NEWS FROM THE FIELD

WATTMORE's Summer Field Testing

Petra Melounova
Dan Lenz
Dr. Qiao Li
Roya Karimian
Dr. Kevin Davies
Dr. Reza Ghorbani

www.wattmore.com

Overview

WATTMORE was chosen by Pine Gate Renewables in the Fall of 2021 to provide energy management and optimization services (EMOS) for a battery energy storage system (BESS) installation at a Logan Power & Light substation in Logan, Utah. Services include offsetting use of peaker plants, demand reduction, and backup power. The details of this stand-alone battery storage project are outlined below:

Location: Logan, UT
Year: 2022
Type: EMS services
Interconnection: Front-of-Meter
Battery Size: 125 kW, 500 kWh
WATTMORE Roles: EMS provider and integrator

Partners on this project include:

- Pine Gate Renewables
- Blue Ridge Power
- LS Energy (providing inverter)
- Eos Energy (providing battery)
- DEIF (providing controller)

Testing Goals

The goal of testing was to verify the successful integration of Eos Energy Battery Block 2.3, LS Energy PowerBriC and the WATTMORE Intellect EMS + Controller. During testing, the following capabilities were successfully demonstrated by the Intellect EMS as part of the comprehensive factory acceptance test (FAT):

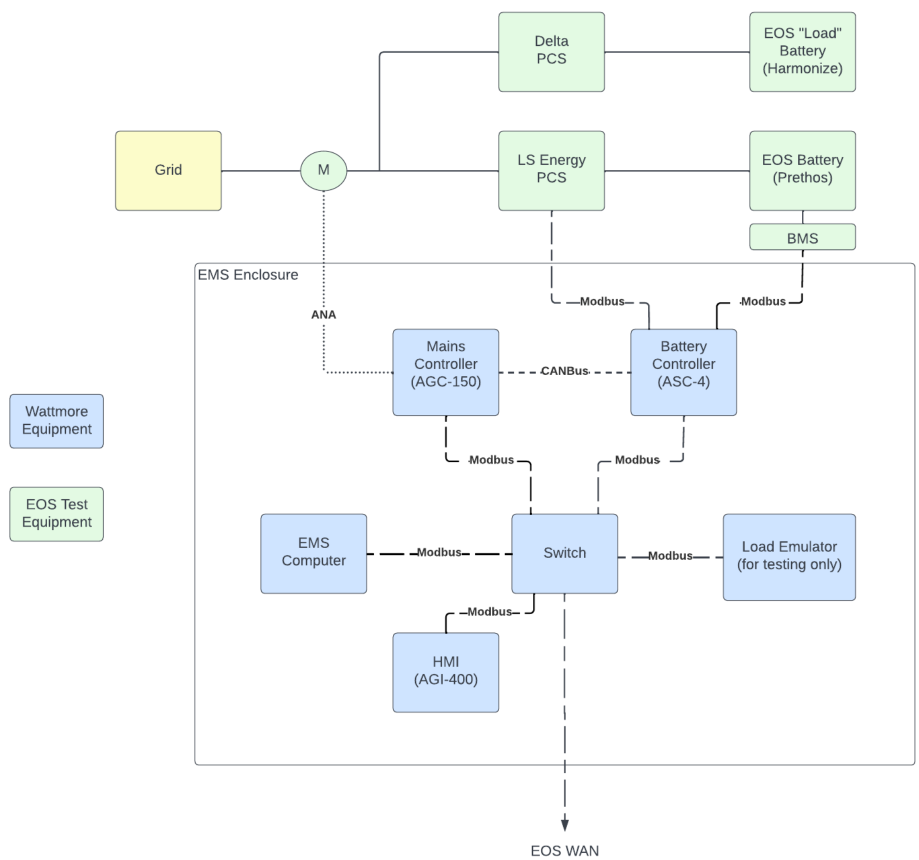
1. Monitor and visualize data points from the BESS on the controller, human-machine interface (HMI) and web dashboard
2. Monitor the BESS for alarms, warnings and faults
3. Perform string-level battery controls to bring the BESS online after a string fault was detected
4. Keep the BESS within manufacturer warranty specifications even when warranty-voiding commands were sent
5. Bring the BESS to stable operation from 0% state of charge (SoC) by performing “boost charging”
6. Demonstrate the ability of the Intellect EMS to control the BESS in multiple operating modes including:

a. Manual dispatch with fixed active and reactive power (PQ) setpoint
b. Manual dispatch with fixed power factor
c. Peak shaving

These modes and functions provide customer value by maximizing the use of the battery investment for demand charge reduction and reactive power compensation to reduce local distribution line losses and power factor charges.

Approach to Factory Acceptance Testing

To meet the testing goals, WATTMORE worked with Pine Gate Renewables to design a rigorous set of factory acceptance tests. Eos provided test facilities and support including two battery blocks, one to serve as the actively controlled battery and the other to emulate the required load scenarios. The WATTMORE system included its EMS plus power measurement devices and interfaces to communicate with the Eos battery management system (BMS) and the LS Energy power conditioning system (PCS) or inverter. The physical setup was a close approximation of the device layout for the project.



The WATTMORE team sent key team members to the site over three separate trips for a combined 4 weeks on-site over a 12-week period. The team included Dr. Qiao Li, Dr. Kevin Davies, Dan Lenz (Sr. Director, Product) and Petra Melounova (Electrical Engineer). The WATTMORE team was frequently accompanied by others including leadership and project managers from Pine Gate Renewables, Factory Acceptance Test (FAT) witnesses, an owner's engineer.

After days of setup, troubleshooting, and preliminary testing, the final FAT required three days to complete. A wide range of criteria was tested, reviewed, and ultimately approved down to details in the HMI display.

Perspectives and Lessons Learned

- Physical integration is an inherently time-consuming process because it involves troubleshooting problems that cannot be uncovered in the pre-integration period. This includes reconciling differences between documented specs and actual specs. For example, it is common for communication details such as Modbus register maps to change over time so the EMS drivers and even core software may require changes. This is a process of uncovering "unknown unknowns" so adequate time must be allotted and the appropriate expectations set about this being a process, not a set of tasks to complete.

- Unfortunately, due to the cost and size of components at this scale of energy storage, the final steps of integration, testing and refinement must often be performed at a dedicated facility such as the battery supplier. However, facility time and personnel are not cheap so their use must be saved for essential physical integration. Careful design and planning of pre-integration efforts, such as the use of emulators to test communications, can help minimize but not eliminate the time and resources required for in-person integration work.

- Buy-in and engineering support from hardware providers and partners is essential to bridge the inevitable gap between product documentation and reality for successful, robust integration. Given the complexity and rapidly changing nature of hardware in the industry, the fastest resolutions will be found with direct assistance from the engineers who built the products. However, these engineers are often dedicated to developing and testing new products, so strong buy-in at the business leadership level is essential to allocate the required level of resources and support.

- Detailed plans and contingencies for communications and networking is crucial. Network-related issues can consume significant time because it may be difficult to identify the fundamental issue among network configuration/design issues, discrepancies between network design and implementation, protocol-level conflicts, and firmware/datasheet discrepancies. These issues can display similar symptoms and may be intermittent, so their efficient resolution requires specialized IT professionals and tools under close coordination among the facility manager and the commissioning team.. Ideally, the main network setup can be completed and verified prior to the arrival of the core commissioning team.

- The intricacies and unique properties of the particular energy storage chemistry matter to the integration effort and the EMS software design. For example, the EOS Zynth (zinc hybrid cathode) battery chemistry operates very differently from other chemistries such as lithium-ion batteries.
    - Due to various natural characteristics in chemistry, physical construction and metallurgy, the current flowing through the parallel battery strings within an energy block may not be balanced. To address this, the BMS may implement custom battery-specific or proprietary procedures to rebalance SoC, voltage, and current during periods of the charge/discharge cycle. This affects the maximum allowable charge and discharge rates, which must be considered for the reliable and optimal operation of the EMS.
    - Due to moderate self-discharge rates, the battery can reach low SoC when left unattended. At low SoC, the battery voltage can drop so low that the PCS cannot charge the battery normally. This requires a boost charger or auxiliary high-voltage power supply to charge the batteries enough to engage the PCS. This requires coordination among the EMS, BMS and aux power supply to operate the battery when starting at very low SoC/ voltage.

Conclusion and Outlook

The WATTMORE team has now successfully completed three robust field tests since 2019. The results of the factory acceptance testing in 2022 demonstrated WATTMORE's ability to provide robust, cutting-edge software to forecast, optimize and control a variety of battery systems under a range of economic conditions and stringent commercial and industrial requirements. This is a critical milestone that will be the foundation for business growth and technical capabilities expansion to be released in 2023.

About WATTMORE

WATTMORE is a Denver-based climate tech company specializing in AI-powered software tools that focus on interoperability, value-stacking and scaling. The WATTMORE Intellect EMS platform is a state-of-the-art SaaS and Enterprise software engine built to help utilities, developers, and asset owners optimize and monetize energy storage.