Shell.ai Hackathon for Sustainable and Affordable Energy

Windfarm Layout Optimisation Challenge

Data Interpretation

Wind Data

The usual method to visualize a wind distribution data is by creating *wind rose diagrams*, with appropriate size of wind speed and wind directions bins. Creating a wind rose diagram is simple and some information is provided here about how to create one.

The wind rose diagram for the data in the file `wind_data_2007.csv` is shown in Figure 1. The way to interpret this diagram is straightforward. Roughly 3% of the total observations have `drct` values (270°). So on and so forth for the other directions. Within a particular direction sector, segment lengths are 'chunked' out depending on the percentage of wind speed observations that fall out in a particular speed bin (similar to stacked histogram). Colored according to the legend on the right.

Power Curve

In Figure 2, we plot the power (in red) and thrust coefficient (in blue) versus the wind speed. In there, we show the *cut-in* wind speed, *cut-out* wind speed, *rated wind speed* and *rated power* of the turbine are labeled. We explain these terms below:

- Cut-in Wind Speed - Speed at which the blades start rotating and generating power.
- Cut-out Wind Speed - Speed at which the turbine shuts down to avoid exceeding load limits.
- Rated Wind Speed - Speed at which the turbine is able to generate electricity at its maximum, or rated capacity.
- Rated Power (MW) - Maximum power that a turbine can generate in megawatts.

Test Turbine Locations

In the file `turbine_loc_test.csv`, we have provide a test data file containing the x and y coordinates of the location of 50 turbines. You can use this data to perform test runs of wind farm evaluator codes.

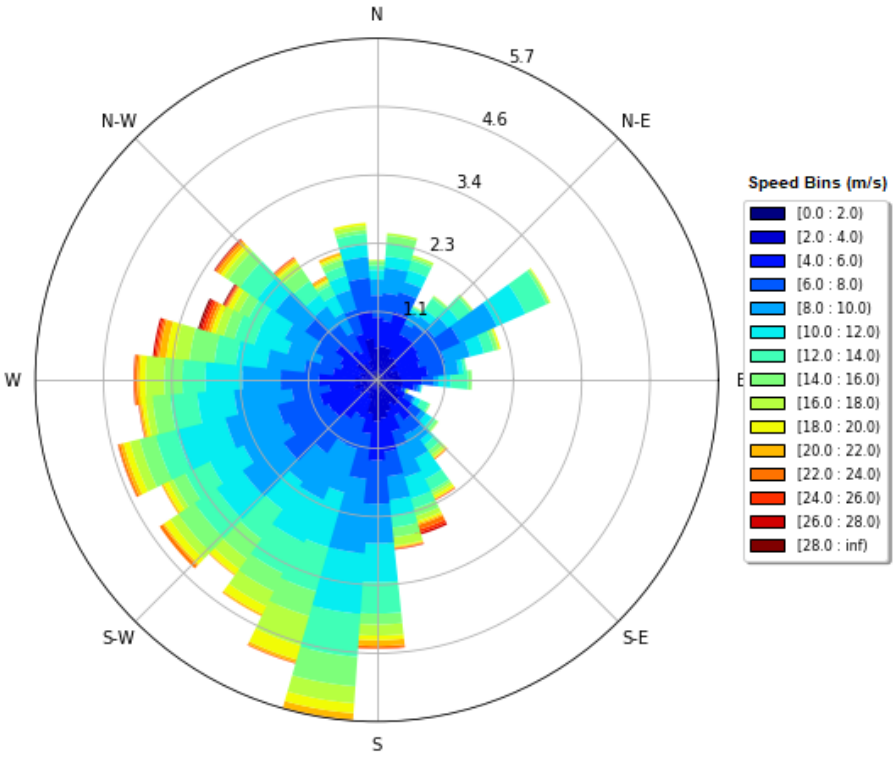

Figure 1: Wind rose diagram for the data in the file wind_data_2007.csv. Radial directions are partitioned into 36 equal sectors of 10° each and wind speed is binned into bins of 2 m/s (see legend on right).

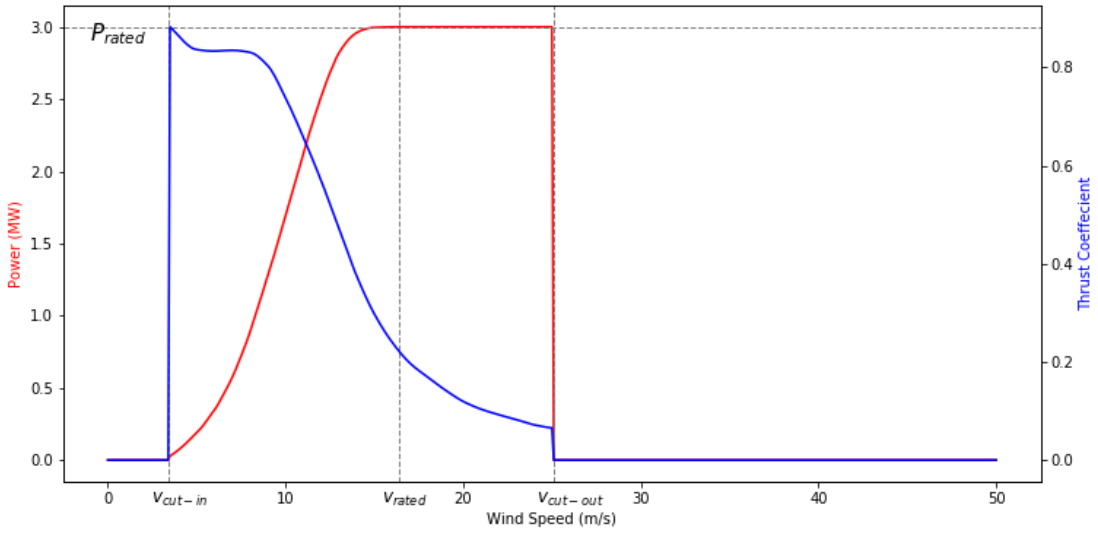

Figure 2: Power curve and thrust coefficient of the turbine.