# WindCube Nacelle for Nacelle Transfer Function

Case Study

VAISALA

**The client:**

RWE Clean Energy

**Vaisala solution:**

WindCube Nacelle

## THE CHALLENGE:

### Accurate wind speed measurements for data-driven wind turbine improvements

Regular anemometer checks and calibrations are vital for accurate SCADA-based wind turbine performance. Monitoring Nacelle Transfer Function (NTF) parameters and recognizing drifting anemometers is also crucial. Accurate wind speed measurements depend on instrument quality, calibration and anemometer degradation, with SCADA relying on a healthy anemometer and NTF for accurate operational performance analytics.

The limitations of met masts led the company to pursue nacelle-based lidar. As Eric Eggleston, Senior Manager Reliability Engineering at RWE Clean Energy, explained, "RWE's objective is to measure the wind speed accurately and make improvements based on data and value creation. The whole idea of having a nacelle-mounted lidar is to measure the real wind speed in front of the turbine (known as free stream wind speed), find an actual in-situ power curve, and use that to see if anemometers and nacelle transfer functions are healthy."

## THE APPROACH:

### Mature nacelle-based lidar technology and exceptional support

RWE selected Vaisala WindCube® Nacelle to conduct NTF campaigns, not only because of the mature and accurate WindCube lidar technology, but also for Vaisala's ability to advise, support, and fix any issues during initial measurement campaigns. RWE appreciates the fact that WindCube Nacelle is well-suited to any size wind farm and can easily be moved from one turbine to another.

As they conducted four NTF campaigns, they quickly discovered that WindCube Nacelle has

> *"RWE's objective is to measure the wind speed accurately and make improvements based on data and value creation... WindCube Nacelle has proven to be a superb tool to accomplish our goals, and we are impressed with Vaisala's support and service which helped us get up and running very quickly with great results."*
>
> *Eric Eggleston*
> *Senior Manager Reliability Engineering, RWE Clean Energy*

important advantages over nacelle anemometers. "We've found nacelle anemometers can be off +/-3 to 5 m/s in the extreme, though inaccuracy by under +/- 2m/s is more common. These inaccuracies lead to suboptimal pitching on some older turbine models and shifts in high wind cut-out away from accuracy, losing energy on all turbines with overreporting NTFs and anemometers," Eric said.

## THE RESULTS:

### An accurate, reliable and versatile solution for production improvements

WindCube Nacelle has proven to be a perfect fit for RWE's NTF campaigns. Eric said, "Nacelle-mounted lidar provides a real measurement of free stream wind speed and power performance. Comparing to SCADA data will tell you how unhealthy your anemometers and nacelle transfer functions may be and how much energy might be recovered and leveraged to make corrections providing accurate analytics data for operations and decision making in the future." Eric continues, "Depending upon the power purchase price and the site wind resource, correcting this can recover up to USD 7,000 per year per turbine on high energy price sites with ~3MW turbines. Every hour of recovered operation near high wind cut out is a full power hour of turbine operation."

The organization has since used WindCube Nacelle on projects where no other freestream measurement means were available, calculated new NTFs, identified production improvements that would provide valuable results, and convinced the wind turbine OEM to implement the changes.

RWE is also impressed by the cost-effectiveness of nacelle-based lidar over met masts, noting that a met mast costs about $280,000 over its 20-year lifetime (including maintenance and instrument replacement). WindCube Nacelle requires minimal maintenance and is highly reliable, making it cost-effective from the start.

RWE is also adding yaw misalignment measurement using WindCube Nacelle into its lidar campaigns to validate analytical methods for yaw alignment measurement and correction, with the potential to recover another 0.5-1% Annual Energy Production (AEP) across its fleet with proper measurement, analysis and corrective alignment.

## Why Vaisala?

We are innovators, scientists, and discoverers who are helping fundamentally change how the world is powered. Vaisala elevates wind and solar customers around the globe so they can meet the greatest energy challenges of our time. Our pioneering approach reflects our priorities of thoughtful evolution in a time of change and extending our legacy of leadership.

Vaisala is the only company to offer 360° of weather intelligence for smarter renewable energy, nearly anywhere on the planet. Every solution benefits from our 85+ years of experience, deployments in 170+ countries, and unrivaled thought leadership.

Our innovation story, like the renewable energy story, continues.

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