![TrendMiner - A Software AG Company logo]

INDUSTRY
Energy Generation-Renewable

PROCESS TYPE
Continuous

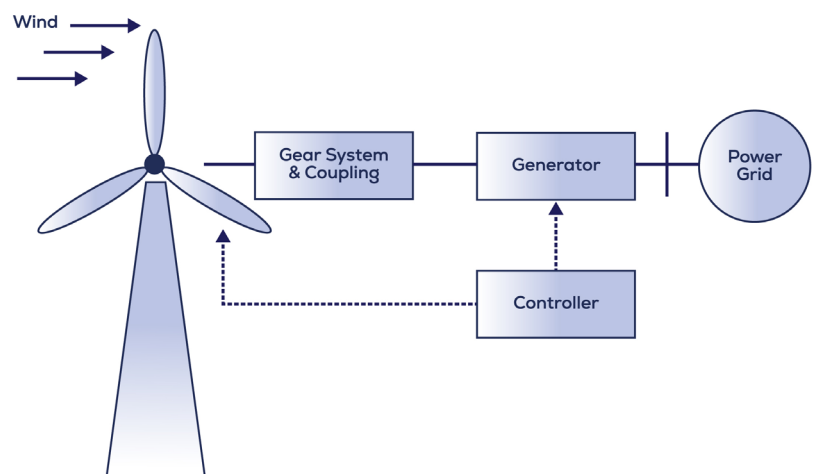**ANALYTICS TYPE**
Correlative

KEY OBJECTIVE
Find the best turbine power output curve

Monitoring the Relationship Between Wind Speed and Power Generation

BACKGROUND

Energy companies that operate wind farms must continuously control and optimize them to ensure they are generating the most power in relationship to the wind. Large wind turbines that turn in the wind to produce energy are one of the critical assets on site. The conversion from wind to electricity has an optimal correlation to maximize the performance of the equipment.

Wind → → →

Gear System & Coupling → Generator → Power Grid

Controller

CHALLENGE

To optimize the relationship between power generation and steady wind speed, operational experts need to define the good operating zone from the cut-in speed to the cut-out speed of the turbine. This curve must then be monitored continuously to avoid any operating condition anomalies.
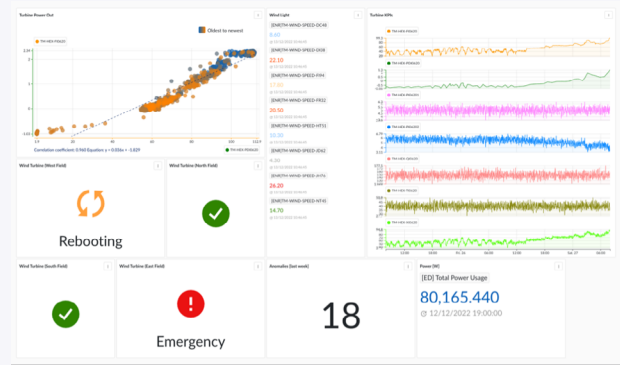
SOLUTION

- Use TrendMiner's Scatterplot Visualization Mode to focus on the correlation between power and wind speed tags

- Filter out all non-relative periods

- Define the good curve and use the Operating Area Search to look for periods when this correlation does not properly match

- Perform a Cross-Asset analysis of the remaining turbines on the grid

Challenges

- Several things could cause a loss in correlation, including problems with the turbine's rotor speed or loss of wind direction in relation to its blades

- When operational experts know they have lost the good operating zone in one turbine, they often will reboot its system (which usually takes less than an hour) rather than find a specific root cause

RESULT

- Using TrendMiner, operational experts were able to determine the good operating zone that is the optimal correlation between wind speed and power generation

- They set up a monitoring system to follow the optimal correlation between a turbine and wind speed

- When the correlation no longer shows the optimal curve, operational experts receive an alert and can begin searching for the root cause of the anomaly

TRENDMINER FEATURES USED

GOOGLE-LIKE SEARCH

TrendMiner allows for an easy click and search for tags, just like using Google. While typing, our software auto fills best matching terms to speed up the analysis search. In addition, the asset framework structure can be used to retrieve tags of interest hierarchically, and the time-series data of the tag of interest is then displayed for visual inspection. Multiple tags can also be visualized at the same time to see graphical correlations.

AREA SEARCH, CROSS-ASSET SEARCH

An Area Search is used to gain new pattern-based insights to detect anomalies outside best operating zones. It is achieved by combining two tags. The Cross-Asset Search allows you to search through similar assets based on pre-defined templates in your Asset Framework. Easily analyze data from assets of the same type and compare the data across your production plant or even multiple plants worldwide.

BEST OPERATING ZONE

Besides fingerprints, scatter plots based on "best operating zones" can be created with TrendMiner. The designated "best operating zones" can be used in the same way as a fingerprint. Alarms can be put in place to notify process experts when deviations from these zones are detected. Monitoring the best operating zones reduces unnecessary equipment stress, increases asset reliability, and extends equipment lifetime.

DATA VISUALIZATION MODES

TrendMiner offers various visualization modes for analyzing time series data. Besides the common time trend, time series data of multiple tags can be shown in a stacked mode for specific time sequences or can be grouped together in a "swim lane." For multivariate analysis, our software offers a multi-scatterplot that shows tag histograms and multiple histograms of each pair of the selected tags.

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