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HOST NEW YORK STATE OF OPPORTUNITY. NY Power Authority

Demonstration of PowerUp's Battery Insight® analytics program on NYPA asset

TECHNOLOGY SOLUTION

PowerUp's cloud-based battery analytics platform, Battery Insight®, takes Li-ion BESS operational data that are already being collected (current, voltage, temperature) and applies battery expertise (patented algorithms) to identify risks for thermal runaway months earlier than the integrated battery management system (BMS),improve performance with accurate capacity (State of Health or SOH) and energy (State of Charge or SOC) measurements, and extend BESS lifetime through informed monitoring.

Once a BESS is integrated into the Battery Insight® platform, owners, operators, and asset managers can evaluate safety and performance alerts and their associated root causes themselves. The level of detail gained allows stakeholders to hold OEMs, integrators, and O&M providers accountable when it comes to fulfilling their obligations or supporting their performance claims.

Months-early safety alerting instantaneously identifies failing components without the need for extensive testing. This extra time allows operators to streamline repairs by simplifying the inspection process and facilitating batched replacement of failing modules.

Improved accuracy in SOH and SOC, reducing typical error ranges from ±10% to ±2%, means that operators can confidently commit to delivering their energy or ancillary service while preventing damage to components that would otherwise overcompensate for these measurement errors.

Finally, using battery ageing models, Battery Insight® is able to project the remaining useful lifetime of BESS assets, providing the information necessary to extend project life.

PROJECT OVERVIEW

The first aim of the project was to seamlessly onboard the WPO BESS, located at NYPA's headquarters, onto PowerUp's Battery Insight® platform. During this process, PowerUp was able to improve upon best practices for onboarding new assets. This process meant NYPA was tasked with transferring the data for PowerUp to review, format, and integrate into the cloud platform.

Following the onboarding process, NYPA gained visibility into their system at a level far beyond what was previously possible. The Battery Insight® dashboard allows NYPA to closely monitor the safety and performance of their asset.

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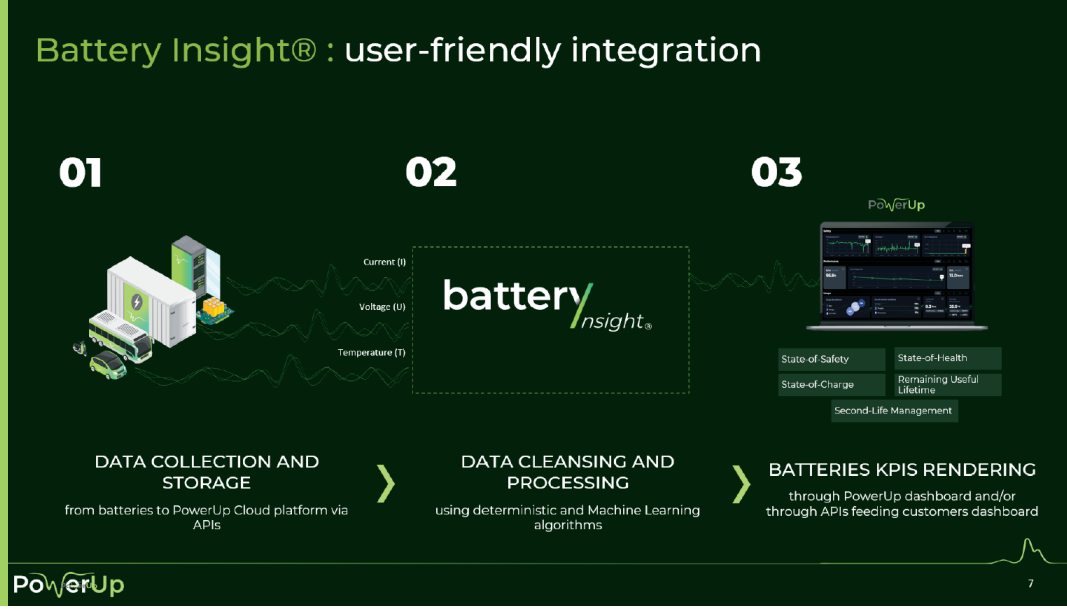
Second, after the onboarding is completed, the system could be analyzed to better understand the concerns that could arise around safety, performance, and endurance of the BESS. These same insights can be applied to improve the performance of the system in future operations. One of the critical aims of the program with NYPA was to validate PowerUp's claims regarding safety alerting to both prevent thermal runaway in the WPO BESS system, as well as validate the claims made by the battery manufacturer surrounding safety and longevity. In short, NYPA hopes to rule out safety and even performance concerns that could result from the root causes Battery Insight® is able to identify.

Finally, since this project was more collaborative than a typical commercial pilot, PowerUp was to be prepared to perform various ad hoc analyses to better understand the performance of the WPO BESS system and offer guidance for taking action to resolve anomalous behavior observed on the asset.

A number of insights were identified by PowerUp's technology that helped confirm the performance of our battery storage system.

Alan Ettlinger, New York Power Authority, Sr. Director Research, Technology Development & Innovation



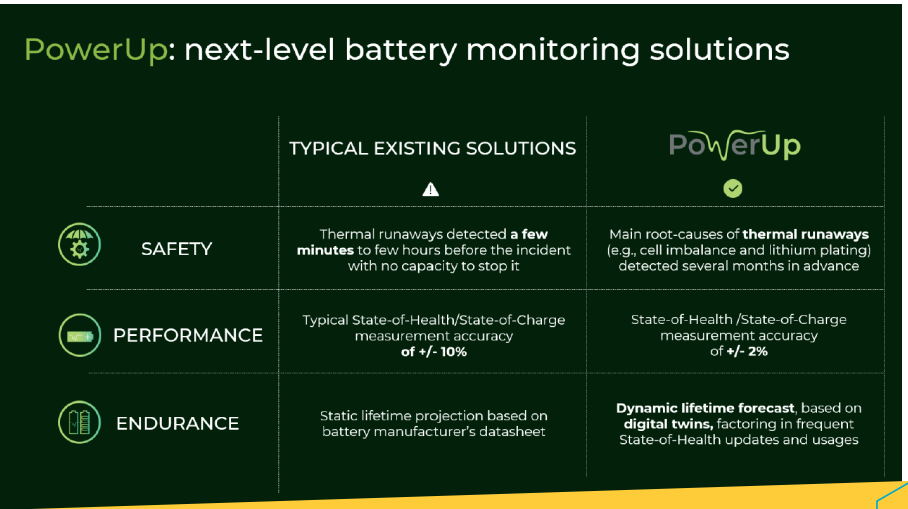
RESULTS & LEARNING

Through monitoring of the WPO BESS, PowerUp was able to verify its claims for safety alerting, state of charge and state of health measurements, and demonstrate the degradation of the asset. This understanding gave NYPA the information and leverage to return back to the manufacturer and compare against their claims for the longevity of the system that was sold. It is critical to note that, even if the chemistry of cells was well known by PowerUp's algorithms, the battery reference and system architecture is entirely novel. While it is still within the Li-ion family of NMC batteries, PowerUp had never investigated the performance of such cells.

Even under these circumstances, PowerUp's monitoring claims were validated. Moreover, the Battery Insight® software was able to identify anomalous behavior within this novel system design. Underperformance on one of the racks was identified due to cell imbalance malfunctions that may have led to the accelerated degradation.

PowerUp was able to perform these measurements and analyses on two different levels of data granularity. During the monitoring pilot, the data logging WPO BESS' performance was no longer available in its original frequency. After communicating with the team, the Battery Insight® platform was adjusted to account for this data granularity change without interruption to NYPA's monitoring capabilities.

It became abundantly clear during this pilot program that completeness of data and a steady stream of data are critical to the effective monitoring of a BESS asset. PowerUp



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was able to roll out an additional KPI, Data Quality, that monitors the completeness of the data streams over time. This helped to identify gaps in data that could explain anomalous performance, but also sensor errors that could result in false positives of malfunctioning components.

Finally, an additional finding during this pilot was the identification of a constant energy leak on the WPO BESS. PowerUp identified a current draw that was affecting the overall efficiency of the system and reducing its efficacy. The problem can now be addressed so that the system can reach its targeted performance levels.

After this current leak was identified, NYPA became curious about the overall AC to AC round-trip efficiency of their system. PowerUp conducted this ad hoc analysis to offer NYPA greater insight into the overall performance of their system.

IMPLICATIONS & NEXT STEPS

There were several results from the pilot with NYPA that resulted in meaningful progress in the development of PowerUp's Battery Insight®. The value demonstrated with the additional Data Completion KPI confirmed PowerUp's assumptions that clients would benefit from its inclusion. Additionally, applying monitoring capabilities on a completely novel cell reference confirms that Battery Insight®'s capabilities are as robust as expected.

These findings help make the case to future clients that there are many different ways they could be served. These facilitate the next steps that include monitoring for assets across various geographies and cast an even wider net for those with untested battery designs. With additional monitored data, battery references, and KPIs, the value the software provides increased during this pilot alone.

Next steps will also include the incorporation of various SMS alerting capabilities, lithium plating detection, and a more customizable reporting as the KPIs offered become more numerous, such as Round Trip Efficiency.

As each new asset is added, Battery Insight®'s capabilities grow through its machine learning mechanisms. The goal will be to continue to implement this platform on projects of differing designs, use cases, geographies, and more to produce the most effective battery analytics platform available on the market. Doing so will facilitate the global energy transition from fossil fuels to renewables by allowing owners of BESS systems to operate their batteries more safely, reliably, and for longer.

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3002028659 March 2024

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