WHEN TRUST MATTERS

Storage in Practice

Insights from NYSERDA's Energy Storage Programs

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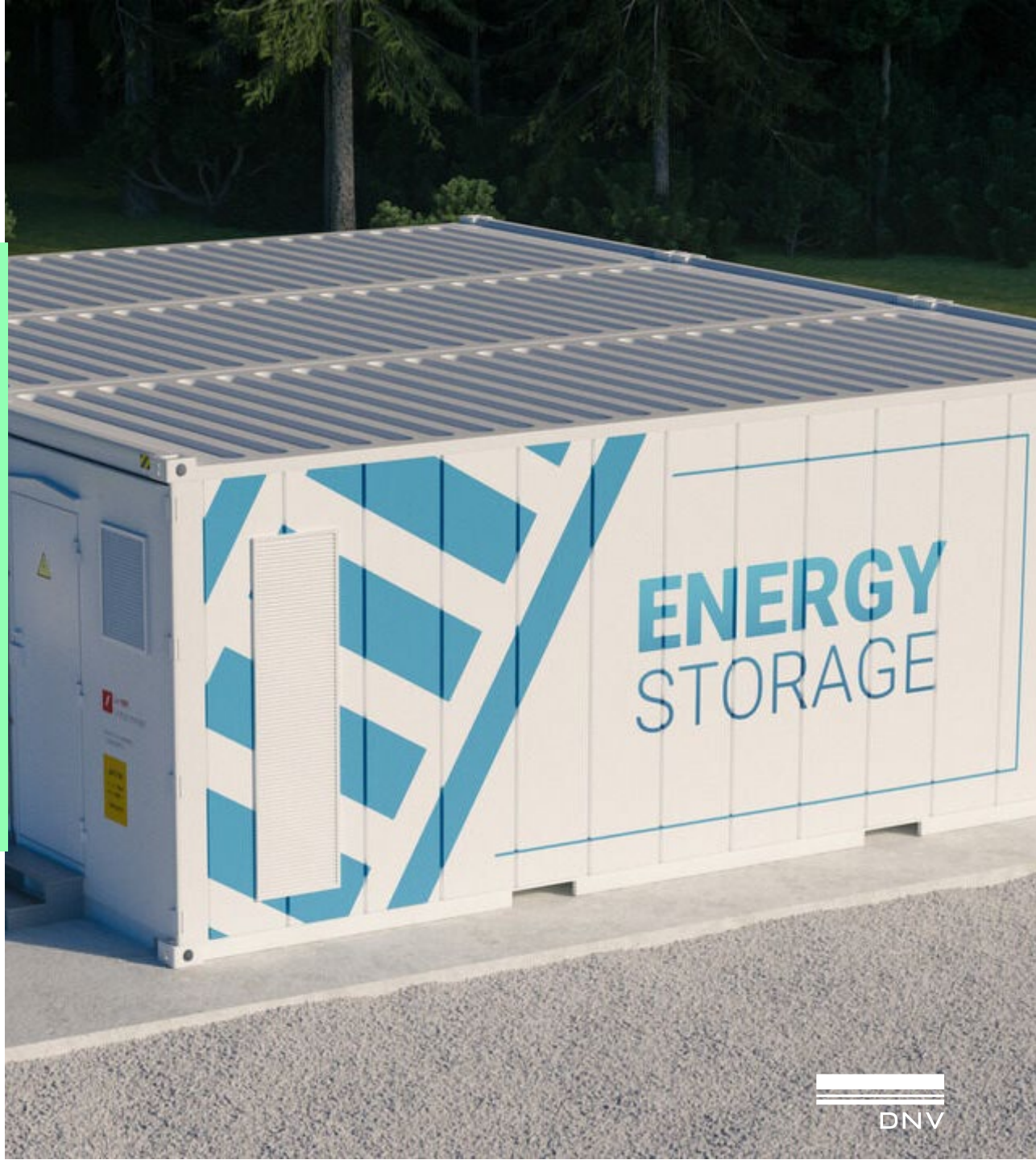
AGENDA

- Introduction and Objectives
- Data Coverage and Validation
- Operational Characteristics
- Site Impacts and Results
- Takeaways and Recommendations

Key Research Questions

1. **HOW** are Energy Storage Systems performing in real-world conditions?

2. **WHAT** are the main drivers (and obstacles) to market adoption of these systems?



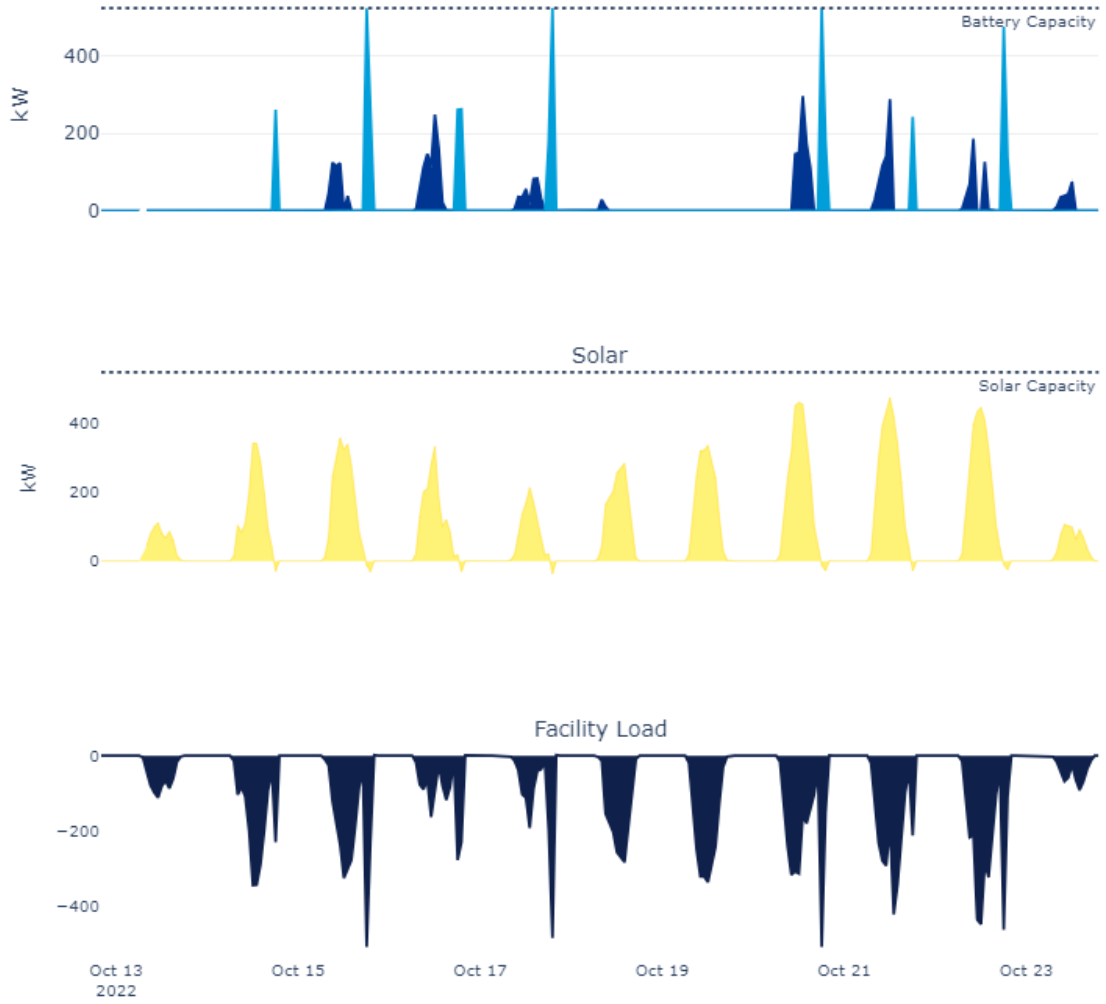
(A subset of) Methods

- AMI interval data, from 2020 through 2022, for 42 NYSERDA incentivized sites + contextual program tracking data
- How do site characteristics (e.g., primary use case, system size, and meter position) relate to performance and operational strategies of systems?
- Understand the system and site benefits provided by BESS and co-located solar PV + BESS systems – to both system owners and the grid – across different revenue streams.
- Published Evaluation report here

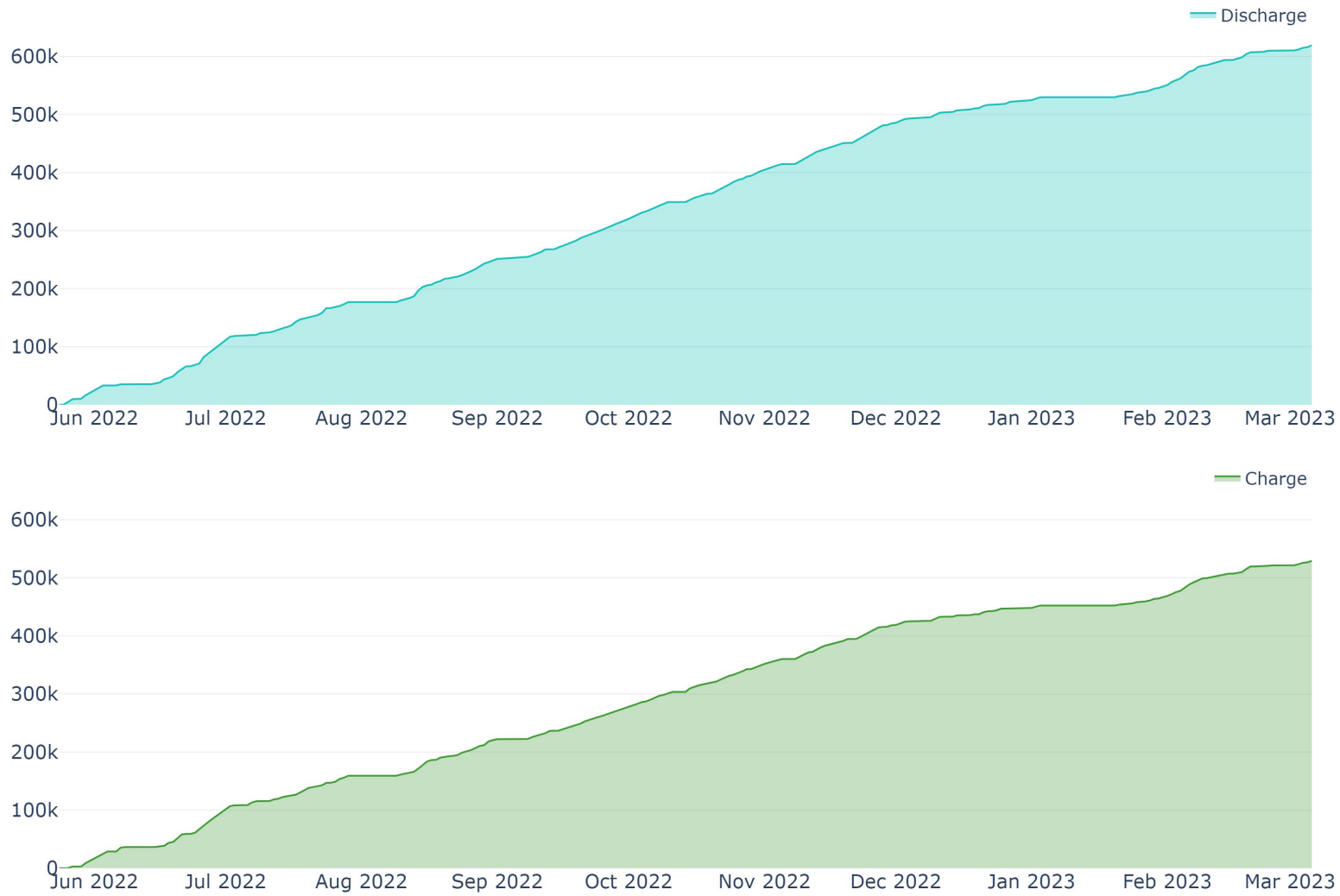
Data Coverage and Validation

Data coverage and validation

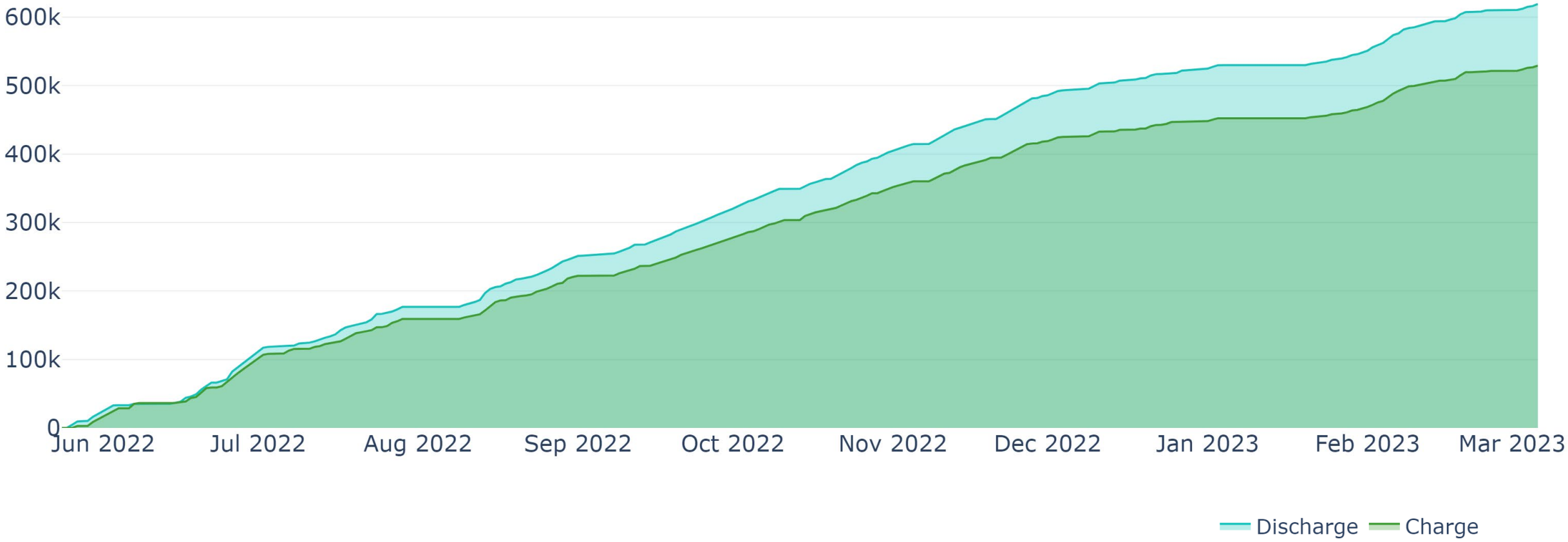
Nulls in ~20% of records and validation issues across data fields



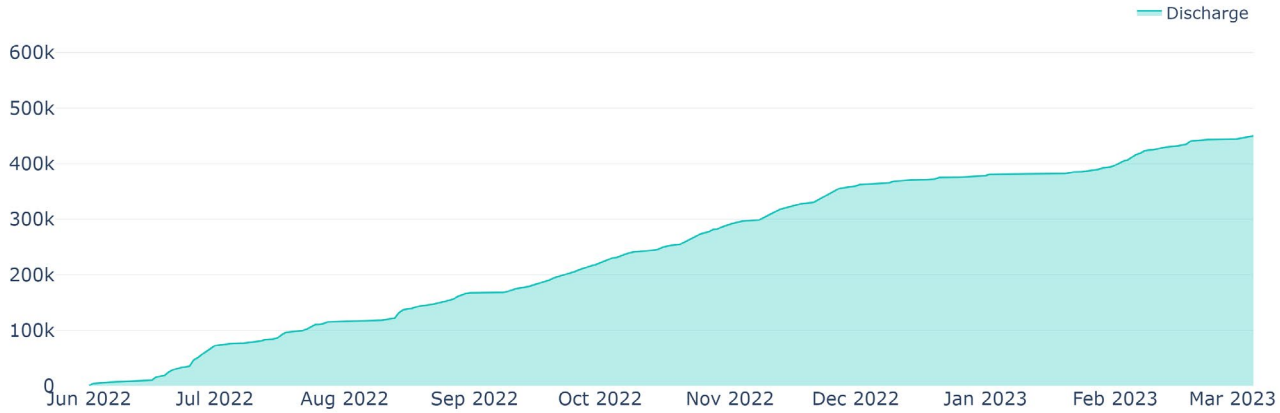
Does anything stand out?

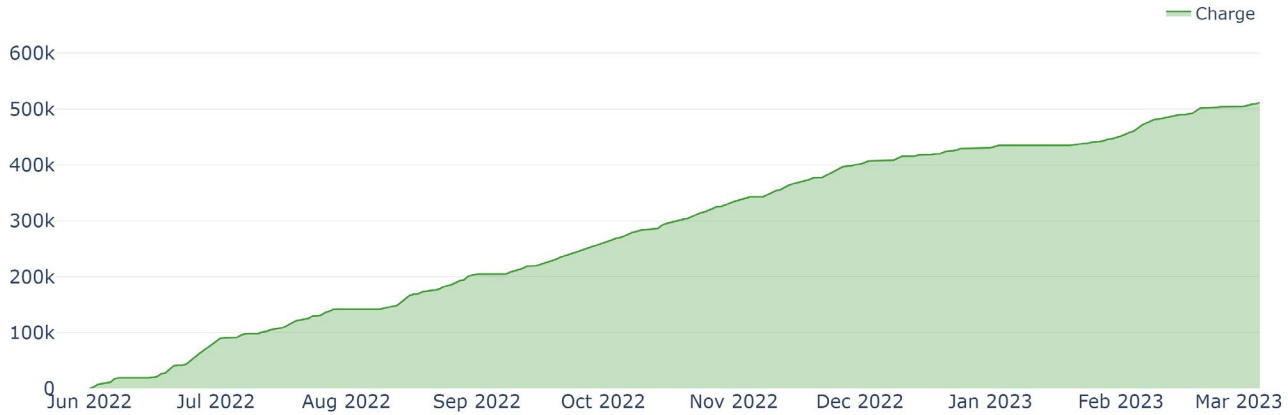


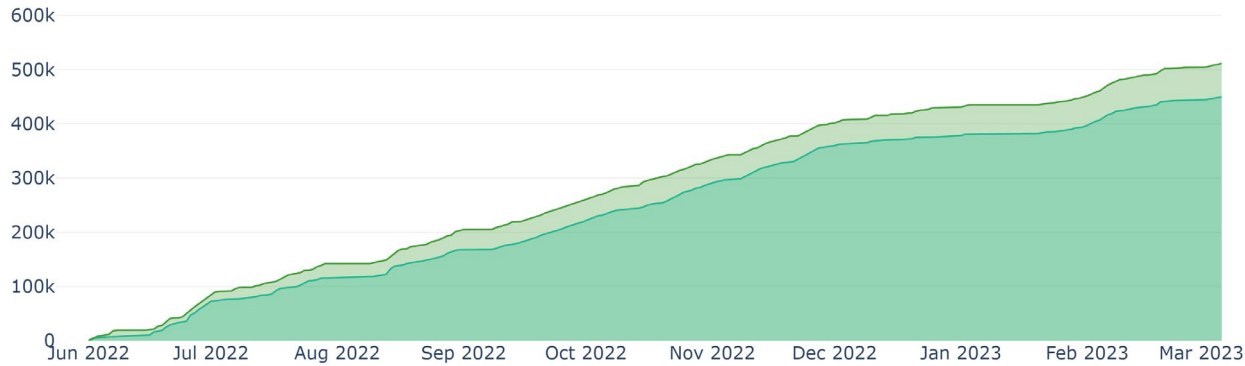
How about now?



What happens when we resolve the outliers?

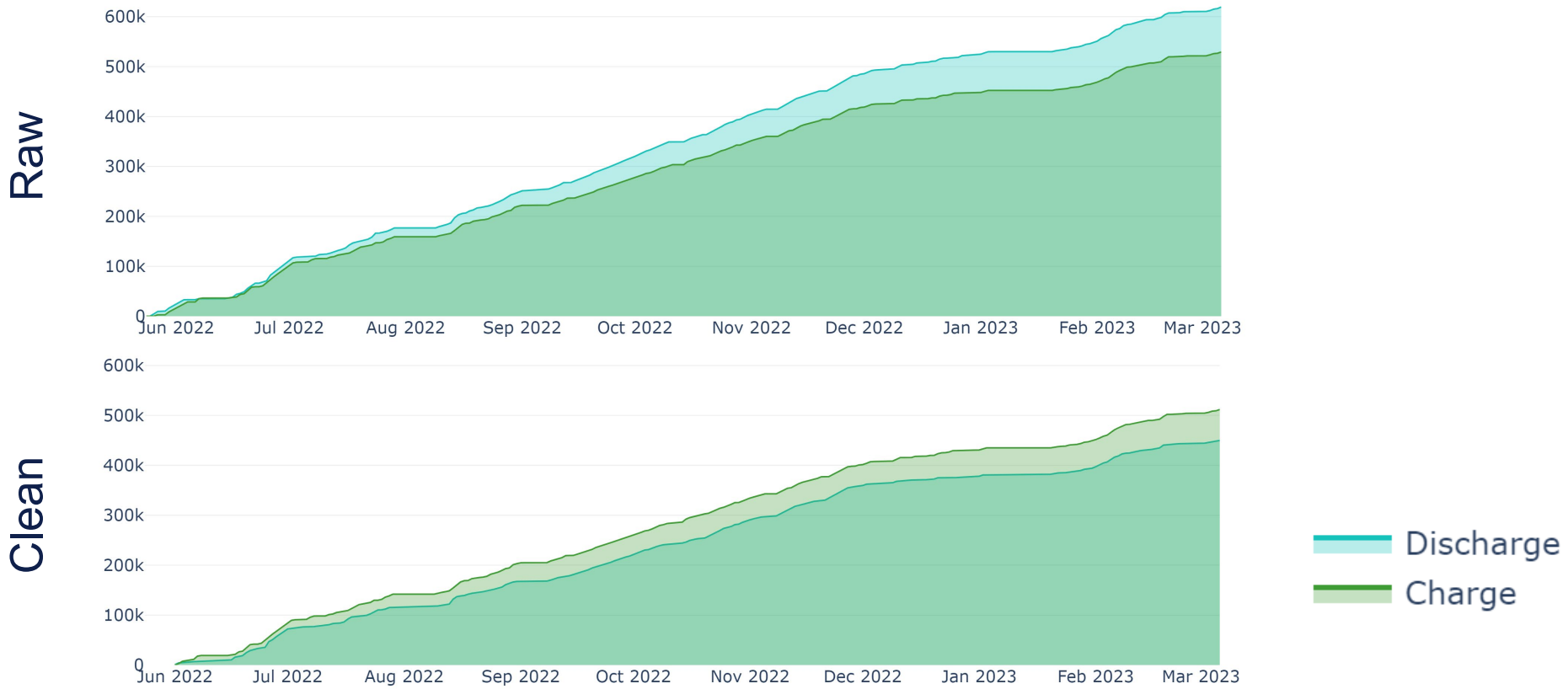




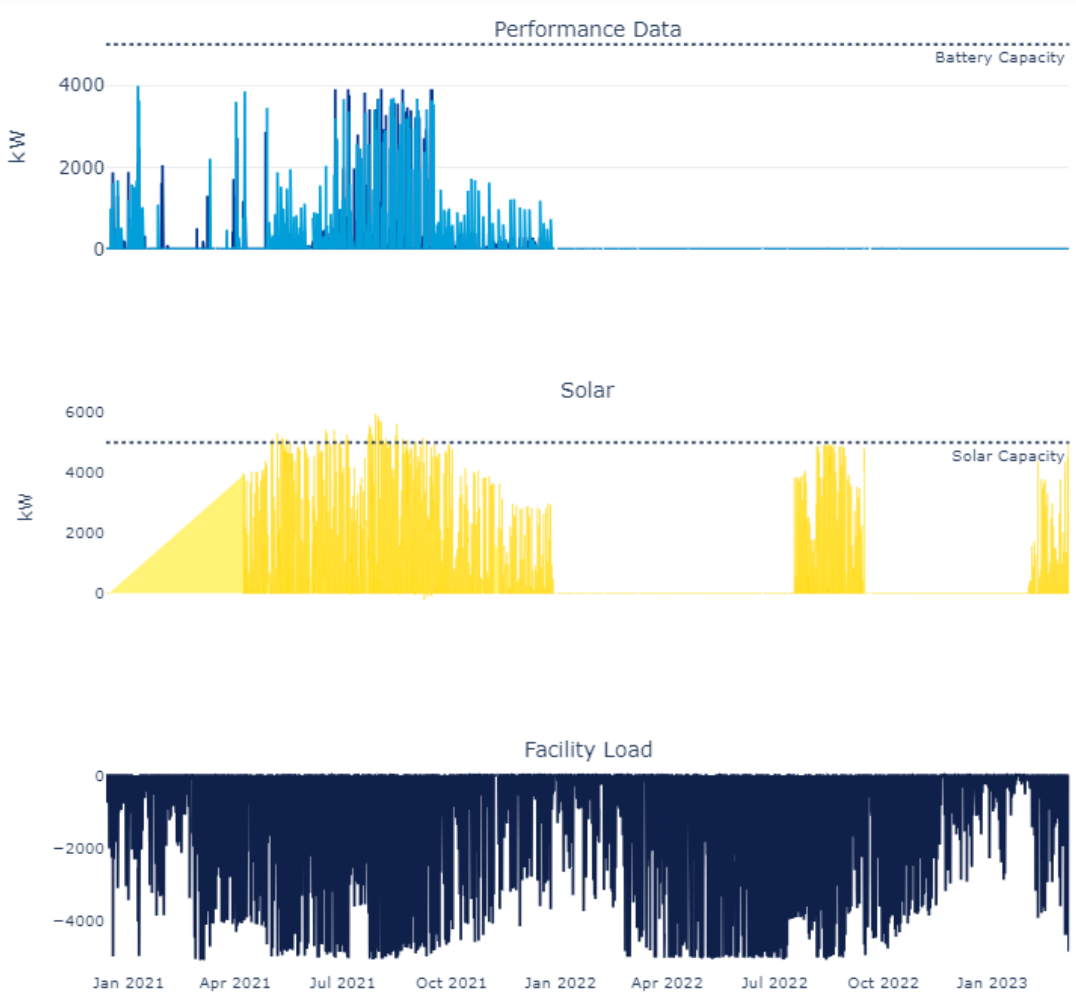


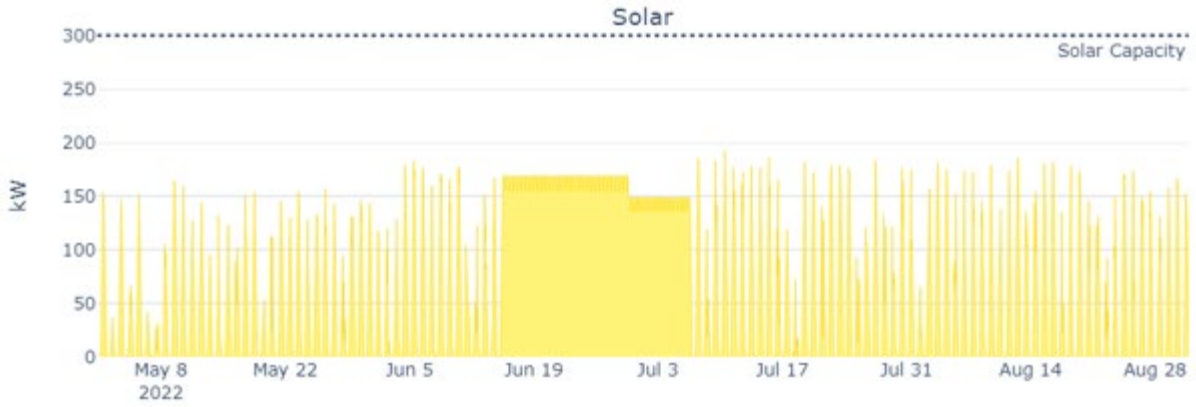
Cumulative Charge/Discharge

Since it is **impossible** for cumulative discharge to exceed cumulative charge, observing this phenomenon at multiple sites **undermines** the ability to draw meaningful insights from their interval data. Removing outliers helps, but the data loss can **obscure patterns** and **impact analysis accuracy.**



“Phantom” Generation (and other anomalies)





$$Net\ Facility = Intrinsic\ Site\ Load - (Solar\ Gen\ + ESS\ Discharge - ESS\ Charge)$$

Revenue mechanisms

Demand Response programs

- Program design dictates if known/Unknown dispatch period, dispatch windows, etc.
- DER specific DR programs – fixed dispatch windows
- Typical compensation $/kW for generation

Ancillary services

- E.g., Frequency Regulation
- Significantly higher volume of discharge

Demand Charge Management (aka) Peak Shaving

- Behind-the-meter systems

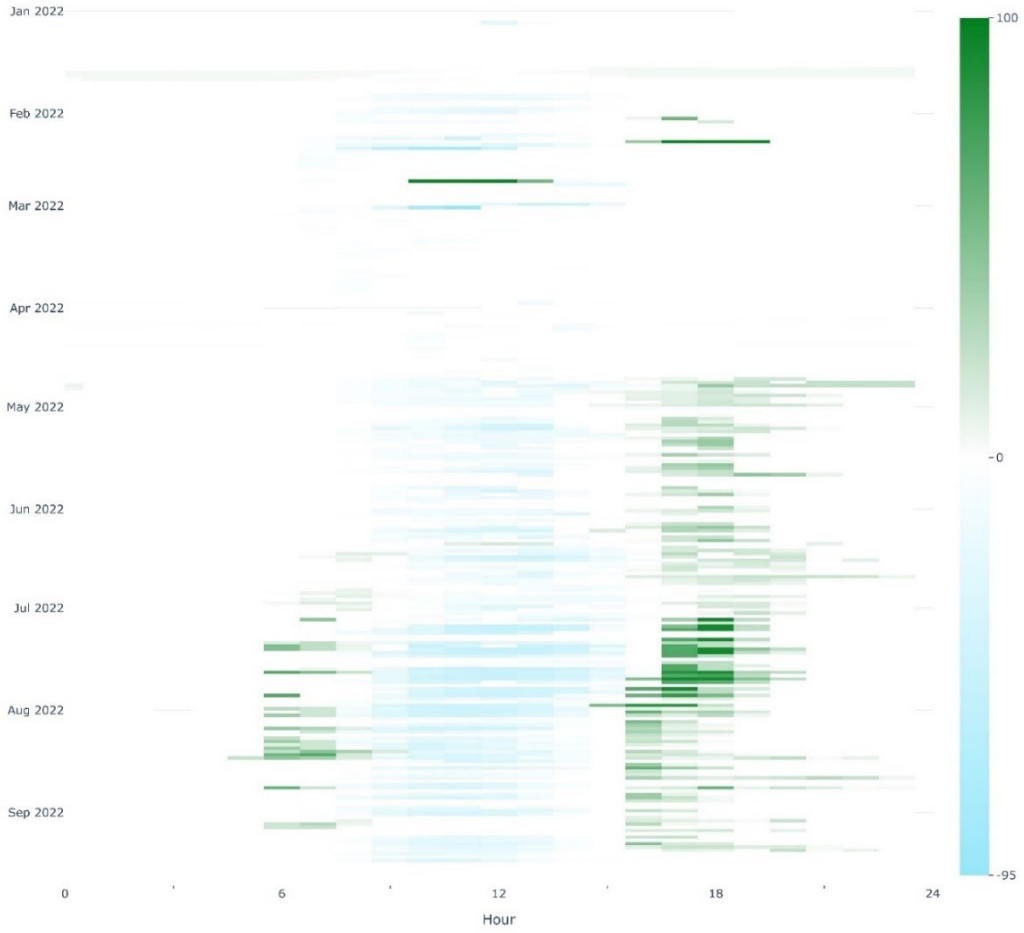
NY's Value of Distributed Energy Resources mechanism

- DERs compensated for grid injections
- Location-specific hourly unit prices

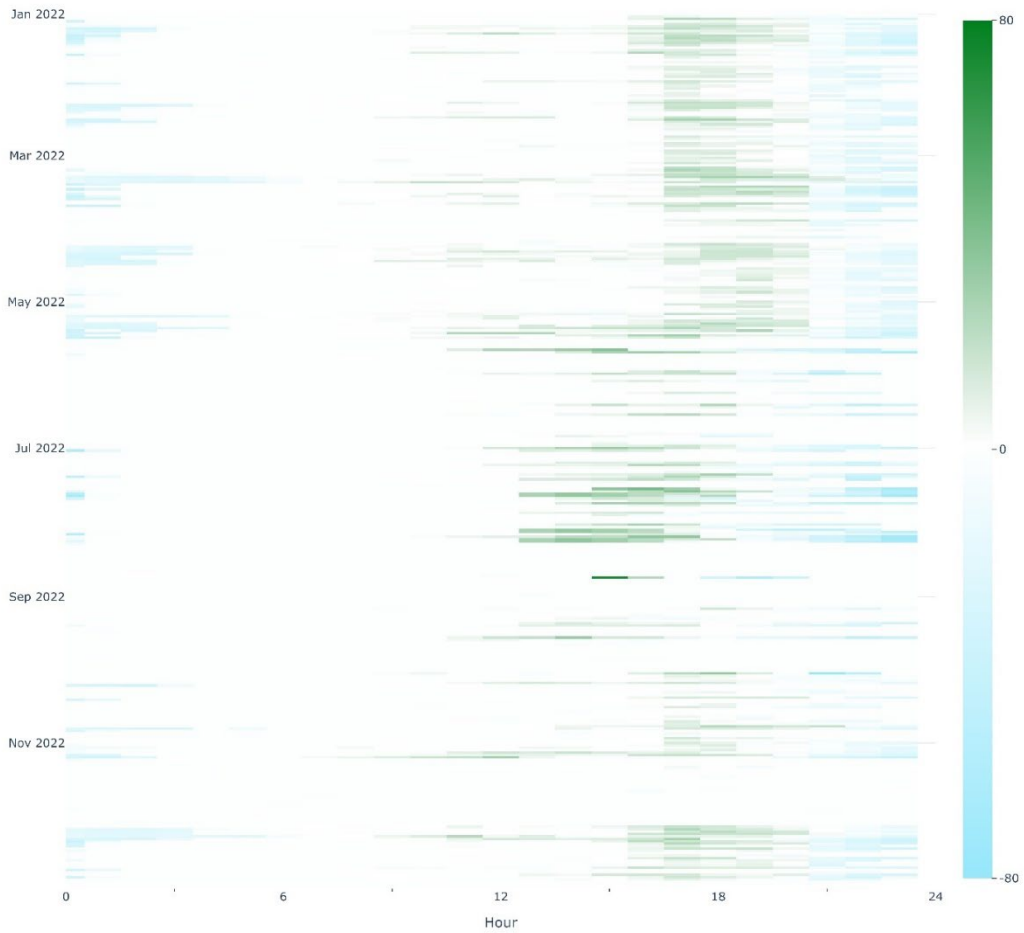
Operational Characteristics

- Site operator dispatching power only when the financial incentive is strongest.
- VDER systems cycle 50 times per year on average – substantially lower than the 700+ cycles at Ancillary Services sites (n=2) and 100+ cycles at Demand Reduction sites (n=4).
- Common for sites to have extended periods of no discharge activity.

Seasonal and Diurnal Trends

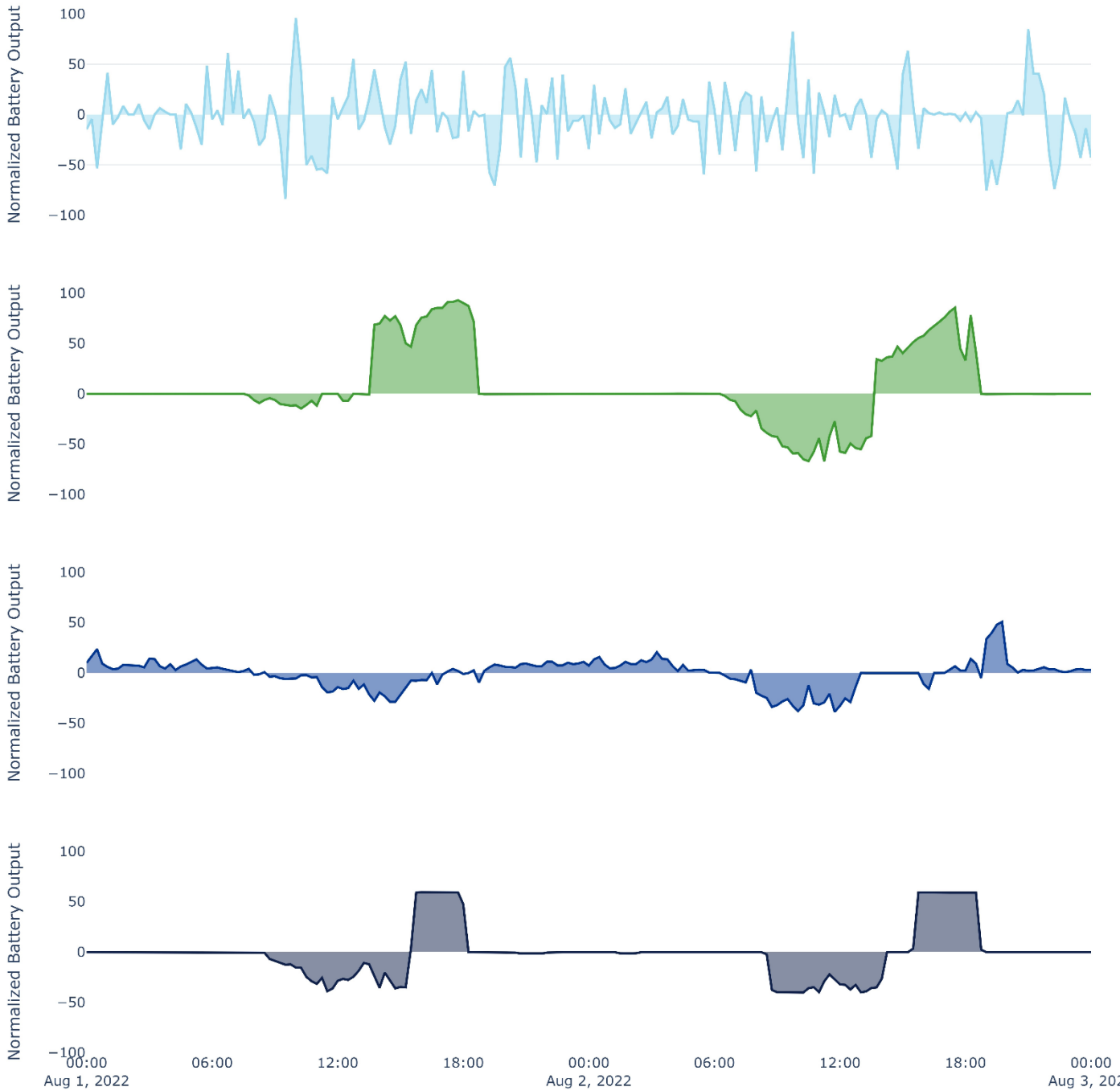


Increased Discharge in Summer



Overnight Charging

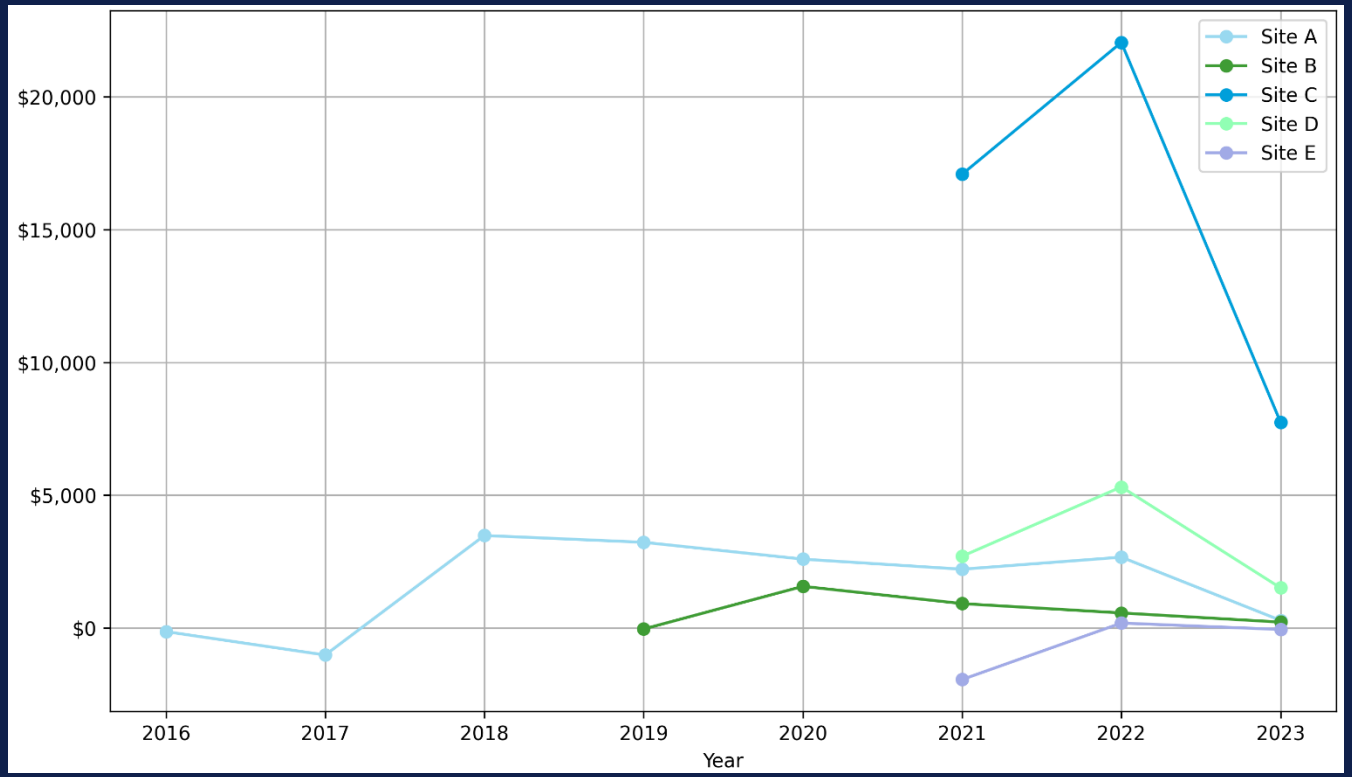
Concurrent Discharge



X-axis: Time
Y-axis: Normalized Battery Output

Site Impacts

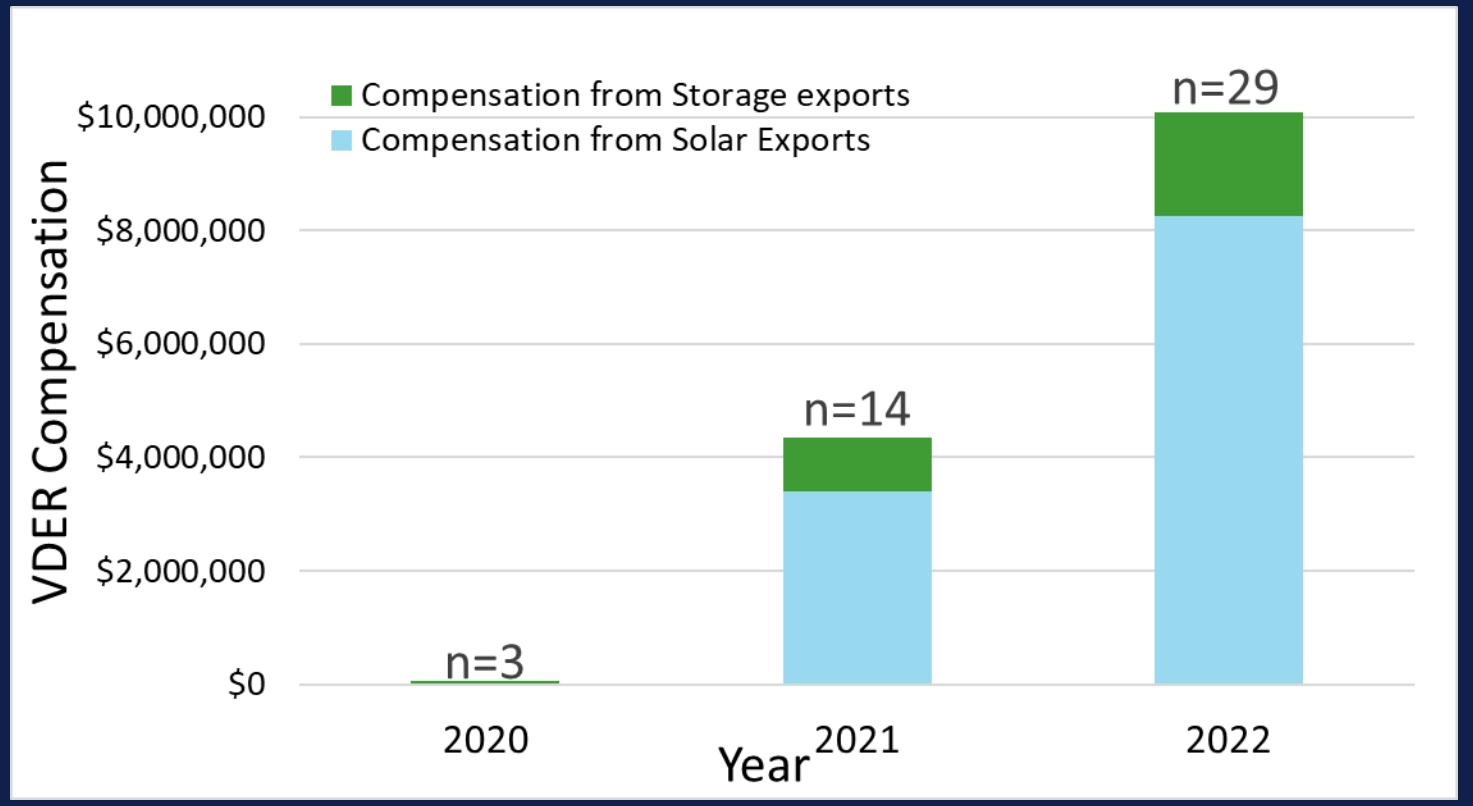
- Largely negative energy costs
- Positive Demand charge savings
- Benefits were modest when compared to VDER compensation



Energy Storage Total Site Benefits (kWh + kW benefits) over years

VDER Impacts

- Average VDER compensation per site was over $300k/year
- Imputed Storage and Solar Exports
- Assumed VDER configurations (e.g., ICAP Alternative 2, Community Distributed Generation)



Takeaways and Recommendations

Takeaways and recommendations

Market Signals

Site operators try to minimize the cycling of the battery and dispatch only when there is a significant incentive to do so

Underutilization

Common for sites to have extended periods of no discharge activity

VDER Revenue

VDER revenue is driving the market currently.

Program Information

All contextual information about the site aids in understanding system performance.

Completeness of interval data

Currently, it is difficult to parse what is real activity and what is an issue with the data feed.

Takeaway/Rec. 1

As most of the battery usage is focused on the summer months, opportunity for winter-targeting programs that have defined hours of needs (e.g., winter DR programs), to which the batteries can contribute.

Takeaway/Rec. 2

Low observed activity does not necessarily indicate poor performance. Underutilization could be based on individual site economic tolerances.

Takeaway/Rec. 3

Refining the VDER modeling tool to let vendors compare projected and actual earnings

Takeaway/Rec. 4

Establish comprehensive site data collection (e.g., utility rates, system specifications) as a standard requirement for participation.

Takeaway/Rec. 5

Make resolving data collection issues a program participation requirement.

Implement regular validation of control system data streams against on-site revenue-grade metering.

Thank you

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