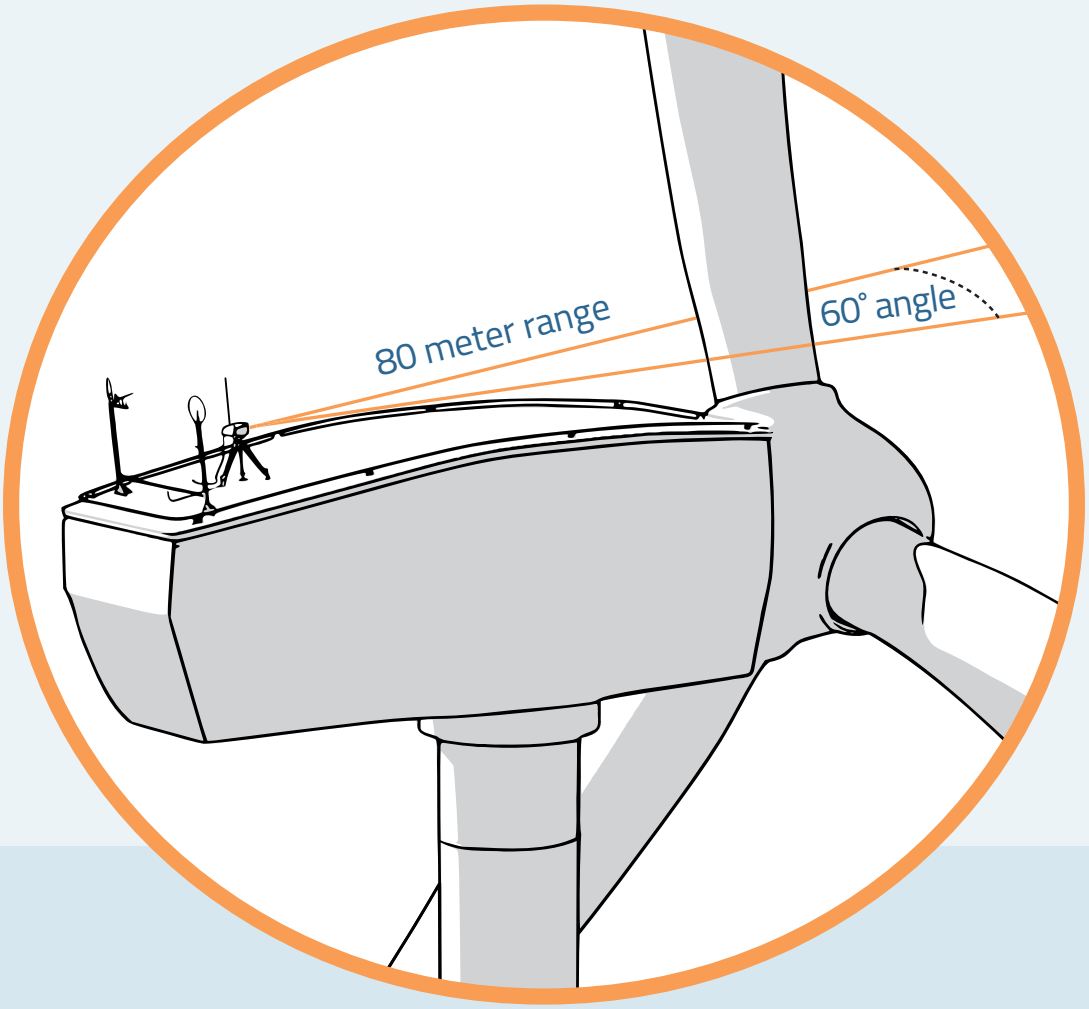
WINDAR
PHOTONICS

LiDAR assisted

Optimisation & Monitoring Solutions



Key Benefits:

- 2-4% increase to AEP
- Reduction of critical loads above rated power
- Plug and Play integration for any model of wind turbine

LiDAR assisted

Optimisation & Monitoring Solutions

Windar Photonics' LiDAR assisted solutions offers asset owners the ability to both optimise and monitor their wind turbine generators, resulting in increased energy production, reduced loads, a wealth of wind field data, and accurate performance tracking of individual turbines and entire fleets.

The Optimisation and Monitoring solutions can be installed on and integrated with any model of wind turbine, and can likewise be operated in any climate.

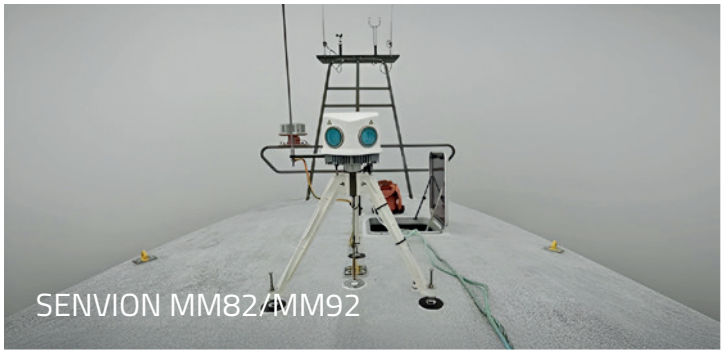
WINDEYE

WINDVISION

WINDTIMIZER

NEXUS OS

NEXUS TPM


SENVION MM82/MM92


GE 1.5/1.6/2.X/3.X


GE 1.5/1.6/2.X/3.X


SENVION MM82/MM92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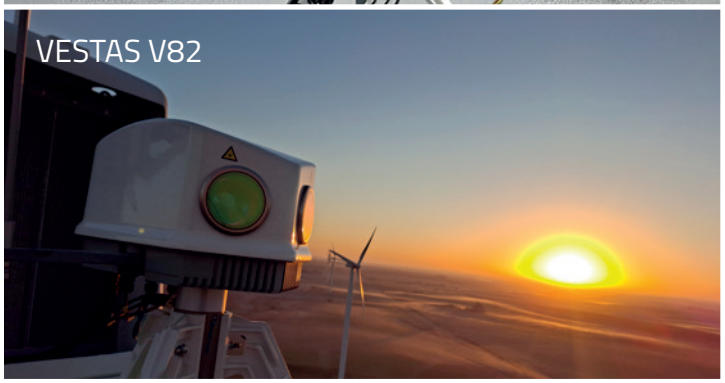

VESTAS V82


VESTAS V82


GE 1.5/1.6/2.X/3.X


VESTAS V82

Optimisation Solution

The Windar Photonics Optimisation solution enables asset owners to increase annual energy production (AEP) by 2-4% and to decrease loads at high wind speeds by optimising the yawing of the wind turbine.

The Optimisation solution can be installed and integrated with the control system of any model of wind turbine and is delivered with the cyber-safe Nexus OS software platform.

The Windar Photonics Optimisation solution consists of:

- The WindEYE LiDAR sensor
- The WindTIMIZER integration solution
- The Nexus OS software platform

WINDEYE WINDTIMIZER NEXUS OS

Key Benefits:

• 2-4% increase to AEP • Reduction of critical loads above rated power
• Plug and Play integration for any model of wind turbine

WINDEYE

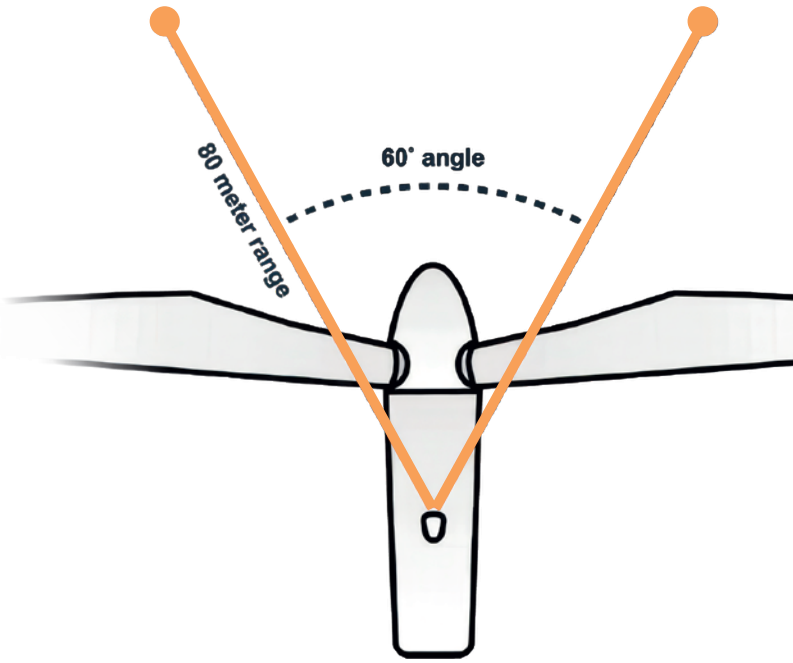
LiDAR Sensor

How the WindEYE LiDAR Works to Optimise Wind Turbine Performance

The WindEYE nacelle-mounted LiDAR sensor measures wind direction and wind speed up to 80 meters in front of a wind turbine, delivering accurate forward-looking wind data.

The WindEYE LiDAR integrates seamlessly with the wind turbine control system, enabling the turbine to receive precise wind information before it reaches the rotor.

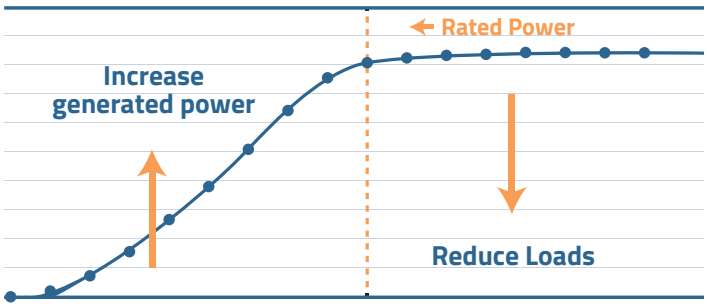
By supplying the controller with this high-accuracy wind measurement, the WindEYE sensor combined with the WindTIMIZER integration can optimise yaw alignment, potentially increasing Annual Energy Production (AEP) by 2–4% and reducing turbine loads at high wind speeds on critical components.

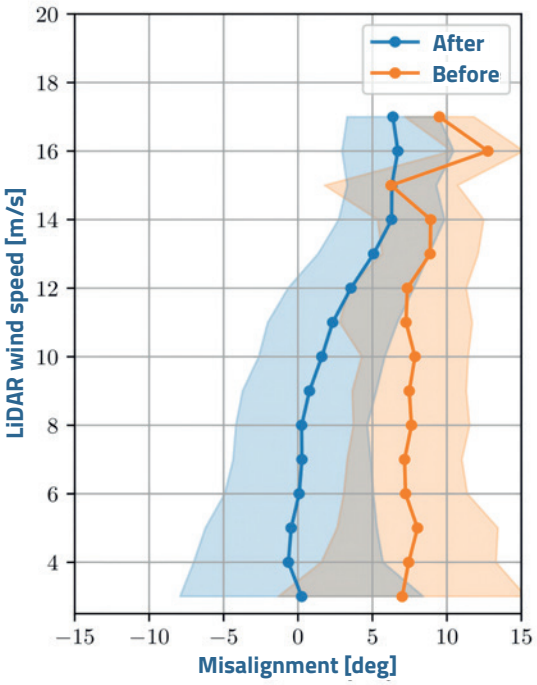


Increasing Energy Production and Reducing Loads with Yaw Optimisation Strategies

By correcting yaw misalignment on wind turbines, operators can achieve higher energy production below rated wind speed.

When the turbine is operating above rated power, the Windar Photonics optimisation solution introduces a controlled degree of misalignment. This strategy helps to reduce critical loads caused by high wind speeds – without sacrificing wind power output.





Graph show the degree of yaw misalignment in relation to wind speed before and after the optimisation. Correcting the yaw-misalignment corresponds to an AEP increase of 2.5%

Laser Source: Continuous Wave Laser

Eye safety class:
Laser Source, Eye safety class 4M
LiDAR system, Eye safety class 1M

Wind speed range: 2 m/s – 75 m/s

Data output rate: 1 Hz (2Hz optional)

Operating temperature: -40°C to +55 °C

Physical interfaces: RS485, Ethernet

Dimensions:
Optical Unit: 425mm x 300mm x 250mm
Tripod: 620mm ø 1000mm
Packed: 800mm x 400mm x 620mm

Weight:
Optical Unit: 16kg
Tripod: 8kg
PSU (Power Supply): 9kg
Total, Packed: 42kg

Cable: Length: 10m. **Diameter:** 16.5mm

IP Class, Laser System Unit: IP67

IP Class, Optical head: IP67

Power supply: 110 VAC / 230 VAC

Data storage: 12 Months

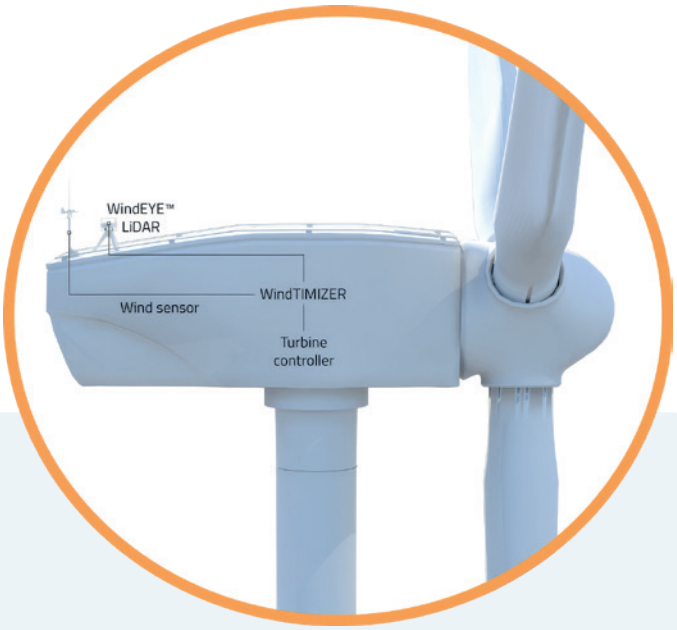
WINDTIMIZER

Plug-and-Play LiDAR integration solution for any model of wind turbine

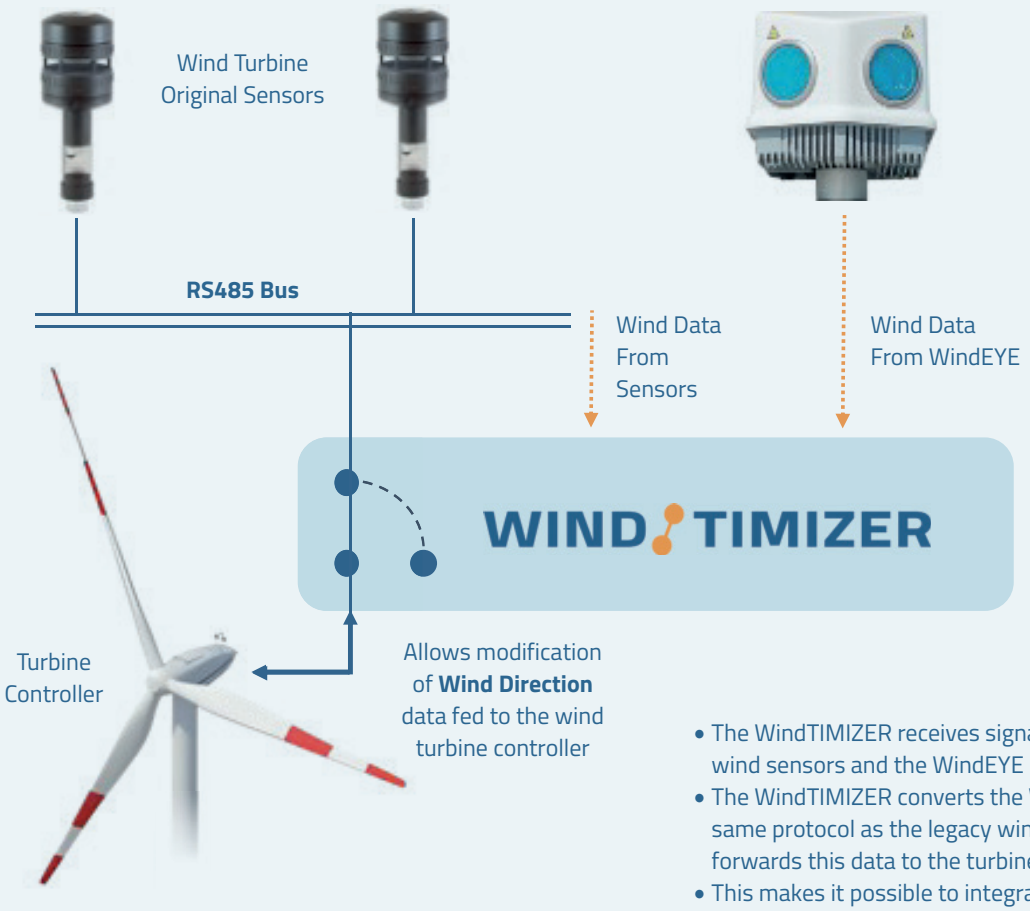
Control Integration

To activate the dynamic yaw optimisation feature of the WindEYE nacelle-mounted LiDAR sensor, the LiDAR must be integrated with the wind turbine control system.

The WindTIMIZER is Windar Photonics' plug-and-play retrofit solution, allowing the LiDAR sensor to connect seamlessly with both the turbine's control system and its legacy anemometry.



How the WindTIMIZER Works



- The WindTIMIZER receives signals from both the existing wind sensors and the WindEYE LiDAR system.
- The WindTIMIZER converts the WindEYE signals into the same protocol as the legacy wind-sensor signals and forwards this data to the turbine controller.
- This makes it possible to integrate the WindEYE without making any modifications to the control system itself.

NEXUS OS

Operating system for LiDAR Assisted Optimisation and Monitoring

The NEXUS OS is an operating system for Windar Photonics' LiDAR assisted solutions that offers groundbreaking advancements in wind turbine asset monitoring, enabling wind farm operators and asset owners to make informed, data-driven operations and maintenance decisions.

When the NEXUS OS is installed in conjunction with Windar Photonics' LiDAR sensors, the platform enables operators to:

- Monitor entire wind turbine fleets with LiDAR sensors and collect data in one cyber-secure location.
- Optimise yaw alignment across the turbine fleet using the WindTIMIZER integration technology.
- Generate on-demand and automated reports on turbine yaw alignment and performance.
- Ensure cyber-safe fleet and asset management with on-premises installation and no reliance on modems or remote data transfer.

Cyber-Safe On-Premises Deployment

The NEXUS OS is deployed entirely on-premises, isolated from external networks. This allows operators to retain full control of servers and data traffic, while eliminating dependence on modems or service personnel. The result is automatic, cyber-safe monitoring and data handling.

Future-Proof and Upgradeable Platform

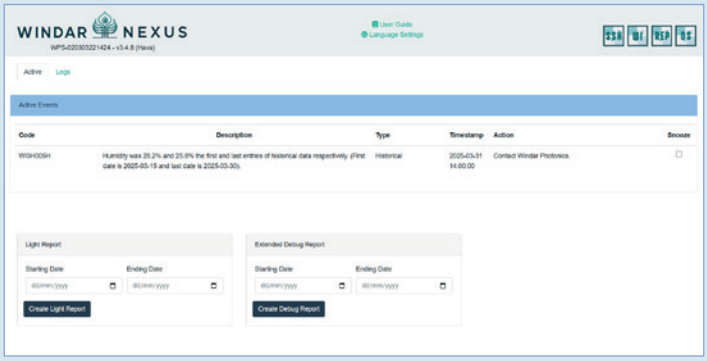
The NEXUS OS is designed to be upgradeable and modular, allowing customers to add new software modules and features based on their specific wind turbine optimisation and monitoring needs.

Easy-to-Use Graphical User Interface

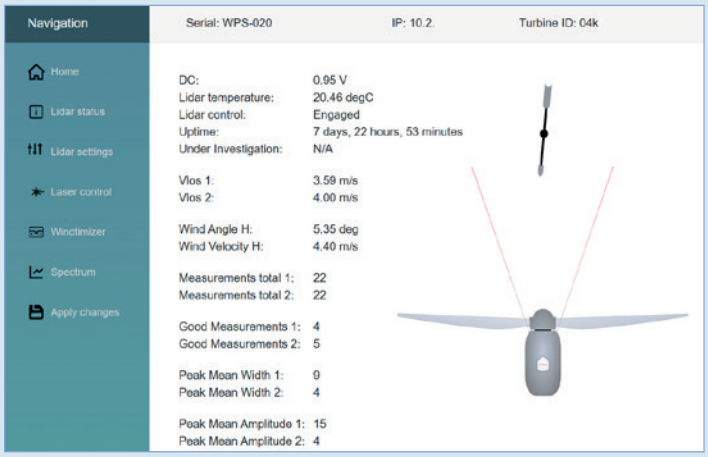
All turbine-specific data is presented in an intuitive graphical interface, making it simple to navigate the different modules of the NEXUS OS and access detailed asset-specific information.

The main components of the NEXUS OS GUI include:

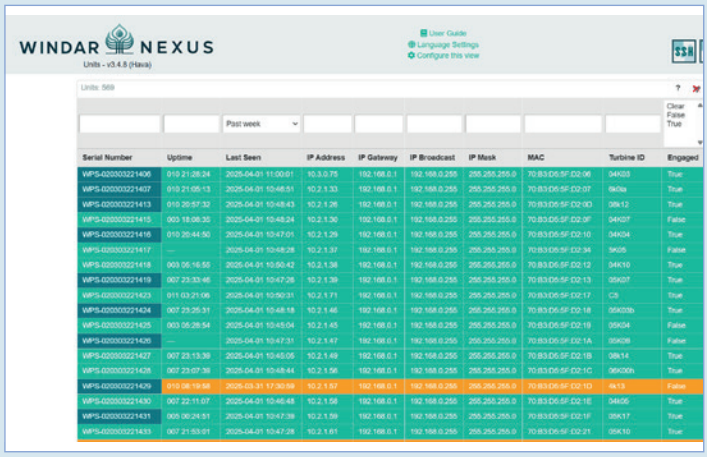
- A **Control Center** that lists every deployed unit
- An **Event View** section with detailed logs of events and flags
- The **Li-App**, a live monitoring application for individual LiDAR units



The **Event View** displaying events or flags related to the unit



The **Li-app** provides live monitoring of the LiDAR unit



The **Control Center** listing the deployed LiDAR units

Monitoring Solution

Turbine Performance Monitoring (TPM) Module

NEXUS TPM

Key Benefits

- Unique solution for precisely monitoring wind turbine performance independently from other data sources
- Monitoring of wind turbine efficiency within ± 0.5% accuracy
- Enables monitoring of both single turbines and entire fleets

Unbiased wind field data

- Wind speed
- Wind direction
- Wake effect intensity
- General turbulence intensity
- Rotational speed
- Air density

Turbine Performance Monitoring

The key component of the Monitoring solution is the Nexus TPM (Turbine Performance Monitoring) module, which is a software add-on for the Windar Optimisation solution.

The Nexus TPM provides an unbiased set of extremely accurate data relating to the performance of individual wind turbines, the performance of the entire fleet, and the wind field, enabling asset owners to both assess wind turbine performance and formulate data-driven optimisation strategies for enhancing the performance of entire wind farms.

Advanced wind turbine analytics

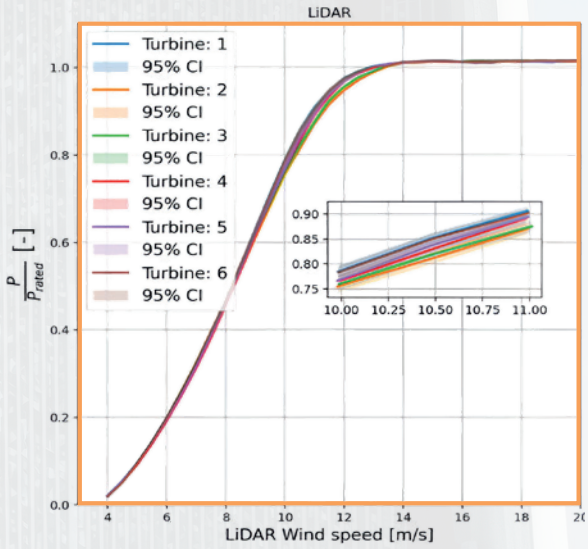
The LiDAR assisted Monitoring solution provides an unparalleled set of reliable wind turbine performance data. This data serves as the backbone for understanding the complex dynamics that affect wind turbine efficiency and forms the foundation for optimisation strategies targeting underperforming turbines.

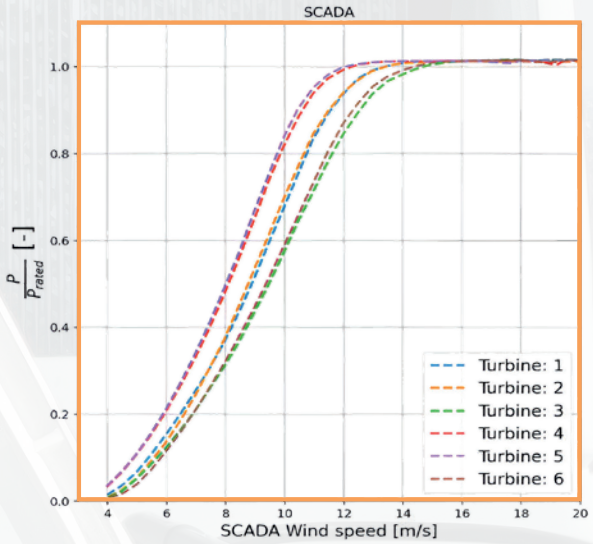
Tracking precise turbine performance within ±0.5% accuracy

The Nexus TPM module uses accurate wind speed measurements from the LiDAR sensor to precisely track wind turbine performance within ± 0.5% accuracy. Implementing the TPM module with the Windar Optimisation solution thus provides a quantifiable metric for actual turbine performance that is wholly independent of SCADA data.

LiDAR measurements provide accurate turbine performance data

The below graphs show the relation between normalised power production and wind speed based on respectively SCADA-data and LiDAR measurements from a measurement campaign with six wind turbines located in the same wind farm - and as shown, the data from the LiDAR sensors are within an accuracy of ±0.5%.





User-friendly Graphical Interfaces

The TPM module includes a dedicated graphical user interface (GUI) that enables asset managers to track and compare the performance of both individual turbines and the entire wind farm fleet. The intuitive dashboard provides real-time visibility into turbine efficiency, historical performance data, and fleet-wide benchmarks, making it easier to identify underperforming assets, plan maintenance strategies, and maximise Annual Energy Production (AEP) across the portfolio.

Scan the QR code and **watch a video walkthrough of the GUI**

Overview of the performance of a single unit from the TPM GUI

Overview of the performance of each unit in an entire wind farm equipped with the TPM-module

About Windar Photonics

Windar Photonics is a Danish manufacturer of nacelle-mounted LiDAR sensors for wind turbines, and a globally leading provider of retrofit optimisation and wind turbine monitoring solutions.

In 2008, Windar Photonics was started as a spin-off company from the DTU Risø research environment, where the basic blueprint for the cost-efficient LiDAR technology was initially conceived in 2005. In 2014, Windar Photonics was established as a PLC in the UK and listed on the Stock Exchange of London AIM in 2015.

In 2018, a distribution agreement was signed with Vestas Service, and the first orders for wind farms with Vestas V82 assets were received in 2021, which led to the commissioning of the first roll-out orders for two entire NA wind farms in 2022, and by 2025, 25% of the entire fleet of Vestas V82 turbines in North America was equipped with Windar Photonics' LiDAR assisted solutions.

In 2024, Windar Photonics launched the Nexus OS software; a customisable and subscription-based software operating system that can be utilised to monitor both individual wind turbines and entire fleets. During 2025, the Turbine Performance Monitoring module (TPM module), the first optional add-on upgrade to the Nexus OS, was launched.

Windar Photonics' head office is located in Ishøj, near Copenhagen in Denmark, with additional well-established sales and technical offices in Shanghai, China. Windar Photonics is likewise serving the European, North American and South American markets with local sales representation and technical support.

Contact

For more information please visit www.windarphotonics.com

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Scan the QR code to view our LinkedIn Company Page.

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