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Optimizing Renewable Energy Asset Performance and Safety with Predictive/Prescriptive Analytics

BACKGROUND

Renewable generation owners/operators are challenged to extract maximum performance and profitability from an increasingly diversified fleet of wind, solar, and storage assets. Meeting this challenge safely and economically demands real-time, data-driven insights, automated system performance prediction, and prescriptive failure mitigation to maximize production, optimize storage, and ensure safe operations.

CHALLENGES

- **VALUE UNCLEAR:** Lack of awareness of the benefits of digital enablers and tools not being fully utilized.
- **VOLUME OF DATA:** Lacking capability to generate insights due to overwhelming amount of data.
- **ACCESS TO DATA:** Unable to obtain data from the OEM and lack of clarity on the rights to data.
- **STANDARDIZATION OF ALARMS/FAULTS:** Lack of consistency of alarms, tags, faults, OEMs, asset models, reports, and benchmarking.

METHODOLOGY

AI's power lies in its ability to ingest huge quantities of performance data on complex assets and then apply ML algorithms to predict—with remarkable prescience—when systems will require maintenance, when they present a safety hazard, or when they are on the verge of failing. Renewable asset owners and maintenance personnel gain advance notice that can turn a catastrophic (for both workers and hardware) equipment failure into a less expensive maintenance task.

BENEFITS OF AN AI POWERED PERFORMANCE MANAGEMENT SYSTEM FOR RENEWABLES

INCREASED REVENUE

Automated detection and alerting of underperforming or malfunctioning assets helps increase energy production and revenue.

- More efficient asset utilization and production means more return from your capital investment.
- Reduced energy loss lowers maintenance costs and enhances profitability.
- Improved matching of electric power production with demand.

FEWER FAILURES

Advanced early anomaly detection and predictive analytics ensure timely and effective maintenance.

- Longer asset lifetimes mean lower CapEx and reduced equipment installation costs.
- Reduced downtime optimizes generation and revenue.
- Lower OpEx and CapEx costs contribute to faster ROI and long-term profitability.

OPTIMIZED TIME

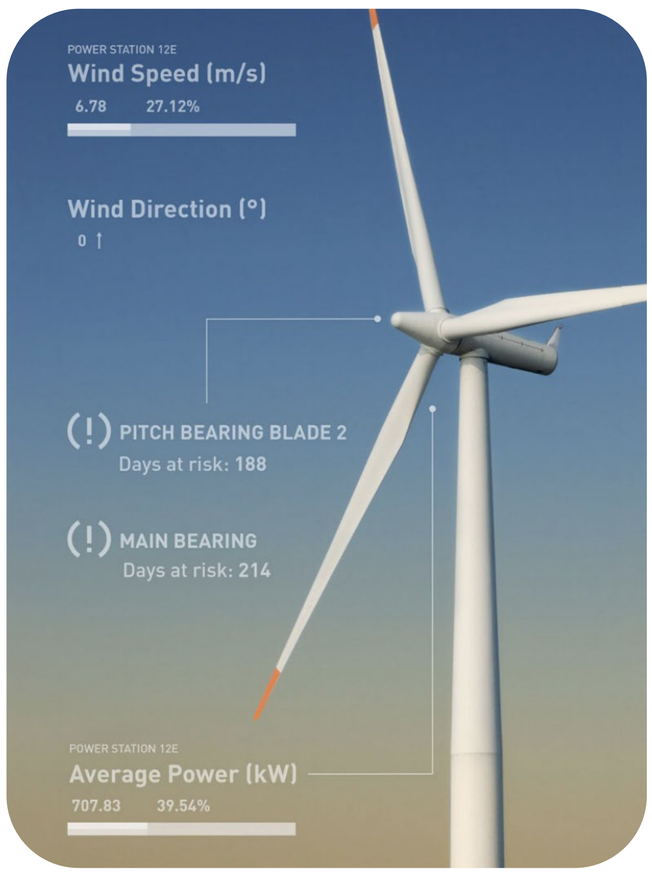
Analysts and technicians spend less time processing and managing data and more time working on solutions that increase equipment uptime and productivity.

- More efficient use of staff drives down outage times.
- Staff health and safety are optimized, increasing retention and employee satisfaction.
- Faster, more accurate outcomes mean less wasted effort and cost.

BETTER PLANNING

Visibility into future spare parts needs and advanced planning of crane callouts help avoid unnecessary costs and inefficient use of staff time.

- Reduced parts inventory and carrying costs drives efficiency.
- Faster repair turnaround times mean more generation and revenue.
- More efficient use of heavy equipment like cranes improves efficiency and maintenance outcomes.



USE CASE:

Predicting Wind Turbine Pitch Bearing Failures

Modern wind turbines vary the pitch angle of each blade to optimize energy capture, requiring a pitch bearing at the base of each blade. These bearings are subjected to demanding operating conditions and can be very costly to replace. Predicting such failures in advance can result in much lower crane callout costs. The most common way of diagnosing pitch bearing health is by analyzing grease samples from the bearings. The amount and size of wear particles provides insight into the health of the bearing. However, obtaining samples is both time consuming and expensive, as the turbine needs to be taken offline and technicians need to enter the hub to obtain samples.

OUTCOMES

Failures can be predicted with over 90% accuracy up to 6 months in advance, allowing project owners to order replacement parts quickly and ensure that all damaged bearings can be replaced with a single crane callout, saving up to $150k each time multiple pitch bearings are simultaneously replaced.

BENEFITS

- Algorithms run 24 hours/day using only existing signals from the turbine, so no additional hardware is required and no turbine climbing is required.
- Industrial AI platform automatically alerts users of faulty pitch bearings so that damage can be confirmed.
- Owners can have long-lead-time replacement bearings on order, ensuring that all damaged bearings are replaced in a timely manner.

USE CASE:

Detecting Soiled Solar Panels

Natural accumulation of dust, pollen, and other debris reduces the ability of photovoltaic panels to turn solar energy into electric power. Also, uneven soil patches affecting some, but not all, cells of a PV module can disrupt the flow of current throughout the entire module. That can create hot spots that damage sensitive components, shortening their lifespan. Soiled solar panels produce less electricity and can lead to PV module damage. Energy loss annually can exceed as much as 7% in parts of the U.S. In more arid regions, energy output reductions due to soiling can range up to 50% per year, creating multi-billion-dollar revenue losses. Soiling also creates higher operating costs because of constant equipment monitoring and cleaning/replacing of damaged assets.

OUTCOMES

Industrial AI platform's AI-powered asset management platform eliminates the need for expensive soiling stations, helping solar operators implement optimized cleaning intervals that maximize their energy production at the lowest possible cost.

BENEFITS

- Using AI and ML to interpret weather forecast data, operators can better determine when a precipitation event of sufficient magnitude to clean the panels will occur.
- All data sources are combined with the actual cost for cleaning the panels and an optimization process provides the operator with the ideal time to clean panels for maximum project profitability.

CONTACT INFORMATION

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