2018 Crosscutting Demand Demonstration Project Evaluation Report

prepared for

Eversource

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1 EXECUTIVE SUMMARY

Eversource contracted ERS and DNV GL to evaluate a demand demonstration project that consists of the deployment of four technologies through six vendors over the span of two years.[1] These four technologies include manual curtailment, BMS controls, thermal storage, and battery storage. Manual curtailment entails the manual reduction of load by the participants, typically through reduction of HVAC or lighting loads. BMS controls entails the reduction of load by automated controls programmed into the facility BMS. Thermal storage entails the reduction of cooling or refrigeration load through the use of ice storage or phase change materials. Battery storage entails the use of batteries to reduce facility load. Through this evaluation, ERS and DNV GL seek to help Eversource understand the impacts on summer and/or winter peak consumption, customer acceptance of the various solutions, barriers and drivers to program implementation, and the ability of the demand demonstration projects to complement efficiency programs, among other topics. The understanding captured in this study will be applied to the development of future demand reduction strategies and programs. Economic evaluation is not in this scope.

The demand demonstration projects are being deployed for the 2018 and 2019 summer seasons and 2018–2019 and 2019–2020 winter seasons. This evaluation report summarizes the findings from the 2018 summer season. This study consists of process and impact evaluation efforts.

Table 1 summarizes the 2018 project information for each vendor.

[1] A small commercial thermostat program is the subject of separate study. A seventh commercial/industrial vendor has joined the demonstration but is not in the scope of this first interim report.

Table 1. Summary of Solutions

Metric	Vendor Number					
	1	2	3	4	5	6
Technology	Manual curtailment	BMS controls	Thermal storage	Thermal storage	Battery	Battery
Targeted customer type	Large C&I	Large C&I	Cold storage facilities	C&I facilities with small and medium HVAC units	Large commercial	Medium and large C&I
Season	Summer and winter	Summer	Summer and winter	Summer	Summer and winter	Summer and winter
Typical planned DR per site (kW)	300	300	140	26	500	125
Evaluated year 1 average kW per site	296	N/A	25.5	N/A	191	84
Participant SOW target for year 1	17	18	2	9	3	1
Achieved participant count for year 1	18	0	1	1	1	1
Cumulative participant target over 2 years	24	18	11	19	3	10

Through the evaluation thus far, the evaluation team has identified eight key findings:

1. **Reporting by technology:** The batteries and manual curtailment solutions reduced load as expected and reported. The thermal storage solutions' performance was as reported for one vendor and unclear for the second. More clarity on the thermal storage solutions will be available after the 2019 summer season. The impact of the BMS controls solution was not evaluated in year 1.
2. **Installed Capacity Tag (ICAP) reduction:** The ICAP hour is the ISO-NE system peak hour for the entire year. The evaluated demand reduction at system peak hour (August 29, 2018, hour ending at 5 p.m.) was 8,669 kW, with 97% of demand reduction resulting from manual load curtailment.
3. **Performance variation:** Manual curtailment results were particularly variable across events. This was due to two factors: customer behavior and the baseline algorithms. An extreme example of both occurred on the days either side of July 4th, which fell on a Tuesday. Some manual curtailment participants were already shut down likely due to the holiday (behavior) but received no credit due to baseline adjustment. Total load curtailment for those days was lower as a result. The batteries were found to be more consistent in delivering load reduction.
4. **Net energy impact:** Battery solutions would result in an electric energy penalty (53% for the site with the event-based dispatch solution and 81% for the site with the daily dispatch solution), while thermal storage, manual curtailment, and BMS controls could

result in energy savings depending on the demand reduction measures and dispatch strategies employed.

5. **Recruiting:** A mix of recruiting approaches were employed for these projects, ranging from almost entirely vendor-driven to almost entirely account executive (AE)-driven. AE involvement, while very beneficial, could create delays if AEs were pulled for other responsibilities, such as for other programs or even customer support during winter storms.
6. **Demand versus energy education:** AEs and customers are not used to thinking in terms of kW reductions and ICAP. Training and education are required to expand thinking beyond traditional energy efficiency metrics.
7. **Technology education:** The energy storage (thermal and battery) market is nascent in Massachusetts, and lack of needs customer education is a barrier to participation. For thermal storage projects in particular, it was valuable to have a demonstration facility to show other customers.
8. **Customer satisfaction:** In general, participating customers were very satisfied with their respective projects.

The evaluation team has developed crosscutting recommendations in response to evaluation findings for year 1. They are categorized below into program -design-oriented recommendations and evaluation-oriented recommendations.

Program -Design-Oriented Recommendations

- **Recommendation #1: Consider how to balance recruiting expectations between the vendor and the Eversource AEs**. Eversource's AEs increased the program's marketing effectiveness and reduced costs. They acted as a valuable resource for the demonstration projects by prescreening potential customers and coordinating between vendors to minimize competition. Several vendors noted, however, that while some AEs were helpful, others faded away and attended more to other priorities, sometimes unpredictably. In addition, the four back-to-back winter storms in March 2018 pulled AEs away for storm duty, delaying their ability to start recruiting. Consider how to clarify the amount and timing of AE involvement in order to create more certainty for the vendors.
- **Recommendation #2: Continue to work with the interconnection team to advocate for a streamlined interconnection process**. The interconnection process, as designed, does not adequately distinguish between different types of distributed energy resources – in particular, exporting vs. non-exporting – and can lead to prohibitively long review times. While this is handled by a separate division that the Demand-Side Management (DSM) staff have no control over, the program team should continue to meet with the

interconnection team to understand the process and share their knowledge about the value of creating different pathways for review, especially for non-exporting resources.

- **Recommendation #3: Use a centralized dispatch platform to call DR events and allow enough time for vendors to integrate before the summer**. Eversource used a third-party load control dispatch platform on a pilot basis for some projects in summer 2018. One vendor stated that they preferred the platform over receiving emails from Eversource, but the software integration was tricky and needed more time ahead of the summer. While sending out emails to vendors was sufficient for the small number of vendors and events seen in the pilots, a centralized platform allows for much greater scale for Eversource in its future program. Eversource has indicated that this is their intention.
- **Recommendation #4: Continue to work with battery implementers to optimize recharging.** Battery recharging should be optimized to ensure that recharging does not contribute to the facility peak demand. Delaying the charging to night time instead of late evening would potentially reduce the facility peak demand charges to the extent that monthly peak occurs during this period, and could relieve Eversource of early evening peak load just outside of the contracted period.
- **Recommendation #5: Use thermal storage for longer dispatch windows.** Based on the limited number of thermal storage projects that were evaluated in year 1, it appears that there is potential for longer dispatch windows to be implemented. Based on low rates of temperature increase, the thermal mass appears to have more capacity than is being realized. This would be site-specific since the space temperatures would be the primary consideration. It would be beneficial for Eversource and the vendors to explore this possibility during the project scoping.
- Recommendation #6: Eversource should continue to explore the optimal relationship between Eversource load control programs and the ISO-NE market offerings. Eversource wants to increase control over its own peak load and explore the potential for value stacking (the bundling of multiple value streams to improve the economics for distributed energy resources) without undermining the ISO-NE markets. Multiple challenges exist including:

  i. Prioritization of load reduction between Eversource and ISO NE

  ii. Influence on the ISO-NE market participation and reliability.

  iii. Degradation of one another's baseline.

  Vendors should be required to indicate their ISO-NE market participation strategies to avoid unanticipated consequences.

Evaluation-Oriented Recommendations

- **Recommendation #1: The vendors should provide their initial committed reduction per site and, at the end of each season, their reported load reduction.** Currently, the vendors do not consistently provide the committed and delivered demand reduction per site. This information allows the evaluation team to assess the vendors' ability to track delivered demand reduction, compare delivered to committed reduction, and present results in a more consistent manner.
- **Recommendation #2: The vendors should inventory and document all affected equipment.** Site visits conducted by the evaluation team are intended to be verification visits confirming the site conditions and equipment information presented by the vendors. However, a lack of project documentation has resulted in the evaluation team conducting inventories of existing equipment and extended discussions with site staff to understand the demand reduction plans to be implemented. This adds cost to Eversource and disrupts customers more than necessary. The vendors should provide this information in a systematic manner to enable the evaluation team to verify the site conditions without having to duplicate efforts.
- **Recommendation #3: Involve M&V contractor during DR feasibility testing to allow for real-time verification of manual curtailment and BMS controls projects**. In order to prevent customer fatigue, and to allow for an easier evaluation of the implemented projects, the BMS controls and manual curtailment project vendors should include the evaluation team in the feasibility testing phase of the projects. This will allow evaluators to understand the equipment operation and load reduction through the test, rather than having to conduct an additional site visit for the same purpose.

2 DESIGN OF DEMONSTRATION PROJECTS

Eversource contracted with six vendors and later added a seventh to deploy four peak demand reduction technologies with a variety of dispatch strategies over two summer and two winter seasons starting in the summer of 2018. The company's goals are to understand the impacts on summer and/or winter peak consumption, customer acceptance of the various solutions, barriers and drivers to program implementation, and the ability of the demand demonstration projects to complement efficiency programs, among other topics.

This section describes the technologies and dispatch strategies that were tested as part of this demand demonstration project. The goal of the project was to study the effectiveness of various technologies and dispatch strategies in reducing the utility peak demand.

2.1 Dispatch Strategies

Dispatch strategies are the criteria that determine when and how a demand response (DR) resource is deployed to mitigate peak load. This section describes the different dispatch strategies that were studied as part of this demonstration project.

2.1.1 Daily Dispatch

Daily dispatch involves the dispatch of demand response (DR) resources during scheduled windows daily during the summer season (June through September).

2.1.2 Utility-Triggered Event Dispatch

Event-based dispatch involves the dispatch of DR resources based on a utility-called peak load event. These events could be on any day and hour during the summer season (June through September). The utility event trigger aims to forecast the Installed Capacity Tag (ICAP) hour. The ICAP hour is the ISO-NE system peak hour for the entire year.

During the winter, events are be called based on real-time locational marginal prices (LMPs) at the 5-minute level spike above $500 per MWh within a load zone within Eversource's territory (NEMA, SEMA, WCMA) during business hours (8 a.m. – 6 p.m.) on non-holiday weekdays.

2.1.3 Vendor-Triggered ICAP Hour Forecasting Dispatch

Customized algorithms seek to forecast and dispatch to shed load during the predicted ICAP hour. These algorithms are developed by the vendors.

2.1.4 Facility Monthly Peak Demand Mitigation

Customized algorithms seek to mitigate facility monthly demand by setting a reference peak demand value and dispatching to prevent the facility from crossing the reference value. The facility monthly peak demand sets the demand charge for the month for the customer, and so, limiting the monthly peak demand would reduce the monthly demand charges. These algorithms are developed by the vendors with input from the facility staff.

2.2 Technologies

This section describes the technologies that were studied as part of this demonstration project.

2.2.1 Thermal Storage

Two thermal storage solutions were deployed to test their effectiveness in mitigating utility peak demand, with an emphasis on summer peak demand. One solution sought to limit peak demand by reducing summer air conditioning loads at commercial and industrial facilities, while the other solution sought to limit peak demand by reducing refrigeration loads at cold-

storage facilities. Both solutions were deployed daily during scheduled dispatch windows in the summer. The dispatch windows were modified during the season to meet the anticipated ICAP hour. One solution did not participate in the winter season, while the other solution would dispatch during the winter to mitigate facility peak demand.

2.2.2 Batteries

Two battery solutions were deployed to test their effectiveness in mitigating year-round utility peak demand. The two battery offerings were deployed with different dispatch strategies to gain a deeper understanding of their round-trip efficiencies[2] and effectiveness. . During the summer, one solution was deployed daily during scheduled dispatch windows (typically 5 hours between 1 p.m. and 6 p.m.), and the second solution was deployed to mitigate peak load during Eversource-called events (typically 2-hour dispatch) and through a customized approach to mitigate the load during the ICAP hour (typically 3-hour dispatch during ICAP forecast hours). During the winter, both solutions are dispatched according to real-time locational marginal prices (LMPs) at the 5-minute level spike above $500 per MWh within a load zone within Eversource's territory (NEMA, SEMA, WCMA) during business hours (8 a.m. – 6 p.m.) on non-holiday weekdays.

2.2.3 Manual Curtailment

One manual curtailment provider was selected to test the strategy of targeted demand reduction for the annual utility peak. With manual curtailment, the provider agrees with the participant in advance on the amount of load reduction that the site can deliver in advance. The provider does not install any equipment or controls and is not involved with how the participant reduces load. Most participants reduce HVAC or lighting loads or temporarily reduce production, but it is up to them to choose what to equipment to shut off and how the activation occurs. Activation may be manual or programmed by the participant, and the nature of the response may vary from event to event.

This solution utilizes active DR to reduce demand during peak periods. During the summer availability period, DR is dispatched with the intent of being active during the ISO peak load hour. During the winter availability period, DR is dispatched according to real-time locational marginal prices (LMPs) at the 5-minute level spike above $500 per MWh within a load zone within Eversource's territory (NEMA, SEMA, WCMA) during business hours (8 a.m. – 6 p.m.) on non-holiday weekdays. The duration of each dispatch is between 1 and 4 hours, with up to 20 dispatch hours during the summer and up to 8 hours during the winter.

[2] Round-trip efficiency indicates the percentage of energy delivered to the battery during charging that is returned to the electrical system by the battery during discharge

2.2.4 Building Management System (BMS) Controls

BMS controls are part of the demand demonstration project but have not yet been actively deployed to curtail load. BMS controls will be assessed for their ability to reduce a facility's load during system peak hours and at their monthly facility peak load. The solution is similar to manual curtailment in that load reduction can come from HVAC, lighting, refrigeration, process equipment, or other non-critical systems like fountains or lobby TV screens. The BMS solution differs from the manual solution in the way customers are alerted to the need for DR, the types of events that trigger the alerts, and the pre-arrangement of actions taken.

To assess when conditions are ripe for energy reduction, a relay device would be installed on the customer's meter that monitors consumption relative to their monthly peak. Depending on the customer's preference, when a trigger condition is met, this device either sends a signal to the customer's BMS, which has been programmed by the customer's BMS contractor to automatically take a predetermined action to reduce energy use, or alerts the customer through lights, horns, or some other notification to manually make the adjustment. The triggers used in this demonstration project are when a customer nears 95% of their monthly peak, or when a potential ISO-NE ICAP hour is forecasted. There is no utility-triggered DR component to the BMS controls solution. The BMS controls solution also expects to see some "passive demand reduction" through behavior change as a result of the customer having increased visibility into their energy use.

2.2.5 Summary

All four dispatch strategies defined previously in this section were deployed as part of this demand demonstration effort. Table 2 shows the summary of technologies studies and their corresponding dispatch strategies.

Table 2. Summary of Technologies and Dispatch Strategies

Technology	Summer				Winter	
	Daily	Utility-Triggered Event	Vendor-Forecasted ICAP	Facility Peak	Utility-Triggered Event*	Facility Peak
Manual Curtailment		X	X		X	
BMS Controls			X	X		
Thermal Storage 1	X					X
Thermal Storage 2	X					
Battery 1	X				X	
Battery 2		X	X	X	X	X

*Winter peak event would be based on the LMP trigger described above

3 EVALUATION OBJECTIVES

The objective of the impact evaluation is to verify that the various solutions succeeded in meeting their demand response goals through performance verification, site visits, and baseline verification. The objective of the process evaluation is to understand customer acceptance and experience with the equipment or intervention, the readiness of systems for larger deployment, and PA and vendor success in delivery. The impact and process evaluations will help Eversource answer the question: "Should we offer this at scale?"

Table 3 lists all the identified crosscutting researchable questions. This report does not attempt to answer all questions yet. In red are the questions that have not been answered and in black are questions that have been at least partially answered. At the conclusion of the 2019 winter season, the evaluation team will update this report to answer the questions that have not been answered during the year 1 evaluation of this project.

Table 3. Crosscutting Evaluation Researchable Questions

Cross-Cutting	
Successful customers: What are the characteristics of successful participants for this technology? What delivery channels are most appropriate/effective for various customer types?	
Value streams: What benefits/value streams does the solution provide to customers? To the utility?	
Degree of automation: How automated is the solution, and what advantages and disadvantages does that entail?	
Barriers: Are there technological, economical, or regulatory barriers to full-scale deployment of the solution?	
Impact	**Process**
Magnitude of reductions: How much demand reduction is the solution able to provide? How does that compare to their SOWs? How does that compare to what was promised to customers?	**Customer recruitment:** How did the recruitment process compare to vendor/PA expectations? What were successes and barriers?
Efficiency: What are the net energy usage implications of the solution, if any?	**Motivations:** What were the customers' key motivations for participation? What benefits did they find most compelling?
Complementarity with other strategies: Is the solution mutually exclusive with other peak demand reduction strategies, or is it complementary?	**Satisfaction:** Are the participants satisfied with their experience? Are they satisfied with the solution? What could be improved?
M&V strategy: What is the most effective M&V strategy for this solution?	**Non-energy benefits:** What non-energy benefits, if any, does the solution provide to the customer or PA?
Cost-effectiveness: What is the most cost-effective solution? (Consultants to develop kW data, Eversource to analyze dollars.)	**Integration into business:** How well was the solution able to integrate into existing systems and business practices? How well does it "open the door" for additional demand or energy reductions?
Territory-wide potential: This will be a separate study out of the consultant scope.	**PA satisfaction:** How satisfied is the PA with the vendor? Were there any challenges or best practices that could be replicated in design, recruitment, data collection, and data transfer between the two parties?

4 METHODOLOGY

4.1 Process Evaluation Methodology

For the process evaluation, the evaluation team studied the requirements and procedures in place to achieve the demand reductions and investigated the ways that the program can most effectively reach its goals. In the first year of the demonstration project, the process evaluation focused on understanding each vendor's solution and processes. The evaluation team used several primary data collection activities over the course of this evaluation:

- **Interviews with the Eversource program managers**: The evaluation team conducted interviews with the two program managers overseeing the vendors in late June, as well as two Eversource staff involved in designing and supervising the demonstration projects.

These interviews were repeated at the end of the summer to discuss the experience over the summer.

- **Interview with the vendor project managers**: The evaluation team interviewed each vendor's project manager for the Eversource demand demonstration project in late October. The interviews were used to clarify each vendor's approach, their experience with Eversource, and any successes or challenges.
- **Participant pre-summer surveys:** Whenever possible, the evaluation team conducted a site visit to verify the installation and operating schedules for the impact evaluation, at which time the team also conducted a pre-summer survey with the participant. If the survey could not be conducted on site, the evaluation team would follow-up via email and phone if needed.
- **Participant post-summer surveys**: In early November, the evaluation team emailed a customer experience survey to all customers participating in a demand demonstration project to assess their satisfaction and experience. These surveys were more tailored to the particular vendor and technology.
- **Marketing material review:** The evaluation team received and reviewed one-page marketing brochures for each vendor, as well as the overall demand demonstration fact sheet. Eversource also provided a slide deck that was used to educate their Account Executives (AEs) on each vendor's technology and target customers.

Table 4 provides a summary of the interviews and surveys conducted in the first year of the evaluation.

Table 4. Summary of Year 1 Interviews and Surveys

Survey/Interview	Pre-summer	Post-summer	Total
Eversource project manager interviews	2	2	4
Eversource design/supervisory staff interviews	2	2	4
Vendor program manager interviews	0	6	6
Participant surveys	5	14	19
Total	**9**	**24**	**33**

4.2 Impact Evaluation Methodology

For the impact evaluation, the evaluation team utilizes uses several different methods and strategies to calculate the performance of the various demand demonstration project technologies. The evaluation team performs pre-installation and post-installation site visits for the thermal storage, BMS controls, and manual curtailment projects, and performs post-installation site visits for the battery storage projects.

For thermal storage projects, the team uses the power draw of the affected equipment to quantify the delivered demand reduction during the dispatch windows. During the site visits, the evaluation team verifies the space temperatures of affected spaces, confirms the nameplate and controls of existing equipment, and obtains trend data from the BMS where available. In projects that involve a high magnitude of demand reduction with respect to the facility load, the team will analyze utility interval data to validate the calculated demand reduction.

For battery storage projects, the battery charge and discharge data are used to quantify the delivered demand reduction during their respective dispatch windows. During the site visit, the evaluation team verifies that the battery meters are revenue grade meters. If not, the evaluation team utilizes calibrated meters to take spot measurements to confirm that the battery meters are accurate.

For manual curtailment projects, the team uses the utility interval data to quantify the delivered demand reduction during their respective dispatch windows. In addition to interval data, the evaluation team obtains a combination of trend data from the BMS and spot measurements during the site visits for a sample of equipment during the site visits to better understand the demand reduction strategies employed by the vendors.

For BMS controls projects, the evaluation team will use an ex-post regression approach that can capture both active and passive demand reduction caused by the DR solution. The part of the regression that will capture active demand response will be similar in structure to the ex- post regression specification used for the manual curtailment impact evaluation. In contrast to the ex- post regressions for manual curtailment, this regression will also incorporate pre-installation data that will make it possible to estimate passive demand reduction that occurs after the BMS controls solution is installed. No impact analyses have been conducted for the BMS controls projects as of the writing of this report.

5 EVALUATION FINDINGS

This section describes the evaluation findings for the Summer 2018 season, grouped into four components of the project's implementation, as shown in Figure 1.

Figure 1. Evaluation Findings Categorization

5.1 Recruitment

The recruitment process differed for each vendor. Generally each vendor generated leads from a mix of leveraging previous relationships and receiving pre-screened customers from the Eversource AEs. Previous relationships could include existing local customers participating in a different program or receiving consultation on a different technology; for the vendors based in other states, these were typically national accounts (i.e. grocery stores, manufacturers) with offices in Eversource's Massachusetts territory.

Eversource's AE team contributed by pre-screening their customer accounts and providing introductions to the vendor(s) most suitable for the facility. The vendors considered the AE involvement valuable, as it reduced marketing costs in generating leads and helped to minimize competition and duplication between vendors by coordinating customer leads between them. However, the AEs often had other priorities, including storm duty and quotas they had to meet for other programs. Half of the vendors noted that AE involvement could be inconsistent; some AEs were more interested in providing leads than others, and some could seem to "drop off" in communications once a quota was reached. The four back-to-back winter storms in early 2018 also caused delays for the two vendors that were dependent on leads from Eversource (both have since requested permission to do their own recruiting as well).

Recruiting was challenging for all but two of the vendors. The manual curtailment vendor has an existing customer base from ISO-NE Forward Capacity Market (FCM) DR events that it successfully leveraged; half of its participants in the demonstration project were already customers. One battery vendor, likewise, used existing relationships from another Massachusetts-based effort to recruit enough participants to meet its demand demonstration project quota. For the other vendors, though, several issues contributed to low participation in the first summer:

- **Delayed start**: Delays in contracting with Eversource reduced the time vendors had to recruit and implement before the summer started. This created different challenges based on the vendor. Some vendors chose to work at risk during this period, with one battery vendor even ordering the equipment without a guarantee of payment in order to meet the original June 1 implementation deadline. Others waited for the Eversource AEs to be trained and removed from storm duty before they could start receiving leads. Extended contracting issues with one of the thermal storage vendors pushed recruiting into the summer, when customers were less willing to allow shutdowns to their HVAC equipment during the peak cooling season. One vendor has a particularly complex screening process and long sales cycle. Coupled with the delayed start, they were only able to install their first project at the end of the summer (though they have since recruited several additional

customers). In general, the slow ramp-up and delayed start was one of the largest contributors to lower-than-expected participation.

- **Poor understanding of demand reductions**: Multiple Eversource staff and vendors commented that customers (and even the Eversource AEs) were used to talking about energy savings, but demand reductions have an entirely different value proposition. Additional education was required to explain the concept of demand and the benefits of reducing it.
- **Less familiarity with storage technologies**: Three of the four storage (thermal and battery) vendors are based in the West Coast and noted that the degree of familiarity and understanding with storage technologies is far lower in Massachusetts. As the storage market is nascent in the territory, vendors had to spend more time explaining their technologies and building customer comfort with them. For the two thermal storage vendors, having a demonstration project "open house" where other interested customers could come see the technology in action was a critical sales tool. Both vendors listed having an early project in the ground as an educational opportunity as one of their key learnings from the first year of the demand demonstration project.

Each vendor faced additional challenges related to their particular solution and its needs. For example, the BMS controls solution required extensive involvement from the customer's existing BMS vendor, which added delays to the process. One thermal storage vendor's equipment was only compatible with certain HVAC systems and many of the initial leads were not compatible. One battery vendor found that differences in utility demand charges between Western and Eastern Massachusetts and a lack of clarity in whether or not potential customers were exposed to ICAP charges resulted in difficulties in quantifying cost savings for customers.

In most cases, the vendors have begun to resolve these issues, and most have enough leads in their pipelines to meet their participation targets in the second year of the project.

5.2 Delivery

Delivery encompasses both the effort required to install and/or commission a successful solution, and the processes involved in dispatching the solution to lead to reduced demand.

Installation was relatively smooth for most of the projects included the 2018 summer season. Challenges tended to focus around the need for programming tweaks to ensure that the unit was coordinating properly with existing equipment and BMS, and that shutdowns were often required when integrating capital equipment. (These could be major; one battery customer noted that there were significant hardware upgrades and two campus-wide shutdowns required during the installation. While he said that had been expected, it could deter other customers from participating.)

The battery vendors experienced one of the largest barriers to installation, which was the interconnection process required to vet and approve the batteries. Only one of the two battery vendors was installing batteries large enough to meet the interconnection thresholds and therefore experienced issues with the process this summer, but the second expects to run into similar challenges next year as their projects become larger. When the vendor submitted their application for interconnection approval for the first customer, it was over the 500 kW threshold that triggered a more in-depth review by Eversource. The Eversource interconnection team informed the vendor that the project was behind numerous larger projects in the queue and their application would not be reviewed for over a year; the Eversource demonstration project team worked with the interconnection team and the vendor to approve a smaller portion of the original application. However, the second portion has yet to be approved.

The cost causation principle requires the sequential review of projects in the interconnection queue.[3] However, there are long delays in the eastern Massachusetts interconnection queue, sometimes involving several years before a project is reviewed. This creates both an immediate problem for the demonstration projects and a longer-term issue for Eversource's ability to achieve the goals set in its new 3-year plan. The vendor and the Eversource demand demonstration project team believe that it may be possible to create multiple review pathways based on defined criteria (e.g., whether the project is exporting or non-exporting). Southern California Edison (SCE) has such a process that uses a simple, fast-track application for non-exporting battery projects under their Rule 21. It appears that Eversource may also have used a fast-track interconnection process in some cases.

The demand demonstration team continues to meet internally with members of interconnection department. The team has recommended that the interconnection application screening documents be updated to include a battery storage section. This section would require customers to provide a detailed description of how battery storage will be implemented throughout their facility and will provide justification if battery storage nameplate values should not be used when calculating total system size. This new application data should provide the interconnection group with the required documentation to adequately distinguish between different types of distributed energy resources, which should alleviate the interconnection review process for load-reducing, behind-the-meter, non-exporting, battery storage projects.

Once the technologies have been installed and/or commissioned, they can be used by the vendor to reduce demand to benefit Eversource, the ISO-NE system, and the customer. As

[3] "All approved rates [must] reflect to some degree the costs actually caused by the customer who must pay them." *K N Energy, Inc. v. FERC*, 968 F.2d 1295, 1300 (D.C. Cir. 1992).

described previously in this report, each vendor employs some combination of dispatch strategies to do so (daily, event, and customer targeted, or some combination). During the summer, the two thermal storage solutions and one battery solution are dispatched daily during scheduled dispatch windows. The manual curtailment and one battery solution are dispatched during Eversource-called events. One battery solution, the manual curtailment solution, and the BMS controls solution also have customized dispatches through their own algorithms. These algorithms could target the ICAP hour, facility peak demand, or a combination of targets.

Eversource typically emailed and/or called each vendor to provide notice of a projected event the next day. For some of the vendors, Eversource tested out a third-party automated load control dispatch platform (this platform was also used in the National Grid demand response pilot). The software directly ties into the vendor's software; the vendor that used the platform the most noted that the integration was challenging, but it worked well once complete. Using two separate notification systems for different customers within the same demand demonstration project (i.e. Eversource emails for some, alerts from the platform for others) did create some duplication of effort. As a result, the vendor recommended that Eversource shift to calling its events entirely through the dispatch platform and give the vendor more notice ahead of the season to allow for enough time to integrate with the software.

5.3 Customer Experience

Overall, the participating customers were found to be satisfied with the implemented projects. The evaluation team conducted pre- and post-summer customer surveys for the manual curtailment, BMS controls, and thermal storage projects, as well as post-installation surveys for the battery projects. Table 5 summarizes the results of the surveys.

Table 5. Summary of Customer Experience Survey Results

Survey	Program Component	Manual Curtailment N=18 Pre- n=2 Post- n=10	BMS Controls N=1 n=1	Thermal 1 N=1 n=1	Thermal 2 N=1 n=1	Battery 1 N=1 n=1	Battery 2 N=1 n=0
Pre-summer	Upfront project information	4.5	4.0	5.0	5.0	N/A	N/A
	The application/enrollment process	4.5	4.0	5.0	5.0	N/A	N/A
	Site walk-throughs/curtailment plan development	5.0	4.0	5.0	5.0	N/A	N/A
	Interactions with vendor	5.0	4.0	5.0	5.0	N/A	N/A
	The incentive, if applicable	5.0	5.0	5.0	5.0	N/A	N/A
	Overall project	4.5	4.0	4.0	5.0	N/A	N/A
Post-summer	Installation	4.2	4.0	4.0	5.0	3.0	N/A
	Vendor's technology/solution	4.3	4.0	5.0	5.0	4.0	N/A
	Interactions with vendor	4.2	4.0	5.0	5.0	4.0	N/A
	Demand/energy reduction	3.6	3.0	5.0	5.0	4.0	N/A
	Cost savings/financial benefits	3.6	4.0	5.0	5.0	4.0	N/A
	Eversource's involvement	4.1	3.0	5.0	5.0	N/A	N/A
	Overall project	4.2	4.0	4.0	5.0	4.0	N/A

N – Total number of participants in the 2018 summer season

n – Number of participants interviewed in the 2018 summer season

Challenges for manual curtailment projects tended to focus on setup – three customers had some issues with coordinating or installing the Eversource interval meters or ensuring that it was connected correctly. Only one customer mentioned employee complaints as a result of participating in the DR event; (instead of opting out, however, they set up a small "cooling center" where people could go when the A/C was shut off during an event). Half (five) of the survey respondents did not fully reduce their load or "opted out" for at least one event. Three based their decisions on the production or usage needs of their facility on that day, while the other two were practical constraints – the person responsible for responding to the event was not on-site.

The customer in the BMS control project ran into some challenges getting the system operational, but reported that they were resolved quickly. The surveys did indicate that the customer could use additional information on what conditions would trigger a load reduction; both the pre- and post- surveys (which were taken by different people) reference a rather nebulous understanding of the triggers.

One thermal storage solution was found to have gone smoothly for the participating customer who stated that the spaces that were affected by the project also benefitted from reduced

humidity and increased comfort. The only challenge was that there were some programming issues with respect to the affected equipment. These issues were handled between the vendor and the site BMS contractor, and they had been taken care of prior to the evaluation team's site visit.

The evaluation team was unable to survey the participating customer for one battery solution. The participant in the second battery solution was satisfied with the solution but found that the utility interconnection process slowed them down. The customer also stated that there were some significant hardware upgrades and two campus-wide shutdowns experienced during the installation; however, the customer stated they had anticipated some of these issues when signing up for the project.

5.4 Data and Reporting

For the manual curtailment projects, customers receive access to a reporting dashboard with their performance. There is also a variety of communication directly points with customers before, during, and after events. At the beginning of the season, customers receive a reminder of their demand response goals and the different benefits available to them. During an event, customers receive an email showing their actual load compared with their target reduction. At the end of the season, each customer receives a report displaying their performance along with their payment for that period. Eversource received reports for the first few events in July 2018 including graphs with the overall performance of manual curtailment projects.

For the BMS controls and battery projects, there is a customer portal that customers can access for system performance data, real-time information on peak load reduction, consumption, and savings. Eversource has access to the battery project portals. It is unclear at this time if Eversource has access to the portals for the BMS controls projects.

One thermal provider does not currently provide real-time performance data; however, it does offer historical performance data. The other thermal provider has a customer portal that provides several types of data to participants, including temperature, equipment operation, kW reduction reporting, and some predictive tools. Eversource receives reports for both thermal solutions from the vendors.

5.5 Performance

The year 1 performance of the participating solutions is summarized in Tables 6 and 7.

Table 6 presents results for the three solutions that are dispatched daily in the summer to reduce customer load. The daily dispatch battery system also targets ICAP and customer monthly peak demand reduction. Conversely, the three vendors in Table 7 do not manage load each weekday. All dispatch to reduce demand during days that vendors believe may include

the ICAP hour and dispatch for a mixture of Eversource called events targeting the ICAP hour and possible customer facility peak days.

Manual curtailment delivered their scope of work's year 1 committed load reduction, and constituted over 90% of the total evaluated summer 2018 demand reduction. While the other five offerings fell short of their commitments for year 1, all the vendors have gained momentum since the end of the summer 2018 season and are expecting to achieve their 2-year committed load reductions.

Table 6. Demand Reduction Summary for Technologies with Daily Dispatch

Key Metric	Thermal 1	Thermal 2	Battery 1
Planned year 1 kW reduction capacity	280	234	1,500
Installed year 1 kW reduction capacity	24.0	N/A[a]	520[b]
Reported delivered kW	24.0	TBD	195
Evaluated delivered kW	25.5	TBD	191
Reported ICAP hour kW	N/A	N/A	N/A
Evaluated ICAP hour kW	21.0	TBD	195
Reported monthly peak kW	N/A	TBD	47
Evaluated monthly peak kW	N/A	TBD	47

TBD = To be determined

N/A = Not applicable

[a] 20 tons of thermal storage capacity was installed.

[b] Due to interconnection approval issues, only 195 kW was commissioned for the summer 2018 season

Table 7. Demand Reduction Summary for Technologies without Daily Dispatch

Key Metric	Manual Curtailment	BMS Controls	Battery 2
Planned year 1 kW reduction capacity	5,100	5,400	75
Installed year 1 kW reduction capacity	5,100	0	100[a]
Reported delivered kW	6,272	0	84
Evaluated delivered kW	5,324	0	84
Reported ICAP hour kW	N/A	0	53
Evaluated ICAP hour kW	8,400	0	53
Reported monthly peak kW	N/A	0	N/A
Evaluated monthly peak kW	N/A	0	9

TBD = To be determined

N/A = Not applicable

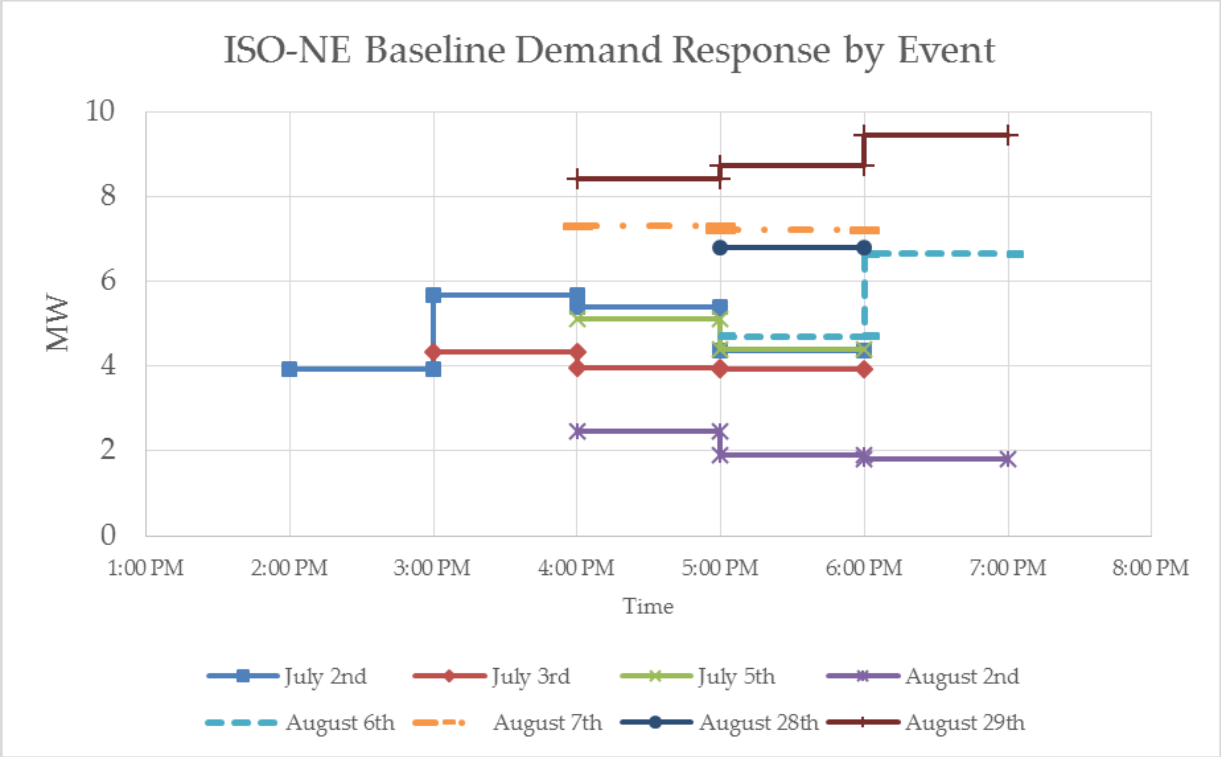
[a] One 200 kWh system was installed. 100-kW capacity is based on a 2-hour dispatch window. The battery system would have a 50-kW capacity for a 4-hour dispatch window.

Manual curtailment delivered the planned year 1 demand reductions. The evaluation identified two interesting findings for manual curtailment:

- Although the vendor was successful in delivering the committed reduction, they needed to recruit almost double the committed load to meet the requirements. Through interviews with the vendor and site-specific demand reduction plans, the evaluation team will collect more data on the recruited demand reduction versus the delivered demand reductions in year 2 of the evaluation. The evaluation team will try to better understand how the vendor typically determines how much they need to recruit to meet their committed reductions.
- The variability in load reduction across event days was pronounced for manual curtailment. The two different approaches used to assess performance (settlement baseline and regression) had similar overall load reduction but were differently variable across event days.

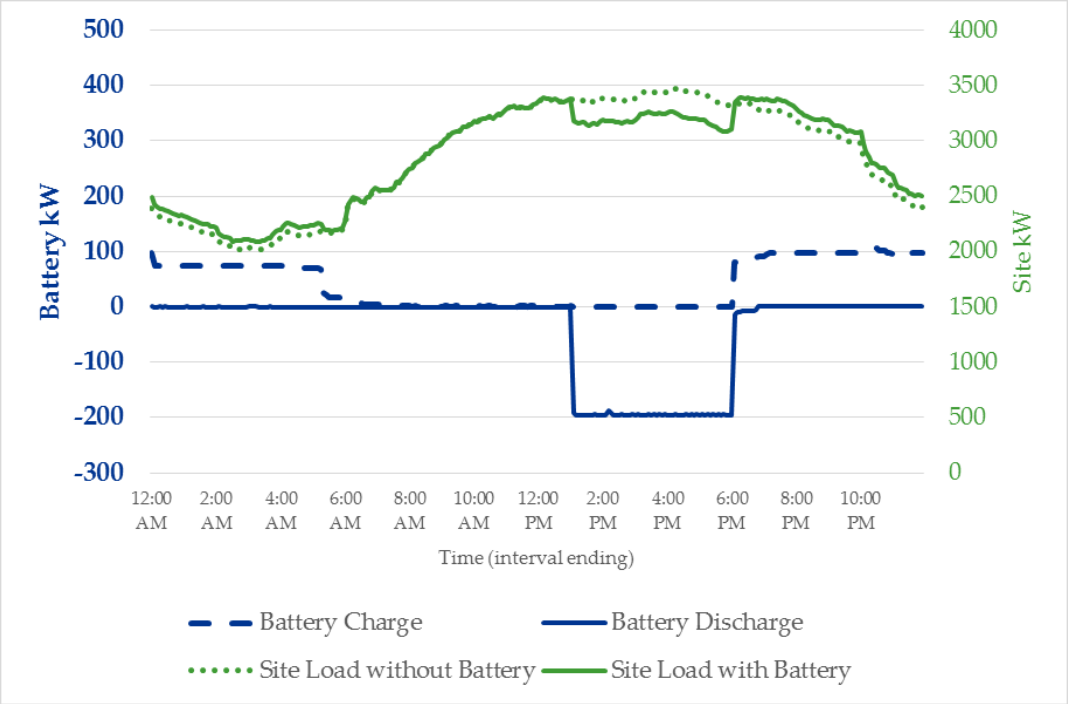
The variability of the manual curtailment offering can be seen in Figure 2.

Figure 2. DR By event (Adjusted 10 of 10 Baseline)



The battery solutions delivered the committed reductions with minimal variability between event days. The stable performance of the battery offerings is illustrated in Figure 3.

Figure 3. Performance of Battery (No Variation Between Dispatches)



The thermal storage solutions had one participant each. One solution met the reported reduction for its participating site; however, the reduction was much lower than the planned committed reduction for year 1. No general statements regarding the impact of this solution can be made at this time due to the low participation in year 1. The impact evaluation was inconclusive for the second solution; more substantial results will be reported after the summer 2019 season.

The BMS controls solution did not receive an impact evaluation for year 1 of the demand demonstration project because installation was not complete until the end of the summer season.

5.6 Net Energy Impact

The net energy impact was analyzed by the evaluation team for each of the participating solutions, with the exception of BMS controls since no sites were installed for the summer 2018 season.

5.6.1 Battery Systems

Battery solutions increase net electricity use on-site, as the amount of energy used to charge the batteries exceeds the amount of energy discharged by them. The difference is primarily lost as heat. Round-trip efficiency varies as a function of dispatch strategy, battery type, power electronics, and possibly other factors such as battery manufacturer.

The evaluation team found that the round-trip efficiencies of the two solutions were substantially different (81% for daily dispatch versus 53% for event dispatch). Although the net energy impact of the reduced efficiency was small for the two participating customers relative to their total energy use, this finding could be substantial once the program is rolled out to a larger customer base. Since the two battery solutions were deployed with different dispatch strategies, different electronics, and they used batteries manufactured by different companies, it is not possible to state with certainty how much of the difference in round-trip efficiency was attributable to the dispatch strategy and how much of it was attributable to the different batteries used or control losses. It is important to note, however, that both solutions used lithium ion batteries and controls losses are not expected to vary significantly. Hence, it is likely that the difference in round-trip efficiency was more due to the different dispatch strategies than battery manufacturer. This parameter will be worth monitoring in future seasons.

5.6.2 Non-Battery Systems

Thermal energy storage solutions can either save energy or increase its use. If the thermal storage is discharged during the hottest period of the day (as is typical) and recharged when the temperature is cooler, there may be kWh savings due to increased cooling system efficiency. Conversely, the addition of auxiliary electric equipment can increase energy use, as can new coils in air handlers of commercial rooftop systems. Thermal system net energy impact was examined at one of the two facilities. No measurable effect was found. Further evaluation is planned for future seasons.

Manual curtailment delivers net kWh savings when dispatched if the solution involves load shedding during DR triggers. If the curtailment solution involves a load shift (e.g. pre-cooling, load recovery), there typically is little net energy impact. In particular, if shifted load is weather-independent, there is likely to be no energy savings. As with thermal storage, if the load is weather dependent and the load is shifted to night when the outdoor air temperature is cooler, there may be small energy savings due to factors such as cooling systems running more efficiently or with less cycling.

BMS controls were not evaluated for impact in the summer 2018 season. BMS controls could result in energy savings depending on the measures deployed. Passive demand reduction, in particular, could result in significant energy savings.

5.7 ISO-NE Overlap Concerns

Demand response resources (DRRs) can participate in the ISO-NE capacity market. The capacity market has two components: a capacity supply obligation (CSO) component and a pay-for-performance (P4P) component.

Capacity supply obligation. An active DRR bids load reduction into the capacity market at a chosen price. If the market price goes above a certain threshold (bid clears), the DRR will be awarded a CSO. ISO-NE pays a fixed incentive for resources with a CSO regardless of actual dispatch. It is possible that a DRR could receive a monthly payment for being available via the capacity market and never actually be required to reduce load.

A CSO requires that a DRR participate in the wholesale energy and reserve market as well.

> **CSO wholesale market.** The wholesale energy market is a system for purchasing and selling electric energy using supply and demand to set the price of electricity. The energy markets operated by ISO NE are the Day-Ahead Energy Market (based on forecasted load) and the Real-Time Energy Market (difference between the day-ahead commitments and actual load and generation).
>
> A possible strategy for DRRs participating in the ISO-NE involves bidding into the energy market at levels that make it unlikely the resource will ever clear. This is consistent with the reality that most DRRs are not interested in regular load curtailment (they prefer to have minimal interruptions and dispatch infrequently for larger payments). This approach can be used by DRRs to limit the occasions on which they would need to provide load reduction to capacity scarcity conditions. If the DRR can be dispatched as fast-start (30 minutes or less) they can bypass the energy market but be available on the reserve market.
>
> **CSO reserve market.** The reserve market is the backup capacity that serves as a contingency in case of unexpected outages.
>
> Dispatch on the reserve market would depend on the clearing price of reserves and this would be an additional opportunity for DRRs to be rewarded, perhaps with limited curtailment. A capacity scarcity condition[4] occurs when the electricity supply is constrained and the reserve capacity is deployed.

Pay for performance (P4P). Resources are paid for their performance during dispatch and penalized for inadequate performance.

[4] Definition of capacity scarcity condition from ISO NE Market Rule 1: A Capacity Scarcity Condition shall exist in a Capacity Zone for any five-minute interval in which the Real-Time Reserve Clearing Price for that entire Capacity Zone is set based on the Reserve Constraint Penalty Factor pricing for: (i) the Minimum Total Reserve Requirement; (ii) the Ten-Minute Reserve Requirement; or (iii) the Zonal Reserve Requirement, each as described in Section III.2.7A(c); provided, however, that a Capacity Scarcity Condition shall not exist if the Reserve Constraint Penalty Factor pricing results only because of resource ramping limitations that are not binding on the energy dispatch.

Under a full capacity scarcity condition, all capacity resources, whether available for reserve market or not, will be dispatched. Dispatch in the energy or reserves market, or due to capacity scarcity condition, is the P4P aspect of the capacity market. Resources that clear during the scarcity conditions are evaluated by ISO-NE to ensure that they delivered the expected load reduction. They are paid for their performance and penalties are levied on resources that do not provide the expected load reduction. ISO-NE uses its standard adjusted 10 of 10 baseline to determine performance during a scarcity condition.

Interaction between utility and ISO market participation. The concern with respect to the utility demand response participation is two-fold. One is that DRRs could be committed to serve both ISO-NE and Eversource at the same time. The second concern is that participation in the utility DR events would result in eroding the ISO-NE baseline for performance or vice versa.

Regarding the first concern, a CSO commits a resource to provide the load reduction when ISO-NE needs it. If participation in the Eversource program undermines that commitment, then it is problematic for the ISO. Furthermore, to the extent that both entities are paying for access to the same resource at the same time, there is a question of either double counting or free-ridership. Since a capacity scarcity condition occurs due to supply constraints and peak demand conditions occur due to increased usage, the likelihood of them occurring at the same time has historically been low.

For the demand demonstration project, the concerns depend on the technology and dispatch strategy employed.

- Thermal Projects - For thermal storage resources that dispatch daily during a fixed window, they would participate in the capacity market as passive resources, thereby being subject to customized M&V requirements. This is because they are not actively being dispatched based on scarcity conditions, but instead, offer consistent load reduction during the peak hours each day. Passive resources do not set prices in the ISO-NE market and ISO-NE would ostensibly get the resources they pay for, so ISO-NE would not have concerns about this resource. From the Eversource perspective, there could be a free-ridership issue. To the extent that the CSO is sufficient to motivate the load reduction then Eversource should not be paying additional incentives.
- Batteries - Batteries would participate in ISO-NE markets as generation resources. They would provide positive and negative performance data for all hours, avoiding baseline-related issues. Depending on the strategy for participating in the ISO-NE markets, there is the possibility for conflicts with the Eversource program, as described below for active DRRs.

- BMS controls - For BMS controls measures, the categorization based on ISO-NE market would depend on the demand reduction strategies (active or passive reduction). If they opt for passive strategies, then they would function similar to the thermal resources discussed above. If they function as active demand resources, they that would participate in the capacity market as described for active DRRs.
- Manual curtailment resources - Manual curtailment resources would likely participate in the capacity market as an active demand resource.

For active demand resources participating in both the demand demonstration project and ISO-NE markets, potential issues depend on the specific activity in the ISO-NE markets. Currently the contracts with the various vendors state that an ISO-NE trigger would take precedence over a utility-called event. The goal of this language was to avoid overlap between the two entities. This solution was mapped out before Eversource fully understood the potential overlap issues. The practical feasibility of this approach is challenging due to timing and it is not clear it fully addresses the concerns. For instance, Eversource events could occur earlier in a day than a capacity scarcity condition. As a result, the resources might be unavailable and/or the baseline adjustment corrupted. Under either scenario, ISO-NE expectation of access to the resource would be undermined. Furthermore, activity in the energy market, though less likely for DRRs, would be difficult to impossible for Eversource to track.

A more realistic option would allow DRRs to have a CSO and be active on the reserve market as discussed above. DRRs would make themselves unavailable to ISO-NE when the aggregator intends to participate in utility DR events. If a capacity scarcity condition arose on that day, the DRR would face penalties for not being available. However, this approach would ensure that ISO-NE had an accurate understanding of the available resources and would prevent the aggregators from being double-paid by the utility and ISO-NE for those hours. This strategy relies on prior experience that capacity scarcity conditions typically do not occur during peak load periods. The two entities are effectively paying for the same resource but at different times. This option may address the concerns for active DRRs. Further exploration will be required to understand the best options for the thermal and battery resources if they opt to participate in ISO-NE markets.

6 Evaluation Findings and Recommendations

Through the evaluation thus far, the evaluation team has identified eight key findings:

1. **Reporting by technology:** The batteries and manual curtailment solutions reduced load as expected and reported. The thermal storage solutions' performance was as reported for one vendor and unclear for the second. More clarity on the thermal storage solutions will

be available after the 2019 summer season. The impact of the BMS controls solution was not evaluated in year 1.

2. **Installed Capacity Tag (ICAP) reduction:** The ICAP hour is the ISO-NE system peak hour for the entire year. The evaluated demand reduction at system peak hour (August 29, 2018, hour ending at 5 p.m.) was 8,669 kW, with 97% of demand reduction resulting from manual load curtailment.
3. **Performance variation:** Manual curtailment results were particularly variable across events. This was due to two factors: customer behavior and the baseline algorithms. An extreme example of both occurred on the days either side of July 4th, which fell on a Tuesday. Some manual curtailment participants were already shut down likely due to the holiday (behavior) but received no credit due to baseline adjustment. Total load curtailment for those days was lower as a result. The batteries were found to be more consistent in delivering load reduction.
4. **Net energy impact:** Battery solutions would result in an electric energy penalty (53% for the site with the event-based dispatch solution and 81% for the site with the daily dispatch solution), while thermal storage, manual curtailment, and BMS controls could result in energy savings depending on the demand reduction measures and dispatch strategies employed.
5. **Recruiting:** A mix of recruiting approaches were employed for these projects, ranging from almost entirely vendor-driven to almost entirely account executive (AE)-driven. AE involvement, while very beneficial, could create delays if AEs were pulled for other responsibilities, such as for other programs or even customer support during winter storms.
6. **Demand versus energy education:** AEs and customers are not used to thinking in terms of kW reductions and ICAP. Training and education are required to expand thinking beyond traditional energy efficiency metrics.
7. **Technology education:** The energy storage (thermal and battery) market is nascent in Massachusetts, and lack of needs customer education is a barrier to participation. For thermal storage projects in particular, it was valuable to have a demonstration facility to show other customers.
8. **Customer satisfaction:** In general, participating customers were very satisfied with their respective projects.

The evaluation team has developed crosscutting recommendations in response to evaluation findings for year 1. They are categorized below into program -design-oriented recommendations and evaluation-oriented recommendations.

Program -Design-Oriented Recommendations

- **Recommendation #1: Consider how to balance recruiting expectations between the vendor and the Eversource AEs**. Eversource's AEs increased the program's marketing effectiveness and reduced costs. They acted as a valuable resource for the demonstration projects by prescreening potential customers and coordinating between vendors to minimize competition. Several vendors noted, however, that while some AEs were helpful, others faded away and attended more to other priorities, sometimes unpredictably. In addition, the four back-to-back winter storms in March 2018 pulled AEs away for storm duty, delaying their ability to start recruiting. Consider how to clarify the amount and timing of AE involvement in order to create more certainty for the vendors.
- **Recommendation #2: Continue to work with the interconnection team to advocate for a streamlined interconnection process**. The interconnection process, as designed, does not adequately distinguish between different types of distributed energy resources – in particular, exporting vs. non-exporting – and can lead to prohibitively long review times. While this is handled by a separate division that the Demand-Side Management (DSM) staff have no control over, the program team should continue to meet with the interconnection team to understand the process and share their knowledge about the value of creating different pathways for review, especially for non-exporting resources.
- **Recommendation #3: Use a centralized dispatch platform to call DR events and allow enough time for vendors to integrate before the summer**. Eversource used a third-party load control dispatch platform on a pilot basis for some projects in summer 2018. One vendor stated that they preferred the platform over receiving emails from Eversource, but the software integration was tricky and needed more time ahead of the summer. While sending out emails to vendors was sufficient for the small number of vendors and events seen in the pilots, a centralized platform allows for much greater scale for Eversource in its future program. Eversource has indicated that this is their intention.
- **Recommendation #4: Continue to work with battery implementers to optimize recharging.** Battery recharging should be optimized to ensure that recharging does not contribute to the facility peak demand. Delaying the charging to night time instead of late evening would potentially reduce the facility peak demand charges to the extent that monthly peak occurs during this period, and could relieve Eversource of early evening peak load just outside of the contracted period.
- **Recommendation #5: Use thermal storage for longer dispatch windows.** Based on the limited number of thermal storage projects that were evaluated in year 1, it appears that there is potential for longer dispatch windows to be implemented. Based on low rates of temperature increase, the thermal mass appears to have more capacity than is being

realized. This would be site-specific since the space temperatures would be the primary consideration. It would be beneficial for Eversource and the vendors to explore this possibility during the project scoping.

- Recommendation #6: Eversource should continue to explore the optimal relationship between Eversource load control programs and the ISO-NE market offerings. Eversource wants to increase control over its own peak load and explore the potential for value stacking (the bundling of multiple value streams to improve the economics for distributed energy resources) without undermining the ISO-NE markets. Multiple challenges exist including:

  iv. Prioritization of load reduction between Eversource and ISO NE

  v. Influence on the ISO-NE market participation and reliability.

  vi. Degradation of one another's baseline.

  Vendors should be required to indicate their ISO-NE market participation strategies to avoid unanticipated consequences.

Evaluation-Oriented Recommendations

- **Recommendation #1: The vendors should provide their initial committed reduction per site and, at the end of each season, their reported load reduction.** Currently, the vendors do not consistently provide the committed and delivered demand reduction per site. This information allows the evaluation team to assess the vendors' ability to track delivered demand reduction, compare delivered to committed reduction, and present results in a more consistent manner.
- **Recommendation #2: The vendors should inventory and document all affected equipment.** Site visits conducted by the evaluation team are intended to be verification visits confirming the site conditions and equipment information presented by the vendors. However, a lack of project documentation has resulted in the evaluation team conducting inventories of existing equipment and extended discussions with site staff to understand the demand reduction plans to be implemented. This adds cost to Eversource and disrupts customers more than necessary. The vendors should provide this information in a systematic manner to enable the evaluation team to verify the site conditions without having to duplicate efforts.
- **Recommendation #3: Involve M&V contractor during DR feasibility testing to allow for real-time verification of manual curtailment and BMS controls projects**. In order to prevent customer fatigue, and to allow for an easier evaluation of the implemented projects, the BMS controls and manual curtailment project vendors should include the

evaluation team in the feasibility testing phase of the projects. This will allow evaluators to understand the equipment operation and load reduction through the test, rather than having to conduct an additional site visit for the same purpose.