RENEWABLE WIND POWER PROJECT BY AXIS WIND FARMS (RAYALASEEMA) PVT. LTD.

Document Prepared by EKI Energy Services Limited

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Project Title	Renewable Wind Power Project by Axis Wind Farms (Rayalaseema) Pvt. Ltd.
Version	02
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Monitoring Period	01-December-2019 to 31-December-2020 (inclusive of both start and end dates)
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The main purpose of this project activity is to generate clean form of electricity through renewable wind energy source. The project involves installation of 105 MW wind project in Anantapur district of Andhra Pradesh.

The project activity utilizes 50 Suzlon made S 88 WTGs each with capacity of 2.1 MW.

This is a Greenfield project activity and the electricity generated by this wind power project displaces an equivalent amount of electricity from the grid, which is fed mainly by fossil fuel fired power plants. Hence, it results in reduction of GHG emissions. Electricity supply from grid is considered as the baseline scenario of this project.

The project was commissioned in 6 phases - first phase of the project was commissioned on 02-March-2018 while the final phase was commissioned on 27-September-2018.

The scenario existing prior to the implementation of the project activity, is electricity delivered to the grid by the project activity that would have otherwise been generated by the operation of fossil-fuel dominated grid connected power plants and by the addition of new generation sources.

The total actual GHG Emission reductions generated in current monitoring period of 01-December-2019 to 31-December-2020 are 208,479 tCO_2e through displacing 222,544.19 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

The project activity is not a grouped project.

1.3 Project Proponent

Organization name	Axis Wind Farms (Rayalaseema) Pvt. Ltd
Contact person	Mr. Santhosa Kumar
Title	Project Representative
Address	H.No.6-3 680/3, Plot No.3, 2nd Floor, PMR Plaza, Thakur Mansion lane, Somajiguda, Hyderabad -500082
Telephone	+91-73973 26444

Email	Skumar@brookfieldrenewable.in

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	Enking Embassy, Office no. 201, Plot 48, Scheme 78 part 2, Vijay Nagar, Indore-452010 (M.P, India)
Telephone	+91 9109120945
Email	souvik@enkingint.org

1.5 Project Start Date

Start date of the project activity is the earliest date of commissioning of the WEGs i.e. 02-March-2018 and hence it is considered as the project start date.

Project Start Date: 02-March-2018

1.6 Project Crediting Period

Crediting Period Start date: 02-March-2018

Crediting Period End date: 01-March -2028

The project activity adopts renewable crediting period of 10 years period which can be renewed for maximum 2 times.

1.7 Project Location

The project is located in the state of Andhra Pradesh, India.

The location wise respective co-ordinates are mentioned below:

Location	Latitude	Longitude
Kalagalla	14.8138° N	77.4178° E
Ipperu	14.7770° N	77.4250° E
Padmati	13°40′59″N	79°20′49″E
Yaleru	14.6298° N	77.5082° E
Atmakur	15.87791°N	78.58842°E
Kuderu	14.7212° N	77.4128° E

Thimmapurumu	17.0286° N	82.2461° E

The details of the project locations are mentioned in the table below

Project Investor	Capacity (MW)	Village	State	Commissioning Date
Axis Wind Farms (Rayalaseema) Pvt. Ltd	10.5	Kalagalla and Ipperu	Andhra Pradesh	02-March-2018
	25.2	Ipperu, Padmati Yaleru & Atmakur		30-March-2018
	16.8	Ipperu, Kuderu & Atmakur		15-June-2018
	10.5	Ipperu & Kuderu		19-July-2018
	21	Kalagalla, Kuredu, Padamati Yaleru & Atmakur		04-September-2018
	21	Kammuru, Kuredu & Thimmapurumu		27-September-2018

The project location have been highlighted in the maps shown below

1.8 Title and Reference of Methodology

Methodology: ACM0002 ver. 19.0

Methodology Title: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC CDM[1].

[1] https://cdm.unfccc.int/methodologies/PAmethodologies/approved

The methodology also refers to the latest approved versions of:

- Tool to calculate the emission factor for an electricity system, Version 07.0 (EB 100, Annex 4)[2]
- Tool for the demonstration and assessment of additionality - Version 07.0.0 (EB 70, Annex 08)[3]

1.9 Participation under other GHG Programs

The project activity has not been registered and is not seeking registration at moment under any other GHG programs. The project also proponent has provided undertaking that it will not claim any GHG credits under any GHG program other than that under 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 any other forms of environmental credits e.g. REC for the monitoring period under consideration.

1.11 Sustainable Development

Ministry of Environment, Forest and Climate Change (MoEFCC), India's Designated National Authority (DNA) for CDM projects has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. During the current monitoring period, the project has contributed to sustainable development through the following ways.

Social well-being:

- The project activity has resulted in creating job opportunities for the local population on temporary and permanent basis. Manpower is required both during erection and operation of the renewable energy projects. This would result in the improvement in living standards of the local community.
- The installation of the renewable energy projects also led to development of basic infrastructure like roads, communication with the nearby cities etc. which also improved in living standards of the local population..

Economic well-being:

- The project activity has created direct and indirect job opportunities to the local community during installation and operation of the renewable energy projects.

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

[3] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

- The investment for the project activity has led to the improvement in the economic activity in the local area.

Environmental well-being:

The project activity utilizes renewable energy for generating electricity which otherwise would have been generated through alternate fuel (most likely - fossil fuel) based power plants, contributing to reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions. As renewable energy projects produce no end products in the form of solid waste (ash etc.), they address the problem of solid waste disposal encountered by most other sources of power. Being a renewable resource, to generate electricity contributes to resource conservation. Thus the project causes no negative impact on the surrounding environment.

Technological well-being:

The successful operation of project activity has led to promotion of wind power generation and would encourage other entrepreneurs to participate in similar projects.

2 SAFEGUARDS

2.1 No Net Harm

The project activity and the initial project activity instance being wind power project, it does not involve any potential negative environmental and socio-economic impacts.

2.2 Local Stakeholder Consultation

Before implementation of the project activity, the project proponent did thorough consultation with stakeholders – identifying the stakeholders, consultation with the stakeholders in number of phases and through number of media – focus group discussion, detailed social mapping and fieldwork, inclusion of local stakeholders from all sections of community , explanation of project activity – purpose and details to them and resolving the comments/ grievances along with seeking suggestions from them. The PP has engaged a number of local NGOs for local stakeholder consultations by applying various strategies to engage them in project and for taking care of their complaints/grievances/suggestions. The process is ongoing and continuous; this process is undertaken throughout the year.

During the current monitoring period, the project proponent has engaged with the local stakeholders in different ways including various Corporate Social Responsibility (CSR) activities undertaken by the company. Besides, the PP has kept grievance register in plant site office seeking complaints/grievances from local community. There has also been the

provision of receiving letters from local community for any suggestion/comment/complaint.

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.

Technical specifications of Suzlon S 88 WTG

Operating data	
Rated power	2.1 MW
Cut-out speed	25 m/s
Cut-in speed	4 m/s
Rated speed	14 m/s
Hub height	80m
Rotor diameter	11.8 m
Rotor speed	15.47 rpm
Rotor	
Pitch system	Electric drive with electric brake, gearbox, frequency converter & batteries.
Diameter	88 m
Swept area	6082 m^2
Blade material	The rotor blades are made of high grade GRP and manufactured by using Resin Infusing Moldings (RIM) technology
Generator Type	Single fed Induction Generator with slip-rings, variable rotor resistance with SUZLON-FLEXI-SLIP control system.

Yaw System	
Type	Electric motors with brake, gearbox & pinion
Bearings	High tensile double-row ball-bearing
Braking System	3 independent Aero Brakes with power back up supply.

The details of commissioning schedule of the WTGs in this project activity have been provided below:

Project Proponent	Capacity (MW)	Date of Commissioning
Axis Wind Farms (Rayalaseema) Pvt. Ltd	10.5	02-March-2018
	25.2	30-March-2018
	16.8	15-June-2018
	10.5	19-July-2018
	21	04-September-2018
	21	27-September-2018

The WTGs are under operation including scheduled shutdowns during the current monitoring period and no such event has been identified in the current monitoring period which may impact GHG emissions reductions. The details of plant breakdowns in the current monitoring period are provided in APPENDIX 2.

3.2 Deviations

3.2.1 Methodology Deviations

No methodology deviation is applied during the monitoring period.

3.2.2 Project Description Deviations

As per the VCS PD section 4.2, the monthly electricity supplied/exported by the project activity in the JMR report is cross checked with the monthly invoices of sale (of electricity). However, as per the project site practice, there are two types of invoices - one for electricity export while the other (HT bill) is electricity import.

The values of electricity export are adjusted with line loss percentage (provided in monthly JMRs) in accordance with the formula Electricity Delivered (export) = Meter reading – (meter reading* line loss%). The values of electricity export thus obtain are compared with the values of electricity export invoices and for each month, smaller of them is considered for Emissions Reductions calculations as per conservative approach for all the months covered in current monitoring period.

In case electricity import, for the months of December 2019 and January 2020, the values of import considered as per the values of import for 220 kV metering point mentioned in Annexure III of monthly JMRs for import electricity invoice as per project site practice and the same values are considered for Emissions Reductions calculations; for the months February 2020 to December 2020, the values of electricity import(as in JMR) are adjusted with transmission and distribution losses according to the formula as per project site practice:

Electricity Import = Import (as per JMR) *103%

The values of electricity import thus obtained (for months February 2020 to December 2020) are compared with values of import in invoices (HT bills) and greater of the values are considered for Emissions Reductions calculations as per conservative approach.

In order to obtain the values of "Quantity of net electricity generation supplied by the project plant/unit to the grid", the monthly values of electricity import (obtained by the method described here) are subtracted from the values of electricity export (obtained by the method described here). This is conservative approach for Emissions Reductions calculations.

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 CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 14, Dec 2018[4]
Value applied	0.9610
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 2015-16, 2016-17 and 2017-18,. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 14, 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

[4] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

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 14, Dec 2018[5]
Value applied	0.8644
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 2017-18. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 11, 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	tCO2/MWh
Description	Combined Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 14, Dec 2018[6]
Value applied	0.9368
Justification of choice of data or description of measurement methods and procedures applied	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid, BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO2/MWh) $EF_{grid,OM,y}$= 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	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

[5] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

[6] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver14.pdf

4.2 Data and Parameters Monitored

<table>
<tr><td>Data / Parameter</td><td>EG $_{PJ, y}$</td></tr>
<tr><td>Data unit</td><td>MWh/y</td></tr>
<tr><td>Description</td><td>Quantity of net electricity supplied by the project plant/unit to the grid in year y in MWh</td></tr>
<tr><td>Source of data</td><td>Monthly JMRs from SLDC</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>The difference of final value of export and import is used for monthly values of net electricity supplied to the grid by the project activity and same value will be considered for ER calculations.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Continuous measurement & monthly recording</td></tr>
<tr><td>Value monitored</td><td><table><tr><td>Year</td><td>Net Electricity Supplied</td></tr><tr><td>2019</td><td>4654.34</td></tr><tr><td>2020</td><td>217,889.86</td></tr><tr><td>Total</td><td>222,544.19</td></tr></table></td></tr>
<tr><td>Monitoring equipment</td><td>The electricity exported / supplied by the plant to pooling substation and further to substation. This meter also measures electricity imported by the plant from the grid. The details of meters are given in APPENDIX 1.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The meters are approved, tested & sealed by the State Utility. The meters are in the custody of State Utility. The frequency of calibration is once in 5 years.
The monthly electricity supplied/exported by the project activity in the JMR report is cross checked with the monthly invoices of sale. In the absence or delay in the meter calibration appropriate Guidelines will be applied appropriately to confirm the conservativeness of metering.

The metering arrangement, accuracy class of meters, calibration frequency is under control of state electricity board and PP do not have any control on it. PP is getting value of net electricity supplied to grid and the same is considered the monitoring parameter.

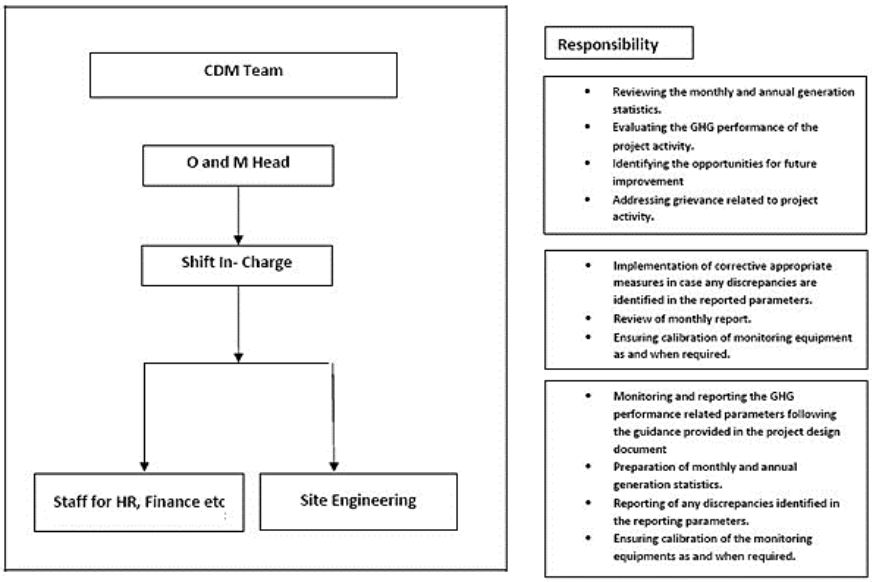
The billing is raised based on substation meters.</td></tr>
</table>

Purpose of the data	Calculation of baseline emissions
Calculation method	Thus, Net electricity supplied to the grid by the project plant in a given month = Export (MWh(– Import (MWh)
Comments	Data will be archived in paper & electronic form for two years after the end of crediting period or of the last issuance of VERs for this project activity, whichever occurs later.

4.3 Monitoring Plan

The monitoring plan is developed in accordance with the modalities and procedures for CDM project activities and is proposed for grid-connected wind energy project being implemented. The monitoring plan, which will be implemented by the project participant describes about the monitoring organization, parameters to be monitored, monitoring practices, quality assurance, quality control procedures, data storage and archiving.

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

The export and import energy will be measured continuously using above mentioned Main and Check meters located at the substations. Readings of meters shall be taken on monthly basis by authorized officer of SEB in the presence of PP or representative of PP. Based on the Meter Reading Statement to PP, invoices will be raised. These invoices can be used for cross checking the meter readings taken for the respective project activity.

Data collection and archiving

Readings from meters will be collected in the presence of the plant in-charge. Export and Import data would be recorded and stored in logs as well as in electronic form on a daily basis. The records are checked periodically by the Plant Manager and discussed thoroughly with the plant supervisor. The period of storage of the monitored data will be 2 years after the end of crediting period or till the last issuance of VERs for the project activity whichever occurs later.

Emergency preparedness

The project activity will not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

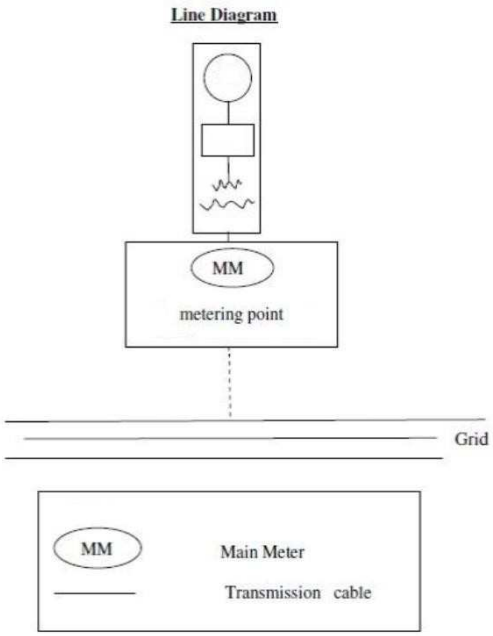
In the event that the main meter, which is used to record the net electricity exported by the project, is found to be faulty it will be repaired or replaced and the data from the check meter will be used in its place. In the unlikely event that the check meter fails it will also be repaired or replaced.

Personnel training

In order to ensure a proper functioning of the project activity and a properly monitoring of emission reductions, the staff will be trained. The plant helpers will be trained in equipment operation, data recording, reports writing, operation and maintenance and emergency procedures in compliance with the monitoring plan.

Metering Arrangement

Line diagram with metering arrangement for the wind project activity is shown below



QA/QC procedures

The energy meters at the feeders are maintained and owned by state electricity board. Neither the project proponent nor the site personnel have any control over it. The records will be crosschecked with the records of sold electricity to state electricity board. The meters are calibrated by state electricity board at-least once in five years.

Apportioning

In case the dates of a particular monitoring period do not match with the dates of the billing cycle, the net electricity exported to the grid would be calculated from:

- Apportioning the net electricity exported to grid, as recorded in the consolidated Share Certificate / JMR Report / Credit Notes certified by the respective state DISCOM, based on the number of days in the monitoring period and the number of days for which Share Certificate / JMR Report / Credit Notes was prepared.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As per the approved consolidated Methodology ACM0002 (Version 19.0) para 42:

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid- connected power plants and the addition of new grid- connected power plants. The baseline emissions are to be calculated as follows:

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

Where:

BE_y = Baseline emissions in year y (t CO_2/yr)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/year)

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh)

Total net electricity exported $EG_{PJ,y}$ = 230.745.50 MWh

$EF_{grid, CM, y}$ = 0.9368 tCO_2/MWh

Year-wise calculation of Baseline Emissions

Year	**Net Electricity Supplied (MWh)**	**Baseline Grid Emission Factor (tCO_2/MWh)**	**Baseline Emissions(tCO_2)**
2019	4654.34	0.9368	4,360
2020	217,889.86	0.9368	204,119
Year	**222,544.19**		**208,479**

Therefore, Baseline Emissions BE_y = 208,479 tCO_2e (round-down value)

5.2 Project Emissions

Not Applicable, since emissions from the project activity is zero as per ACM0002 methodology.

Hence, project emissions PE_y = 0 tCO_2e

5.3 Leakage

Not Applicable, since leakage emissions are not to be considered as per ACM0002 methodology.

Hence leakage LE_y = 0 tCO_2e

5.4 Net GHG Emission Reductions and Removals

This section will be completed during the Verification

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	4,360	0	0	4,360
2020	204,119	0	0	204,119
Total	**208,479**	**0**	**0**	**208,479**

It is to be noted here that as per the estimated emission reduction to be achieved from the project activity for the current monitoring period is 220,201 tCO_2e, whereas actual emission reductions achieved are 208,479 tCO_2e, which is approximately 5.3 % lower than the estimated emission reductions.

This variation is majorly due to the variations in wind flow pattern, grid availability and other parameters which are not in the control of project proponent.

APPENDIX 1: METER DETAILS

Meter Serial Number and Type	Make	Accuracy Class	Date of Calibration	Due Date of Calibration
17103228 (Main Meter)	L & T	0.2 s	28-March-2018	27-March-2023
17103230 (Check Meter)	L & T	0.2 s	28-March-2018	27-March-2023
17103234 (Standby Meter)	L & T	0.2 s	28-March-2018	27-March-2023

Considering the last calibration date and next due date of calibration, it can be concluded that the calibration frequency of monitoring equipment of this project is in accordance with the QA/QC procedures.

APPENDIX 2: BREAK-DOWN DETAILS

Date	Feeder No.	Shutdown or Trip	From	To	Duration (Hours)	Reason
18-Nov-19	220 KV	EHV Trip	17:05	18:53	1:48	220KV LINE TRIPPED
02-Feb-20	220 KV	EHV Trip	09:29	12:24	2:55	220 Kv Line zone-1 trip due to Y-ph earth fault
01-April-20	220 KV	Internal S/D	13:07	14:42	1:35	220KV Line-01 Shutdown
23-Jul-20	220 KV	Internal S/D	12:44	15:01	2:17	220KV Line-01 Shutdown
11-Oct-20	220 KV	EHV Trip	11:09	11:48	0:39	220kV Line
05-Dec-20	220 KV	External S/D	9:27	17:50	8:23	--
10-Jun-20	220 KV	EHV Trip	16:45	17:07	0:22	220KV LINE TRIPPED