



HEXAWARE

AI Battery Optimization for Battery Energy Storage Systems (BESS): Enhancing Asset Health, Predictive Maintenance & Operational Reliability for a Global Renewable Energy Leader

Case study

Client

- | Client
- Challenge
- Solution
- Benefits
- Summary

Global renewable energy innovator strengthening grid resilience with intelligent storage

The client is a global leader in renewable energy technologies, operating advanced Battery Energy Storage Systems (BESS) to support grid stability and the integration of renewable energy. As operational demands expanded, the organization needed enhanced battery management systems to improve real-time battery health monitoring, predict degradation, and minimize downtime.

To ensure reliability at scale, the organization needed a modernized approach combining energy storage analytics, predictive models, and intelligent battery optimization.



Challenge

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Accelerated battery capacity degradation and lack of predictive intelligence hindered operational reliability

The client’s extensive BESS portfolio faced several operational challenges:

- Battery Capacity Degradation**
 Rapid battery capacity degradation impacted usable storage performance, caused unplanned outages, and reduced lifespan.
- System Reliability Issues**
 Degradation patterns affected efficiency, operational stability, and grid-response performance within the battery management systems.
- Limited Predictive Insight**
 The absence of battery degradation prediction models limited visibility into health trends and risk events, preventing proactive maintenance.

These issues reduced uptime, increased maintenance costs, and affected compliance with performance guarantees.



Solution

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AI/ML-enabled AI battery optimization and energy storage analytics to modernize BESS operations

A comprehensive, AI-driven optimization framework was deployed across data, analytics, and operations.

- **End-to-End Data Operations Management**

- Established a robust data engineering pipeline that captured high-frequency IoT data from the Battery Energy Storage Systems (BESS).
- Standardized ingestion, cleaning, transformation, and lifecycle management.
- Enabled scalable energy storage analytics for advanced modeling and reporting.

- **AI/ML-Based Degradation Modeling**

- Conducted multi-factor analysis to identify leading drivers of battery capacity degradation, including temperature, C-rate, and discharge cycles.
- Built sophisticated battery degradation prediction models using machine learning to forecast RUL and detect anomalies.
- Enabled early warnings, proactive maintenance, and AI-driven recommendations for optimal cycling.

- **Visualization & Operational Optimization**

- Delivered real-time dashboards integrating battery health monitoring, degradation trends, and predictive alerts.
- Provided optimized operational parameters drawn from AI battery optimization models to reduce stress on cells and extend lifespan.

This created an intelligence-driven, predictive-operations ecosystem across the entire BESS infrastructure.



Benefits

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Meaningful improvements in availability, reliability, and cost performance

8%
increase in asset availability through proactive insights and optimized cycles.

\$2M+
in savings achieved through reduced downtime and minimized compliance penalties.

Improved battery health monitoring helps extend asset life.

Real-time energy storage analytics enabled faster decision-making and operational efficiency.



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A predictive and intelligent BESS ecosystem enabled by AI battery optimization

Through advanced ML-driven battery degradation prediction, end-to-end data modernization, and optimization of operational parameters, the client transformed the reliability and performance of its Battery Energy Storage Systems (BESS). This solution delivered significant gains in system availability, predictive visibility, and financial performance, which in turn helped drive multi-million-dollar value and enable scalable, intelligent grid operations.



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