loss percentage (Z).

Quality control and Quality Assurance procedures:

Calibration Procedures:

Main meters and check meters are installed for monitoring of the energy exported. The main and check meters shall be tested for accuracy every calendar year with reference to a portable standard meter. The meters shall be deemed to be working satisfactorily if the errors are within specifications for meters of 0.2 accuracy class. The data registered by the main meter alone will be adopted for the purpose of calculation as long as the error in the main meter is within permissible limits. If during the annual accuracy tests, the main meter is found to be within the permissible limit of error and the corresponding check meter is beyond the limits, the main meter reading shall be considered as usual. However, the check meter shall be calibrated immediately. If the main meter is found to be beyond the permissible limits of error, but corresponding check meter is within limits, then the check meter reading shall be adopted for that period. The main meter shall be calibrated immediately.

Apportioning Procedures in case the dates of monitoring period do not match with billing cycle dates

The monitoring period for the project activity may start from a date that does not coincide with the date of the initial reading of the respective JMR statement. For instance the monitoring period may start on the 20th of the month whereas the JMR Statement may report the net electricity generation data from the first of the month to the first of the next month. In such a scenario, the net electricity generation data from the start of the monitoring period to the first date of the next month (the apportioning period) would be determined as follows:

$$\text{Apportioned Net Electricity Generation} = \text{Apportioning Ratio} \times \text{Net Electricity Generation as per JMR Statement}$$

The apportioning ratio would be determined as the ratio of the electricity generation at the WTG for the apportioning period to the electricity generation at the WTG for the entire period covered under the JMR statement. This procedure would only have to be followed for the first and last month of the monitoring period if the start and end dates do not coincide with the date of the joint meter readings of the energy meters.

Apportioning Procedures for calculation of Net Electricity Exported from Project Activity:-

The net electricity exported to the grid by project activity is recorded in JMR statements. The main billing meter at substation records total export, and total import by all the connected WEGs to the particular feeder. Additionally, the O&M contractors maintain records of the electricity generation from individual WEGs which is monitored through the SCADA system. This data is used for the apportioning of electricity export and import to individual WEGs.

The electricity export and import by the WEGs of HZL calculated by using the following methodology.

$$EG_{BL,Y} = EG_{EXP,Y} - EG_{IMP,Y}$$

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.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions (BE_y in tCO_2e) are the product of the baseline emissions factor ($EF_{CO_2,grid,y}$ in tCO_2/MWh) times the electricity supplied by the project activity to the grid ($EG_{BL,y}$ in MWh) as described in registered PDD.

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

Where,

BE_y baseline emissions, tCO_2e

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

$EF_{CO_2,grid,y}$ grid emission factor, i.e. $0.9154 t CO_2/MWh$ (it has been fixed ex-ante)

$$EG_{BL,y} = EG_{EXP,y} - (1+15\%) EG_{IMP,y} - EG_{TL,y}$$

$$= 98251.96 - 745.61 - 1,443.81 = 95,950.7 MWh$$

So,

$$BE_y = 95,950.7 \times 0.9154$$

$$= 87,833 tCO_2 \text{ (Round down to nearest integer)}$$

4.2 Project Emissions

There are no Project emissions from the project activity

4.3 Leakage

There are no Leakage emissions from the project activity

4.4 Net GHG Emission Reductions and Removals

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

$$ER_Y = BE_Y - PE_Y - LE_Y$$

Where,

ER_Y = Emission Reduction in tCO₂/year

BE_Y = Baseline emission in tCO₂/year

PE_Y = Project emissions in tCO₂/year

LE_Y = Leakage Emissions in tCO₂/year

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2012	1,763	0	0	1,763
2013	23,145	0	0	23,145
2014	21,315	0	0	21,315
2015	19,241	0	0	19,241
2016	22,369	0	0	22,369
Total	87,833	0	0	87,833

It is to be noted here that as per the registered PD, the emission reductions during the current monitoring period was estimated to be 130,295 tCO₂e, whereas actual emission reductions achieved are 87,833 tCO₂e, which shows 32% decrease in the estimated value for the current monitoring period. The generation of electricity depends upon the wind flow, which is influenced by natural phenomena and not within the control of the project participant.

ANNEXURE 1: METER CALIBRATION DETAILS

Serial No	Location No	Calibration Date	Validity	Calibration Date	Validity	Calibration Date	Validity	Calibration Date	Validity	Calibration Date	Validity
11068520	G 04, G 03, G 02			06/08/2012	05/08/2013	10/07/2013	09/07/2014	22/05/2015	21/05/2016	21/05/2016	20/05/2017
11068533				06/08/2012	05/08/2013	10/07/2013	09/07/2014	22/05/2015	21/05/2016	21/05/2016	20/05/2017
11068516	G 17	25/07/2011	24/07/2012	15/12/2012	14/12/2013	09/07/2013	08/07/2014	22/05/2015	21/05/2016	21/05/2016	20/05/2017
11068503		25/07/2011	24/07/2012	15/12/2012	14/12/2013	09/07/2013	08/07/2014	22/05/2015	21/05/2016	21/05/2016	20/05/2017
11068511	GP 23, GP 24	25/07/2011	24/07/2012	15/12/2012	14/12/2013	10/07/2013	09/07/2014	22/05/2015	21/05/2016	21/05/2016	20/05/2017
11068519		25/07/2011	24/07/2012	15/12/2012	14/12/2013	10/07/2013	09/07/2014	22/05/2015	21/05/2016	21/05/2016	20/05/2017
11068522	G 31	25/07/2011	24/07/2012	15/12/2012	14/12/2013	10/07/2013	09/07/2014	22/05/2015	21/05/2016	21/05/2016	20/05/2017
11068527		25/07/2011	24/07/2012	15/12/2012	14/12/2013	10/07/2013	09/07/2014	22/05/2015	21/05/2016	21/05/2016	20/05/2017

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, import and transmission losses values as per accuracy class of meters to retain conservativeness for the month of Dec 2012 and July 2014 to May 2015.

ANNEXURE 2: BREAKDOWN DETAILS FOR THE CURRENT MONITORING PERIOD

Gen. Date	Loc. No.	Breakdown Remark	Breakdown Hrs.
01-Apr-2014	G 31	Check	0.40
01-Apr-2014	G 17	Elec SafetyChainStop	0.20
01-Apr-2014	G 04	Pitch BatterySurveillance2	12.30
01-Apr-2014	G 04	Preventive Check	0.40
01-Apr-2014	G 31	Line Breakdown due to Earthfault	0.10
01-Apr-2014	GP 23	Line Breakdown due to Earthfault	0.10

02-Apr-2014	GP 24	Elec FB YawCW Error	6.40
02-Apr-2014	G 17	Pitch Akku1Voltage LowStop	6.00
02-Apr-2014	G 04	Elec FB GeneratorFan	0.10
03-Apr-2014	G04	Preventive Check	0.10
07-Apr-2014	G 03	Rep Pitch FreqConvPitch2 ErrStop	0.50
07-Apr-2014	G 17	Rep Pitch CANComFail	0.60
07-Apr-2014	G 04	Elec UPSBattChange	2.10
11-Apr-2014	G 17	Rep Pitch CANComFail	4.40
11-Apr-2014	G 23	IDRV Audit	3.30
12-Apr-2014	G 24	Theft	4.20
02-May-2014	G 17	Shut Down Taken By EB	4.20
02-May-2014	G 04	Shut Down Taken By EB	4.00
02-May-2014	G 17	Shut Down Taken By EB	4.30
02-May-2014	G 04	Shut Down Taken By EB	4.00
02-May-2014	G 03	Shut Down Taken By EB	20.30
02-May-2014	G 04	Shut Down Taken By EB	14.00
02-May-2014	G 02	Shut Down Taken By EB	4.00
02-May-2014	G 17	Shut Down Taken By EB	4.30