Use Case Test Results for Battery Energy Storage Systems

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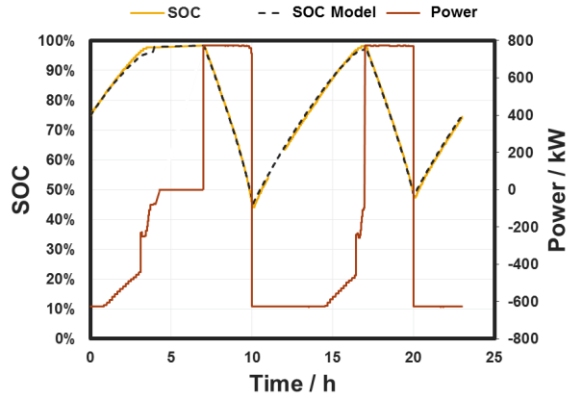
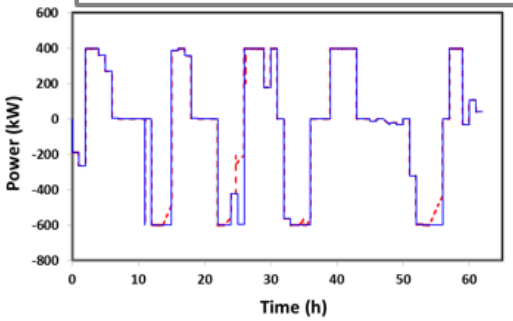
- Battery energy storage system (BESS) integration with the grid is key to increasing grid reliability and penetration of renewables.
- Baseline BESS performance metrics were evaluated using the US DOE-OE Energy Storage Performance Protocol.
- Multiple use cases were conducted to evaluate BESS performance, with performance metrics developed for each use case.
- Data at various levels including power flow at the Power Conversion System (PCS), Auxiliary load, DC battery power flow, DC battery state of charge (SOC), temperature was analyzed.

Results and takeaways

- A battery model was developed and validated to predict SOC as a function of time at various power levels, temperature and SOC.
- Incorporation of these findings in economic models allows optimum allocation of the BESS to various services to maximize benefits.
- Use cases ranged from Arbitrage – non-volatile duty cycle to Frequency Regulation – highly volatile
- Round Trip Efficiency (RTE) calculated with and without Rest, with and without Auxiliary Load consumption
- Signal tracking highly dependent on communication latency – RMSE 1% of rated power for one system and 16% of rated power for another
- RTE for Frequency Regulation 35 to 40% for one system, and 86% for the other.

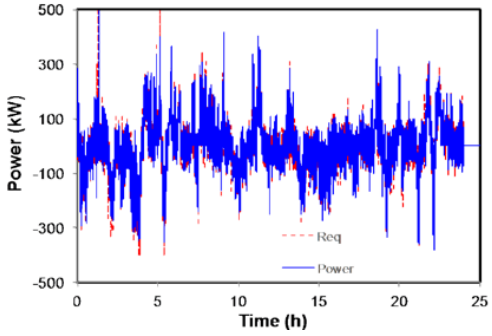


Arbitrage Use Case



RTE 74%
80% w/o Aux

Frequency Regulation Use Case



RMSE 10 kW
Or 1% of rated power