Active Demand Reduction – Daily Dispatch Update

Massachusetts Energy Efficiency Advisory Council

January 22, 2020

WE ARE MASS SAVE®:

Agenda

- Introduction & Background
- Plan to seek DPU Approval for Daily Dispatch
- Summer 2019 Evaluation Findings – Draft
  - Residential Daily Dispatch
  - C&I Daily Dispatch
- Next Steps

Seeking Daily Dispatch Full Approval

Background

- This presentation builds on November EEAC meeting on Active Demand Reduction – refer to November meeting materials for a full and detailed presentation on 2019 and 2020 activity on active demand reduction of all dispatch approaches
- Recap:
  - Department did not approve full scale, statewide deployment of daily dispatch because it found it was an untested form of dispatch
  - Department found merit in exploring the potential for daily dispatch through demonstration offerings
    - National Grid, Eversource, and Until filed a budget for each plan year, in February 2019, to test the daily dispatch
    - The Compact will file a budget for daily dispatch as part of the request for approval of full scale daily dispatch
  - Program Administrators must submit a "compliance filing" to the Department, including the results of the demonstrations, before the PAs can implement statewide and at full scale
    - Until the DPU approves:
      - the demonstration offering budgets may not exceed the planned budget level for daily dispatch
      - the PAs can not offer the five-year incentive lock for daily dispatch

PAs Proposed Timeline & Plan

1. Run Demonstrations – Complete Summer 2019
2. Gather Evaluation Results – Complete Fall 2019 & Winter 2020
   - Final results should be available end of January 2020
   - Draft reports reviewed and commented on by EEAC Evaluation Consultant
3. Seek Council Resolution
   - Expected at February 2020 EEAC meeting
   - PAs hope Council will pass a Resolution supporting all PAs to offer daily dispatch, the already filed budgets, and the Compact's proposed budgets
4. PA Compliance Filing with Department
   - Filed in the Three-Year Plan dockets in March 2020
   - Filing will include final evaluations, PA testimony, and request to approve the budgets already filed for National Grid, Eversource, and Unitil, as well as the Compact proposed budget
   - While the Program Administrators hope the Department will approve the offering before the summer, there is no deadline for such approval
     - National Grid and Eversource will continue their daily dispatch demonstrations for each sector at the proposed 2020 daily dispatch budget levels until the Department's final decision

2019 Summer Activity Evaluation Timeline

Evaluation Timeline

- Evaluation data collection run in parallel with summer programmatic activity to the extent possible and did not wait for year end
- Aimed to have Evaluated MW performance earlier than normal
- Residential
  - Communicating Tstats – Draft January, Expected Completion February 2020
  - Daily Dispatch Storage – Draft December, Expected Completion January 2020
- C&I
  - Targeted Dispatch – Draft January, Expected Completion February 2020
  - Daily Dispatch Storage – Draft December, Expected Completion January 2020

2019 Summer Activity Highlights & Key Takeaways

Summer 2019 Daily Dispatch Performance & Takeaways

PA	Sector	Dispatch Type	Participants	Unit	2019 Planned (MW)	2019 Enrolled (MW)	2019 Performed (MW)	2019 Evaluated (MW)
National Grid	Resi	Daily - Storage	49	accts	-	0.19	0.19	0.135
Eversource	C&I	Daily - Storage	3	accts	-	1.07	0.971	0.972

- Key Takeaways
  - Residential – Positive customer response, low opt- outs, measurable peak demand reductions, PAs should reset, or lower, max discharge output expectations in future due to various reasons in customer control
  - C&I – Complex installation and commissioning, seasonal performance is good and consistent, ESS optimization logic is challenging, customers not yet satisfied by financial benefits but value of performance payments is easier to understand than savings

ESS = energy storage system

Residential Daily Dispatch Evaluation Findings

Residential Daily Dispatch Program Design

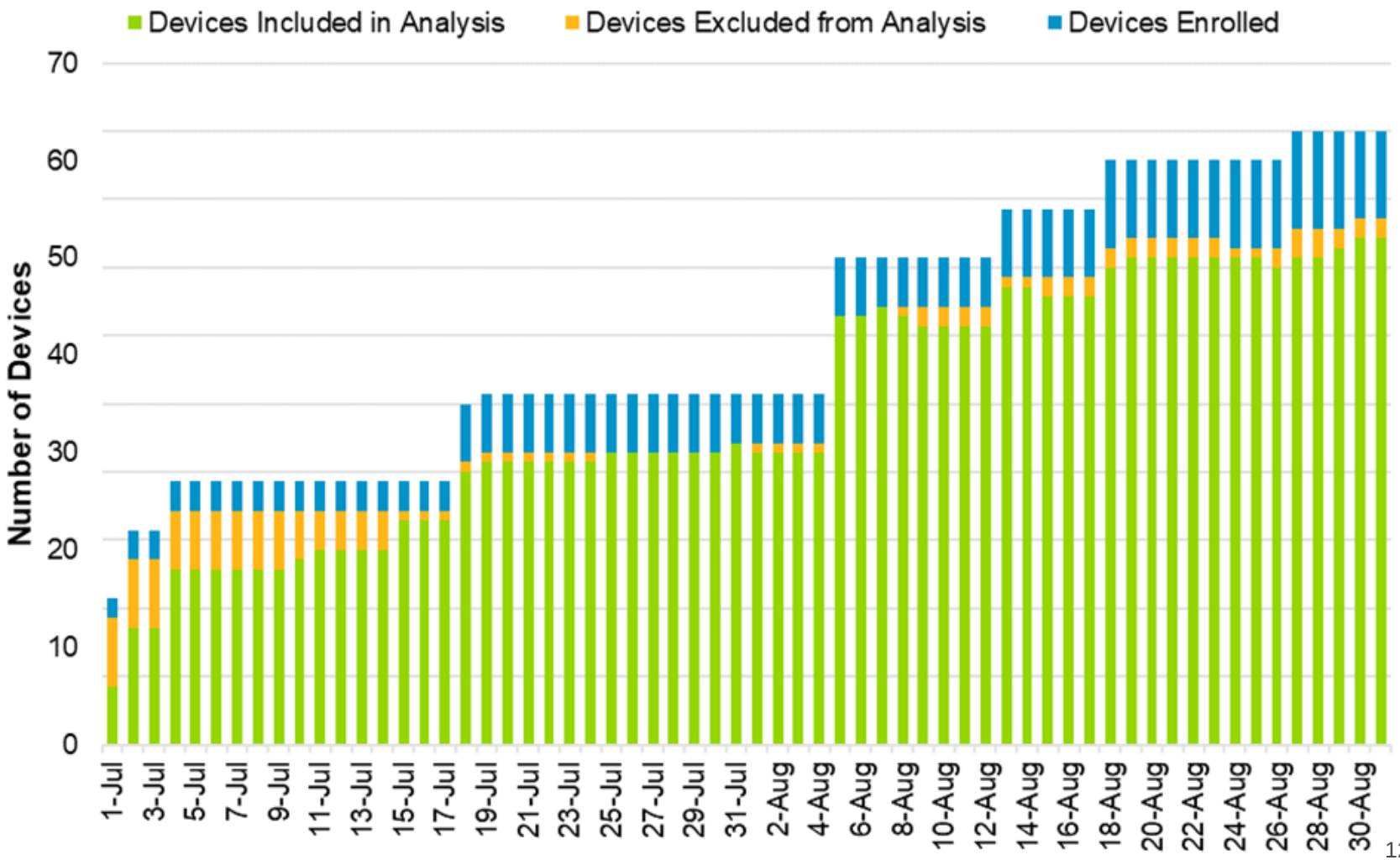
Table 1-1: Residential Energy Storage DR Demonstration Summary – Summer Season

Demonstration Attributes		National Grid
Participants	Customer Segment	Residential
	Participating Customers, as of August 31	50
	Battery Ownership	Participant owned (BYOB)
Incentives	Enrollment Incentive	No enrollment incentive
	Participation Incentive	$225/kW in summer
Summer Event Criteria	Season	July 1 to September 30
	Event Days	Non-holidays
	Event Window	2 p.m. to 7 p.m.
	Event Dispatch Criteria	Most days
	Event Duration	Max of 3 hours
	Battery Control Logic	Battery discharges evenly throughout event duration
	Battery Reserve Requirement	None or 20% (differs by manufacturer)

Source: Navigant, 2019 Residential Energy Storage Demand Response Demonstration Evaluation; Summer Season, December 27, 2019 - Draft

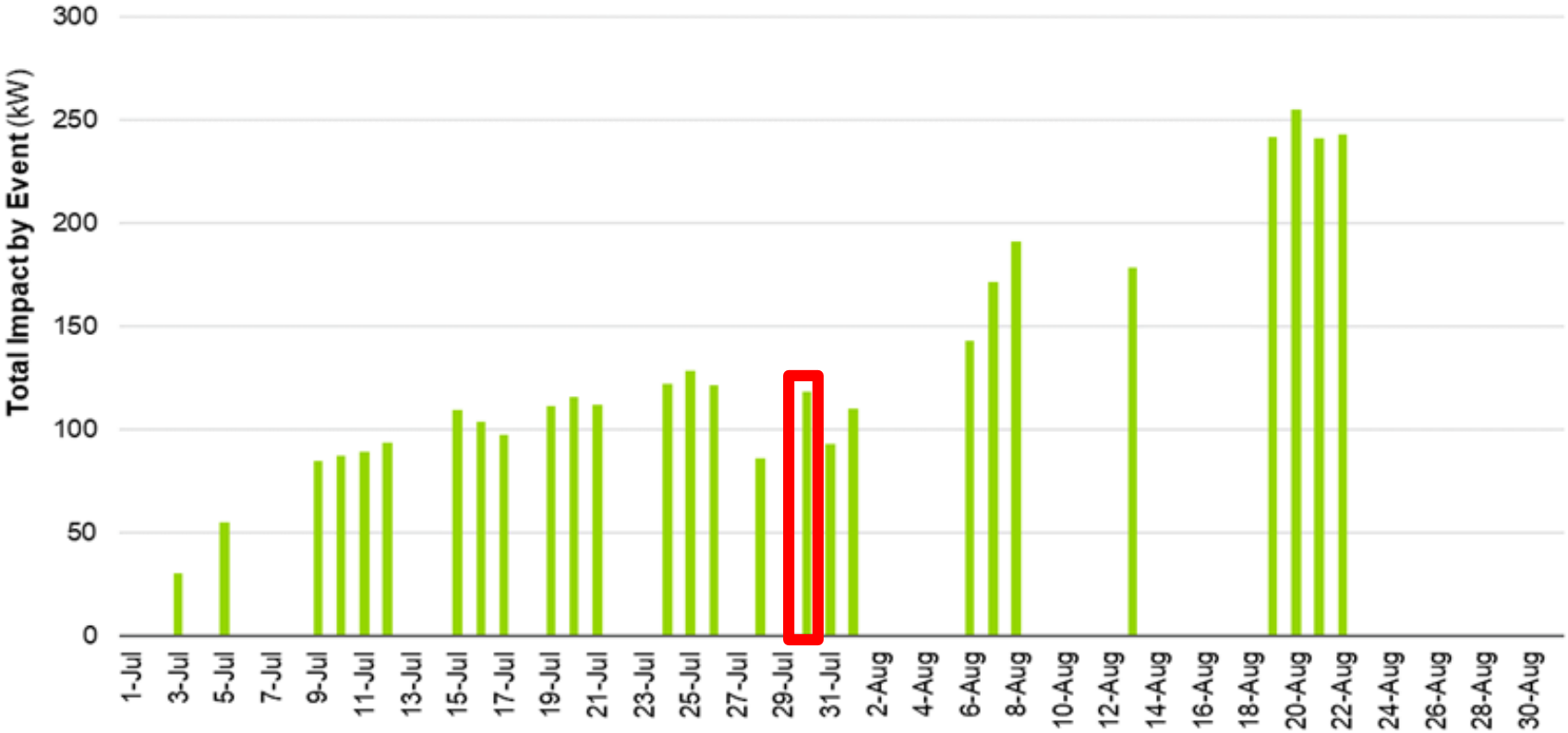
- Key Components
  - Customer-owned or leased
  - Behind the meter; likely coupled with solar PV
  - No upfront incentive
  - Performance-based incentive
  - Multiple storage integrators
  - System peaks forecasted by PAs
  - Events signaled through PA DR Management System
  - Customer's retain the ability to opt-out and control their own systems

Enrollments build, like thermostats, overtime



Source: Navigant, 2019 Residential Energy Storage Demand Response Demonstration Evaluation; Summer Season, December 27, 2019 - Draft

Total impact of reductions grew as more customers enrolled

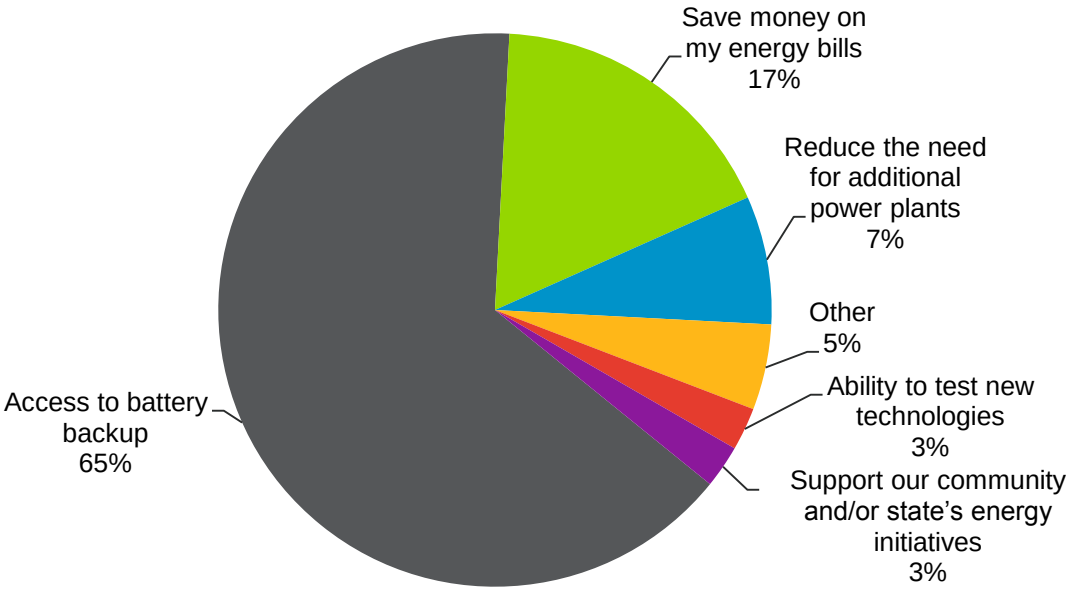


Source: Navigant, 2019 Residential Energy Storage Demand Response Demonstration Evaluation; Summer Season, December 27, 2019 - Draft

- The program saved around 135 kW per event on average, including 119 kW during the 2019 ISO-NE Peak Hour.
- Battery devices that successfully participated in 2-hour events saved an average of 5.5 kW per unit.

Residential Participant Research

Participants Motivations for ESS Purchase



OTHER HIGHLIGHTS

94% never **opted out** of an event

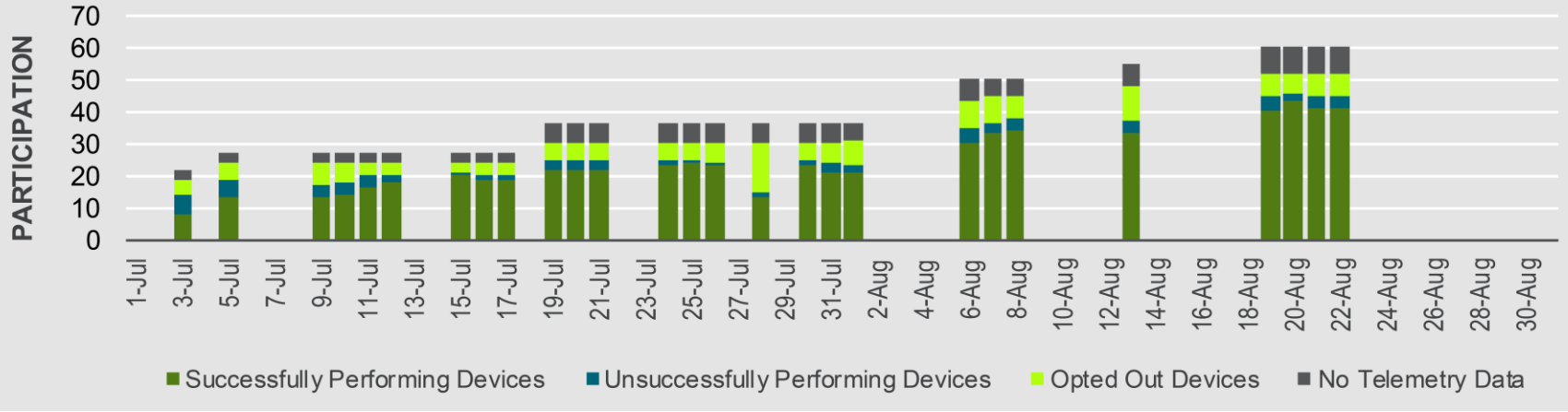
97% would **recommend** the program to other customers

97% are likely or very **likely to continue** with the program

Source: Navigant, 2019 Residential Energy Storage Demand Response Demonstration Evaluation; Summer Season, December 27, 2019 - Draft

Residential Event Participation - intermittent device availability, like thermostats, also exists

90% of enrolled devices successfully performed in the majority (**>60%**) of events they participated in. On average, **61%**of devices enrolled on a given event day successfully performed in the event.



Participation Category for Each Event	Definition
Successful	Average discharge >20% of maximum discharge
Unsuccessful	Average discharge <20% of maximum discharge or excluded by data QA/QC
Opted out	Battery manufacturer indicated the customer opted out of the event
No telemetry	Telemetry never received, indicating device was not operational during the season

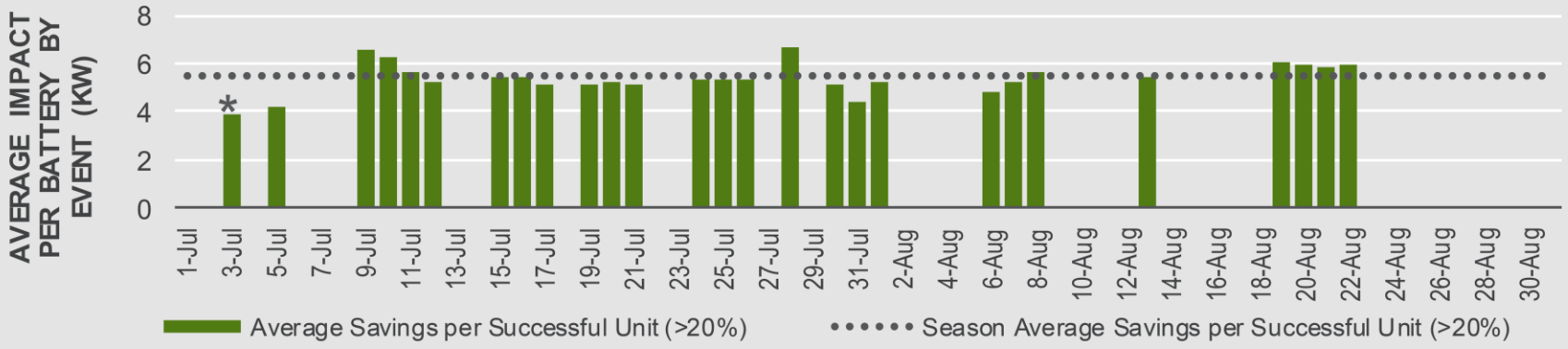
Causes of unsuccessful performing devices

- Devices not fully charged before event
- Inverter efficiency losses
- Customer/OEM reserve programming

Source: Navigant, 2019 Residential Energy Storage Demand Response Demonstration Evaluation; Summer Season, December 27, 2019 - Draft

Residential Event Impacts

The program saved **135 kW** per event on average, including **119 kW** during the 2019 ISO-NE Peak Hour. Batteries that successfully participated in 2-hour events saved an average of **5.5 kW/unit**.



Source: Navigant, 2019 Residential Energy Storage Demand Response Demonstration Evaluation; Summer Season, December 27, 2019 - Draft

Residential Daily Dispatch Findings – Participant Motivations

Research Category	Findings
Participant Motivations and Lessons Learned	**Access to backup power is a primary motivation for participation.** Access to backup power was a majority of respondent's primary motivation in purchasing a battery backup system, and one of the most important factors in participants decisions to enroll in the program.
	Survey respondents rarely opt out of events. Survey respondents reported extremely low opt-out rates, with 94% reporting they never opted out of an event. They also demonstrated low levels of event awareness, reporting low levels of event participation compared to their actual participation rate.
	Survey respondents support the program. Ninety-seven percent of respondents reported they would recommend the program to other National Grid customers, and 97% reported they were likely or very likely to continue with the program should it be offered in the future.

Source: Navigant, 2019 Residential Energy Storage Demand Response Demonstration Evaluation; Summer Season, December 27, 2019 - Draft

Residential Daily Dispatch Findings – ESS Performance

Research Category	Findings
Energy Storage System Performance	**The program saved around 135 kW per event on average, including 119 kW during the 2019 ISO-NE Peak Hour.**
	Battery devices that successfully participated in 2-hour events saved an average of 5.5 kW per unit.
	On average, called events had 63% of the maximum impact expected given the maximum expected discharge of the batteries enrolled and operational at the time of the event. This is affected both by the ratio of batteries that successfully performed and lower relative performance by some devices, especially DC coupled batteries.
	40 out of the 50 devices that participated in at least one event successfully performed in more than 80% of the events they participated in, whereas two eligible devices never successfully participated in called events, and as many as eight devices were enrolled in the program without having a battery installed and operational in time to participate in events (i.e., no telemetry data).
	Consecutive event days appeared to have a negligible effect on impacts this season. Weather had a larger effect on devices not being fully charged in time for the next event.
	Successfully participating devices dispatched at a constant rate for the length of the event. This includes DC coupled batteries.
	The conventions (e.g., sign, time zone) associated with the telemetry data varied across manufacturers. Navigant made informed corrections to align the telemetry data for all devices into a single convention.

Source: Navigant, 2019 Residential Energy Storage Demand Response Demonstration Evaluation; Summer Season, December 27, 2019 - Draft

Residential Daily Dispatch Recommendations & Consideration

Research Category	Recommendations and Considerations
Participant Motivations and Lessons Learned	**Recommendation 1:** Ensure customers are aware National Grid knows backup is important to them. Two manufacturers include the existence of a battery reserve in their marketing materials, and one offers the option, but National Grid does not make this clear in the marketing materials. Create a consistent battery reserve level and publicize both the battery reserve and the restriction of events prior to storms. This will help alleviate customer concern about batteries being depleted when they are being relied upon to provide power in an emergency
Energy Storage System Performance	**Consideration 1:** Demand savings per event averaged 63% of the maximum impact expected given the maximum expected discharge of the batteries enrolled and operational at the time of any event and anticipated event duration; confirm the appropriate maximum expected discharge to use for different battery models and confirm this estimate in a subsequent summer evaluation.
	Recommendation 2: National Grid to encourage EnergyHub to work with manufacturers and/or integrators to align all details of the telemetry data so the data fields are consistent.
	Consideration 2: Explicitly monitor enrollment date versus operational date for devices to ensure devices that can perform in events are performing.
	Consideration 3: Monitor batteries and potentially troubleshoot batteries that are consistently not performing or routinely opting out of events.

Source: Navigant, 2019 Residential Energy Storage Demand Response Demonstration Evaluation; Summer Season, December 27, 2019 - Draft

C&I Daily Dispatch Evaluation Findings

Daily Dispatch Program Design

- Demonstration batteries were installed at three customer sites: two were online for summer 2019, and the third came online in fall 2019
- Two vendors participated
- All batteries installed were lithium-ion and ranged in discharge capacity from 520kW to 1500 kW
- Two batteries deployed during the summer were dispatched on a daily basis on non-holiday weekdays, with shorter dispatches and greater demand reduction during peak events
- A third battery installed in the fall was dispatched daily on a test basis for four hours for four weeks
- Dispatch strategies tested in the demonstration projects may be further refined if daily dispatch is rolled out as a full-scale program

Daily Dispatch Program Design cont'd

- Eversource paid for battery equipment for two batteries installed under DPU order 16-178. For the remaining project, Eversource paid a performance incentive at a rate of $200/kW-summer for daily dispatch and $100/kW-summer for targeted storage
  - For a full-scale program, Eversource would use a pay-for-performance model (i.e., a performance incentive, rather than paying for equipment)
- Potential customer benefits:
  - Cost avoidance (e.g., reduced ICAP tag charge, reduced monthly demand charges)
  - Revenue creation (Eversource incentive, incentives for participating in ISO NE market)
  - Environmental and resilience benefits
- Eversource research objectives: develop better understanding of the value and reliability of daily dispatch batteries as a demand resource

Daily Dispatch Evaluation Approach

- Conducted by an independent third-party evaluator
- Subject to the EM&V framework; both EEAC Evaluation Consultants and PA coordinated with independent evaluator
- Quantitative impact results and qualitative process results
- Current results are draft; final results planned by end of January

Impact Evaluation Results

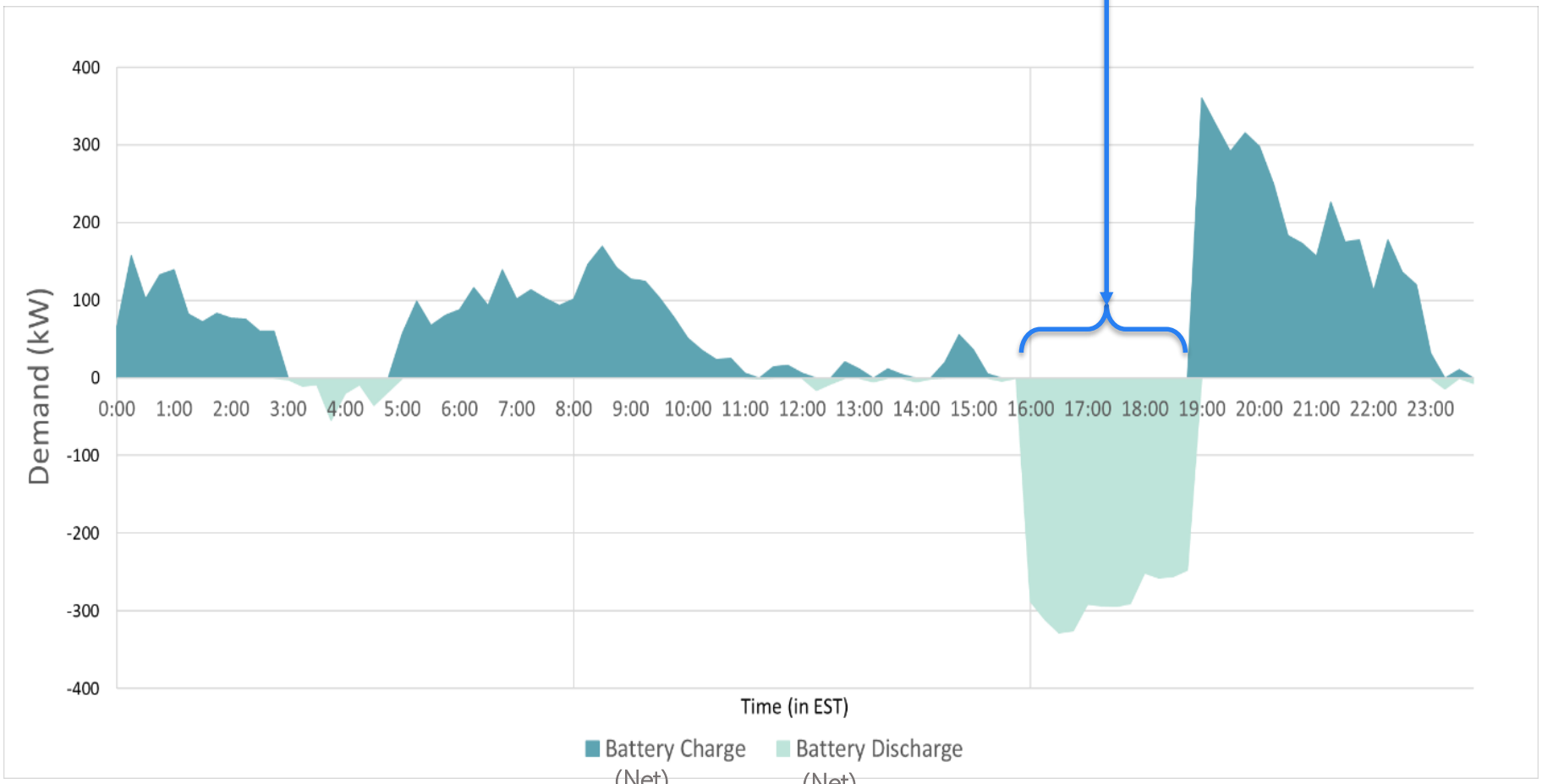
- Overall committed load reduction was 1,070 kW.
- Average evaluated load reduction during the dispatch periods was 972 kW, 91% of the commitment.
- Load reduction during the ICAP hour was 56% higher than committed for the two systems in place during the hour due to planned shorter dispatch window (3 hours vs. 4).

Site	Demand Reduction	Daily Dispatch Reduction Average (kW)	ISO-NE ICAP Hour Reduction (kW)	Billed Demand Reduction Average (kW)	Seasonal Battery Efficiency (total discharge/total charge)
A	Committed	500	500	N/A	N/A
	Evaluated	409	800	258	67%
B	Committed	375	N/A	N/A	N/A
	Evaluated	353	N/A	N/A	88%
C	Committed	195	195	N/A	N/A
	Evaluated	210	290	13	89%
Total	Committed	1,070	695	N/A	N/A
	Evaluated	972	1,090	271	73%

Average Battery Activity Across the Season

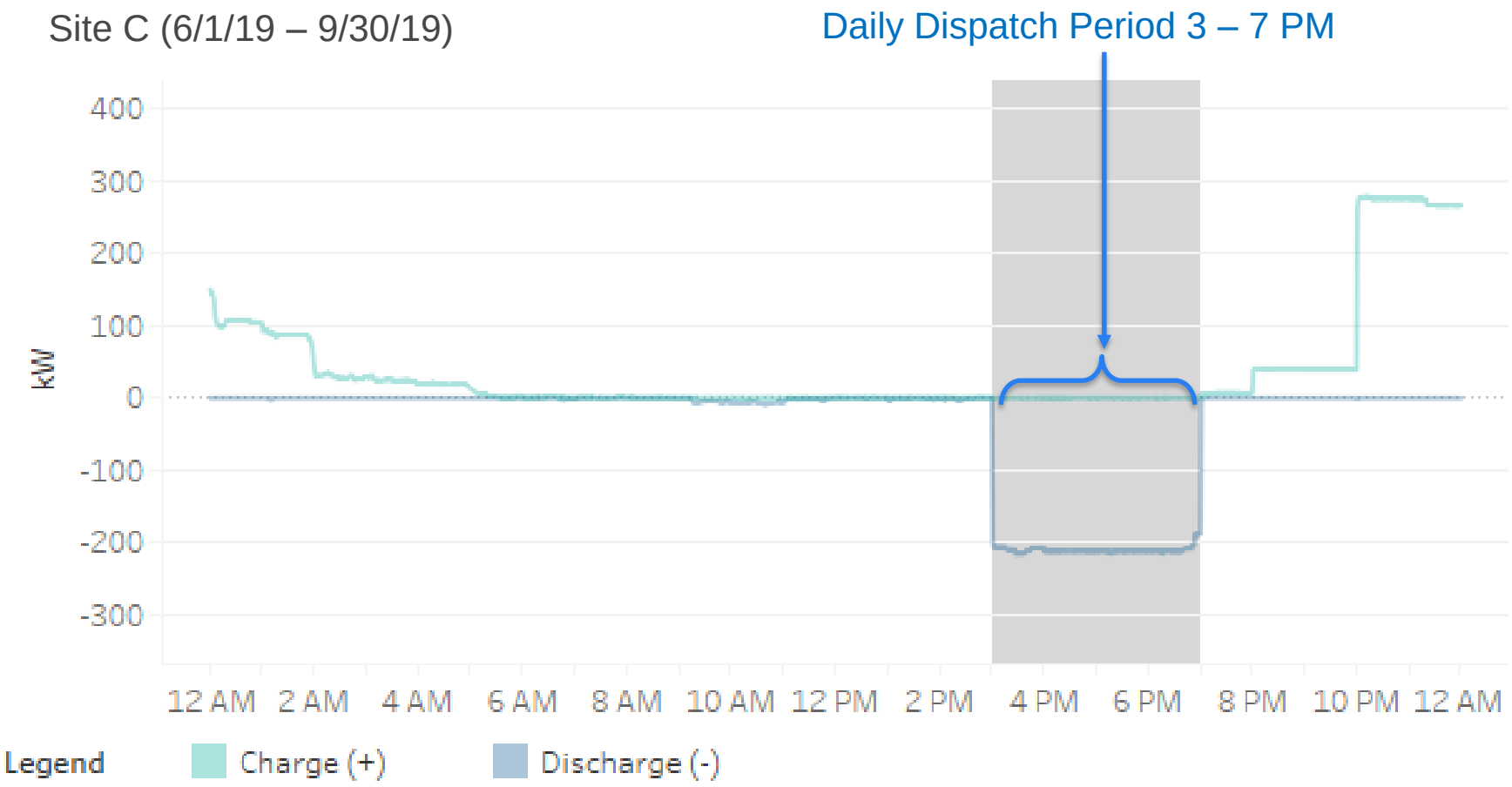
Site A (7/11/19 – 9/30/19)

Daily Dispatch Period 4 – 7 PM



Average Battery Activity Across the Season

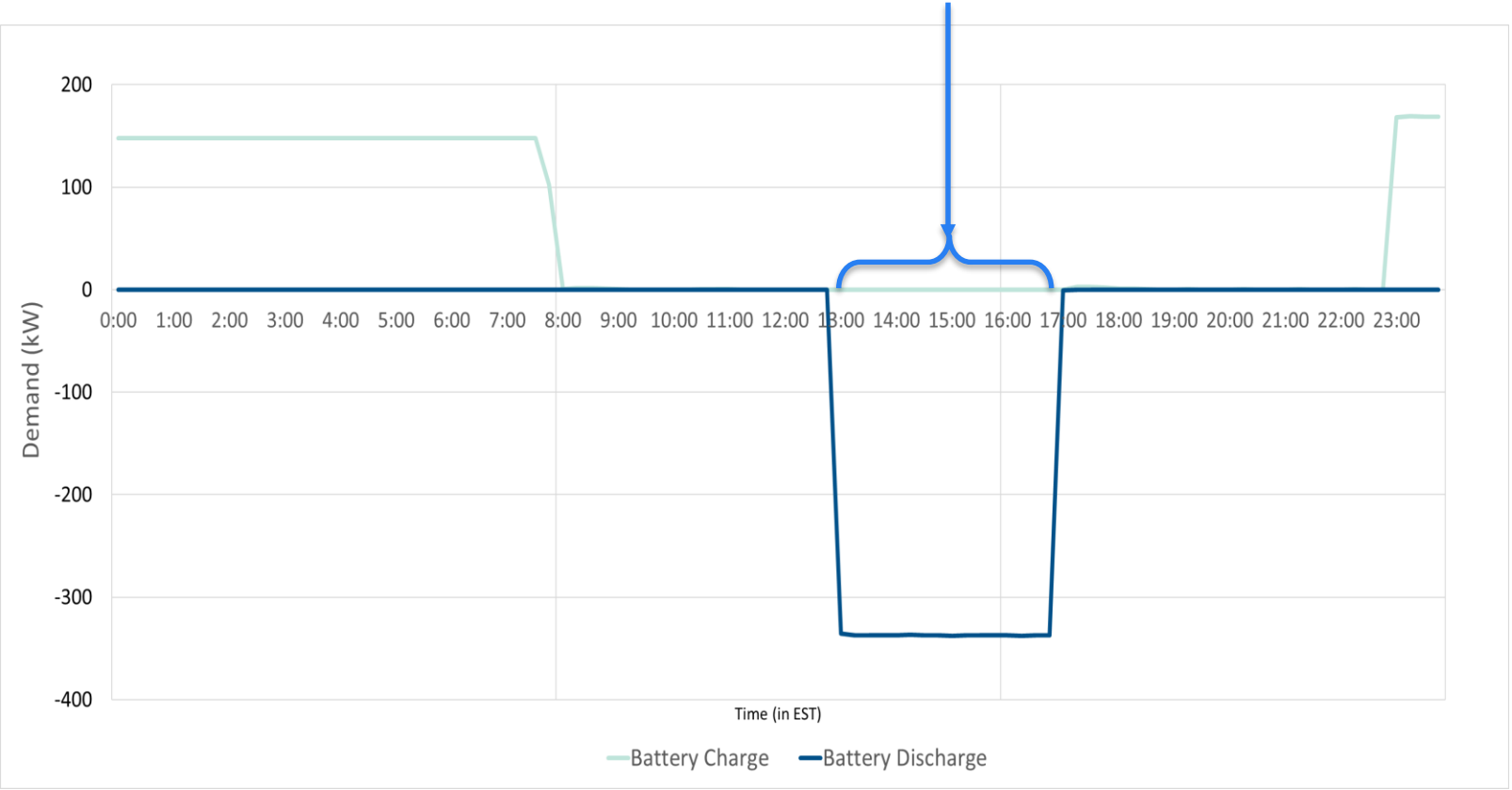
Site C (6/1/19 – 9/30/19)



Average Battery Activity Across the Season

Site B (11/11/19 – 12/6/19)

Daily Dispatch Period 1 – 5 PM



Process Evaluation Results

- Customers were satisfied with the projects overall, with highest satisfaction for technology and vendor performance, but less satisfaction for financial benefits so far.
- The projects experienced some implementation challenges:
  - Delays in installation for the one project installed in the fall were due to liability concerns and municipal zoning concerns. In general projects had long lead times.
  - Challenges in operations included defective hardware that vendors replaced, software glitches and programming errors, and problems in communications with vendor servers; these issues have been resolved.
  - For the two sites that had existing CHP systems, interactions between the batteries and the CHP caused challenges. For example, in some cases when a CHP tripped offline, the battery tried to “make up” for the CHP, and exhausted its charge before the daily dispatch period. This issue has since been addressed.

Evaluators' Key Findings

- The installation and "shakedown" period required to refine operation is long and complex
- Once functional, seasonal average performance is good, and daily dispatch systems are almost meeting their committed levels
- Daily dispatch systems can escalate load reduction for the ICAP hour
- Overall the technology performs reliably as instructed, but charging logic is complex and can have unintended consequences, especially when dealing with on-site generation and/or multiple objectives
- Customers are not yet satisfied with financial benefits (in part because of lack of full information), but are generally satisfied with their vendors and are optimistic about future performance

Evaluators' Recommendations

- Plan for long commitment-to-conversion times as the market continues to mature.
- Vendors should educate customers regarding realistic financial expectations for their systems.
- Help customers understand the interactions between multiple demand management objectives (some of which may be mutually exclusive).
- Require more gradual recharging.
- To assist future evaluation:
  - Collect additional contextual information
  - Have vendors communicate site control objectives to Eversource and evaluators

Daily Dispatch Full Approval Next Steps

Next Steps for Seeking DPU Approval

- Program Administrators must submit a “compliance filing” to the Department, including the results of the demonstrations, before the PAs can implement statewide and at full scale
- Evaluation results expected to be final by end of January
- PAs will seek a Council Resolution at February EEAC Meeting
  - PAs hope Council will pass a Resolution supporting all PAs to offer daily dispatch, the already filed budgets, and the Compact’s proposed budgets

- PA Compliance Filing with Department
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  - Filing will include final evaluation, testimony, and request to approve the budgets already filed for National Grid, Eversource, and Unitil, as well as the Compact proposed budget
  - While the Program Administrators hope the Department will approve the offering before the summer, there is no deadline for such approval
    - National Grid and Eversource will continue their daily dispatch demonstrations at the proposed 2020 daily dispatch budget levels until the Department’s final decision

Thank you

For Reference Only

Standardizing nomenclature for consistent understanding

What is a MW? It depends…

- Planned MW – filed in 2019-2021 Three Year Plan
- Enrolled MW – An ex ante, estimate based on customer recruitments ahead of summer activity multiplied by a estimate of expected response based on experience
- Performed MW – an ex post gross average demand reduction calculation based on the event and customer baseline prior to an event, used for customer settlement
- Evaluated MW – an ex post gross average demand reduction using evaluation-determined regression baseline establishment and customer/event performance, used for reporting and benefit calculation