10 MW WIND POWER PROJECT BY POWERICA AT BDS - GUJARAT

Document Prepared by EKI Energy Services Limited

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Project Title	10 MW wind power project by Powerica at BDS - Gujarat
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity involves installation and operation of a 5 Wind Turbine Generators (WTG s) of total generating capacity of 10 MW. The project activity will utilise V110 model of WTGs supplied of Vestas Wind Technology India Private Limited. The WTGs involved in the project are commissioned in villages, Beraja, Datrana and Samor of Khambaliya Taluka of Devbhoomi Dwaraka district of Gujarat. The project aims at providing electricity to the state of Gujarat by effective utilization of renewable resources. The electricity generated from the project activity is supplied to the national grid of India.

The total installed capacity of 10 MW comprises of 5 WTGs, each with a capacity of 2.0 MW. The project provides electricity to the state of Gujarat by effective utilization of renewable resources. The technology has been supplied by Vestas. The project utilizes wind energy for exporting electricity which otherwise would have been generated through alternate fuels (most likely - fossil fuel) based power plants, contributing to reduction in specific emissions (emissions of pollutant) including GHG emissions. Electricity produced from the project activity is supplied to INDIAN electricity grid i.e. the integrated pan-India electricity grid, formed by synchronization of erstwhile Northern, Eastern, Western, North-Eastern(NEWNE) and Southern grids.

Start date of the project activity is the earliest date of interconnection with the grid i.e. 04-February-2017. This is the date of commissioning of 4 MW (2 WTGs) capacity of Project activity.

The WTGs involved in the project activity were commissioned in two phase - 04-February-2017 (4 MW) and 15-February-2017 (6 MW).

The project activity is a greenfield project for generation of electrical energy using wind which is a renewable source of energy. In wind energy generation, kinetic energy of the wind is converted into mechanical energy and subsequently into electrical energy. Wind turbines capture the wind's energy with three propeller-like blades, which are mounted on a rotor, to generate electricity. The turbines sit high atop towers, taking advantage of the stronger and less turbulent wind. As the wind blows through the blades of the windmill, a pocket of low-pressure air forms on the downwind side of the blade. The low-pressure air pocket then pulls the blade towards it, causing the rotor to spin. The rotor turns the shaft that further spins the connected generator. The spinning of this generator produces the required electricity. Since power is generated from wind energy, no emissions are attributed to the project emissions and due to that equivalent amount of fossil-fuel dominated grid can be displaced due to the project activity.

Emission reductions are claimed on the net electrical energy that is supplied to grid which is metered using meters located at the electrical yard of the respective WTGs. These electrical energy meters are electronic tri-vector meters of appropriate accuracy class. Since these meters are not designed to measure high voltages and currents as generated

in the WTG, the WTG output is connected to these meters via transformers (CT/PT) for stepping down the generated voltage and current to ranges which the meters can record. As such, these meters have a multiplying factor which when multiplied to the meter reading provides the actual amount of electricity generated. The technology providers for the project have additionally installed an LCS meter at the WTG controller.

The electricity generated is monitored using electrical meters which provide a measure of the actual electrical energy that would have been sourced from a fossil-fuel based power plants in the absence of the project activity. Hence, the fossil-fuel power based grid is the baseline for the project activity.

The total emission reductions achieved by this project activity in the monitoring period from 01-October-2018 to 31-January-2020 38,098 tCO_2e through displacing 40216.22 MWh of electricity from fossil-fuel dominated electricity grid with electricity generation using wind energy resources.

1.2 Sectoral Scope and Project Type

Sectoral scope 1: Energy Industries (renewable / non-renewable sources).

Project type: Renewable energy project (Wind)

The project activity is not a grouped project

1.3 Project Proponent

Organization name	Powerica Limited
Contact person	Mr. Pradeep Gupta
Title	Head - Wind Energy Division
Address	9th Floor, Godrej Coliseum, Sion (E) Mumbai – 400022, Maharashtra, India
Telephone	+ 91 22 4001 2000
Email	pradeep.gupta@powericaltd.com

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the Project	Project Consultant
Contact person	Mr. Souvik Mitra
Title	Project Manager
Address	Office No 201, Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore 452010, India
Telephone	+91-9109120945
Email	souvik@enkingint.org

1.5 Project Start Date

The project start date is 04-February-2017 which is the date of commissioning of the first phase of the 10 MW wind power project.

1.6 Project Crediting Period

The crediting period of the project activity is for 10 years (renewable twice).

Project crediting period: 04-February-2017 to 03-February-2027.

1.7 Project Location

The project activity is located at Village –Beraja, Datrana and Samor, Taluka – Jamkhambhaliya, District – Devbhoomi Dwarka in the state of Gujarat.

The geo-coordinates of each WTG are as follows:

Serial No.	WTG ID	Village	Latitude	Longitude
1	BRJ 16	Beraja	22° 12′ 58.4″	69° 23′ 22.1″
2	BRJ 17	Beraja	22° 12′ 50.1″	69° 23′ 42.8″
3	DTR 12	Datrana	22° 11′ 34.1″	69° 23′ 46.8″
4	SMR 01	Samor	22° 15′ 14.2″	69° 32′ 28.6″

5	SMR 05	Samor	22° 15/ 50.5//	69° 32/ 55.0//

1.8 Title and Reference of Methodology

Methodology: Grid connected renewable electricity generation[1]
Reference: AMS I.D. Version 18.0
Project Category : I.D. Grid Connected renewable electricity generation
Version: 18, valid from 28/11/2014. Scope: 01, EB 81, Annex 24
Tools referred with above methodology are:
Tool to calculate the emission factor for an electricity system - Version 07.0 (EB 100, Annex 04)[2]
Demonstration of additionality of small-scale Project activities" Version 12 EB 99 Annex 3[3]
Investment Analysis - Version-07, EB92 Annex-5[4]

1.9 Participation under other GHG Programs

The project is also listed in UNFCCC under validation in CDM[5]. However, PP is yet to proceed further in registration in CDM of the project. However, the project proponent has provided undertaking that it will not claim any GHG credits for under any GHG program other than that in VERRA during the current monitoring period.

1.10 Other Forms of Credit

India is Non-annex1 country and there is no compliance with an emission trading program or to meet binding limits on GHG emissions for this project activity. PP has submitted undertaking that it would not use net GHG emission reductions by the projects for compliance with emission trading program to meet binding limits on GHG emissions. PP has also submitted undertaking for not availing other forms of environmental credit for the same crediting period under consideration.

1.11 Sustainable Development

The Contribution to sustainable development:

Ministry of Environment, Forest and Climate Change (MoEFCC), has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. The project contributes to sustainable development using the following ways.

[1] https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

[2] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v12.pdf

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v7.0.pdf

[5] https://cdm.unfccc.int/Projects/Validation/DB/OP7BL41FJ56ICWJZVO34VXC0IVVDRM/view.html

Social well-being: The project would help in generating employment opportunities during the construction and operation phases. The project activity will lead to development in infrastructure in the region like development of roads and also may promote business with improved power generation.

Economic well-being: The project is a clean technology investment in the region, which would not have been taken place in the absence of the VCS benefits the project activity will also help to reduce the demand supply gap in the state.

Technological well-being: The successful operation of project activity would lead to promotion of wind power generation and would encourage other entrepreneurs to participate in similar projects

Environmental well-being: Wind being a renewable source of energy, it reduces the dependence on fossil fuels and conserves natural resources which are on the verge of depletion. Due to its zero emission the Project activity also helps in avoiding significant amount of GHG emissions.

2 SAFEGUARDS

2.1 No Net Harm

The project does not involve any potential negative environmental and socio economic impacts and hence this criteria is not applicable to this project activity.

2.2 Local Stakeholder Consultation

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The process of local stakeholder consultation is continuous. During the current monitoring period, the project proponent has kept grievance register at plant site office and comments/grievances/suggestions can be submitted by local stakeholders including local community, government agencies and NGOs. Besides, the PP has also kept provision for submitting comments/grievances/suggestions from local stakeholders through direct mail. However, no major comments/grievances/suggestions have been received from the aforementioned stakeholders during the current monitoring period and all such minor suggestions have been take care by the PP.

2.3 AFOLU-Specific Safeguards

Not applicable to this as this is not an AFOLU project activity.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project has been completed and the monitoring equipments were installed to monitor the parameters as described in the registered Project Description (PD). All the WTGs involved in the project activity are already commissioned and operational. The WTGs are under operation since the date of commissioning and no event has been identified which may impact GHG emission reduction.

The technical details of the WTGs involved in the project activity are as below.

Parameters	Value/Information
Make	Vestas
Model	V-110
Rated Power	2000 kW(50 Hz)
Rotor diameter	110 m
Cut in wind speed	3 m/s
Rated wind speed	11.5 m/s
Cut out wind speed	20 m/s
Operating Temperature range standard turbine	-20°C to 40°C
No. of Blades	3
Rotor diameter	110 m
Swept area	9503 m^2
Rotor Speed	14.4 rpm
Hub Height	78 m
Generator Type	Asynchronous
Insulation	Class F
Generator Type	1 speed Generator, Water Cooled
Gear Box Type	1. Step Planet 2. Step Helical
Gear House Material	Cast
Gear Box Mechanical Power	1800 kW

The WTGs involved in the project activity were commissioned in two phase - 04-February-2017 (4 MW) and 15-February-2017 (6 MW).

The commissioning dates of all the WTGs are provided as below.

Serial	**WTG ID**	**Date of**

No.		commissioning
1	VWT / 2000/16-17 / 4030	04-February-2017
2	VWT / 2000/16-17 / 4031	04-February-2017
3	VWT / 2000/16-17 / 4096	15-February-2017
4	VWT / 2000/16-17 / 4097	15-February-2017
5	VWT / 2000/16-17 / 4098	15-February-2017

There has been no events (e.g. major breakdown) in the current monitoring period that may impact the GHG emission reductions or removals and monitoring.

3.2 Deviations

3.2.1 Methodology Deviations

No methodology deviation is applied during the monitoring period.

3.2.2 Project Description Deviations

No deviation is project description has taken place for the project activity.

3.3 Grouped Projects

The project is not a grouped project thus this is not applicable.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO2 emission factor in year y
Source of data	Calculated from CEA database, Version 13, June 2018[6]
Value applied	0.9726

[6] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as 3-year generation weighted average using data for the years 2014-15, 2015-16 & 2016-17. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 13, published by the Central Electricity Authority, Ministry of Power, Government of India.
k Purpose of Data	Calculation of baseline emissions
Comments	The value is fixed and it is same for the entire crediting period

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 13, June 2018[7]
Value applied	0.8723
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as per the latest data available for the most recent year 2015-16. The data is obtained from "CO_2 Baseline Database for Indian Power Sector" version 13, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	Calculation of baseline emissions
Comments	The value is fixed and it is same for the entire crediting period

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 13, June 2018[8]
Value applied	0.9475
Justification of choice of data or description of measurement methods and procedures applied	The combined margin emissions factor is calculated as follows: $\mathbf{EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}}$ Where: $EF_{grid,BM,y}$= Build margin CO_2 emission factor in year *y* (tCO_2/MWh)

[7] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

[8] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver13.pdf

	$EF_{grid,OM,y}$= Operating margin CO_2 emission factor in year *y* (tCO_2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM}= Weighting of build margin emissions factor (%) = 25%
Purpose of Data	Calculation of baseline emissions
Comments	The value is fixed and it is same for the entire crediting period

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{facility,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Source of data	Monthly Certificate for Share of Electricity Generated by Wind Firm issued by GEDA/SLDC
Description of measurement methods and procedures to be applied	Monitoring: a) At WTG yard: Electrical Energy Meters which are electronic tri-vector meters of accuracy class 0.5s or above b) At substation: Electrical Energy Meters which are bidirectional electronic tri-vector ABT meter of accuracy class 0.5s or above Data type: Measured & Calculated Archiving: Paper & Electronic Responsibility: a) At WTG yard: The O&M site-in-charge shall be responsible for the regular recording of data. b) At substation: The representatives of the GEDA/SLDC in the presence of O&M team are responsible for taking monthly joint meter reading at the substation. Calibration Frequency: The meters shall be calibrated at least once in five years period as per CEA notification
Frequency of monitoring/recording	Continuous monitoring and monthly recording
Value monitored	

Year	Net Electricity Supplied to grid (MWh)
2018	5506.19

<table>
<tr><td></td><td>
<table>
<tr><td>2019</td><td>32345.69</td></tr>
<tr><td>2020</td><td>2364.34</td></tr>
<tr><td>Total</td><td>40216.22</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>Monitoring Equipment: Monitored through the main meter and check meter readings. Both the energy meters are bi-directional tri-vector meters.
Details of energy meters are given below:
Make: Secure
Accuracy Class: 0.2s
<table>
<tr><td></td><td>Main Meter</td><td>Check Meter</td></tr>
<tr><td>Location</td><td>Sr. No.</td><td>Sr. No.</td></tr>
<tr><td>SMR05</td><td>XD 550486</td><td>XD 550501</td></tr>
<tr><td>SMR01</td><td>XD 550489</td><td>XD 550504</td></tr>
<tr><td>BRJ16</td><td>XD 532934</td><td>XD 532935</td></tr>
<tr><td>BRJ17</td><td>XD 550490</td><td>XD 550505</td></tr>
<tr><td>DTR12</td><td>XD 550488</td><td>XD 565857</td></tr>
</table>
Calibration details of energy meters have been mentioned in Appendix 1 of the document.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The Quantity of net electricity generation from the monthly wind energy certificates are cross-checked with the invoices for the sale of power by Powerica Limited. Meter calibration is conducted at least once in a five years period.</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Calculation method</td><td>Thus, Net electricity supplied to the grid by the project plant in a given month = Export(kWh) – Import (kWh). The share certificate mentioned only net electricity supplied to grid, hence single parameter is mentioned as monitoring parameter.</td></tr>
<tr><td>Comments</td><td>The Monitored Data to be kept for a minimum of two years after the end of the crediting period or the last issuance whichever is later.</td></tr>
</table>

4.3 Monitoring Plan

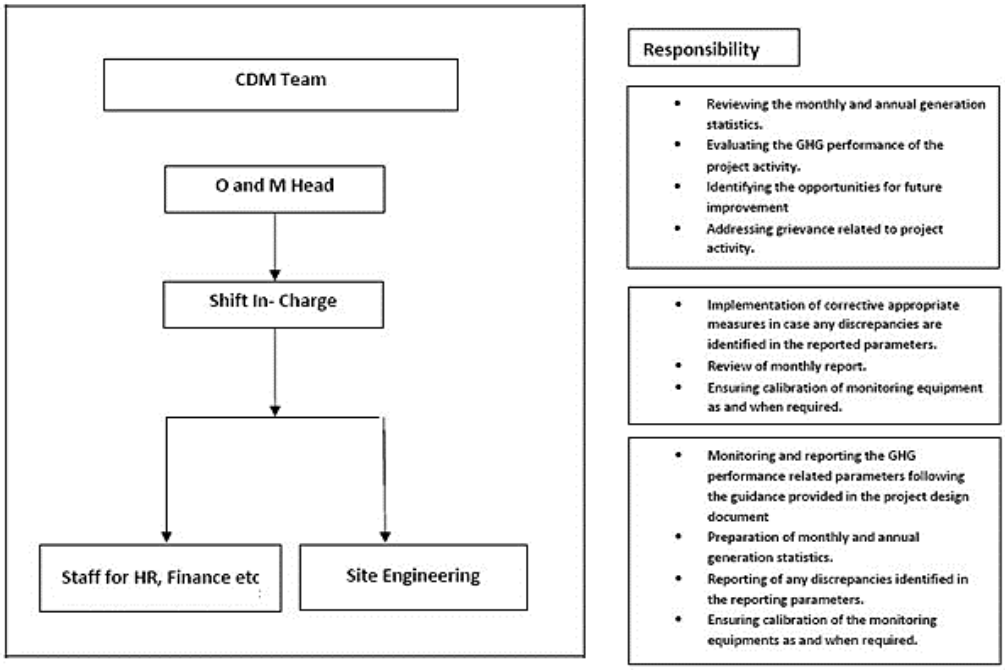
The project activity is in accordance with applied methodology, AMS ID, version 18.0 and therefore, can use the monitoring methodology for the same.

The monitoring methodology specified in the methodology requires that the project-monitoring plan to consist of metering the electricity supplied to the grid by the renewable

technology. In order to monitor the mitigation of GHG due to the project activity, the total energy exported needs to be measured. The net energy supplied to grid by the project activity multiplied by emission factor for regional grid, would form the baseline for the project activity.

Since the baseline emission factor is based on an ex-ante determination, monitoring of this parameter is not required. The sole parameter for monitoring is the electricity exported to the grid. The Project is operated and managed by a fully-fledged O&M team deputed at the project site. There would be a designated Site-In-Charge (O&M) on site who will be responsible for monitoring the electricity exported from the project activity. The organizational structure of the O&M team is as follows:

The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the project participant. PP proposed the following structure for data monitoring, collection, data archiving and calibration of equipments for this project activity. The team comprises of the following members:

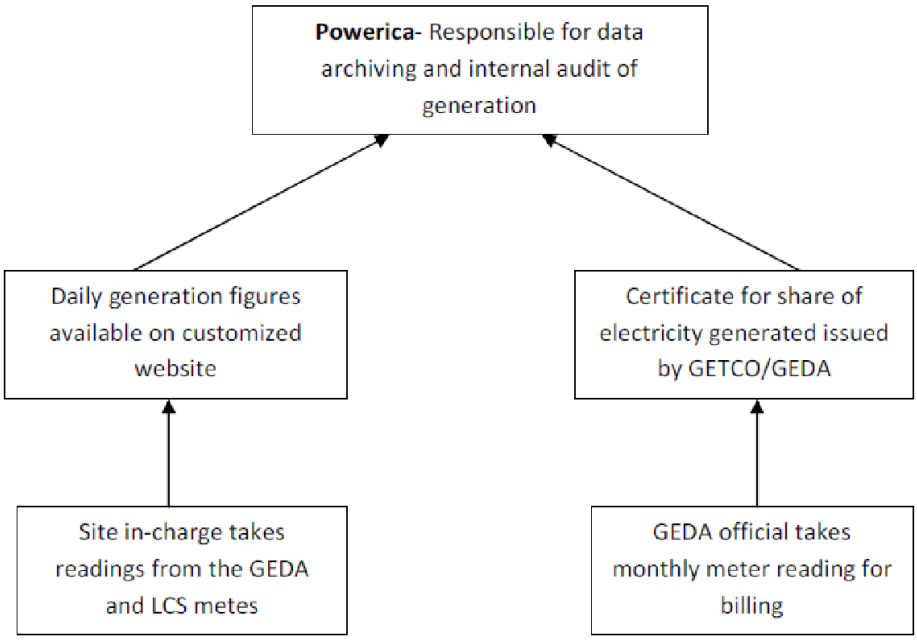


Data Measurement

Personnel Training:

The training for operating and maintaining the plant will be provided to the O&M team whenever there would be necessity or any technological up gradation

The overall flow of information has been depicted using the following hierarchical structure:



Monitoring Process at project site

Metering of wind power is done as under:

- Joint monthly meter reading shall be taken from substation meter by representative of GEDA/SLDC and O&M team/service provider (on behalf of individual wind mill owners). Let the total generation recorded for particular month is 'X' units in sub-station meter
- Joint daily meter reading shall be taken at Local Meter-(transformer yard meter of each WTG) by representative of O&M team/service provider (on behalf of individual wind farm owners) which is approved by representative of GEDA/SLDC on a monthly basis. Let us assume total approved generation of Powerica Limited recorded for particular month is 'Y1' units.
- Similarly, joint meter reading for other wind farm owners shall also be taken. Let the generation of individual owner recorded for particular month are 'Y2, Y3,.....Yn' units.
- The GEDA/SLDC apportions 'X' to individual wind farm owners using following formula and issues monthly certificates.

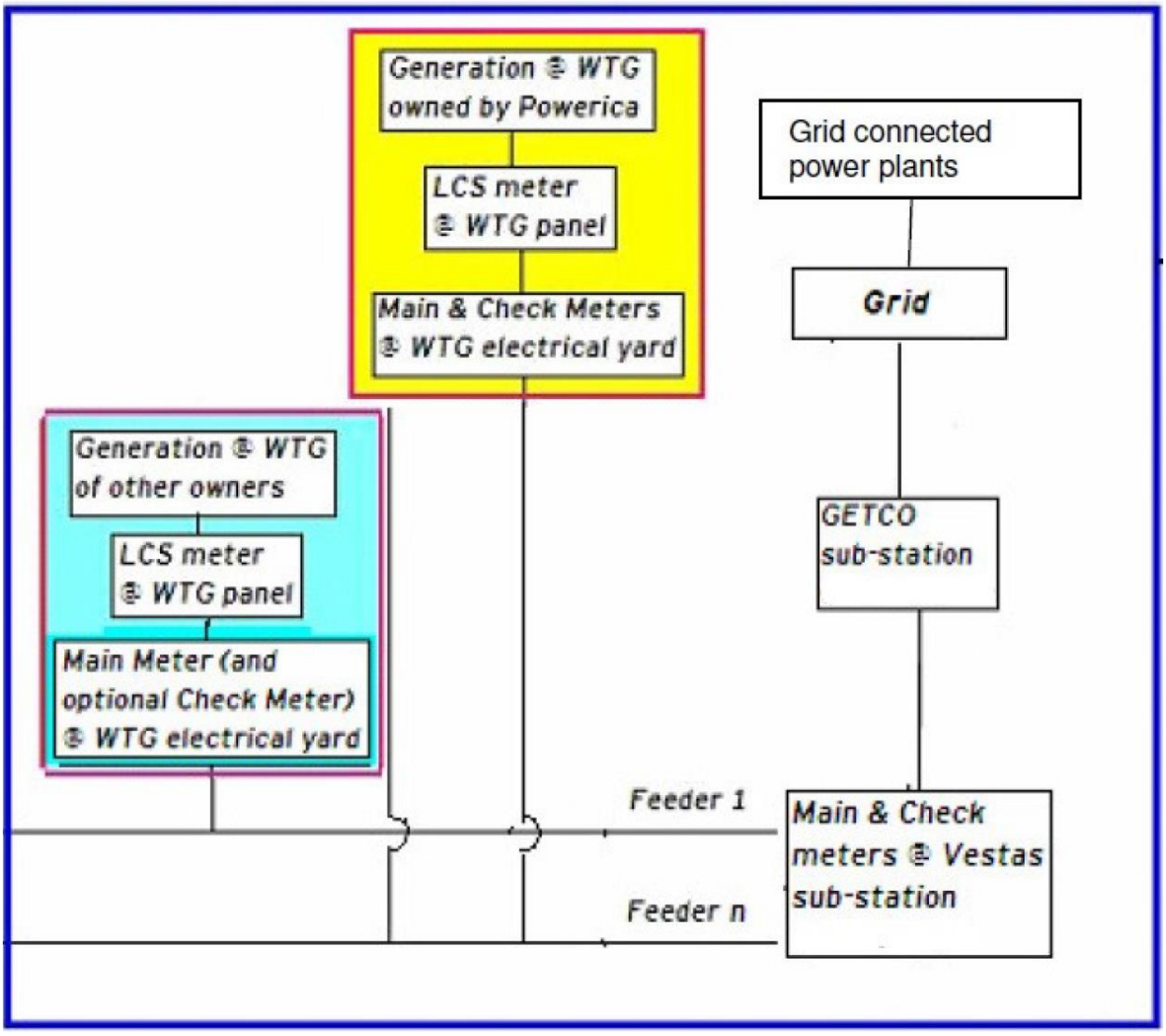
Net units calculated for billing = X * Yi / ΣYn

- For Powerica Limited, net units calculated for billing = X * Y1 / ΣYn
- It must be noted here that the meter readings as mentioned above shall be calculated as the product of meter multiplication factor and the difference of the current and previous meter readings

Based on the above procedure, the Monthly Wind Energy Certificates shall be provided to the project proponent. This is to be noted that the detail procedure of monitoring is illustrated here for the sake of understanding; for the preparation of monitoring report

during periodic verifications, only the net electricity generation value mentioned in monthly wind energy certificates shall be directly used for emission reduction calculation. No other parameters as explained above shall be used and presented in the monitoring report.

The schematic diagram of the metering arrangement is as below:



Emergency preparedness:
In case Main meter or Check meter is found to be outside the acceptable limits of accuracy or faulty or not functioning properly, it will be repaired, recalibrated or replaced as soon as possible. In the event that the Main meter is not in service as a result of maintenance, repairs or testing, the Check meter will be used for readings.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The emission factor value has been fixed Ex-ante and the same shall be used for the monitoring period. Net Electricity Generated is obtained by deducting total import (from grid) from total export (to grid). These values are taken from the "Certificate for Share of Electricity Generated by Wind Farm" issued by state electricity board. This statement is issued on a monthly basis.

Baseline emissions are calculated by multiplying the Net electricity exported to the grid with net baseline emission factor, as given in the registered VCS PD.

$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$

Where,

BE_y = Baseline Emissions (tCO_2/year)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the VCS project activity in year y (MWh/yr)
$EF_{grid,CM,y}$ = Baseline Emission Factor (Combined margin CO_2 emission factor for grid)
The calculation of yearly baseline emissions is provided in the table below:

Year	**Net Electricity Export(MWh)**	**Baseline Emission Factor(tCO2/MWh)**	**Baseline Emissions(tCO_2)**
01-October-2018 to 31-December-2018	5506.19	0.9475	5216
01-January-2019 to 31-December-2019	32345.69	0.9475	30642
01-January-2020 to 31-January-2020	2364.34	0.9475	2240
Total	**40216.22**		**38098**

Hence the baseline emission calculated for the reported monitoring period is 38,098 tCO_2 i.e. BE_y = 38,098 tCO_2

5.2 Project Emissions

No project emissions are applicable to this wind electric power project, since the electricity generation is based on wind resources, which does not involve in combustion or generation of emissions from fossil fuels. Hence, these emission sources are neglected.

$PE_y = 0\ tCO_2e$

5.3 Leakage

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, and transport). These emission sources are neglected.

$LE_y = 0\ tCO_2e$

5.4 Net GHG Emission Reductions and Removals

The 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 tCO_2/year

BE_y = Baseline emission in tCO_2/year

PE_y = Project emissions in tCO_2/year

LE_y = Leakage Emissions in tCO_2/year

For the project activity during the current monitoring period, as per section 5.1

$BE_y = 38{,}098\ tCO_2e$

$PE_y = 0\ tCO_2e$
$LE_y = 0\ tCO_2e$.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2018	5,216	0	0	5,216

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2019	30,642	0	0	30,642
2020	2,240	0	0	2,240
Total	38,098	0	0	38,098

The actual VER is about 14.8% higher than the estimated VER. This variation is majorly due to the variations in wind flow pattern, grid availability and other parameters which are not in the control of PP. The higher generation is owing to fact of higher PLF is due to wind flow pattern in the project location and is beyond the control of PP. However, this higher value does not impact the additionality of the project – as per Section 2.5 of the registered VCS PD, if the net generation increases by 19.85% than the estimated value, the project IRR breaches the benchmark; but in this case, the net generation increases by 14.83% than the estimated generation, so the project IRR does not breach the benchmark; furthermore, the actual PLF for the entire monitoring period is 34.33% which is also within threshold limit and with this annual actual PLF, the project IRR is within the benchmark.

APPENDIX 1: ENERGY METER CALIBRATION DETAILS

The calibration details for meters involved in the project activity and available with PP are as below. The calibration is under control of state electricity board and PP do not have any control on it.
Detail of the energy meters:
Make- Secure
Accuracy Class – 0.2s

Location	Main Meter Serial No.	Check Meter Serial No.	Date of Commissioning	Due date of Calibration
SMR 05	XD 550486	XD 550501	04-February-2017	04-February-2022
SMR 01	XD 550489	XD 550504	04-February-2017	04-February-2022
BRJ 16	XD 532934	XD 532935	15-February-2017	15-February-2022
BRJ 17	XD 550490	XD 550505	15-February-2017	15-February-2022
DTR 12	XD 550488	XD 565857	15-February-2017	15-February-2022

Considering five years calibration frequency as per CEA notification and pre-calibrated meters installed at time of commissioning, there is no any delay in calibration applicable for the project activity.

PP does not control the calibration details for substation meters and these are under control of state electricity board. Hence substation meter details are not mentioned here