

# Eversource Demand Reduction Approach

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## Executive Summary

In the 2016-2018 Three Year Plan proceedings, Eversource noted that “the Company has been very deliberate in its approach to reviewing demand reduction technologies and demand response offerings” and described a research strategy for potential demand reduction solutions (see DPU-COMM 2-38 in D.P.U. 15-169). Pursuant to this strategy, the following demonstration project proposals are designed to leverage opportunities to lower peak demand and save customers money, and include battery storage, thermal storage, software & controls, active demand response, and integrated energy efficiency approaches that reduce energy use and peak demand. Eversource, in collaboration with its fellow Massachusetts Program Administrators, researched successful demand reduction program models and explored new innovative approaches and technologies which could potentially be successfully deployed to address the unique opportunities in the Commonwealth. As discussed extensively below, Eversource proposes to use innovative, targeted approaches for a variety of customers in order to address their specific demand opportunities. By using a Request for Proposals (“RFP”) strategy, Eversource plans to solicit the best demand reduction strategies and technologies in the market using competitive procurement to the maximum extent practicable (consistent with the Green Communities Act) to test and develop initiatives that will help maintain Massachusetts’ leadership in energy efficiency and demand side reduction strategies.

In developing strategies to address demand opportunities, Eversource’s research included review of studies and literature, projects in other jurisdictions and communicating directly with other PAs, program implementers and technology companies, regulators and evaluators. The primary findings from that research include:

- Reducing peak demand produces a variety of benefits for customers, utilities, and the regional power grid as a whole, the most significant of which can be lowering capacity costs.
- The ISO New England system-wide summer peak is driven by the overlap of usage patterns among all rate classes, rather than by spikes in any one customer class. This indicates that solutions that address all customer types will be needed to meaningfully impact the total system peak.
- Peak prices are a function of both supply and demand. The demand part of the equation is more easily predicted and managed than the supply side, since demand depends largely on weather and time of day. Since the system load peaks in the summer, projects designed to reduce summer peak demand will have the greatest impact on reducing the maximum system load, which is what determines the required size/capacity of the electric system. Projects designed to reduce summer peak demand may also create opportunities to reduce winter load.
- The type of solution needed to reduce demand varies by customer type, as each has unique opportunities. Eversource developed six core customer personas that capture types of customers with similar opportunities and challenges.
- While the range of technologies available to manage demand is expanding, more information is needed to foster their adoption.
- Active demand response programs must be designed carefully in order to avoid fatiguing customers.

Based on careful review of these findings, as well collaboration with other PAs and stakeholders in the Demand Savings Group, Eversource has identified a diverse portfolio of demonstration projects that it believes will begin to reduce peak demand for a broad range of customers in Eversource territory in 2017-2018, and will inform design of a full scale demand reduction program to be implemented beginning in 2019 if appropriate. Eversource's strategy in developing these demonstration projects is to:

- 1) Ensure that demand reduction solutions address a range of customers that contribute to the system-wide summer peak, but without duplicating approaches currently being tested by other Program Administrators, in keeping with the goal of having different PAs offer and test unique and complementary approaches.
- 2) Test a broad range of solutions to reduce demand, from new technologies (e.g., batteries) to revised strategies for existing solutions (e.g., deploying active demand response in new ways). The demonstration projects chosen also allow for a range of customer involvement, from full automation (i.e., customers need not take any action to reduce peak demand) to signals that then allow customers to decide which steps are appropriate at that time for them to reduce demand. Solutions will be deployed and evaluated for their impact on summer peak demand as well as winter demand, where applicable.
- 3) Test solutions that integrate with existing energy efficiency programs, as well as those that are wholly separate from energy efficiency and require new approaches to implementation and evaluation.
- 4) Leverage the power of the market to gather the most effective solutions for demand reduction.

To fulfill this strategy, Eversource is proposing to test a portfolio of demonstration projects in the 2017 and 2018 program years. These demonstration projects will address a wide range of customers, including large, medium and small commercial and industrial ("C&I") customers, and will test a variety of strategies and technologies, including technical assistance, training, sub-metering, battery storage, thermal storage, software and controls, and active demand response. For those peak demand reduction approaches that can be carried out alongside existing Energy Efficiency programs, Eversource will develop integrated demonstration projects with current funding. Finally, for other approaches which test new technologies and strategies that go well beyond energy efficiency, Eversource will use a competitive bidding process, specifically a Request for Proposals ("RFP") to select a portfolio of the most effective technologies for demand reduction. In order to ensure that a large range of market-ready demand mitigation technologies was included in the RFP, Eversource drafted and participated in a statewide Request for Information ("RFI") in August 2016. In this filing, Eversource is seeking approval for funding that would allow the Company to test and install the technologies identified through the RFI and enumerated in the RFP. Specifically, Eversource seeks funding to test strategies that include battery storage, thermal storage, software & controls, and active demand response.

Eversource expects that the demonstration projects<sup>1</sup> themselves will result in demand reductions in 2017-2018. However, Eversource believes it is essential to conduct demonstration projects prior to

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<sup>1</sup> Note that within the Executive Summary, the phrase "demonstration projects" refers to projects for which additional funding has been requested. The following Tables 1-5 include information pertaining only to these projects and excludes the existing customer approaches integrating demand and energy efficiency.

developing a full-scale program. While peak demand reduction technologies have been tested to various degrees in other jurisdictions, Massachusetts has different load profiles, rate structures, avoided costs, market costs, and climate than other jurisdictions, such that cost effectiveness and customer acceptance rates cannot necessarily be inferred from elsewhere. In-the-field demonstrations, combined with the lessons learned from fellow Massachusetts PAs' demonstration projects, will enable Eversource to design an optimal portfolio of demand reduction programs long-term that reflect the mix of customers in the Company's service territory. The proposed demonstration projects will be used to test and adapt program designs in order to maximize peak demand savings and cost effectiveness in Massachusetts. Both summer and winter seasons will be examined.

Eversource intends to deploy the proposed demand reduction solutions as soon as funding is approved and has worked to expedite the process as much as possible. For example, the aforementioned RFP has been developed concurrently with this filing and has been released in advance of funding. The intent of this approach is to be prepared to execute contracts with selected vendors as soon as possible following any funding approvals. Ideally, this will enable deployment in time for the summer of 2017 for the technologies with relatively short sales cycles and straightforward permitting. Technologies with longer sales timeframes will be accelerated by working with the selected vendors' pipeline projects whenever possible.

For some of the technologies Eversource is proposing to test, new methods of calculating and evaluating savings will be needed. The traditional Evaluation, Measurement, and Verification ("EM&V") methodologies employed in Massachusetts are not designed to account for time-dependence of savings, and techniques such as billing analyses would be unable to capture efforts such as load-shifting, since the total load wouldn't be changing. The Massachusetts Program Administrators, through a statewide procurement, have selected evaluation firms to develop these new methodologies to properly calculate and value demand reductions.

Eversource is asking for a total of \$21,461,000 to fund the deployment and evaluation of its demand reduction demonstration projects, to be collected through the Energy Efficiency Surcharge.

Eversource has submitted this proposal and asked the Energy Efficiency Advisory Council ("Council") to formally support the deployment of these projects through a Council resolution, which is including with this filing package. Eversource is asking for the Council's support before seeking formal Department of Public Utilities approval for these projects and related expenditures. Eversource's approach is designed to enable the Company to deploy new technologies and approaches that reflect the best that current markets have to offer. Eversource will document lessons learned and assess the effectiveness of these approaches, using a set of key questions and criteria, in order to enable the success of larger scale roll outs.

## Proposed Budget

Eversource is requesting funding for its demonstration projects in four main areas: battery storage, thermal storage, software and controls, and active demand response.<sup>2</sup> These demonstration projects will test technologies and delivery approaches for viability, cost effectiveness, and how to measure results. Due to the peak demand reduction/shifting focus, rather than energy reduction, of these projects, these strategies do not fit into the existing efficiency programs (e.g., battery storage can result in an increase in kWh use by customers). Based on the results of the RFI and additional research, Eversource developed estimates of the potential cost of demonstration projects, along with supporting tasks such as EM&V, program management, and marketing. Since the cost of each technology varies widely, Eversource plans to scale the size of each demonstration project so that the budget is allocated across the solutions.

**Table 1. Proposed Total Budget by Cost Category**

PP&A	Marketing	Participant Incentive	STAT	Evaluation and Market Research	Total Program Costs
\$800,000	\$400,000	\$9,155,000	\$ 9,155,000	\$1,951,000	\$21,461,000

**Table 2. Estimated Budget by Technology Type (Incentive & STAT)**

Solution Technology	Total
Battery Storage	\$5,000,000
Thermal Storage*	\$3,900,000
Software & Controls	\$4,140,000
Active Demand Response	\$5,270,000
<i>Large C&amp;I</i>	<i>\$3,250,000</i>
<i>Small C&amp;I</i>	<i>\$2,020,000</i>
<b>Total</b>	<b>\$18,310,000</b>

\*Thermal Storage includes Ice Storage and Phase Change Material. We have not allocated the costs between these two demonstration projects at this time because we are waiting for responses to the RFP and more information about customer acceptance.

<sup>2</sup> As discussed above, Eversource will also implement several integrated strategies through its existing energy efficiency programs that will provide further peak demand reduction but those strategies will be supported through the Company's already approved energy efficiency program budgets.

## Estimated Timeline

Eversource’s goal is to test demand reduction solutions during 2017 and 2018 in order to inform the 2019-2021 Three Year Plan. In order to get these demonstration projects in the field as expeditiously as possible, Eversource is undertaking multiple parallel processes. For example, Eversource has released an RFP for demand reduction technologies while still awaiting budgetary approval, instead of waiting for approval and then issuing an RFP. This should allow Eversource to sign contracts with demand reduction vendors as soon as the budgetary request is authorized. Additionally, Eversource is actively working towards recruiting customers for battery and thermal storage projects due to their long sales and implementation cycle. Below is a high level schedule for Eversource to deploy each solution technology with a commitment to be in the field as quickly as reasonably possible. It should be noted that Eversource does not necessarily have to wait until the summer to start testing technologies and will begin testing technologies as soon as they can be installed.

**Table 3. Estimated Timeline**

Solution Technology	Year(s) of Testing
Battery Storage	2018
Thermal Storage	2018
Software & Controls	2017-2018
Active Demand Response	2017-2018
<i>Large C&amp;I</i>	2017-2018
<i>Small C&amp;I</i>	2017-2018

Due to the nature of this proposal, there are several extenuating circumstances outside of the Company’s control that do not allow it to produce an explicit timeline of events. Ideally all customers participating in the demonstration for software and controls and demand response will be enrolled in 2017 and continue their participation in 2018. Eversource plans to work with the selected vendor on a customer acquisition plan, which will be shared with the Demand Reduction Subcommittee, to enroll as many customers as possible for the initial roll-out in 2017. If customer acquisition takes more time, additional customers may be added before 2018. For projects that are being tested over the winter, once again the goal is enroll those customers in the summer of 2017 (or before) and have the same customers participate in the winter and summer of 2018. Eversource commits to providing regular updates, the first of which will be at the time that contracts are signed. One of the goals of the demonstration projects is to learn more about these technology-specific sales and implementation timelines, in order to develop strategies for program level implementation. Accordingly, the preceding should be taken as a good faith projection, based upon the best information currently available, and the actual schedule will have some variations based upon the factors noted above. In addition, from a regulatory perspective, the Company does not know when EEAC or DPU approval for the budget will be granted.

## Estimated Number of Customers

Eversource used vendor responses to the RFI to help guide its estimate of the number of customers that could potentially participate in its demand demonstration projects in 2017 and 2018. There is a wide range of anticipated number of customers because it is not yet known what the customer acceptance rate of different types of technologies will be or the most common configuration of those technologies. For instance, the Company may find that there are more customers that can accommodate or prefer a 500 kW battery versus a 1 MW battery. In that case, we would expect to see a larger number of customers participating in the demonstration project within the given budget. This same principle applies to the other solution types. The solution may vary considerably between customers, which will have budgetary impacts, which in turn will impact the number of customers that can participate. Even at the low end of the range, Eversource believes that it is a sufficient number of customers to answer the key questions highlighted throughout this narrative.

Again, the preceding participation figures are estimates based upon the best information currently available and actual participation will vary.

**Table 4. Estimated Number of Customers**

<b>Solution Technology</b>	<b>Anticipated # of Customers</b>
Battery Storage	5-30
Thermal Storage	50-115
Software & Controls	80-400
Active Demand Response	840-1150
<i>Large C&amp;I</i>	40-150
<i>Small C&amp;I</i>	800-1000
<b>Total</b>	<b>975-1,695</b>

## Estimated Savings

Eversource does not have a strict MW reduction goal as part of its demonstration projects. The goals of Eversource’s demonstration projects are to test the viability of new technologies and strategies, and answer key research questions associated with each technology and strategy. Eversource anticipates testing different reduction strategies that are described in the various sections throughout this narrative. For example a 4 MWh battery could possibly be dispatched at 4 MWs for 1 hour or 1 MW for 4 hours. Depending on the strategy employed, there would be very different MW reduction values. Related to these MW reduction values is the cost associated with each type of demand reduction measure. Certain types of installations may be more expensive than others, limiting the number of measures that can be installed. For example, Eversource planned with average costs of battery installations but it is foreseeable in some instances that a smaller battery may cost as much as a larger unit. This in turn impacts the level of anticipated savings. There is also uncertainty of when projects will be in the field, which is highly dependent on the factors highlighted in the Proposed Timing section. Lastly, one of the key questions that the demonstration projects are trying to answer is what the actual level of savings is for each type of solution. Based off of best estimates from vendors responding to the RFI, the following good faith estimated range of peak MW and peak MWh<sup>3</sup> reductions is provided below.

**Table 5. Estimated Savings**

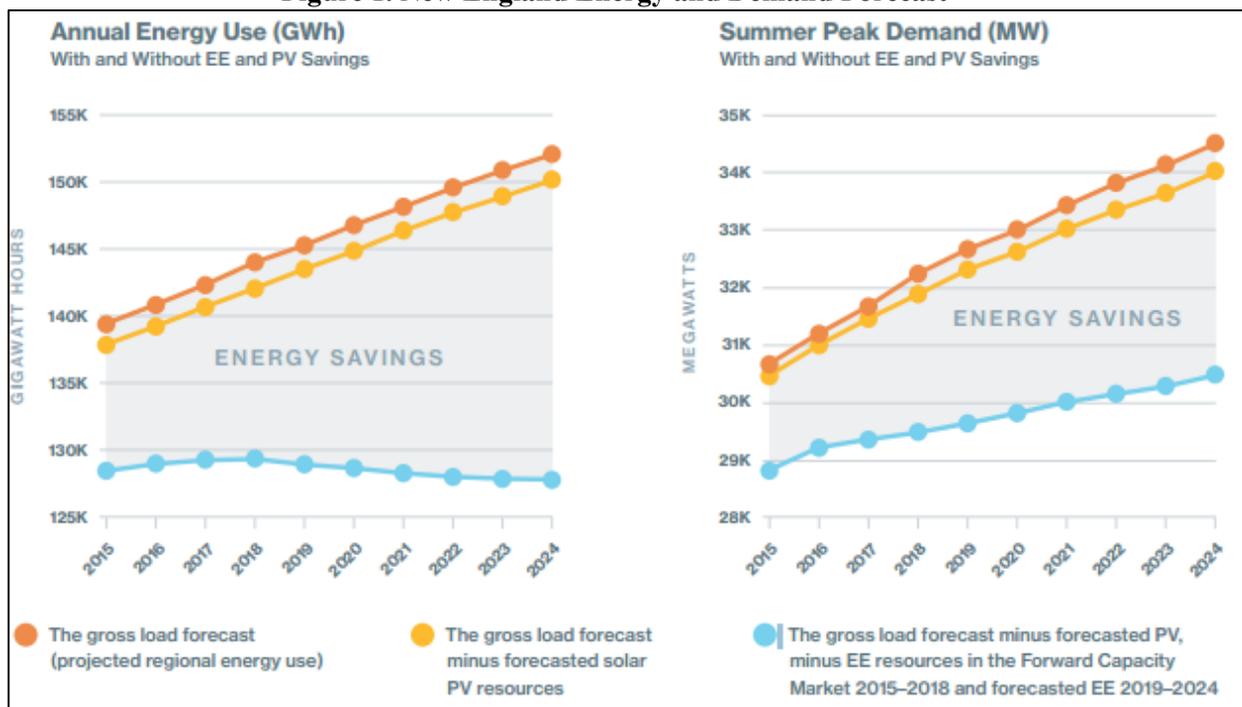
Solution Technology	Range of On-Peak Demand Savings Per Project Per Year (MW)	Range of On-Peak Savings Per Project Per Year (MWh)
Battery Storage	3.56-5.33	1,600-2,400
Thermal Storage	0.38-8.53	170-3,840
Software & Controls	4.44-6.67	2,000-3,000
Active Demand Response	3.79-7.72	1,705 – 3,474
<i>Large C&amp;I</i>	3.33-5.0	1,500-2,250
<i>Small C&amp;I</i>	0.46-2.72	205-1,224
<b>Total</b>	<b>12.17-28.25</b>	<b>5,475 – 12,714</b>

<sup>3</sup> Based upon 450 hours of peak demand (1-6PM on non-holiday weekdays in June, July, August and September).

## Problem Identification—Characterizing the Peak

Over the last several years, ISO New England has been forecasting an increase in the region’s peak demand with a corresponding decrease in energy usage (see Figure 1). This is an indication that the system is being used much more heavily during peak periods (summer afternoons) than during the remainder of the year. Capacity and other infrastructure is sized to meet the peak demand, meaning substantial costs can be incurred to meet the demand for those few hours of the year. These costs are becoming an ever-larger portion of New England’s total energy costs, and in fact in the 2016-2018 Energy Efficiency Plan, avoided generation capacity alone accounted for nearly 20% of the total electric benefits anticipated. While there are many potential forms that a demand reduction program could take, Eversource believes that a strategy focused on reducing capacity and other costs associated with peak demand will maximize benefits for the system and customers.<sup>4</sup> Therefore, Eversource’s approach will be centered on reducing usage during system peak times in order to drive down costs.

Figure 1. New England Energy and Demand Forecast<sup>5</sup>



In order to determine how best to mitigate the ISO-level peak, the Company, in collaboration with other Program Administrators, began its research by investigating the cause, taking a ‘bottom-up’ look at how various customer segments were contributing to the system load. Initially, it appeared that the residential class was driving the peak, as its load shape tracks very closely with that of the ISO load during the afternoon. However, the actual residential peak occurs at 8 PM, at which point the ISO load is already on

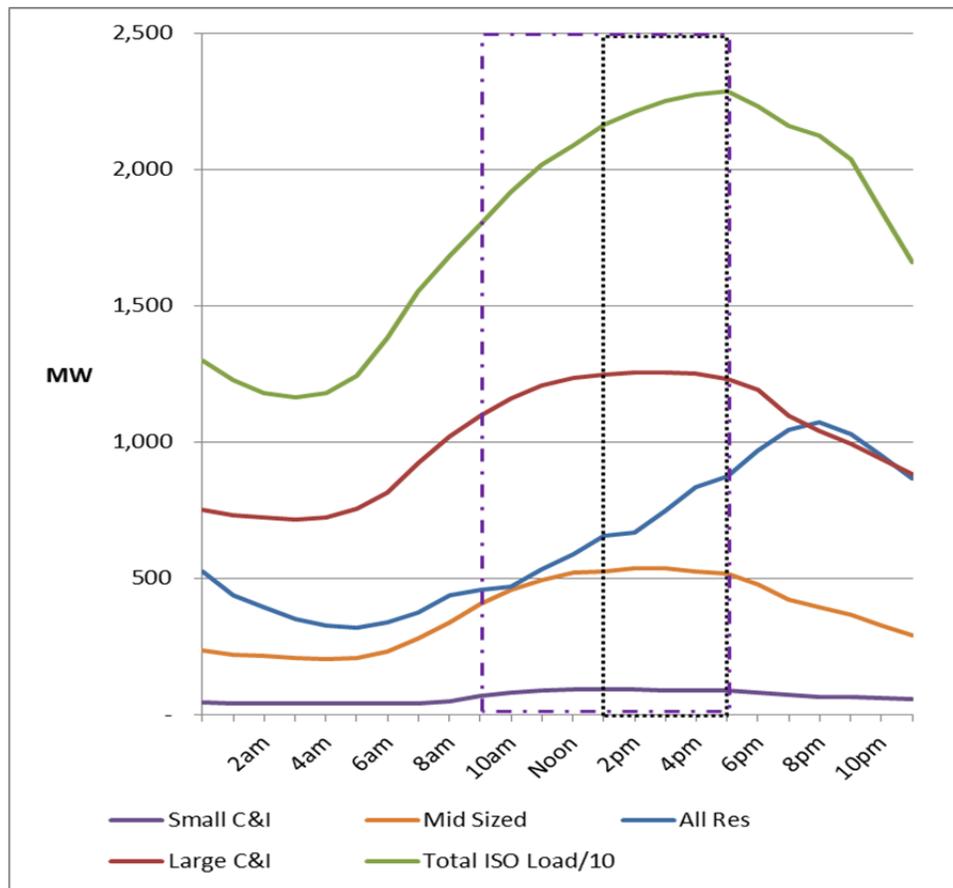
<sup>4</sup> While avoiding capacity costs will be the primary objective, Eversource does anticipate using this portfolio of demonstration projects to investigate how to maximize total benefits associated with demand reduction.

<sup>5</sup> ISO NE 2016 Regional Electricity Outlook. [https://www.iso-ne.com/static-assets/documents/2016/03/2016\\_reo.pdf](https://www.iso-ne.com/static-assets/documents/2016/03/2016_reo.pdf)

a downward trend, with its load curve then tracking with commercial & industrial load shapes. Eversource concluded, therefore, that the overall system peak is caused by a ‘layering’ effect due to the overlap of usage patterns among all rate classes (see Figure 2). It should be noted that the timing of this peak has, in recent years, been observed to be shifting later during the day, presumably due to the integration of solar photovoltaics. Eversource has taken this trend into account when defining its summer peak period.<sup>6</sup>

Additionally, when Eversource examined the peak-to-trough ratios of each rate class, it discovered that every rate class had a more pronounced peak on the ISO peak day than on an average week day, further supporting the ‘layering’ theory (see Figure 3 and Figure 4) and indicating that solution sets will be required across the board in order to have a consistent and measurable impact on system peak.

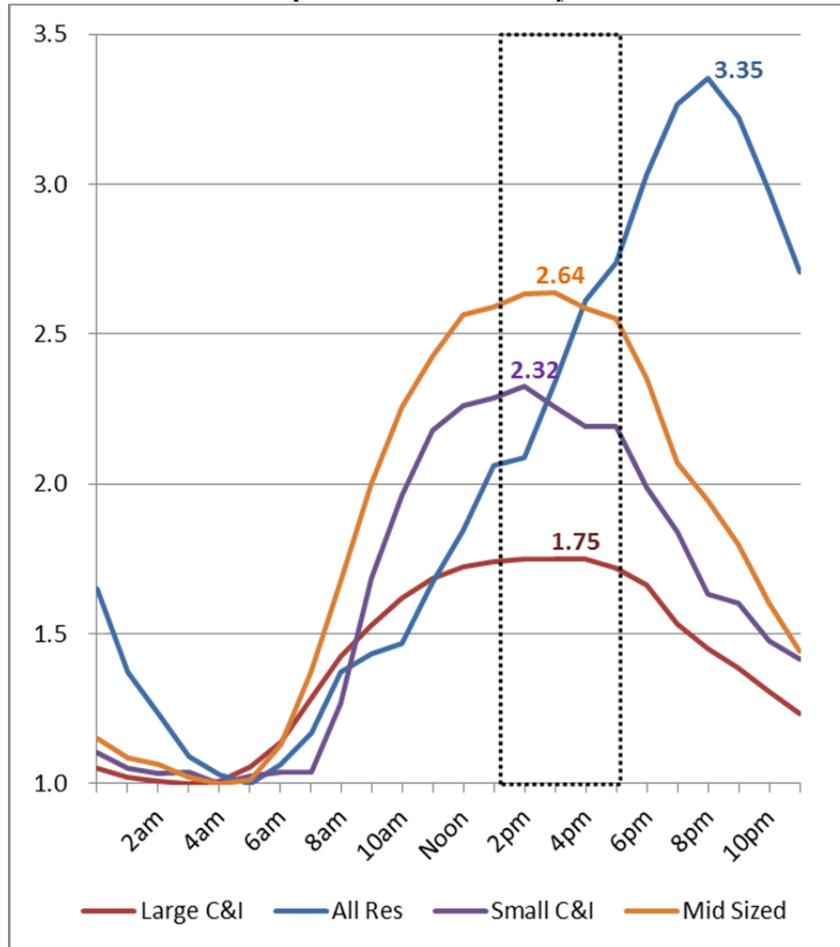
**Figure 2. Loads by Rate Class  
Representative Peak Day for BECO Territory**



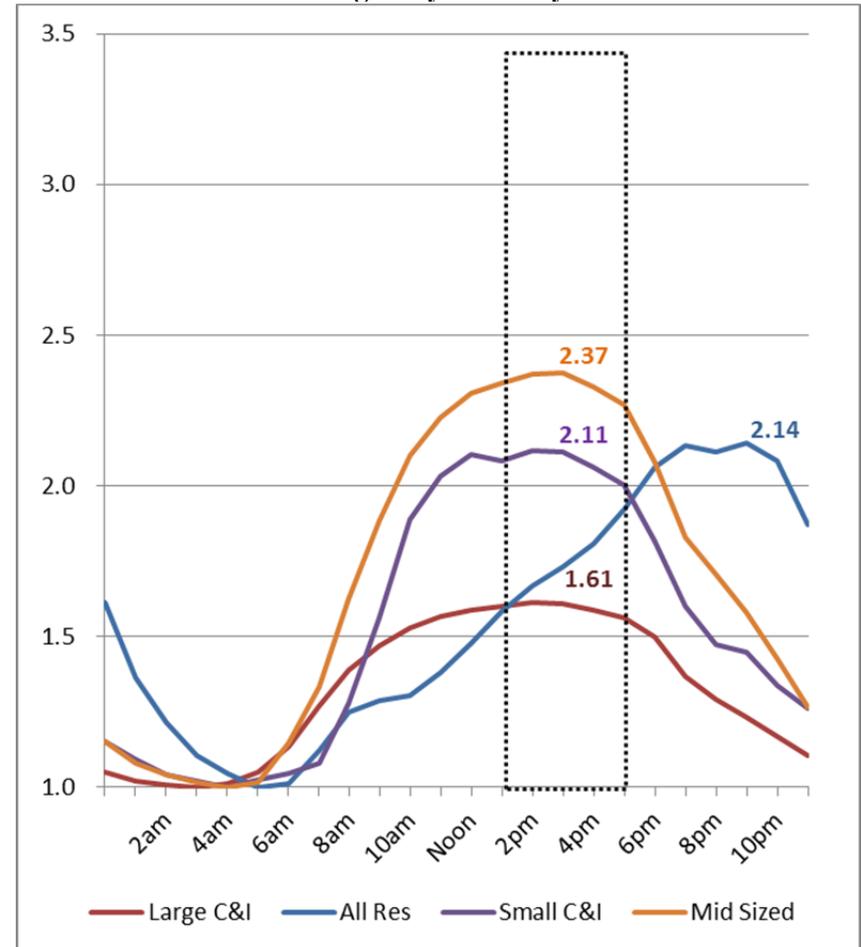
*The black dotted box in Figure 2 above shows the ISO Peak period, 1-5pm. The purple dashed box encases normal business hours, 9am to 5pm. It can be seen that while there is some increase in usage during the afternoon for each rate class, it is not as pronounced as might have been expected based on the shape of the overall ISO load. This supports the ‘layering’ hypothesis that all customer classes combine to give the ISO peak its unique shape.*

<sup>6</sup> In its RFI and RFP for demand reduction solutions (described later in this document), Eversource has defined the summer peak period as June through September non-holiday weekdays from 1 to 6 pm.

**Figure 3. Normalized Peak-to-Trough Ratio  
Representative Peak Day**



**Figure 4. Normalized Peak-to-Trough Ratio  
Average July Weekday**



*It can be seen in Figures 2 and 3 above that the load shape for every rate class is more exaggerated—that is, the peak to trough ratio is higher—on the peak day as compared to an average weekday. The class that changes the most is residential, suggesting that residential peak load is highly weather dependent and likely composed largely of air conditioning, whereas businesses may have more non-weather-dependent base load.*

## Problem Identification—Customer Personas

As noted in its 2016-2018 Energy Efficiency Plan, “the Company has had tremendous success in its previous Three Year Plans by building a deliberate, systematic go-to-market strategy for its offerings that provide real value to its customers.” In researching demand and demand reduction strategies, Eversource used its existing customer relationships to begin conversations with a wide variety of customers to determine what customers view as the challenges, opportunities, and potential solutions to reducing demand. Using this information, Eversource was able to develop a core set of personas that can be used as a framework for understanding customer behavior around demand.

- Large Commercial and Industrial (C&I) customers with time of use rates, high demand charges, and exposure to ICAP tags, of which there are two subsets:
  - Persona 1: Many large, sophisticated customers have already optimized their demand to a large extent. For these customers, further reductions to load during system peak hours may be challenging without impact to operations. For these customers, Eversource hypothesizes that there must either be on-site generation that allow customers to continue operations uninterrupted, or there must be additional payments from Eversource that make it “worth” the interruption in order to reduce peak demand.
    - For some customers (such as large retail), there may be not be an amount that Eversource can offer cost-effectively that would offset the perceived impact to customers. Eversource hypothesizes that these customers’ load during operating hours is highly inelastic.
  - Persona 2: There are some large customers who have not yet optimized demand despite the economic incentives. For these customers, Eversource’s hypothesis is that more information may be needed to motivate customers to reduce demand. For example, Eversource found that some facility managers who are not in close contact with their company’s fiscal staff are not aware of the existence of demand charges, and therefore are not actively managing demand. In addition, at some sites where there is not a facility manager, or where there is high turnover in facility staff, staff do not have information about what they can do to avoid demand chargers. This situation can also occur at sites with particularly complex systems, such as manufacturers and laboratories, where facility staff are unable to disaggregate the load in order to determine what best to turn off to reduce peak demand.
- Mid-Sized customers who have exposure to demand charges but not time of use rates, which may reduce their incentive to reduce usage during peak periods present different opportunities than large C&I customers. These customers may lack facility staff with knowledge of how to manage peak demand. Mid-sized customers often lack the budget to hire and retain highly-trained staff, and are also more likely to have older/less sophisticated building systems.
  - Persona 3: For businesses whose core operations are coincident with the ISO peak (such as office buildings), these combined factors can make mitigating the peak challenging.

Persona 4: For businesses with non-coincident operations (such as restaurants), however, it may be relatively easier to reduce load during the afternoon, as they may be able to simply switch off pieces of equipment that are not needed (e.g. food warming stations, etc.) Even at these customers, however, motivation remains a challenge, since reducing load during the ISO peak may not reduce their own peak, and so may not reduce their demand charges. Therefore, Eversource hypothesizes that solutions that also provide good energy efficiency savings will be most easily accepted by this persona, as those solution sets will maximize benefits.

- Small business customers who are not subject to either demand charges or time of use rates.

Persona 5: Small business customers do not currently have a financial incentive to mitigate demand through strategies such as load shifting or pre-cooling. In order to encourage these customers to reduce peak demand, Eversource may be able to create an incentive to encourage and enable customers to reduce peak demand. Eversource hypothesizes that a successful strategy for this persona must either be an energy efficiency measure that creates continuous savings, or incentive payments to participate in targeted events.

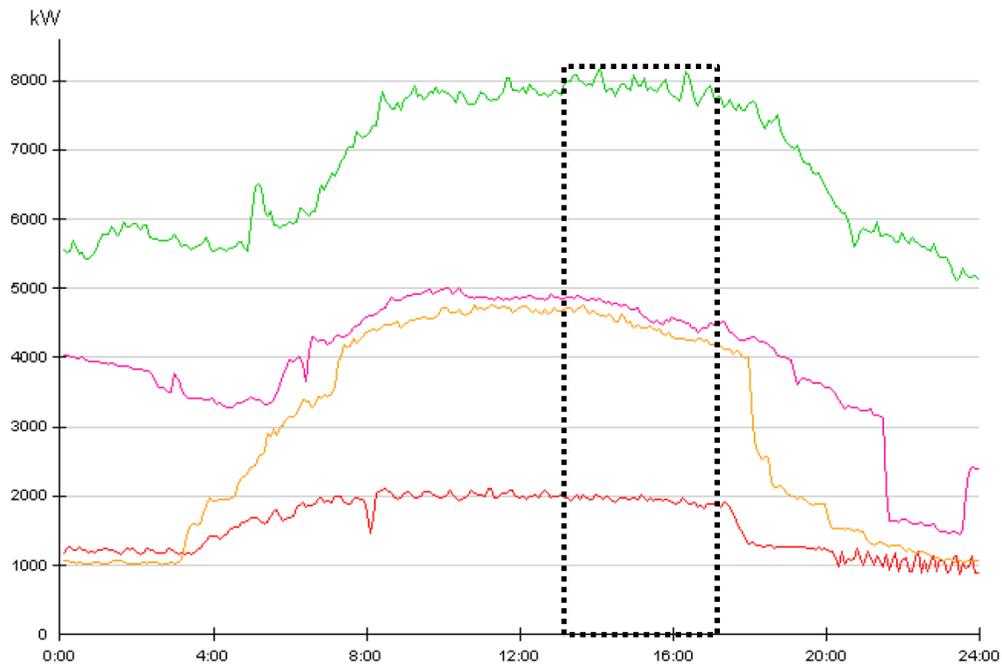
- Residential customers who are not subject to either demand charges or time of use rates.

Persona 6: As with Persona 5, residential customers do not currently have a financial incentive to reduce peak demand. Therefore, solutions that provide demand reduction as a secondary benefit may be more successful than those focused solely on demand reduction. As with Persona 5, Eversource hypothesizes that a successful strategy for this persona must either be an energy efficiency measure that creates continuous savings and/or incentive payments to participate in targeted events (e.g., an incentive to participate in an automated thermostat control program).<sup>7</sup>

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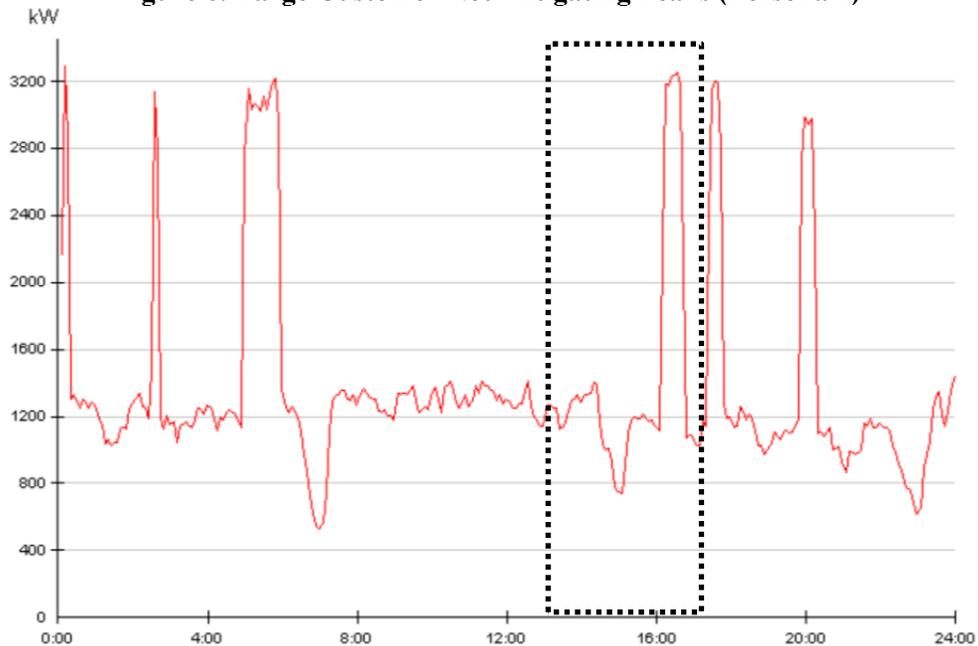
<sup>7</sup> Consistent with the collaborative approach the PAs are undertaking through the Demand Savings Group, other PAs are testing this hypothesis as part of their demonstration projects, and therefore Eversource is not proposing to test this strategy at this time. The PAs continue to collaborate on and share information regarding proposed demonstration projects in order to leverage efforts and results.

**Figure 5. Large Customer Optimizing Demand (Persona 1)**



*Figure 5 displays a large customer who has carefully managed their load to be flat during business hours, employing strategies such as pre-cooling. This customer indicated that additional reductions during afternoon peak hours would likely not be achievable for them. In contrast, Figure 6 shows a large customer who, despite having economic incentive to manage peak demand, is not doing so. Conversations with this customer indicated that a lack of understanding of the causes of their load made it challenging for them to manage it.*

**Figure 6. Large Customer Not Mitigating Peaks (Persona 2)**



**Figure 7. Mid-Sized Customer with Operations Coincident with Peak (Persona 3)**

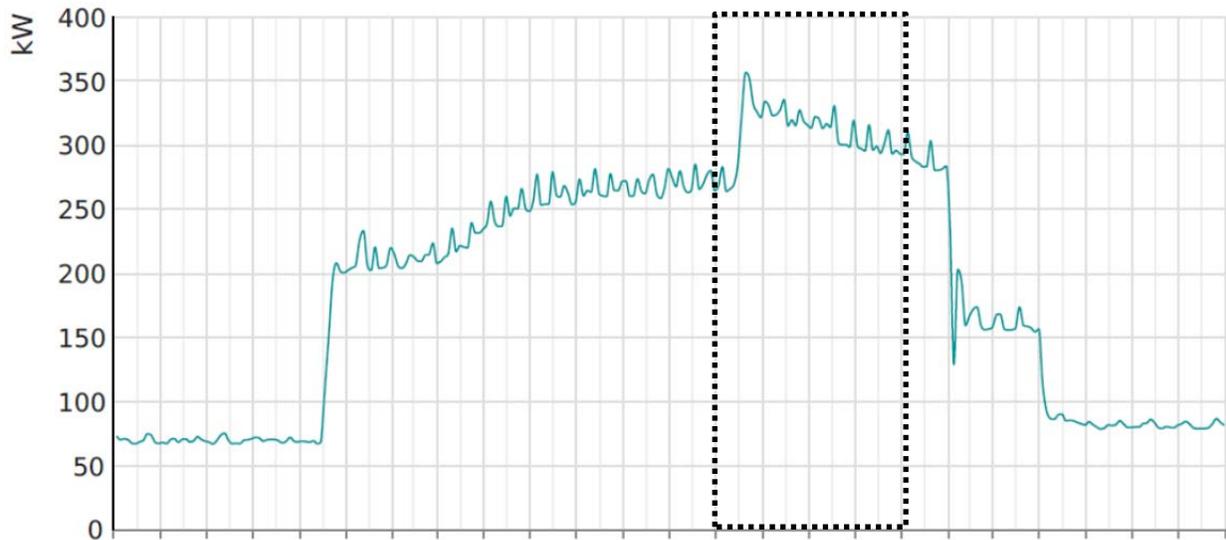
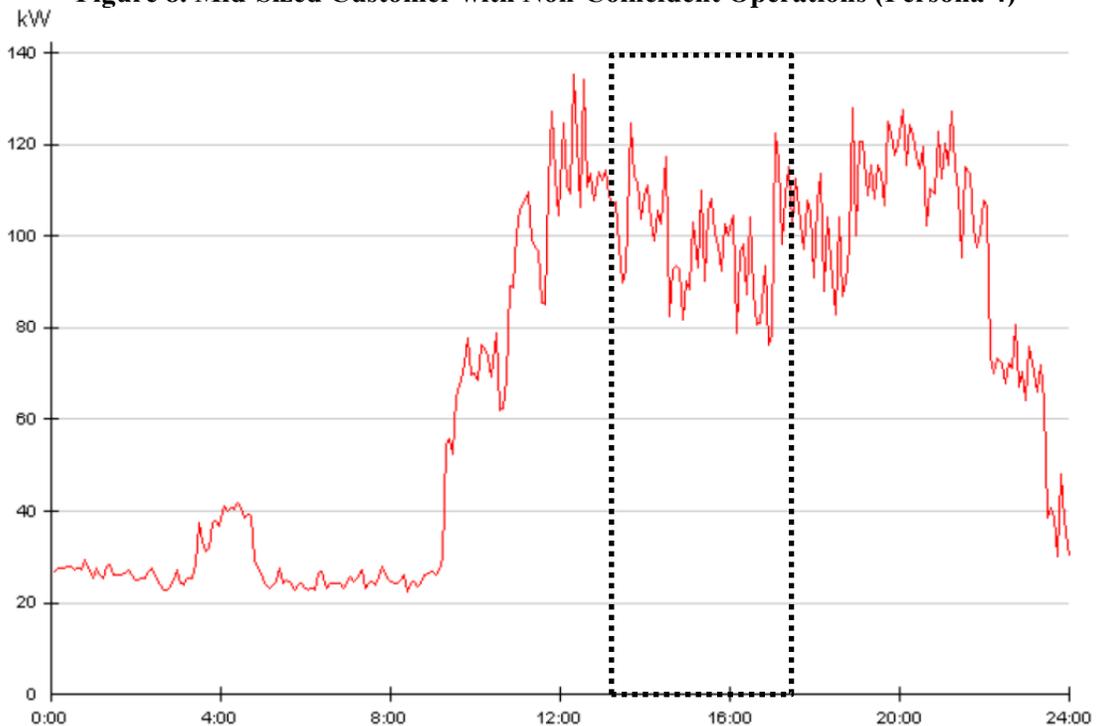


Figure 7 displays a mid-sized customer whose operations are coincident with the ISO peak and who has indicated that they lack on-site controls that would allow staff to more carefully manage demand, resulting in an afternoon spike. In contrast, Figure 8 shows a mid-sized customer whose operations are non-coincident with peak, causing a natural dip in usage during the afternoon hours. Replicating this at other customers with this persona, while creating small reductions at each site, could create meaningful reductions in total.

**Figure 8. Mid-Sized Customer with Non-Coincident Operations (Persona 4)**



## Proposed Demonstration Projects

Eversource has already begun work on several projects at customer sites with strategies that combine energy efficiency with a focus on demand. These projects are included in the proposed demonstration projects descriptions below because of their importance to the overall research strategy. However, the Company is not asking for additional funding for these projects in this filing.<sup>8</sup> Eversource proposes to issue a RFP to select technologies and delivery approaches for strategies that do not fit into the existing efficiency programs. Based on the results of the RFI and Eversource's research, Eversource anticipates awarding contracts for demonstration projects in four main areas: battery storage, thermal storage, software and controls, and active demand response. Through this budget request, The Company is asking for additional funding to deploy and test the viability, cost effectiveness and evaluation of these technologies.

Collectively, these demonstration projects will serve as the first step in designing and rolling out a full scale demand reduction project. Past experience suggests that developing demonstration projects before full scale program implementation is important to ensure that programs are well designed and implemented, that an optimal mix of technologies is deployed, and that the Company uses rate payer dollars judiciously.

A specific business model for each of these solutions has not been pre-selected, but rather Eversource intends to use the RFP to select vendors and then assess both the technology and the business model. Depending upon the technology, Eversource may be able to test both automated and dispatchable demand reduction solutions. More in-depth descriptions are included below in the selected technology solutions section for each technology.

## Key Questions

Eversource is seeking to answer the following key research questions for all demonstration projects included in the RFP. Note that each of the selected market-ready technologies will contribute information to further the Company's understanding of the key research questions. In turn, this increased understanding will be applied to the development of demand reduction strategies and programs for the 2019-2021 plan.

- What is the customer acceptance of the solution, and what delivery channels are most appropriate/effective?
- Which solutions are most appropriate for different customer types?
- What benefits/value streams does the solution provide to customers? To the utility? How do these depend upon the tested business models?
- Which solutions are applicable to address both summer peak demand and winter demand?
- At what scale are demand reductions achievable in Massachusetts?

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<sup>8</sup> Projects for which additional funding has not been requested are not included in Tables 1-5 above.

- Are there technological, economical, or regulatory barriers to full-scale deployment of the solution?
- How should/can reductions be screened and measured?
  - Does the solution fit into the existing evaluation and screening framework, or is a new approach needed?
  - Under what screening model parameters are these solutions cost effective? Are there additional benefits streams that need to be quantified?
- How does the solution complement or reinforce other efforts to increase energy efficiency and reduce peak demand?
  - Does the solution increase or decrease overall system efficiency?
  - Is the solution mutually exclusive with other peak demand reduction strategies, or is it complementary?
- How should each technology be used (i.e., what is the optimal operating profile)?

## Demonstration Project Descriptions

The following section describes the demonstration projects included in the RFP, the technology to be used, the general types of customers targeted, and questions to be answered as a result of the demonstration project. Specific details for each project are not prescribed, since Eversource anticipates selecting specific vendors based on the responses to the RFP, then working with those vendors to recruit participants. However, Eversource intends to test multiple vendors and business models where possible. In addition, flexibility in design of demonstration projects is needed to allow for course corrections to maximize lessons learned. While Eversource believes it has developed an extensive list of critical questions to be answered, the Company will make its best effort to collect all pertinent information that may be necessary to answer additional questions after demonstration projects have been run.

1. **Battery storage:** This solution involves behind-the-meter batteries for energy storage at large commercial, big box retail, and manufacturing customer facilities. Batteries can be dispatched during on-peak hours to reduce peak loads (either as a routine course of business during summer afternoons, when energy demand tends to be highest, or during specific events, such as during high spot market prices that may occur in the winter). Batteries are a rapidly developing technology, and while costs have historically been high, they are starting to come down.

There are various business models offering battery storage such as vendors selling the equipment directly to customers or vendors offering a full Performance Partnership Agreement (“PPA”) whereby the vendor and the customer split the cost savings. The business model will likely have an impact on how the battery is run, and what incentives are required to maximize utility system benefits from battery discharge. Eversource intends to select more than one battery storage vendor, with those selected having different business models, through its RFP process, in order to understand which business model is most advantageous to reduce system-wide peak demand and maximize other benefits. Eversource proposes to test the cost effectiveness of batteries as a demand solution, particularly in regards to dispatching of the battery. Specific questions that the demonstration project will seek to answer include:

- Is it more cost effective to deploy batteries for fewer discrete events or to discharge them on a routine (e.g., daily) basis? What are the costs and benefits of each approach? How many discharges are optimal per day, week, month, or season?
- What are the potential savings from dispatch in both summer and winter?
- What are the potential impacts and savings associated with the distribution system?
- What value streams, e.g., reduced demand charges, increased resiliency, islanding, and price arbitrage, are most important to customers adopting battery storage? How can these be maximized?
- Are customers willing to dispatch in response to grid needs, or only to manage their own peaks? How does this willingness depend upon the business model used to install the battery?
- What value do behind-the-meter batteries provide to all customers if deployed for grid needs? How can these values be maximized?
- How can the values to both customers adopting battery storage and ratepayers be aligned for mutual benefit?
- What are the characteristics of customers who successfully deploy battery technology?
- How does battery storage interact with sites that have solar? Is the value to customers increased when the two technologies are co-located?

Additionally, Eversource hopes to learn more about the logistics and viability of their installation (e.g., do customers have physical space for such an installation, and can their existing electrical systems accommodate it?) Eversource will also test how demand reduction from batteries should be evaluated, but it is anticipated that a pre-post analysis may be appropriate. Eversource believes that battery developers have developed an expertise in how to most appropriately dispatch batteries in order to maximize benefits and looks forward to continuing this research with an eye towards customizing it to Massachusetts conditions. The proposed budget will pay for battery equipment and installation, as well as measurement and evaluation. Eversource anticipates using both internal and external channels to recruit customers into these demonstration projects, notably the use of account executives that have existing relationships with large customers and battery installation companies that may already have a pipeline of potentially interested customers.

2. **Thermal storage:** Eversource proposes to test two types of thermal storage technologies for peak demand reduction: ice storage and phase change materials.
  - **Ice storage:** By using HVAC equipment to create ice (or chilled water) at night and then drawing on that thermal mass during the day, this technology has significant potential to reduce peaks due to air conditioning compressor loads. Moreover, because these systems run the compressors at night, when temperatures are cooler, they can boost the efficiency of the compressor and prolong its life. Historically, ice storage technology was challenging to implement due to space and maintenance requirements, but there have been recent developments that make it more viable for a wider range of customers. Eversource proposes to test the viability and cost effectiveness of ice storage as a demand solution for small and medium business

customers with air conditioner units between 3 and 20 tons. Targeted customer types will include but are not limited to small convenience stores, restaurants, strip malls, and college campuses. Specific questions that the demonstration project will seek to answer include:

- Is this a solution that can target peak loads later in the day?
- What are the characteristics of customers that can successfully deploy thermal storage?
- What value streams, e.g., longer lifetime of compressor equipment, lower O&M costs, and for customers on a Time of Use rate, potentially price arbitrage, are most important to customers adopting ice storage?
- Under what circumstances is thermal storage more cost effective than batteries?
- What are the efficiency implications of thermal storage?
- Is thermal storage appropriate for a wide range of customers?

The proposed budget will pay for customer outreach and ice storage installation costs, as well as measurement and evaluation. Eversource anticipates partnering with an ice storage vendor to help recruit customers into this demonstration project. Internal and external sales staff will be utilized as well as other business partners such as equipment dealers and electrical contractors.

- **Phase change material:** A phase change material (PCM) absorbs and releases thermal energy in order to maintain a regulated temperature. As the temperature rises, the PCM melts and absorbs heat energy. When the temperature falls, the PCM solidifies and releases heat back to the environment. PCM can be stored in small modular units that are easily installed in customer cold storage units or freezers to maintain temperatures even when compressor units are shut off (e.g., during peak demand hours). Eversource proposes to test PCM at large C&I facilities (e.g., warehouses) with cold storage or freezers. Specific questions that the demonstration project will seek to answer include:

- What are the characteristics of customers that can successfully deploy thermal storage? For what range of applications and temperatures is it effective?
- What value streams, e.g., resiliency in the event of a power outage, reduced peak demand charges, are most important to customers adopting PCM? What are the efficiency implications associated with PCM?
- How does PCM interact with EMS and controls?
- Does PCM provide savings in winter as well as summer?
- What are the non-energy benefits associated with PCM?

The proposed budget will pay for customer outreach and PCM installation costs, as well as measurement and evaluation. Eversource anticipates using internal account executives and program managers to recruit customers into this demonstration project.

3. **Software and controls:** There have been a number of software developments in the last few years whose specific purpose is focusing on ‘choreographing’ energy loads, either within a building or across the grid, in order to reduce the coincident load and drive down demand. Software and controls can now coordinate a wide range of customer assets, and some software solutions have the potential to scale up quickly at relatively low cost, because they do not necessarily require installation of hardware at customer sites.

There are many business models offering software and controls. These include, but are not limited to, software sales, shared savings, and software as a service. Given the wide range of customers and software solutions, Eversource intends to select more than one software and controls vendor, with those selected having different business models, through its RFP process. Additionally, Eversource anticipates working with more than one software vendor to test different software approaches, e.g., energy management portals that provide dynamic load monitoring and control, and software for digital queuing of electric loads. Potential software solutions will include applications that range from a complete automation of demand management to applications that are more amenable to customers accustomed to, or preferring, a more hands-on approach to manage their energy and demand usage and costs.

Eversource proposes to test the potential to reduce peak demand through software and controls for building automation systems, HVAC, refrigeration equipment, and/or other distributed energy resources.<sup>9</sup> These software solutions will be used to test the potential demand reductions for both summer peak demand and winter peak pricing periods. Target customers include big box retail, commercial refrigeration/cold storage, municipal, university, school and hospital markets, midsized businesses and industrial clients. Specific questions that the demonstration project will seek to answer include:

- Is software a viable approach for peak demand reduction?
- What scale of demand reductions is possible? In summer? In winter?
- What is the cost effectiveness of software approaches?
- What value streams and other advantages are most important to customers adopting software and controls? How automated are the solutions? What is the customer tolerance for allowing software to control systems?
- Are certain business models more amenable to additional incentives to target system demand peaks than others?
- What functions can software & controls manage?
- What are the most common standards and are there compatibility issues?

The proposed budget will pay for customer outreach, software programming and, if needed, installation of controls. Eversource does not anticipate paying a direct financial incentive to a customer for reduced demand. Eversource plans to work closely with software and controls vendors to identify customers that are appropriate for this demonstration project. Once customers are qualified, the selected vendors will work directly with customers to implement software solutions and

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<sup>9</sup> This demonstration is distinct from the Unitil demonstration project for software, which is focused on whether software can accurately predict economic events on the energy grid, and whether results can be monetized. In contrast, Ever

track peak demand savings. This process may include data analysis on facilities' load shapes to identify customers that present a good opportunity for load optimization through software & controls.

4. **Active demand response:** This approach involves recruiting customers to agree to reduce loads during peak demand events. Customers are compensated for their participation, and may participate through a variety of programs that range from full third-party-automation of the response to customers manually curtailing loads themselves. Eversource proposes to test two approaches to active demand response: a Wi-Fi thermostat active demand response program focused on small C&I customers, and a comprehensive demand response program focused on large C&I customers. Through these demonstrations, Eversource will be testing both a new strategy: to call demand response events for large C&I customers based upon economic triggers in addition to reliability triggers, and a new demand response approach for a customer class, Wi-Fi thermostats for small C&I customers.
  - o **Large C&I:** Active demand response is a well-established strategy in large businesses for the purpose of ISO-called events, but Eversource proposes to test a different strategy for demand response – calling events for both economic and reliability reasons. In addition to ISO reliability events, Eversource proposes to call demand response events in response to peak demand in order to lower ICR and ICAP tags, and thus potentially reduce costs for all customers. Eversource is also interested in learning to what extent the response to a demand event can be automated and does not require the customer to take direct action.

In order to be able to call demand response events, Eversource proposes to work with a third-party aggregator selected through the RFP. This vendor will recruit the participants in concert with Eversource staff; it is likely that a shared savings model will be utilized. Eversource will test large C&I customer willingness to participate in this type of active demand response, the scale of demand reductions possible, level of incentives required to motivate participation, cost effectiveness, and measurement and evaluation approaches. Additionally, the ability of enrollees to respond to winter pricing events will be explored. Specific research questions to be examined include:

- What size and types of large C&I customers, and what sectors, are most successful in reducing peak demand through active demand response?
- How many events are customers willing to participate in each year before they become 'fatigued', and opt-out at higher rates? What length of event is considered acceptable? How many incremental events can a utility call in addition to ISO events?
- What value streams are most important to large C&I customers in participating in a demand response program (e.g., incentive payments, reduced demand charges, etc.?)
- How will a utility-run program interact with the ISO program?
- What are the potential impacts and savings associated with the distribution system?

- What is an appropriate dispatch trigger based on load/system conditions?
- How are savings quantified/what is the baseline? How will success be measured?
- Is demand response a viable way to get additional reductions from the Persona 1 customers (large C&I customers that have already optimized their demand), or is their demand in fact inelastic?
- Could active demand response for large C&I customers help respond to winter pricing events?

The proposed budget will pay for incentives to enrollees willing to assume risk of non-ISO called demand response events and vendor costs. Eversource anticipates partnering with a demand response vendor to collaboratively recruit customers into this demonstration project.

- **Small C&I:** An active demand response program using Wi-Fi thermostats to reduce air conditioning loads during peak demand events could provide a widely applicable demand reduction solution for small and medium businesses, and has not been tested in Massachusetts previously. The use of Wi-Fi thermostats will provide a key benefit to small C&I customers, namely an anticipated reduction in energy costs. In its RFI, Eversource observed a business model that offers Wi-Fi thermostats to small C&I customers. The customers are also enrolled in a demand response program using automated controls integrated with the Wi-Fi thermostat; participants are paid a small incentive for seasonal participation in the demand response program. It is expected that the vendor, in collaboration with Eversource, will call events when a reliability or economic trigger occurs. Eversource proposes to answer the following questions with the demonstration project:
  - How many events are customers willing to participate in each year before they become ‘fatigued’ and opt-out at higher rates? What length of event is considered acceptable?
  - What are the demand savings from a small C&I demand response program? What are the associated energy savings?
  - What value streams are most important to small C&I customers in participating in a demand response program (e.g., the value of having the thermostat itself vs. the value of incentives provided for participating in active demand response program?)
  - What is the customer adoption rate? Is it scalable? How many customers will have Wi-Fi connection vs. needing cellular switches?

The proposed budget will pay for launching a new, full-cycle vendor initiative, from marketing through installation through calling demand response events. Since Wi-Fi thermostats have an energy efficiency as well as peak demand reduction benefit, the proposed budget will pay for the portion of thermostats that are not covered in normal small business program, so that customer costs are zero, as well as an incentive for participating in an active demand response program. Eversource anticipates that the selected vendor will work with the

existing small business direct install vendors to help integrate this demonstration project with existing programs.

5. **Additional Projects Not Requesting Funding:** Complementing the RFP process described above to select vendors for battery storage, thermal storage, software and controls, and active demand response, Eversource is working with several projects at customer sites with strategies that combine energy efficiency with a focus on demand. The Company is not asking for funding for these projects in this filing, but they are explained below because of their importance to the overall research strategy.

○ **Technical Assistance and Training**

- For large manufacturing that have not already optimized their load (Persona 2), the Company has engaged a specialized firm to work with manufacturing customers to assess their processes and make recommendations for improvements, with an explicit look at demand reduction. Eversource is hoping to understand whether including a focus on demand in TA studies done for the purposes of efficiency can reveal opportunities for optimization in a very cost-effective manner.
- At mid-to-large customers who lack awareness of how to manage demand (Personas 2 and 3), Eversource will be starting an Operator Training program, the aim of which is to teach facility staff how to optimize energy and demand usage at their buildings. Eversource hopes to test whether training staff is sufficient to encourage these customers to act.<sup>10</sup>

○ **Integrated Energy Efficiency, Sub-metering and Controls**

- For mixed-use laboratory and office buildings, Eversource is installing sub-metering at specific customer sites to test the hypothesis that a lack of actionable information at these larger/more complex sites is preventing demand optimization.
- At a mid-size customer whose operations are not coincident with peak (Persona 4), Eversource<sup>11</sup> is working to install monitoring controls and software that will analyze the customers' business patterns and automatically shut off equipment that is not needed for certain periods during the day. While this is an energy-efficiency-focused solution, the fact that this customer's operations are not coincident with peak means that there are expected to be system demand benefits as well. Eversource is hoping to test the hypothesis that simply by better aligning this persona's usage with their operations, a meaningful peak reduction can be achieved due to the size of this segment.<sup>12</sup> Looking back at Figure 2, it can be seen that if just one customer class were to dip in usage during the 1-5pm period (like the

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<sup>10</sup> Further, Eversource hopes to test whether this type of targeted training is more effective for lasting efficiency savings than the past approach of offering them as separate efforts (Building Operator Certification Training and Retrocommissioning.)

<sup>11</sup> This customer is actually a large national chain, and this effort is being done in concert with the other PAs in Massachusetts at a number of sites.

<sup>12</sup> Eversource is further testing the ability for this type of technology, which is very new, to serve this customer segment, which has traditionally proven challenging from a cost-effectiveness standpoint.

customer in Figure 8), it could offset the layering effect and flatten overall system load.

## **Conclusion**

Eversource is proposing a suite of demonstration projects designed to answer key questions and to allow the Program Administrators to offer even more robust demand reduction solutions for customers in the next three-year plan. This proposal has been developed based upon research and collaboration. Eversource respectfully requests that the Council support these projects and the budget necessary to successfully roll them out expeditiously.