



Battery Storage Pilot Program

Quarterly Evaluation Report: Q1 2022

Prepared for:

Liberty Utilities



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Background

Guidehouse prepared this report as part of its evaluation of Liberty Utilities' (Liberty's) Battery Storage Pilot Program (pilot) and the report reflects data and progress from January 1, 2022, through March 31, 2022 (Q1 2022). Throughout the duration of the pilot, Guidehouse is providing quarterly updates regarding key metrics and insights with a primary focus on peak demand reduction performance.

The pilot is being executed in two phases. In Phase 1, Liberty is deploying two Tesla Powerwall 2 batteries at each of the 100 participating residential customers' homes. Liberty will own and install the batteries and customers can participate by paying either an upfront fee or a monthly payment for 10 years. Phase 1 began in November 2020 and will proceed through August 2022. Phase 2 is planned to begin in September 2022 and proceed through November 2023 (36 months from the beginning of Phase 1). Phase 2 will introduce additional Tesla Powerwall 2 batteries (up to 500 total) and may also include a Bring Your Own Device program with up to 2,500 kW of additional capacity.

Liberty is dispatching batteries to take full advantage of coincident peak demand reduction during forecasted coincident peak demand conditions.¹ At all other times, participant batteries will be dispatched automatically to deliver additional participant value through time-of-use (TOU) bill savings.² To enable a minimum amount of available energy for backup power in case of an outage, 20% of the battery energy is held in reserve. The remaining energy is available for peak demand reduction and TOU bill savings.

The following sections provide updates regarding deployment progress, peak reduction performance, and customer surveys through the end of the first quarter of 2022.³

Deployment Progress

Figure 1 summarizes deployment progress through March 31, 2022. As of this date, Liberty has made the following progress deploying batteries to pilot participants:

- Installed new meters for all 100 participants.⁴
- Installed batteries for 95 participants (2 added in Q1).
- Commissioned batteries (given authority to connect) for 95 participants (6 added in Q1).
- Activated TOU rates for 94 participants (5 added in Q1).

For most participants, TOU rates were activated for the first billing cycle after the battery was installed (approximately 4 weeks after installation, on average). However, for 10 participants

¹ Batteries are dispatched to offset coincident peak demand charges from ISO-NE associated with Regional Network System demand, Local Network System demand, and Forward Capacity Market demand.

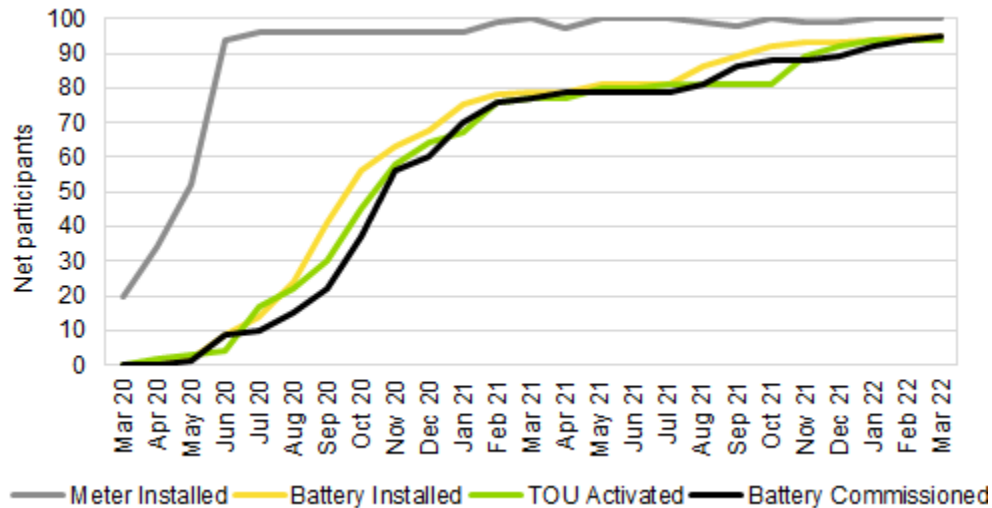
² All participants in Phase 1 are subject to seasonal TOU rates. Batteries will be discharged for TOU bill savings only during Critical Peak hours.

³ All data provided herein is preliminary and based upon availability of data at the time of report preparation.

⁴ This value (100) represents the net total meters for participants. Liberty has installed meters for 104 participants, and 6 subsequently opted out.

with solar PV systems, TOU rates were activated prior to battery installation (approximately 15 weeks before battery installation, on average) as moving those customers to the TOU provided greater bill savings during those months versus continuing service on Residential Rate D. On average, batteries were commissioned approximately 4 weeks after installation.

Figure 1. Cumulative Battery Deployment Progress through Q1 2022

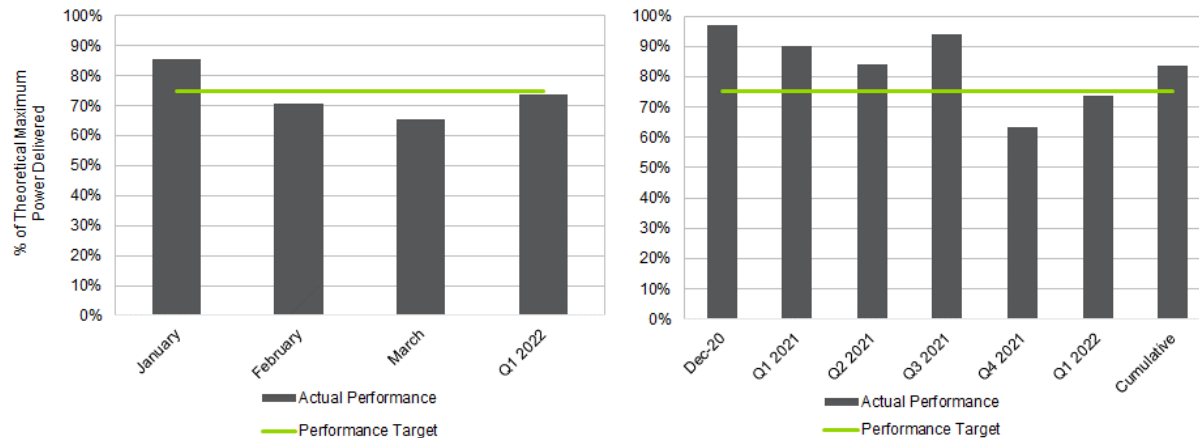


Source: Guidehouse Analysis

Peak Demand Reduction

Figure 2 summarizes the peak reduction performance during the coincident peak hour of each month of the first quarter of 2022.⁵ Peak reduction performance is defined as the actual peak reduction (average kW dispatched during coincident peak hour) relative to the maximum power rating of the batteries (5 kW per battery, 10 kW per customer). As set forth in the pilot settlement agreement, the performance target is 75%. Liberty exceeded this target in one of the three coincident peak hours during Q1 2022. The performance for the first quarter of 2022 as a whole was approximately 74%, which is just slightly below the performance target. Figure 2 also shows the cumulative performance of the batteries during Phase I, starting with December 2020 (the first coincident peak after the start of Phase I). Cumulative performance through the end of Q1 2022 is 84%, which exceeds the performance target.

⁵ For the Peak Demand Reduction analysis data for only 91 out of the 95 commissioned batteries were evaluated in 2022 Q1 based upon availability of data.

Figure 2. Coincident Peak Reduction for Q1 2022 (left), Phase I Cumulative (right)


Source: Guidehouse Analysis

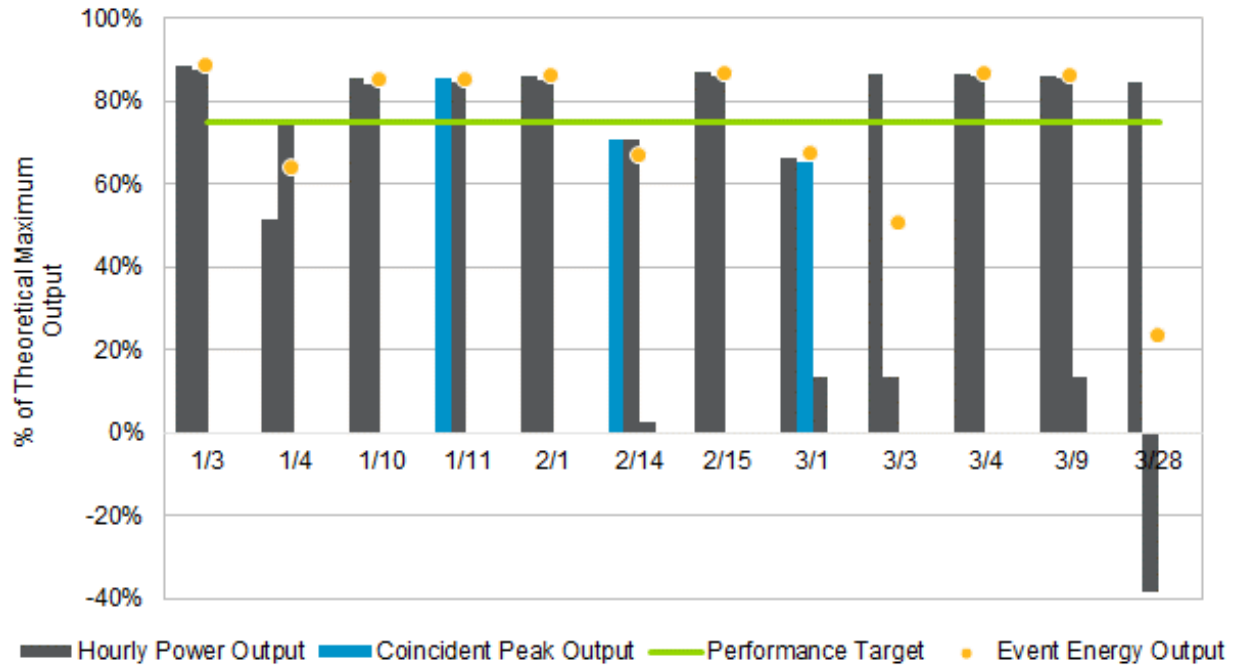
To achieve the targeted coincident peak reduction, Liberty called 12 peak reduction events during Q1 2022. Of those, 3 events were 3 hours in duration, 8 events were 2 hours in duration, and 1 event was 1.5 hours in duration⁶, yielding 26.5 total event hours during this period. Figure 3 shows the hourly power output (relative to total rated power output) during each of the peak reduction events of the first quarter of 2022. Additionally, Figure 3 shows the relative energy output during each individual event (relative to the maximum available energy during the course of the event).⁷

For all events (except the events on 14th February and 1st March 2022), power output exceeded the performance target during at least one hour of the event. Notably, battery power output cannot exceed the target during an entire three-hour event due to limited available energy in the battery (nominal duration at maximum power is 2.2 hours).

Overall performance for Q1 2022 was somewhat lower than prior quarters for a couple of reasons. First, event power output and energy output did not exceed 88% for any event, while these values often exceeded 90% for events in prior quarters. This appears to be driven by a minority of participants delivering significantly reduced performance across all events, though most other participants perform consistently well. It has been identified that some customers are not net exporting during event hours and are instead limited by their household load. Liberty is coordinating with Tesla to correct this issue. Second, for some events (including coincident peak events on 2/14 and 3/1), event energy output is well below 75% of theoretically available energy, and all participants provide lower relative power and energy output. Liberty is currently coordinating with Tesla to understand the cause of these discrepancies to help improve performance for future events.

⁶ The event on 4th January 2022 was 1.5 hours long but it was considered as 2 hours long in the peak demand analysis.

⁷ The maximum available energy is based upon the minimum of (a) the rated power multiplied by the duration of the event and (b) the total usable energy in the batteries (10.8 kWh per battery, which is based upon 13.5 kWh rated energy capacity less 20% energy held in reserve).

Figure 3. Demand Reduction Events, Q1 2022


Source: Guidehouse Analysis

Customer Surveys

To date, the team received 66 responses to the pilot customer enrollment survey, equaling a 75% response rate. During Q1 2022, Liberty sent initial survey requests to three participants and received one additional response. The survey captures customer's motivations for enrolling, satisfaction with installation process, and overall comprehension of the pilot. Guidehouse plans to field the survey until the completion of Phase 1. Results recorded through March 2022 reveal the following findings:

- Half (50%) of participants first heard about the pilot through a Liberty bill insert or letter.
- Backup power in case of power outage was the primary motivating factor for participants to purchase a battery storage system.
- Participants were most satisfied with the professionalism of the technician.
- Almost all participants (95%) were able to correctly identify TOU rates by time of day.

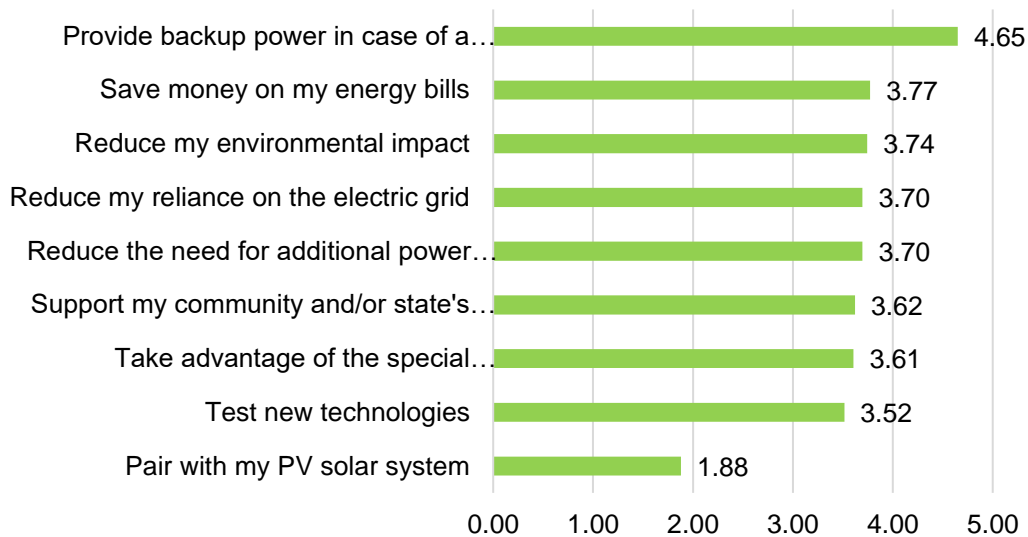
Marketing

Half of pilot participants (50%) responded that they first heard about the pilot through a Liberty bill insert or letter. The second most popular method was the Liberty website (15%). Social media (6%), word of mouth (5%), and architect recommendations (2%) were the least common ways in which the participants learned about the pilot.

Motivation

When participants were asked to rate what factors motivated them to purchase a battery storage system (on a scale of 1-5), the highest rated factor was the ability to provide backup power in case of power outage (4.65). The second highest rated factor was to save money on energy bills (3.77) and reduce my environmental impact (3.74). The factor that motivated customers the least was the ability to pair with their PV technologies (1.88).

Figure 4. Motivations for Battery Storage Installation



Source: Guidehouse Analysis

Survey findings indicate that 36% of customers said they were considering installing a battery storage system prior to enrolling in the program. However, when asked what action the customer would have taken if the pilot did not exist, over half of respondents (54%) said they were very unlikely or unlikely (rating 1 or 2) to purchase a battery storage system without the program.

The evaluation team also asked customers if they were concerned with Liberty accessing their battery storage system. About half of respondents (47%) had no concern with the utility discharging their battery, with only 7% stating they were very concerned and 3% stating that they were not aware that discharging was part of the pilot. Customers who expressed concern stated it was due to their ability, or lack thereof, to power their home in the case of an outage.

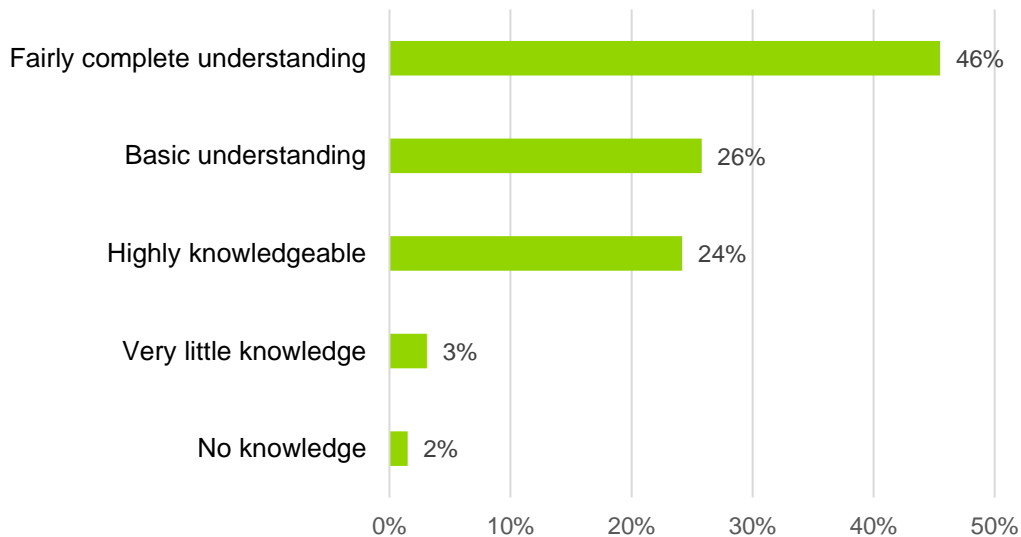
Installation Satisfaction

The team asked participants to rate their satisfaction with the installation of their battery storage system using a scale of one to five. Participants overall were very satisfied with the installation process. The highest levels of satisfaction were related to the professionalism of the technician that came to their home (4.92). Other factors that were rated include the installation process (4.61), and the ease of scheduling the installation with the technician (4.44).

Comprehension

As part of the enrollment survey, participants were asked questions about how their battery storage system charges and discharges. Nearly half of the participants (46%) said that they had a fairly complete understanding of the process, with 26% stating they had a basic understanding. Only 5% of respondents said they had no knowledge or very little knowledge about how the system charges and discharges.

Figure 5. Battery Storage Pilot Comprehension



Source: Guidehouse Analysis

Participants were also questioned on their knowledge of TOU rates. Almost all participants (95%) were able to correctly identify that TOU rates were based on the time of day that the customer uses electricity. When asked what minimum charge would remain in a customer's battery if Liberty needed to send power to the electric grid, 80% correctly responded that 20% would remain in their battery storage system.

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