

The digital bottleneck in scaling up Renewable Energy

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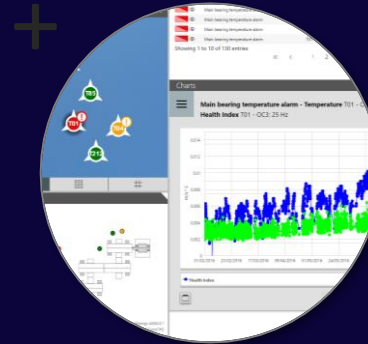
ONYX Insight

- ✘ **Global leader** in hardware, software and engineering services for the wind industry
- ✘ We provide **trusted and unbiased** predictive analytics underpinned by engineering expertise
- ✘ Engineering **heritage of rotating machinery** design, monitoring and lubrication
- ✘ **Global reach:** UK, Spain, USA, S. Korea, India, China and Australia
- ✘ Part of **bp Group**

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Beyond the drivetrain -
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Over **5,000** ecoCMS retrofitted

9,500+ wind turbine monitoring services

2,000+ gearbox teardowns and inspections

70 GW reliability data of wind assets worldwide

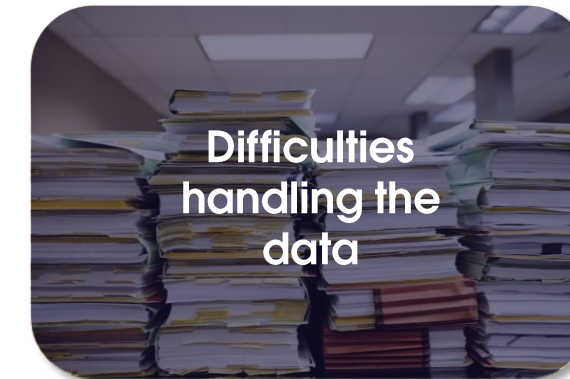
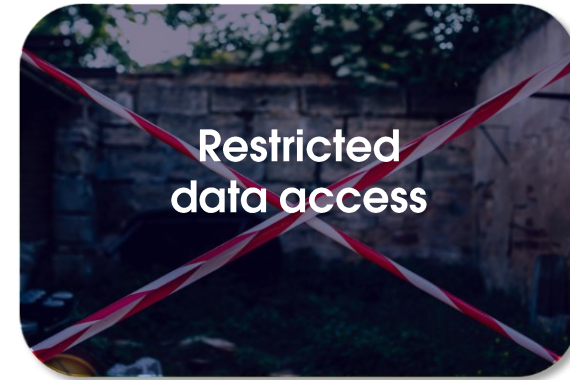
8 out of top **10** global industry IPPs work with ONYX



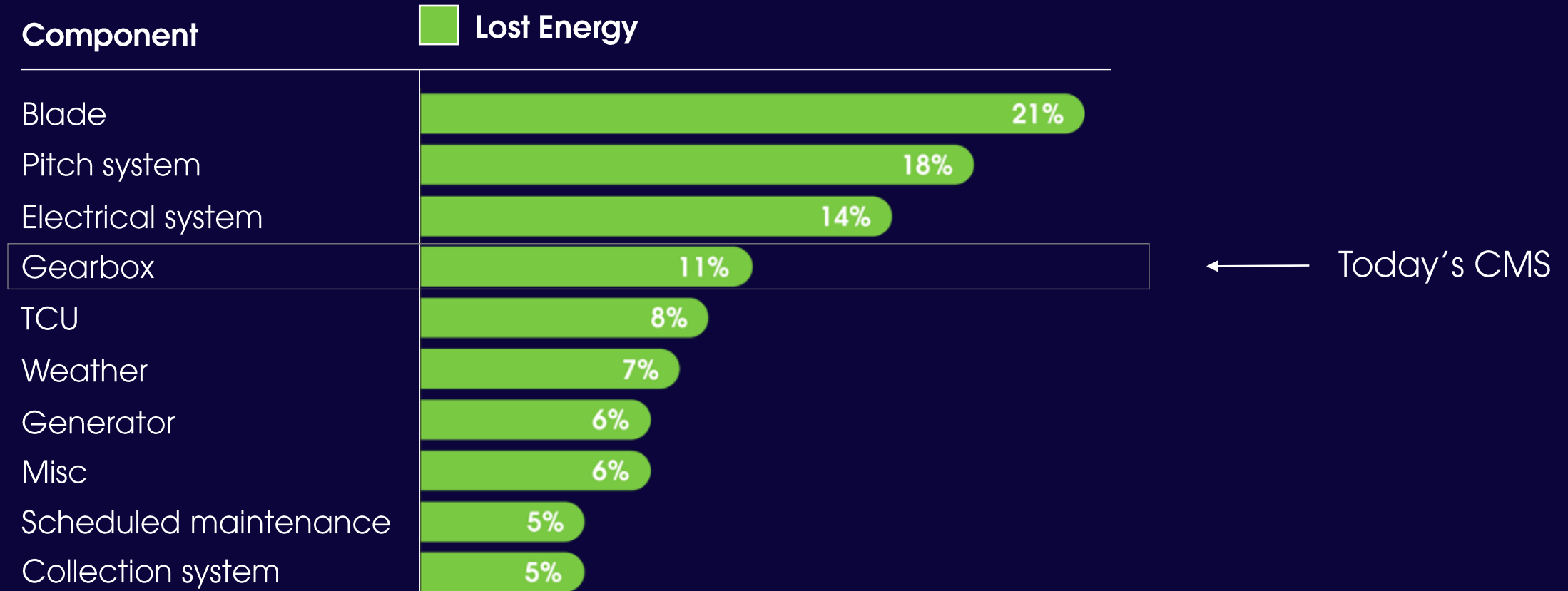
THE PRESENT:

Problems with turbine data that increase losses

- Restricted data access.
- Low quality data.
- Vast amounts of data (historic, real time,...).
- Different turbine models, CMS systems and SCADA.
- Need for a big internal team of experts.
- Difficulty in following handling alarms and following failures.



Unmonitored components account for >50% of lost energy



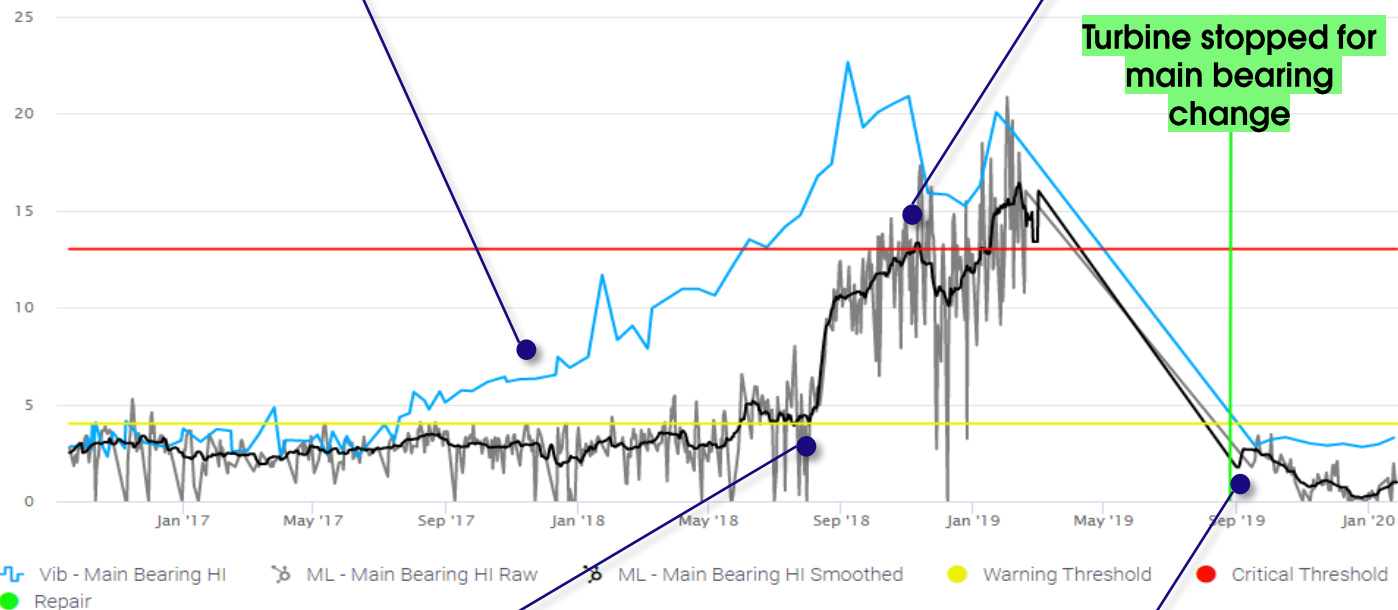
% of lost energy from unplanned maintenance
Example from Major Operator in North America

Vibration

SCADA

1. Vibration detects fault 18 months prior to replacement. As temperature remains low, turbine is kept online to **increase uptime**

3. Both vibration and temperatures now show critical levels. **Replacement scheduled in advance to coincide with others and reduce cost**



2. SCADA temperature models show rapid temperature increase one year after initial onset. **Indicates fault has progressed to severe**

4. After replacement, both metrics return to normal levels

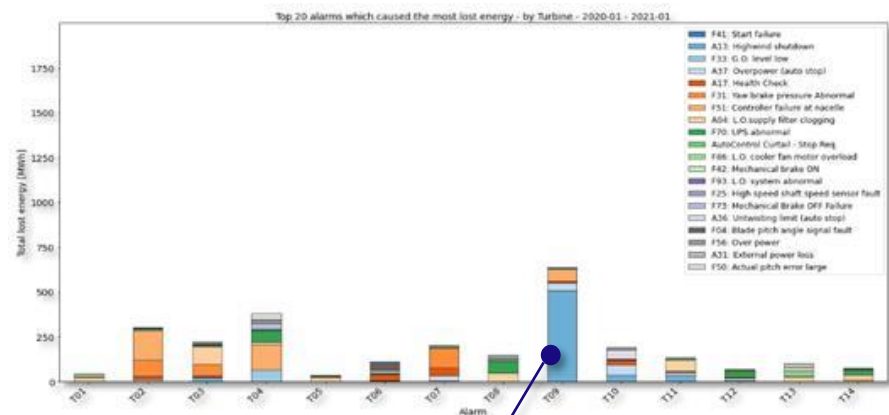
Drivetrain: Main bearing fault

- ✗ Main bearing fault was detected by two independent models – vibration and SCADA
- ✗ Looking at vibration only: **Replace too soon!**
- ✗ The use of both data streams enables **smart maintenance planning**
- ✗ Keep the turbine operating for longer and **enable replacement in the off-peak season**

Turbine Control, Lost Energy: Sensor Malfunction



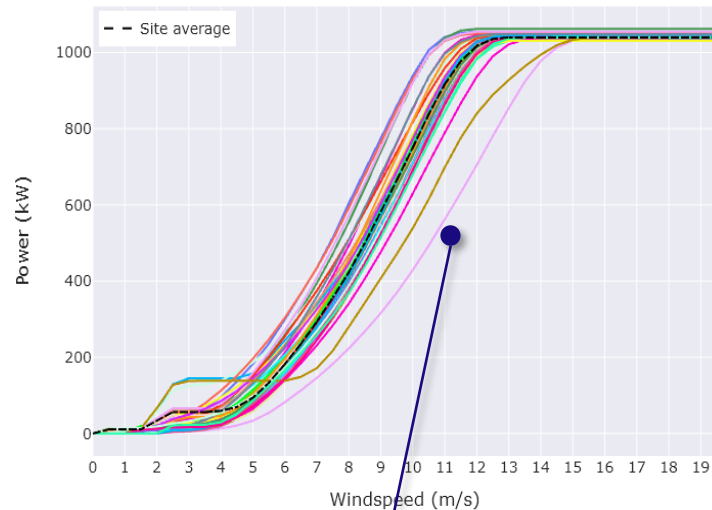
HIGH WIND SHUTDOWN ALARMS



600MWh lost energy per year (\$21000) caused by high wind shutdown alarm

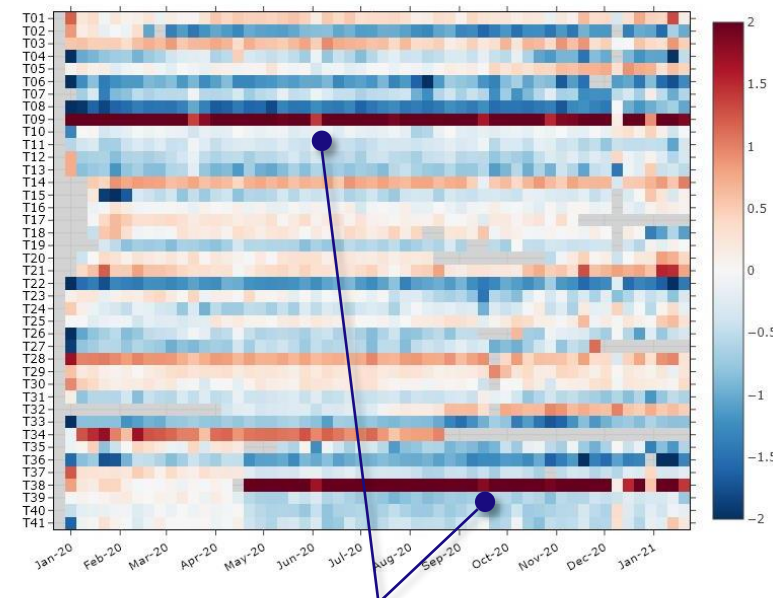
ABNORMAL POWER CURVE

Fitted power curves from site, uncorrected for anemometer issues



Extremely large spread in power curves; indication that something is wrong

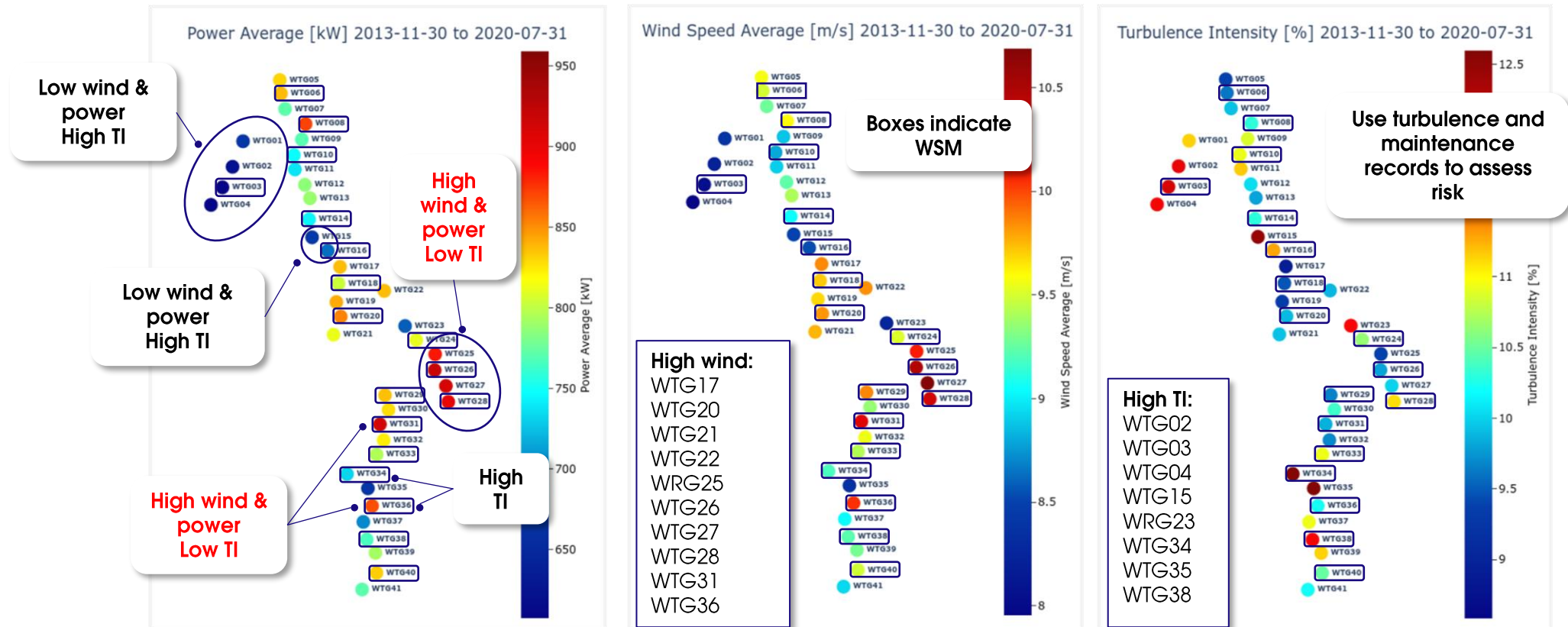
AUTOMATED DETECTION OF BAD ANEMOMETERS



Two faulty turbines detected

Performance: Wind Sector Management (WSM)

- ✗ Wind sector management reduces wake for nearby turbines and self-turbine loading.
- ✗ Analysis combined SCADA 10-minute data, maintenance records, and event data. Used to recommend optimized WSM.
- ✗ Some turbines can stay fully online, or at least be set to derate instead of shutting down
- ✗ After changes, customer saw savings of **200 MWh (\$30K)** over an initial **3-month period** over 12 turbines.





Improve your O&M decisions through **advanced analytics** and **actionable recommendations** that our AI (Artificial Intelligence) platform by combining different data streams in one place.

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