

Utilization of Energy Storage in California's Electrical Grid

A Quantitative Analysis of Batteries in California

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Background

California has experienced massive growth in the energy storage capacity available to the state. In particular, electric batteries have become an integral part of the future of sustainability and efforts to address blackouts, unplanned shortages, and growing energy demands.

Objective

Quantify the extent of the utilization of Electrochemical Battery Storage by California's electrical grid.

Methods

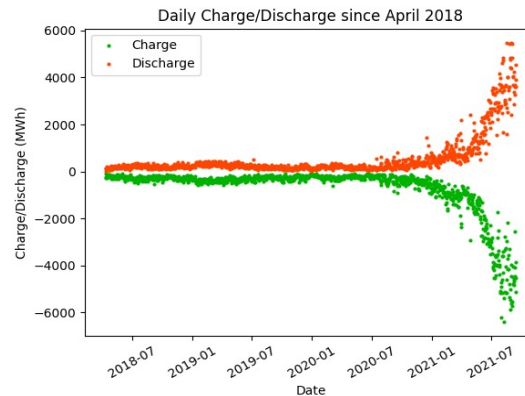
Analyze public data from the California Independent System Operator (CAISO) to observe trends from batteries over the past few years.

Data Analysis

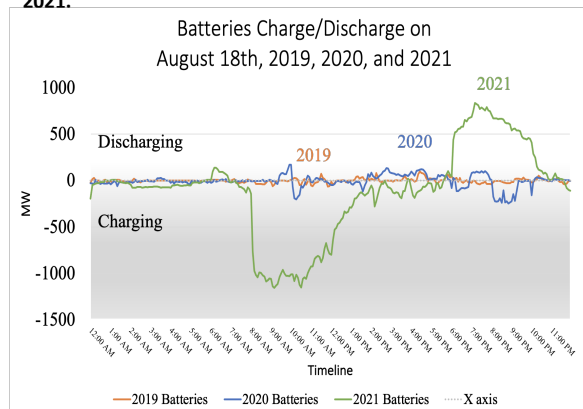
Between 2018 and 2020 there has been a massive growth in the use of batteries in the state of California. Particularly, we have observed a notable increase in the 4th quarter of 2020 into the 1st quarter of 2021 where the daily total power usage grew exponentially.

Conclusion

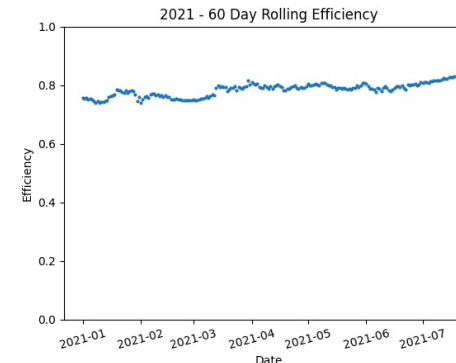
- Utilization of batteries in California has increased from about 0.3 GWh/day in 2019 to about 5 GWh/day in 2021
- Usage pattern has changed from spontaneous bursts to systematic charging when the sun rises and discharging as the sun sets
- The battery efficiency is averaging about 80%



Calculated charge/discharge state of batteries by day between 2018 and 2021, showing the impressive increase in 2021.

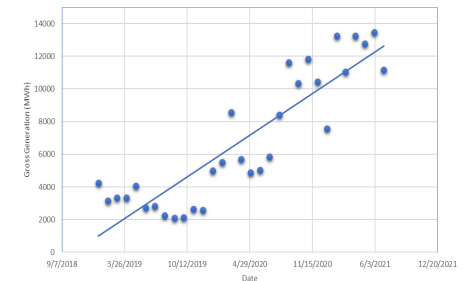


The extent to which batteries are utilized between 2019 and 2021 has seen extraordinary growth. Note that in 2021 the batteries are charging and discharging in 4-hour increments.

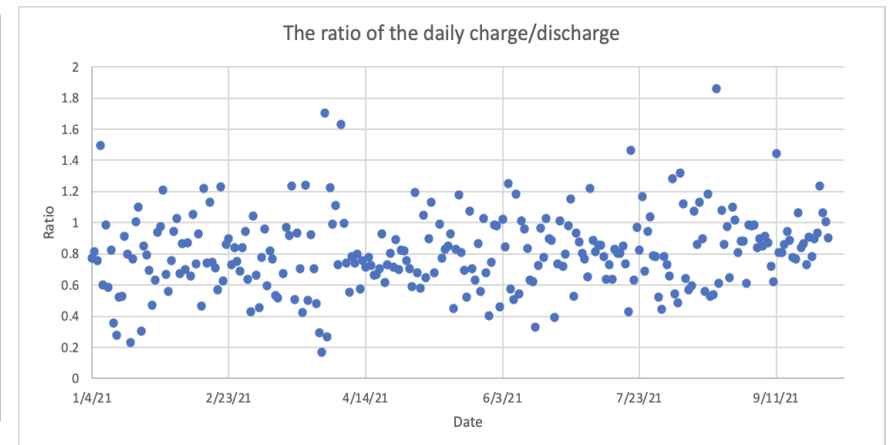


Batteries in California have exhibited an efficiency around 80% in 2021.

Monthly Gross Generation of Batteries performing Arbitrage Since January 2019



A general trend is growing Arbitrage activity with Battery Storage, over three times the Gross Generation has been observed in 2021 compared to 2019.



Effective daily efficiency calculated from the ratio of the charge and discharge showing the large daily variability, which translates on average to the 80% efficiency shown above.