

Leveraging Nacelle-Mounted Lidar(NML) to Ensure Wind Turbine Power Curve(WTPC)

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Intro

The previous study compares the WTPC by Mast and NML(Fig.1), and the result shows WTPC by NML has a lower uncertainty than Met Mast (Fig.2).

This poster conducts a further study of the sensitivity analysis on environmental variables.

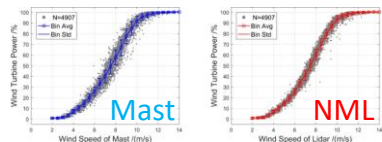


Fig.1 The Comparison of Wind Turbine Power Curve

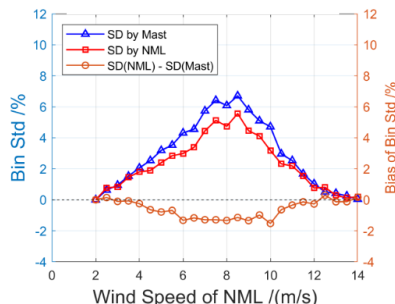


Fig.2 The comparison of Standard Deviation(SD)

Nacelle Mounted Lidar is more accurate than Met Mast for Wind Turbine Power Curve!

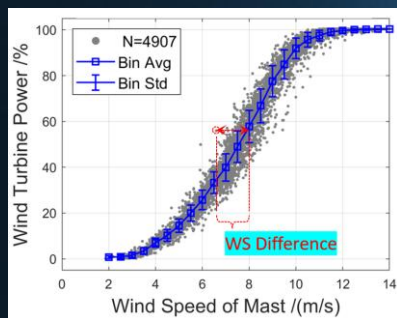


Fig.3 The method for sensitivity analysis

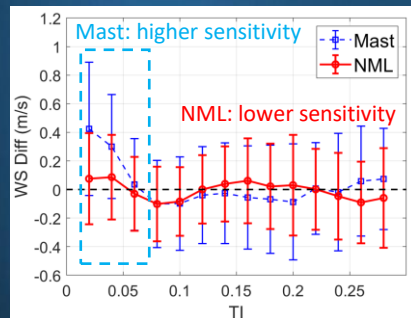


Fig.4 The comparison between Mast and NML of sensitivity on TI



Scan here for more information:
<https://www.vaisala.com/en/products/wind-energy-windcube-nacelle>



Fig.5 The photo of NML, installed on the turbine nacelle

Method

A new method has been developed to incorporate turbine power values for analyzing wind speed sensitivity on WTPC. It involves three main steps.

- Step(1): to average scatters to WTPC(the blue line in Fig.3).
- Step(2): to calculate Wind Speed Difference by below formula.
$$WS_{Diff} = WS(t) - WS$$
- Step(3): to analyze sensitivity on wind speed, shear and TI.

Results

- The standard deviation of WTPC by NML is lower, resulting in more accurate WTPC outcomes. This is because NML consistently yaws with the turbine nacelle, measuring wind speed in front of the turbine and achieving better spatial coherence.
- WTPC by Met Mast shows sensitivity, particularly when shear>0.7 and TI<0.08 (Fig.4), but NML shows no significant sensitivity.

Discussion

Met Masts have traditionally been the wind speed reference for WTPC, but recent studies indicate higher uncertainty. This issue warrants the industry's attention.

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