Case:

This case consider power curves for two wind turbines. The case is that there is a shift in the wind speed measures made at some date and the root cause to this was a software update that would reset a manual configuration.

The Wind Turbine power curve is the relationship between the wind turbine power and free flow wind speed at hub height. It captures the wind turbine performance and is the key in understanding the efficiency and performance of wind turbine.

Measures for both wind speed and power exist in central databases by providing the analysis of performance. The wind speed is measured using the an anemometer located on top the turbine behind the rotor .The wind flow around the nacelle does have an effect on the reading depending on the rotor speed. The turbine controller is designed to apply a correction to adjust and estimate the free flow of the wind and this adjustment can be configure manually. This is technically referred to as the wind correlation parameters.

Data 10 min performance data for two turbine s from 2013-06-01 to 2014-01-01. Here 10 mins refer to signals are compressed into 10 min intervals , where the data points correspond to the average over the previous 10 min period. The Data Columns are described below.

|  |  |  |  |
| --- | --- | --- | --- |
| Column Name | Data Type | Short Discription | Unit of Measure |
| unitlocation | Character | It has two unit location "WTG01" and "WTG02" |  |
| ttimestamplocal | Date Time | 01-06-2013 11:50:00 PM " is in format DD-MM-YYYY HH:MM:SS" |  |
| power | Numeric | Avg. Power generated | kW |
| windspeed | Numeric | Avg. Wind Speed | m/s |
| airdensity | Numeric | Avg. Air Density | kg/m^3 |
| amb\_temp | Numeric | Avg. Outside Temperature | deg C |
| nac\_direction | Numeric | Avg. nacelle direction | deg |
| blds\_pitchangle | Numeric | Avg. pitch angle of Blades | deg |
| rtr\_rpm | Numeric | Avg. Rotar Speed | rpm |
| gen\_rpm | Numeric | Avg. Generator Speed (30-60 rotations per minute (rpm), to about 1,000-1,800 rpm ) | rpm |
| wtg\_state | Character | Turbine Status |  |

|  |  |
| --- | --- |
| wtg\_state | Short Discription |
| Ok | The turbine is in normal operation |
| Curtailed | The turbine is limited in output |
| gen not conn | The genrator is not connected and turbine is off |
| wind low | Wind speed is too low to operate |
| high wind cut-out | Wind speed is too high to operate |
| service | The turbine is in service |
| data error | The data reading are not within the Expected limits |
|  |  |

Question

Ques 1 Evaluate the Power curve for all States ( Turbine State referring to ).

Ques 2 Fit the curve to the two data and compare the two turbines.

Ques 3 Use the fitted curve to create the difference measured data and the fit.

A ) Is there any change point over time?

B) Can you Estimate the Point of Change?

Ques 4 Could this be a Sensor Error or Turbine Performance issue.

Ques 5 Are there other data you would like to have included?