SENACT®

Blade Monitoring & Optimization

Polytech
Wind for life™

Ensuring efficient and safe operations

Monitoring turbines – a smart investment

Monitoring turbines is not just a best practice; it is a strategic investment that pays off in multiple ways. Insights gained through monitoring loads, ice, or structural health can directly help:
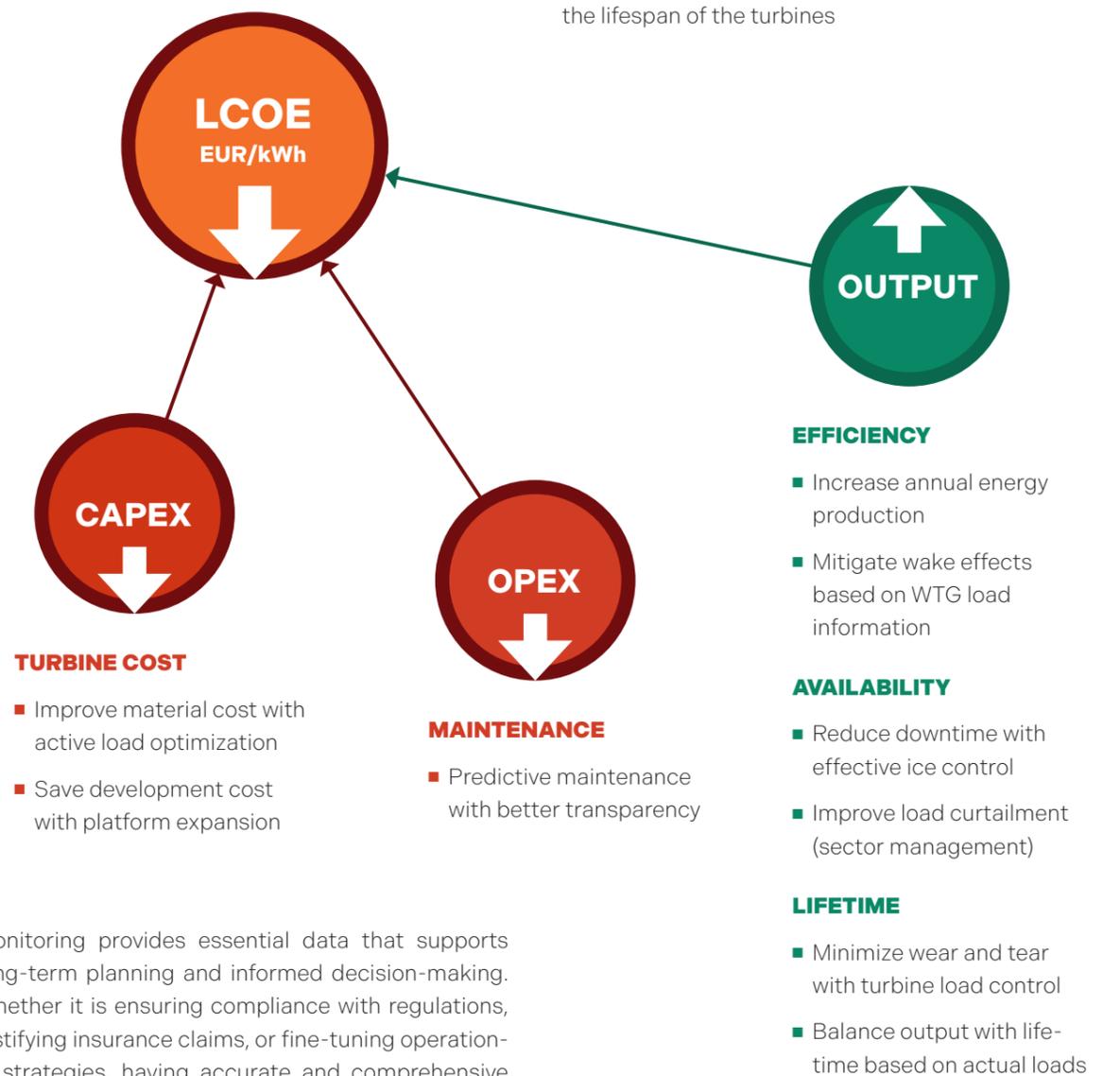
OPTIMIZE
everyday turbine operations, such as power output, maintenance plan, and repairs

DETECT AND PREVENT
potential issues or damages

OPERATE
turbines at peak efficiency

EXTEND
the lifespan of the turbines

Using Polytech's blade monitoring solutions, you can lower your levelized cost of energy through increasing power output and reducing operational costs.

LCOE
EUR/kWh

CAPEX

OPEX

OUTPUT

TURBINE COST
- Improve material cost with active load optimization
- Save development cost with platform expansion

MAINTENANCE
- Predictive maintenance with better transparency

EFFICIENCY
- Increase annual energy production
- Mitigate wake effects based on WTG load information

AVAILABILITY
- Reduce downtime with effective ice control
- Improve load curtailment (sector management)

LIFETIME
- Minimize wear and tear with turbine load control
- Balance output with life-time based on actual loads

Monitoring provides essential data that supports long-term planning and informed decision-making. Whether it is ensuring compliance with regulations, justifying insurance claims, or fine-tuning operational strategies, having accurate and comprehensive data at your fingertips reduces uncertainty and business risks.

SENACT®

Polytech's blade monitoring portfolio

Polytech's blade monitoring solutions, the SENACT® portfolio, provide the digital backbone for blade monitoring, covering a wide range of applications, such as load monitoring, ice monitoring, or condition monitoring.

**SENACT®
Load**

**SENACT®
Ice**

**SENACT®
CMS**

SENACT® monitoring solutions are built on a modular and scalable platform including 2D vibration, strain, and temperature sensors.

Temperature sensors

Strain sensors

Vibration sensor

Measuring devices

Strain sensors

TEMPERATURE MONITORING

Data use:
- Control of ice mitigation systems

LOAD MONITORING

Data use:
- Improved load monitoring accuracy enabled by fiber optics further out in the blade

VIBRATION MONITORING

Data use:
- Condition monitoring
- Ice monitoring
- Detect instabilities

LOAD MONITORING

Data use:
- Input for Individual Pitch Control
- Actual blade load
- Calculate blade deflection
- Life extension through lifetime load envelope
- Detect instabilities

Load monitoring

Wind turbines are exposed to dynamic and complex loads that can affect their performance, reliability, and lifespan. Load monitoring provides measuring and analysis of these loads and use the insights to:

INCREASE ENERGY PRODUCTION
using input from sensors to perform individual pitch control to maximize output while keeping loads under control.

REDUCE OPERATIONAL COSTS
by extending the lifetime of components and planning maintenance activities based on the actual load history.

ENHANCE SAFETY
by avoiding overloading and documenting the structural integrity and fatigue life of the blades.

OPTIMIZE BLADE DESIGN AND MATERIAL COSTS
for new turbine models.

UNLEASH THE POTENTIAL
of your existing turbines models. The more insights you gain the more possibilities of using the same turbine type in a wider range of weather conditions and geographical locations.

Benefits of SENACT® Load

We offer a comprehensive load monitoring system that uses fiber optics technology to measure the loads on each individual blade.

With SENACT® Load, you get:

✅ **Reliable load insights** thanks to the high measurement accuracy it allows you to operate your wind turbines safely and to their fullest potential by providing both flapwise and edgewise bending moments.

✅ **Fast installation and low maintenance costs** due to the use of ruggedized components, less wiring and cabling and independent calibration..

✅ **Compatible** with any type and size of wind turbine.

ABMC – Load calibration made simple

Autonomous Bending Moment Calibration (ABMC) is a software module that enables accurate and efficient calibration of blade load sensors.

Blade load monitoring requires calibration, which is the process of converting the measured strain into bending moments. Calibration typically requires on-site personnel, and it can take several hours or days per turbine to complete. It is therefore a time-consuming and costly process. Calibration is also sensitive to weather conditions (e.g., wind speed and temperature) and it needs to be repeated periodically, as the blade properties change over time due to fatigue.

ABMC solves these challenges by automating and optimizing the calibration process. It can be activated remotely or can be automated, and it can be configured for different types of calibration depending on the wind speed and the quality target.

ABMC uses a model-based approach to calibrate the sensors repeatedly. It always compares the new calibration with the previous one and can be activated if it is better or within a certain deviation threshold. This leads to improved calibration accuracy and therefore improved load data.

Benefits of ABMC

✅ **Heavily reduced calibration time** minimizes the loss of AEP and downtime.

✅ **Reduced resources** as calibration takes place independently without the need for onsite personnel, data analysts, or support functions, lowering the calibration costs.

✅ **Improved accuracy** thanks to multiple calibration iterations at low wind speeds to reach your desired quality target.

✅ **Improved reliability and safety** through constant sensor and system health check that can detect and report sensor or system issues.

✅ **Improved turbine performance** as ABMC provides accurate and reliable blade load data to maximize the AEP and minimize fatigue and risk of damage.

Ice monitoring

In areas with frequent ice events and regulatory obligations, an ice monitoring system is essential for wind turbines. It ensures safe operation by minimizing ice throw, maximizing energy production, and preventing unnecessary shutdowns.

SENACT® Ice is a DNV-certified, rotor blade-based ice monitoring system using fiber optics technology. The system accurately detects the amount of ice directly on each blade.

The detected ice mass either triggers the de-icing system implemented in the turbine and/or trigger the **automatic stop/restart function**. With this function, the turbine can restart automatically. No need to wait for visual inspection or an additional time-safety period causing unnecessary downtime.

Proven savings on operating wind park

SENACT® Ice detection system outperforms conventional power curve or anemometer-based systems significantly in terms of reliability and functionality. Using SENACT® Ice, one of our customers reduced their turbines' downtime loss by 884,000 MWh, gaining more than €70,000 within a week across 26 turbines.

Benefits of SENACT® Ice

✅ **Certified system.** The system is fully certified according to DNV-SE-0439:2021-10.

✅ **Prevent ice-related problems and avoid unnecessary shutdowns.** The DNV certified system monitors ice build-up on the blades and thereby prevents unnecessary downtime while securing both performance and safety.

✅ **Save maintenance and operational costs.** Designed for wind turbines, the system is lightning-protected, rugged, and built to last over 20 years. As such, manual inspections can be minimized while energy production gets maximized.

✅ **Enjoy easy and flexible use.** SENACT® Ice can be installed in the factory or retrofitted on the installed blade. The system features a fully automatic calibration system, AFP. The AFP takes care of ensuring the system is always measuring correctly even when the blade stiffness and vibration response changes over time.

✅ **Robust, ruggedized, and maintenance-free solutions** that withstand even the most extreme operating conditions, lowering maintenance costs.

✅ **Fiber optic technology** to eliminate lightning damages.

AFP - Autonomous Fingerprinting for Ice Monitoring

Fingerprinting is a process that creates a model of the eigen frequencies of the blades on a wind turbine rotor. The model helps to predict how the blades behave under different conditions, such as temperature, pitch angle, and rotor speed. Fingerprinting is essential for ice monitoring, as it allows the system to measure the change in eigen frequencies due to ice accumulation on the blades.

With our ice monitoring system, you get Autonomous Fingerprinting that enables your wind turbines to automatically create and update their own fingerprint models without the need for manual intervention or external data sources. The system uses advanced algorithms and vibration sensors to measure the eigen frequencies of the blades and adapt the models to changes in conditions.

Benefits of AFP

✅ **Improved accuracy and reliability** of ice monitoring, as the system can distinguish between ice and normal operation factors that affect the natural frequencies of the blades.

✅ **Improved efficiency and performance** of the wind turbine, as the system can optimize the turbine availability and reduce the fatigue and damage caused by ice.

✅ **Improved autonomy and convenience**, as the system can create and update the fingerprint automatically without requiring manual intervention or remote access.

Tested, validated, and proven solutions

Today, more than 80,000 Polytech fiber optic sensors are actively controlling & monitoring turbines worldwide.

They have proven their reliability and performance, which stem from rigorous testing and robust and smart design.

Tested according to international standards

All our monitoring solutions have passed thorough testing according to international standards. They are verified by independent, third-party organizations, such as SGS and DNV, you get a reliable monitoring solution for your needs.

Our sensors are installed at some of the most challenging sites all over the world. Above are a few examples.

Lifetime durability in all environments

All our sensor solutions are designed to last for the entire lifespan of the turbines they monitor and control. Our strain sensors can withstand up to 100 million load cycles, which is way more than they experience over their operational lives. All our systems have been rigorously tested to ensure that they will function under the harsh environment found in wind turbines.

Repeatable field and factory installation

Whether you are installing our monitoring systems in the factory or in the field, simplicity, and time efficiency are key. Our sensors can be glued on the blade internally in just few minutes per sensor. And thanks to the fully digitized field and end of life tests, you can start monitoring right on time.

Full solution provider

By choosing SENACT®, you will not only get a sophisticated/advanced blade monitoring and optimization solution, but you will also partner with Polytech – a full solution provider covering everything from engineering through production to aftermarket services to reduce costs and risks.

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Contact

Are you interested to learn more about Blade Monitoring & Optimization or get a site-specific evaluation for your project? Then contact our Sales team at *polytech.com/contact*

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