



AI Monitoring

Take early action with precision



About Turbit

Turbit is an AI Monitoring System for wind turbines.

Detect abnormal behavior early at a turbine and portfolio level with automated live analytics. Technical operators, directors, and asset managers benefit from Turbit's early and precise analytics.



5+
Years AI
Development



12+
API Data
Connections



5,800+
Turbine
Years of Data



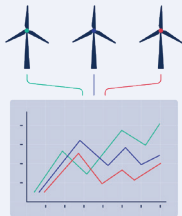
1,500+
Turbines



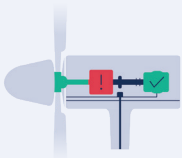
20+
European
Customers

The Complexity of Wind Turbine Monitoring

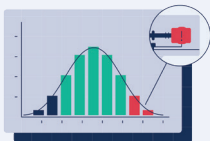
Each turbine behaves differently, even if identical in construction.



Different sites, wakes, turbulences and weather.



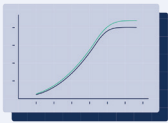
Different compositions of components and control software.



Different wear stages of components.

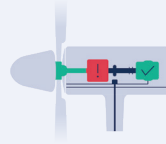
Smart Live Analyses for Every Wind Turbine

Turbit turns complex problems into simple ones:



Analytics

Automated live analyses leverage unnoticed potential and create more time to act.



System Health

Monitoring of health conditions, major components and adjacent subsystems.



Network

Improving anomaly detection with each additional turbine and failure. Smart data development through AI monitoring and fleet learning.

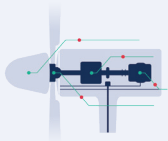


Wildlife Monitoring

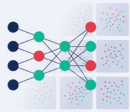
Complex wildlife restriction rules made simple.

A Self Improving Prediction Pipeline

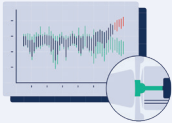
Learning the normal behavior patterns of each turbine and component.



Data pipeline integration into existing software stack



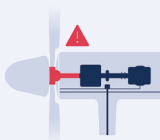
ML-model training for each turbine, component and site



Continuous simulation of the relevant parameters. Dynamic detection of deviation from normal behavior



Classification and labeling of behavior patterns



Automatic failure alarms and reports

Cooperative Workflow with Turbit

Turbit

- Integrates the data pipeline, SCADA data, status logs, service reports, redispach dates and other operation information
- Trains ML-models and scales them onto the whole fleet
- Refines monitoring settings continuously
- Performs intensive onboarding processes and customer success meetings
- Automates immediate failure reports, abnormality detection, root cause prediction

Customer

- Identifies and improves underperformances with early diagnosis of component damage
- Provides direct feedback to Turbit, service and OEM
- Interacts with service partners, operators and Turbit to investigate anomalies in depth and oversees repair processes

Turbit & Customer

- Prepare preventive measure proposals for OEM or service
- Implement settings for wildlife restriction surveillance
- Permanent live monitoring, ad hoc alerting, handling of anomalies as well as documentation
- Discuss and report events to leverage optimization potentials

Show Cases

1. Rotor Bearing Temperature

Root Cause: Defective greasing mechanism

Precision: $\pm 0,5^{\circ}\text{C}$



1 Dezember 2018

Turbit detected an abnormal temperature in the rotor bearing.

2 April 2019

The semi-annual maintenance was performed in April 2019 but the cause of abnormal temperatures couldn't be solved.

3 May 2019

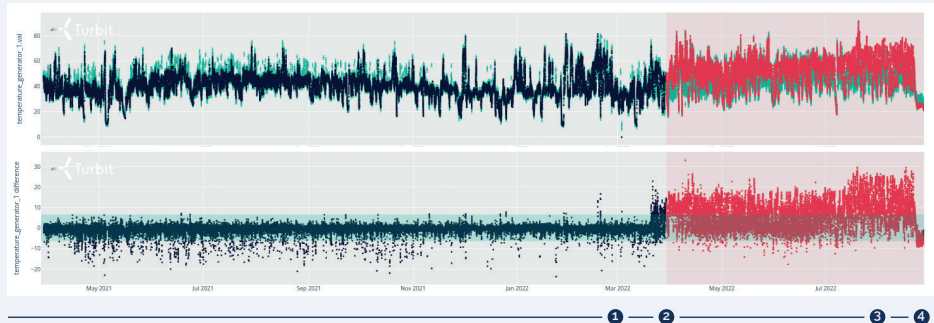
A second service visit was carried out and the defective press connection in the corrugated tube was finally found and replaced.

4 End of May 2019

The temperatures of the corrugated bearing then returned to normal behaviour.

2. Generator Bearing Temperature

Root Cause: Meltdown of generator windings due to increased reactive power



1 March 2022

Turbit first detected an abnormal generator temperature on the 4 WTGs of the park.

2 April 2022

The client informed the maintenance team about those anomalies, but even after a second anomaly report in July, the service replied that they don't see an issue.

3 August 2022

A total generator breakdown occurred.

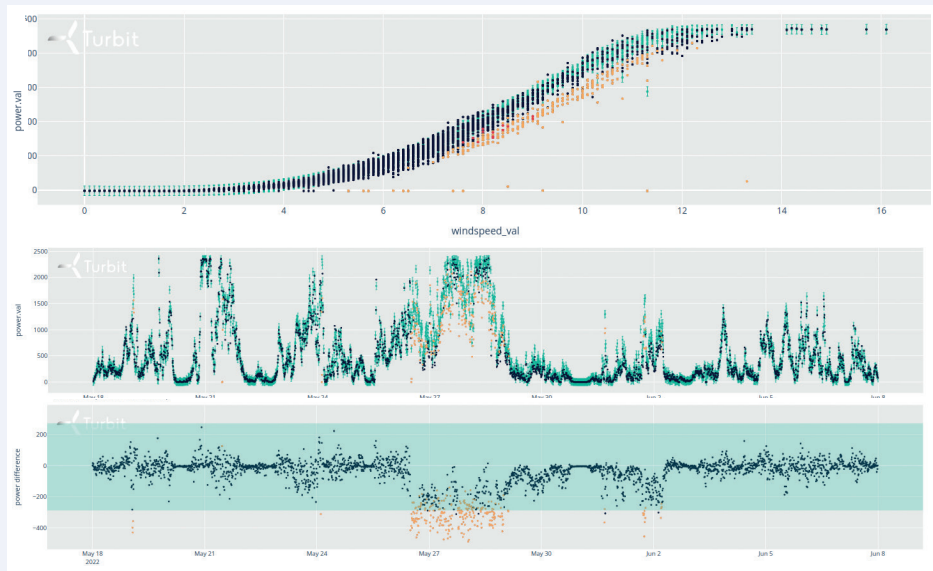
4 September 2022

The client reported a claim to the service and now saves the 3 other generators and gets a better service quality.

3. Loss of Power

Precision: ± 30 kW

Root Cause: Wrong pitch-offset.



1

1 26 May 2022

Turbit detected a loss of power and immediately sent an alarm.

2

2 28 May 2022

The analysis showed a wrong offset of the pitch, and the operator could send a detailed analysis to the service team.

3

3 2 June 2022

A control software update prevented losses of 1000€ per day, which otherwise would have stayed undetected for months.

● Simulation

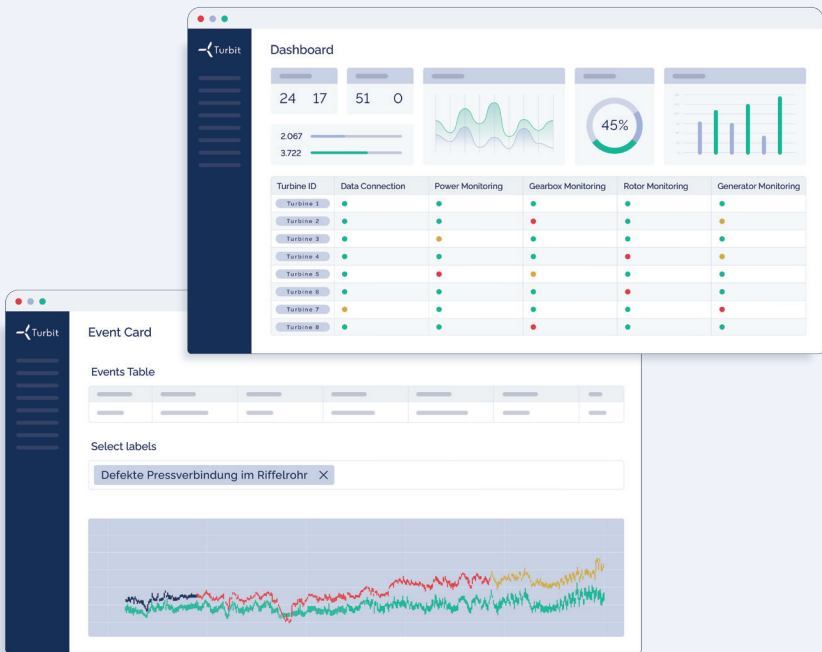
● SCADA

● Outlier

● Escalated Alarm

Turbit Product

A comprehensive automated analysis is sent as soon as Turbit detects a deviation between simulated and actual data. Before sending an event, Turbit filters the alarms by individually tailored status log filters.



Turbit's customers can give feedback by labeling and commenting on the analyses. This constantly improves root cause prediction accuracy and storage in the failure database.

Turbit API & Integrations

- Easy access to Turbit via REST API
- Individual integration into complex software stacks
- Real-time event reporting via API and e-mail



Spotlight Features



ML Label Prediction

Turbit provides tools to automate time consuming manual analytics:

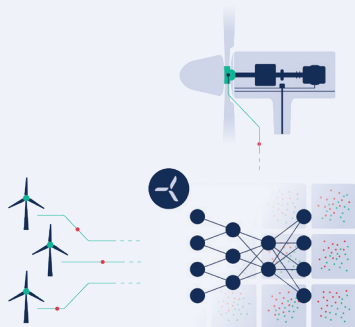
- Prediction of root causes, failure descriptions and solutions
- Individual plots and explanations depending on root causes
- The feedback of Turbit's customers continuously improves ML Label Prediction



Data Labeling

Turbit ensures excellent accuracy and event relevance:

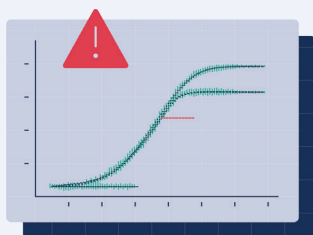
- Individual inclusion and exclusion of time frames and status codes
- Creation and control of individual prediction labels
- Feedback tools to manage relevancy levels of alarms



Benchmarking and Fleet Learning

Having no data is no problem:

- Comparison of turbines with Turbit's big fleet database
- Event detection with minimum amounts of data



Power Monitoring

Even with complicated wildlife restrictions, sector management and wakes, Turbit precisely monitors power:

- Individual learning of sector sound power curve management
- Detection of power deviations starting at 30 kW
- Very low false positive rate by filtering through status codes

AI Modules

Power

- Detection of slightest changes of the power curve within hours
- Loss calculation with highest precision via Machine Learning
- Automatic root cause prediction



Generator

- Detection of bearing break downs, cooling system problems and electrical problems months in advance



Gearbox

- Detection of gearbox problems in HSS or LSS bearings
- Early problem detection with the oil filter and oil cooling system



Rotor Bearing

- Detection of greasing problems and bearing break downs years ahead



More Products

Bat Shutdown

Complex rules with night deciles, windspeed and temperature including hysteresis rules. Immediate alerting if WTG does not run according to rules. Documentation of correct wildlife operation.



Sound Reduction

Wind direction based sector sound power curve management. Immediate alerting if WTG does not run according to rules. Documentation of correct sound operation.

Developer Licence

Creation of individual ML model templates via Turbit Rest API. Management of training, scaling and alerting of large fleets within days. Extended support.

Turbulence Analysis

Analysis and quantification of turbulence effects in the windpark.

Blade Icing

Detection of blade icing through ML and automatic loss calculation.

Label Prediction

Prediction of individual labels with Turbit's ML Label Prediction. Automatic probability prediction of root causes from all data points available.

Yaw Error

Detection of yaw misalignments with SCADA data in the context of the windpark.

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