WIND POWER PROJECT AT THENI BY POWERICA LIMITED

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

Powerica Limited is the largest Genset manufacturer in India. Founded in 1980, it is the project proponent of the wind power project under the Clean Development Mechanism of Kyoto Protocol.

Effective utilization of resources has been a guiding factor for Powerica towards conceptualization of a 9.9 MW wind power project. This project aims at providing electricity to the state electricity grid through effective utilization of renewable resource which, in the case of the project activity, is wind power.

The main purpose of the project activity is to generate electrical energy through sustainable means using wind power resources and to contribute to climate change mitigation efforts. In the absence of the project activity, the electricity thus supplied would have been generated through fossil fuel based thermal power plants. The project activity thus contributes to reduction in specific emissions (emissions of pollutant) including GHG emissions. The project activity is also responsible for sustainable economic growth and conservation of environment through use of wind as a renewable source.

The project activity involves a total installation of 6 Wind Turbine Generators (WTG) of total generating capacity of 9.9 MW (6 units of Vestas make V82 WTG). The WTG units will be installed in Theni district of the state of Tamilnadu.

The project activity essentially involves generation of electricity from wind energy. The employed WTGs use wind energy to produce electricity and do not use any other input-fuel for electricity generation. The operation of WTGs is emission free and no GHG emissions are produced during the lifetime of the project activity.

The project activity replaces anthropogenic emissions of greenhouse gases (GHGs) into the atmosphere, which is estimated to be approximately average 22,798 tonnes of CO2e per year, by displacing the equivalent amount of electricity generation through the operation of existing fuel mix in the grid comprising mainly fossil fuel based power plants and future capacity expansion connected to the grid.

The WTGs installed in the project activity are connected to the Southern grid[1]. Therefore, the emission factor associated with the Southern grid is used to evaluate baseline emissions for the project activity. The project boundary composed of the WTGs, transformer, the metering equipment, substation, and the Southern grid, which is used to transmit the generated electricity.

The project activity does not result in any greenhouse gas emissions and it is a clean source of electricity. The technology is a clean technology as there are no GHG emissions associated with the electricity generation. Technology is indigenous, available within the country, and environmentally safe and sound.

Details of commissioning date of all WTGs:

Sl. No	WTG	HTSC No.	Capacity of WTG (MW)	Commissioning Date
1	TGU28	T - 139	1.65	13/09/2010

[1] Now a part of unified Indian Electricity Grid i.e Indian Grid

2	TM721	T - 141	1.65	13/09/2010
3	TSSP158	T - 142	1.65	13/09/2010
4	TSSP174	T - 143	1.65	13/09/2010
5	TSSP1255	T - 144	1.65	13/09/2010
6	TM41	T-145	1.65	17/09/2010

The total emission reductions achieved by this project activity in the monitoring period from 11 December 2012 to 10 September 2018 is 98,590 tCO2e.

1.2 Sectoral Scope and Project Type

The project activity falls under
Sectoral Scope **:** 01 - Energy industries (renewable / nonrenewable sources)
Project Type **:** I - Renewable Energy Projects
Title **:** AMS-I.D. ver. 16 - Grid connected renewable electricity generation

Methodology AMS I.D. also refers to:-
Tool to calculate the emission factor for an electrical system EB 50, Version 02

This project is not a grouped project activity.

1.3 Project Proponent

Organization name	Powerica Limited
Contact person	Mr Pradeep Gupta
Title	Head of Wind Energy
Address	601, Dakshina Building, Sector -11, CBD Belapur, Navi Mumbai – 400 016, Maharashtra, India
Telephone	-
Email	-

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the project	Project Consultant
Contact person	Mr. Ramkrishna Patil

Title	GM – Operations
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1.5 Project Start Date

The project start date for this project is said to be is 13/09/2010. This is because the first WTG was commissioned on the said date.

1.6 Project Crediting Period

The project is registered under Clean Development Mechanism (CDM) of UNFCCC with 07 years crediting period (Renewable) (Reference No: 4572) on 17 March 2011[2]. First CDM Crediting period of the project under CDM started on 01 May 2011 and ended on 30 April 2018.

The project has begun generating GHG emission reductions from 13/09/2010. Hence, first crediting period for VCS began on 13/09/2010 to 12/09/2020.

The project proponent will also not claim GHG emission reductions under two schemes for the same period.

1.7 Project Location

The project is located in Taluka: Andipatti, District: Theni ,State: Tamilnadu.

The unique location information of the WTG is provided in the table below. The WTG numbers indicated in the table below are unique identification number provided by the state utility.

Latitude & Longitude:

WTG	HTSC No.	Village	Latitude (°N)	Longitude (°E)
TSSP1255	T-144	Shanmuga Sundarapuram	9°59'40"	77°34'10"
TM721	T-141	Mottanuthu	9°58'46"	77°34'43"
TSSP158	T-142	Shanmuga Sundarapuram	9°59'08"	77°34'39"
TM41	T-145	Mottanuthu	9°58'34"	77°35'24"
TGU28	T-139	Usilampatti	9°57'03"	77°33'33"
TSSP174	T-143	Shanmuga Sundarapuram	9°59'23"	77°34'43"

[2] https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1300097036.88/view

1.8 Title and Reference of Methodology

AMS-I.D. ver. 16 - Grid connected renewable electricity generation
Methodology AMS I.D. also refers to:-
Tool to calculate the emission factor for an electrical system EB 50, Version 02

1.9 Other Programs

- Emission Trading Programs and Other Binding Limits: The PP has not applied this project in any Emission Trading Programs and other Binding Limits.
- Other Forms of Environmental Credit: The PP has not applied this project in any other form of environmental credits.
- Participation under Other GHG Programs: The PP has participated under CDM mechanism of UNFCCC. The UN reference id 4572[3] of program with this project activity. The PP would not consider the credit from any other mechanism for the current monitoring plan. The undertaking is provided to confirm that there is no any double accounting for current monitoring period.

1.10 Sustainable Development

Contribution to sustainable development:

Ministry of Environment and Forests, 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.

- **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. Due to generation of employment opportunities, the economic condition of project activity region will be improved.
- **Technological well-being:** The successful operation of project activity would lead to promotion of wind based power generation and would encourage other entrepreneurs to participate in similar projects.
- **Environmental well-being**: The project activity 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.

[3] https://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1300097036.88/view

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

Technology

It is to be noted that the project activity is a greenfield project for generation of renewable electrical energy by harnessing wind power. Thus, this project actually displaces the electricity grid which is essentially fossil-fuel based.

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 will be claimed on the net electrical energy that is supplied to grid which will be metered using electricity meters (Main & Check meters) located at the electrical yard of the respective WTGs. These electrical energy meters are essentially 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.

For the project activity, the project proponent has procured the WTGs from Vestas Limited for supply of 6 units V82 1650 kW capacity. The salient features of the technology employed are:

V82_1.65 MW_50Hz

Parameter	Specification
Rated Power	1,650 kW
Rotor diameter	82 m
Swept area	5,281 m^2
No. of blades	3
Cut in wind speed	3.5 m/s
Cut out wind Speed	20 m/s
Rated wind speed	13 m/s
Regulation	Active Stall
Tower Height	78 m
Insulation	Class F/B

The commissioning details of each WTG is mentioned in section 1.1 of MR.

2.2 Deviations

2.2.1 Methodology Deviations

There is no request for deviation applied during this monitoring period.

2.2.2 Project Description Deviations

The project has requested below deviation

As per registered CDM PDD, the calibration frequency is once in every two years. The calibration of meters is not in control of PP and same is done by state electricity board. The state electricity board does not follow any fixed calibration frequency, hence deviation is requested for change in calibration frequency as once in five years. This calibration frequency is as per CEA notification http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf , page 12

The change in calibration frequency does not have any impact on ER calculations as during monthly reading state electricity board official and PP representative check the meter conditions. Also both parties accepts the reading and PP raise the invoice to state electricity board based on monthly JMR reading. Thus financial obligations are involved which ensures that meters are running accurately.

2.3 Grouped Project

This project activity is not a grouped project activity.

2.4 Safeguards

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

2.4.1 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.

2.4.2 Local Stakeholder Consultation

Local Stakeholder consultation had been carried out during CDM registration of this project activity on 09/07/2010. There were no comments that required follow up action from PP. 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	**$EF_{Grid,CM,y}$**
Data unit	tCO2/MWh
Description	Combined Margin Grid emission factor for South Grid
Source of data	CEA website Version :05 (Valid from 1st November 2009)
Value applied	0.9445
Justification of choice of data or description of measurement methods and procedures applied	The value applied is taken from the plant from CEA reviews. The weights used for calculating combined margin emission factor are 0.75 and 0.25 for operating margin and build margin respectively.
Purpose of the data	This data is used for the calculation of the Baseline Emissions
Comments	Data will be kept for crediting period + 2 Years.

Data / Parameter	**$EF_{Grid,OM,y}$**
Data unit	tCO2/MWh
Description	Weighted average of 3 years (2006-07, 2007-08, 2008-09) CO2 Operating Margin emission factor of the South grid
Source of data	CEA website Version :05 (Valid from 1st November 2009)
Value applied	0.9868
Justification of choice of data or description of measurement methods and procedures applied	The value applied is taken from the plant from CEA reviews.
Purpose of the data	This data is used for the calculation of the Baseline Emissions
Comments	Data will be kept for crediting period + 2 Years.

Data / Parameter	**$EF_{Grid,BM,y}$**
Data unit	tCO2/MWh
Description	CO2 Built Margin emission factor of the South grid
Source of data	CEA website Version :05 (Valid from 1st November 2009)
Value applied	0.8179
Justification of choice of data or description of measurement methods and procedures applied	The value applied is taken from the plant from CEA reviews.
Purpose of the data	This data is used for the calculation of the Baseline Emissions

Comments	Data will be kept for crediting period + 2 Years.

3.2 Data and Parameters Monitored

Data / Parameter	**EGy**
Data unit	MWh
Description	Quantity of net electricity supplied to the grid in year y
Source of data	TNEB statements
Description of measurement methods and procedures to be applied	Measured
Frequency of monitoring/recording	Monthly
Value monitored	104,384.112
Monitoring equipment	Monitoring Equipment: Electrical Energy Meters which are electronic tri-vector meters Accuracy class: 0.5s /0.2s Calibration Frequency: The meters shall be calibrated once every five years. (Please refer section 2.2.2 for deviation requested)
QA/QC procedures to be applied	The amount of electricity exported to grid is cross-checked with the invoices for sale of power. Meter calibration shall be conducted once every five years and internal audit system is in place as mentioned in the Registered PDD.
Purpose of the data	This data is used for the calculation of the Baseline Emissions
Calculation method	-
Comments	**Data archived:** Crediting period + 2 yrs

3.3 Monitoring Plan

The project activity is in accordance with approved small scale methodology AMS I.D, and therefore, of the simplified M&P for small-scale CDM project activities-Version 16, - Grid connected renewable electricity generation.

The monitoring methodology specified in the methodology requires that the project-monitoring plan to consist of monitoring of quantity of net electricity supplied to the grid in the year y. 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 methodology is based on ex-ante determination of the baseline emission factor, the monitoring of baseline emission factor is not required. The sole parameter for monitoring is the electricity exported to the grid. The Project is operated and managed by Vestas Wind Technology India Private Limited (Vestas). Vestas will have a designated Site-In-Charge (O&M) on site who will be responsible for monitoring the electricity exported from the project activity. The overall flow of information has been depicted using the following hierarchical structure:

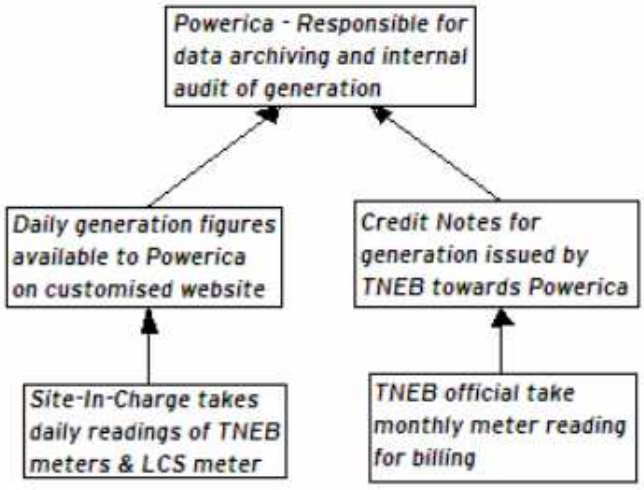

Figure 2: Hierarchical Structure

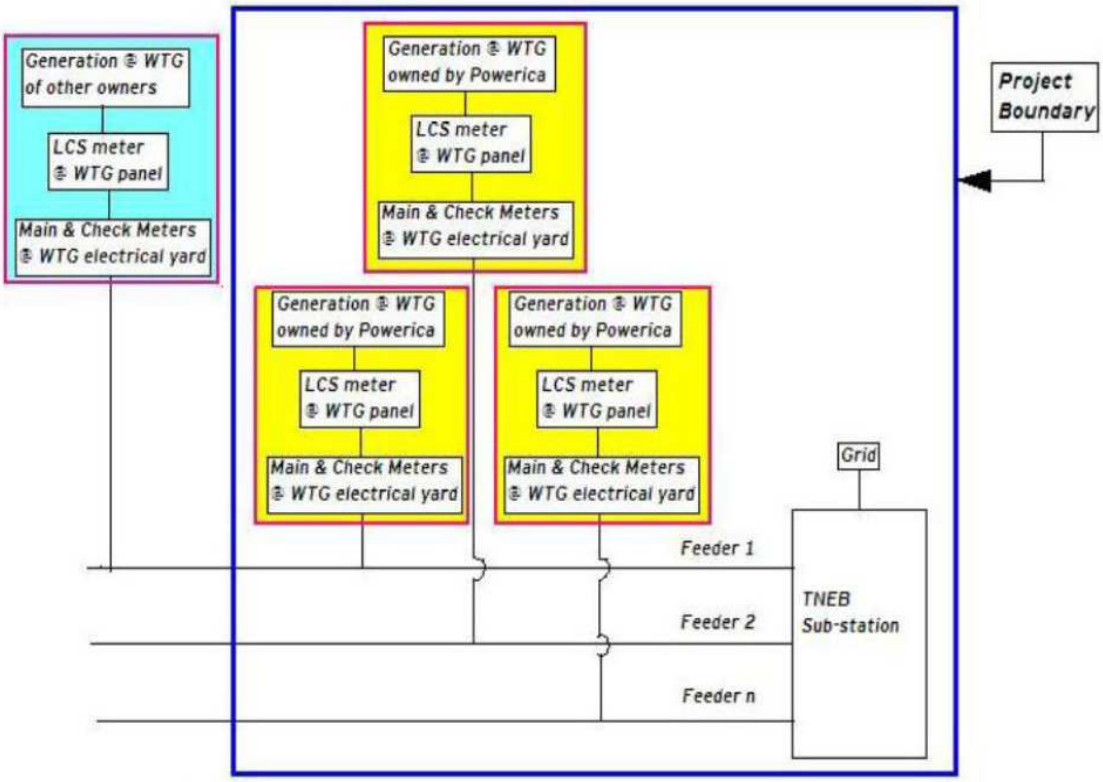

Figure 3: Project Boundary Diagram

The monitoring is done at the WTG electrical yard substation using a TNEB owned electronic tri-vector meters

The net electricity exported to grid is calculated as the product of difference of current and previous TNEB meter readings multiplied with the multiplying factor of the meter. Additionally, all the WTGs at the site are connected to a central monitoring system located at that site only. This system captures daily generation figures which are later made available to Powerica on the customized website of Vestas.

Internal audits & Performance review

The records are regularly audited and checked by the senior officials from project proponent on an annual basis. The officials will monitor the actual emission reduction. The personnel responsible for taking readings at site are adequately trained.

Emergency Preparedness

In the context of the project activity, the meters will be kept in sealed by TNEB and all maintenance will be taken up by TNEB only. In case of failure of the main meter, generation value of controller meter would be considered. The state electricity board has removed check meters, hence only main meters are part of project activity.

The project promoters have contracted the technology supplier for providing O&M services for the power project. The service provider would be responsible for maintenance of the necessary spare parts and consumables for the maintenance of the WTGs such as anemometers, wind vanes and sensors, oil filters, batteries, auxiliary motors and pumps, WTG controllers, slip rings, limit switches and sensors, detergents & solvents etc. The service provider would also be responsible for supply of necessary main components of the WTG such as main gearboxes, blades, generators, towers, hubs, main shafts & bearings, ground and top controller and hydraulic systems. The service provider would also ensure that occupational health and safety procedures are adhered to during the operation & maintenance activities. Additionally, spare meters would also be kept available at the site for replacement in case of failure of any of the monitoring equipment.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

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

BEy = Baseline Emission Factor (EF Grid,CM,y) x (EG y – ECy) Where,

BEy = Baseline Emissions (tons/year)
EGy: Electricity exported to grid annually (MWh)
ECy: Electricity imported from grid annually (MWh).

BEy = (EF Grid,CM,y) x (EG y – ECy)

=0.9445 tCO_2 / MWh x (105,543.384 -1,159.272) MWh

=0.9445 tCO_2 / MWh x 104,384.112 MWh

=98,590 tCO_2 (Rounded Down)

The emission reductions are calculated as per the equation:

ER = BEy – PEy - LEy

ER – Emission Reduction (tCO2/year)
BEy - Baseline Emissions (tCO2/year)
PEy – Project Emissions (tCO2/year)
LEy - Leakage Emissions (tCO2/year)

4.2 Project Emissions

The project activity involves in harnessing wind power. So the emissions from the project are zero. Hence. PEy = 0 tCO2/year

4.3 Leakage

The project proponents have identified no anthropogenic greenhouse gases by sources outside the project boundary that are significant, measurable and attributable to the project activity. Hence, no leakage is considered from the project activity.
LEy = 0 tCO2/year.

4.4 Net GHG Emission Reductions and Removals

ER = BEy – PEy - LEy &

BEy = (EGy– ECy) x EFGrid,CM,y Where,

EGy: Electricity exported to grid annually (MWh)

ECy: Electricity imported from grid annually (MWh)

EFGrid,CM,y = Combined Margin Grid emission factor

Therefore,

ER = (EGy– ECy) x EFGrid,CM,y – PEy - LEy ER = 98,590 – 0 – 0 = 98,590 tCO2e

.

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)
2012	752	0	0	752
2013	17,216	0	0	17,216
2014	15,871	0	0	15,871
2015	11,353	0	0	11,353
2016	19,099	0	0	19,099
2017	18,933	0	0	18,933
2018	15,366	0	0	15,366
Total	98,950	0	0	98,950

The actual VER is -25% lower 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.

APPENDIX 1: CALIBRATION DETAILS

The calibration details for meters involved in the project activity are as below

WTG No.	Serial No.	Make	Year 2012	Year 2015	New Meter Serial No.	Make	Year 2017	Due date of Calibration
TGU 28 SS(T-139)	TNB 04431	Secure	11/08/2012	20/10/2015	627560	HPL	17/05/2017	17/05/2022
TM 41 SS(T-145)	TNB 04425	Secure	11/08/2012	20/10/2015	624763	HPL	17/05/2017	17/05/2022
TSSP 158 SS(T-142)	TNB 04415	Secure	11/08/2012	20/10/2015	624852	HPL	17/05/2017	17/05/2022
TSSP 174 SS(T-143)	TNB 04432	Secure	11/08/2012	20/10/2015	627558	HPL	17/05/2017	17/05/2022
TM 721 SS(T-141)	TNB 04435	Secure	11/08/2012	20/10/2015	627555	HPL	17/05/2017	17/05/2022
TSSP 1225 SS(T-144)	TNB 04427	Secure	11/08/2012	20/10/2015	627553	HPL	17/05/2017	17/05/2022

The old meters are replaced by new meters and calibrated on 17/05/2017.

Earlier there were check meters also installed as back up meters, however state electricity board had removed that check meters and only main meters are used for export, import values. Hence main meters which are used to measure net electricity supplied to grid are mentioned in above table.

As per registered CDM PDD, the calibration frequency is once in every two years. The calibration of meters is not in control of PP and same is done by state electricity board. The state electricity board does not follow any fixed calibration frequency, hence deviation is requested for change in calibration frequency as once in five years. This calibration frequency is as per CEA notification http://www.aegcl.co.in/Metering_Regulations_Of_CEA_17_03_2006.pdf , page 12.
Based on once in five year calibration frequency as per requested deviation, there is no any delay in calibration and no error factor is applicable for current monitoring period.

APPENDIX 2: BREAK DOWN DETAILS

The major breakdown involved in the project activity are as below

Turbine	Duration	Event	Event text	Comment	Date from	Date to
Power 4	58:28	621	Service key	yard structure panding work.	25/4/2013	27/4/2013
Power 2	127:50	9	Grid spikes L1	Breaker problem at ss	8/1/2014	13/1/2014
Power 3	127:50	9	Grid spikes L1	Breaker problem at ss	8/1/2014	13/1/2014
Power 4	127:50	9	Grid spikes L1	Breaker problem at ss	8/1/2014	13/1/2014
Power 5	127:50	9	Grid spikes L1	Breaker problem at ss	8/1/2014	13/1/2014
Power 6	127:50	9	Grid spikes L1	Breaker problem at ss	8/1/2014	13/1/2014
Power 1	60:03	621	Service key	Rotor de-erection work	10/4/2014	12/4/2014
Power 1	251:17	621	Service key	Thyrister fuse blown (main cb 1 tripped)	21/3/2015	31/3/2015
Power 1	64:38	621	Service key	Thyrister fuse blown (main cb 1 tripped)	1/4/2015	3/4/2015
Power 6	75:13	621	Service key	VG fixing work	30/11/2015	3/12/2015
Power 6	55:46	621	Service key	health inspection work	11/12/2015	13/12/2015
Power 1	69:08	12	Grid drop voltage L1	Line brake down	2/5/2018	5/5/2018