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Energy Storage Data Submission Guidelines

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Objective

Often times some Energy Storage System data is inconsistent and incomplete which leads to inefficacy of the data when it comes time to analyze. These data guidelines aim to remedy this issue by providing the necessary data points and sampling rates. High quality data will allow the industry to better understand energy storage systems and allow for faster and more robust data analysis.

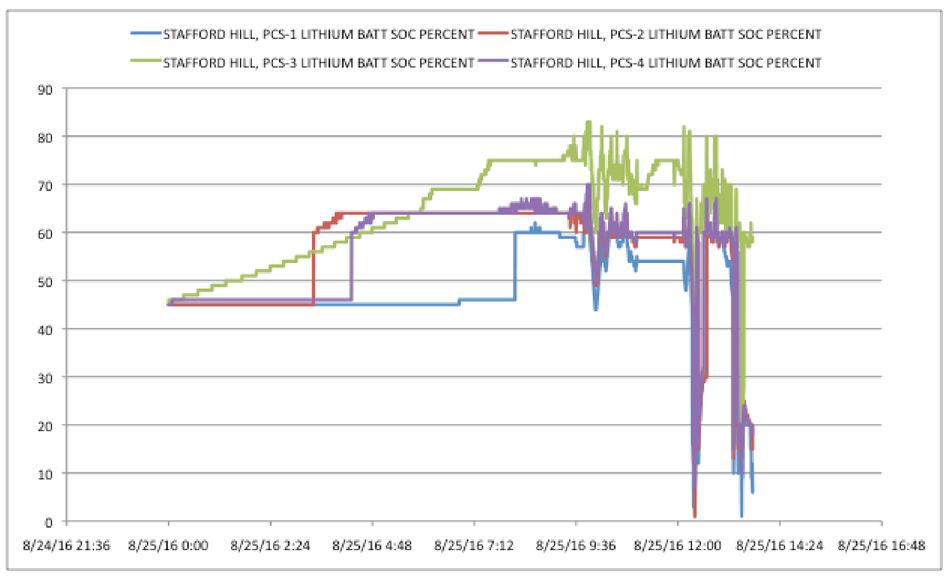
Data Points

Electrical AC Data and Conditions Points

The AC data points are important as they inform the engineer the amount of power coming in and out of the system. With these data points they can find important system statistics that indicate what the system is putting back into the grid as well as overall roundtrip efficiencies, power quality, and capacity fade. In addition, environmental and energy market points are useful because they allow the engineer to see the conditions the system is operating in and how these conditions affect the system. Financial market conditions like electricity price/cost are also included in this set as they help with the economic analysis of the system and its feasibility. (Table 1)

Specific Cell Data Points

While it is important to see how the entire system performs as a whole, it is also useful to see how each cell is behaving within the system, especially from a safety standpoint. By having access to each cell, the engineer can determine if a cell is impacting the system efficiency and if a cell is more likely to lead to safety concerns such as thermal runaway. DC data points for each cell are important as well because they can be used as a barometer of each cell's "health" and to pinpoint which cell could be causing the system to run inefficiently. (Table 2)



Data taken from Green Mountain Power's Stafford Hill 4MW/3.4MWh battery energy system

https://cesa.org/assets/Uploads/SAND2017-6164.pdf

System Data Points

Point	Sample Rate Minimum	Power Application Report Out Minimum	Energy Application Report Out Minimum	Values
AC Real Power	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
AC VAR	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
AC Voltage	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
THD	≥500 Samples/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Flicker	≥500 Samples/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
System Frequency	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Total AC Discharge Energy	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Total AC Charge Energy	≥500 Samples/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Auxiliary Loads	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Outside Temperature	≥1 Sample/Minute	≥1 Sample/Minute	≥ 1 Sample/15 minutes	value, max, min, avg
% Cloud Cover	≥1 Sample/Minute	≥1 Sample/Minute	≥ 1 Sample/15 minutes	value, max, min, avg
Internal Temperature	≥1 Sample/Minute	≥1 Sample/Minute	≥ 1 Sample/15 minutes	value, max, min, avg
Electricity Price/Cost	Sample rate associated with price data	Sample rate associated with price data	Sample rate associated with price data	value
Demand Charge Structure and Load Data	≥1 Sample/Minute	≥1 Sample/Second	≥ 1 Sample/15 minutes	value
Market Structure and price/cost data	Market Data Rate	Market Data Rate	Market Data Rate	value
Events: Errors, Warnings and Faults	≥500 Samples/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Power Quality Events	≥500 Samples/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Maintenance Logs	Per manufacturer	Daily	Daily	value, max, min, avg
Operator Commands	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Communication Conductivity Disruptions	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg

Table 1

Cell/Pack/String Data Points

Point	Sample Rate Minimum	Power Application Report Out Minimum	Energy Application Report Out Minimum	Values
AC Real Power	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
AC VAR	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
DC Power	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
DC Current	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
DC Voltage	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Total DC Charge Energy	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Total DC Discharge Energy	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Min Cell Voltage	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Max Cell Voltage	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Min Cell Temperature	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Max Cell Temperature	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Min Cell Resistance	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Mean Cell Resistance	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Max Cell Resistance	≥1 Sample/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Events: Errors, Warnings and Faults	≥500 Samples/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Power Quality Events	≥500 Samples/Second	≥1 Sample/Second	≥ 1 Sample/15 minutes	value, max, min, avg
Maintenance Logs	Per manufacturer	Daily	Daily	value, max, min, avg

Table 2

Future Perspectives

-Integrate these data points into monitoring an active energy storage system to create an interface that displays each of these points in real time

-After usage in the monitoring of energy storage systems, refine the data points included based on the data analysis performed

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