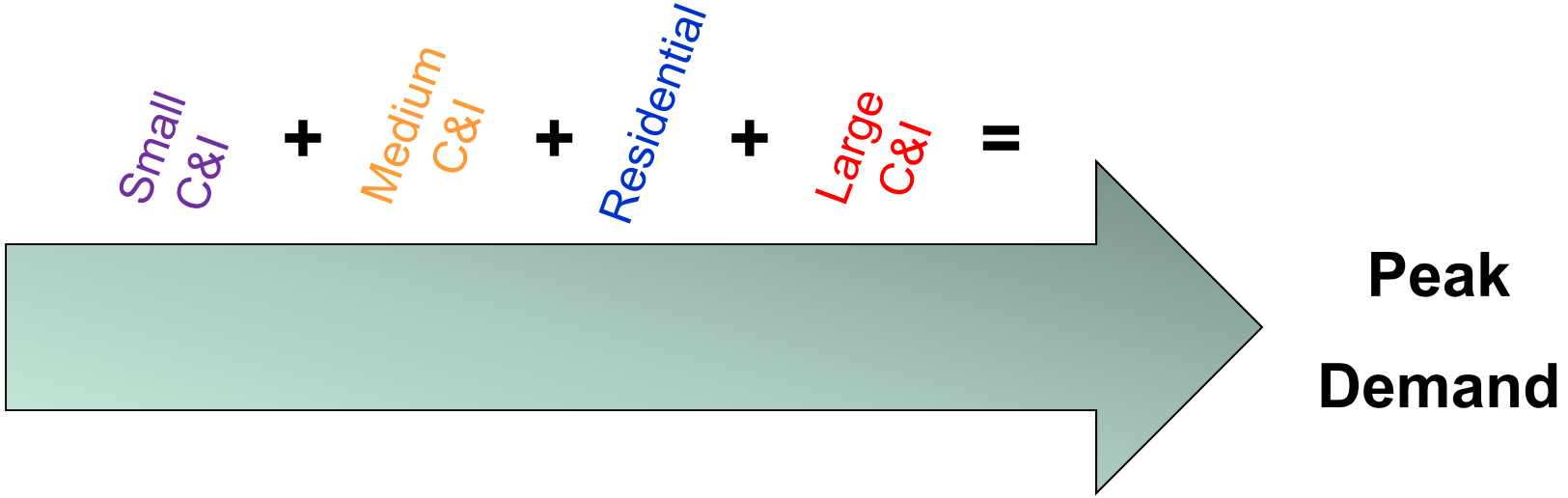
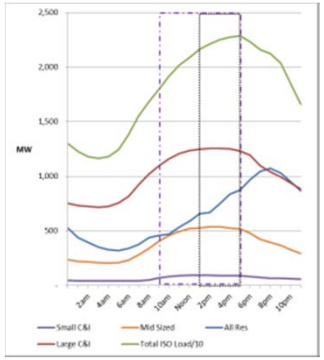
Eversource Demand Demonstration Projects and Budget Update

Peak Demand Solutions for Each Customer Class



Storage	Ice Storage	Ice Storage	Unitil proposal	Battery storage Phase Change Materials
Controls	DR via Wi-Fi Tstats	Software	NGRID & CLC demos	Software Economic DR



Proposed Eversource demand reduction solutions were informed by PA RFI

Why Test Battery Storage?

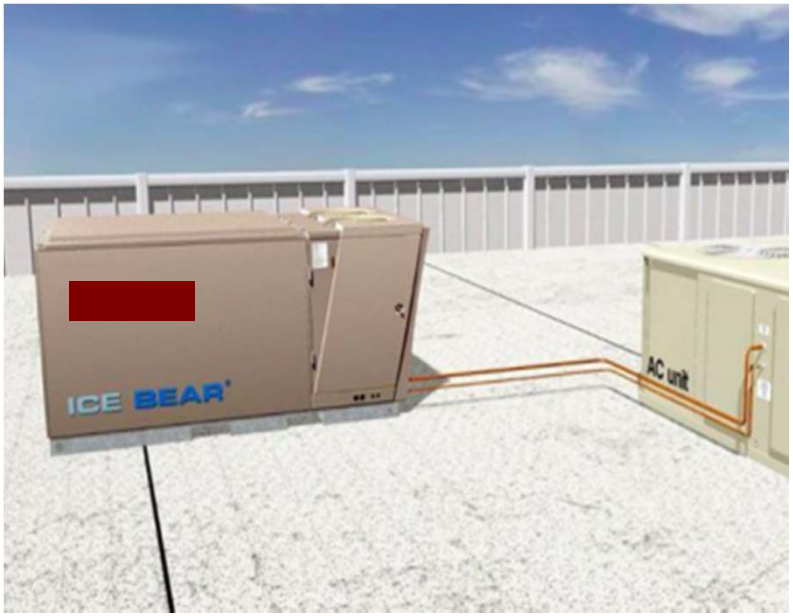
https://www.greenbiz.com/article/nuts-and-bolts-aggregated-energy-storage

Description	Customer sited, behind the meter batteries
Customer Types	Large commercial & big box retail, manufacturing
Why Test	Technology is market-ready Customer excitement

Key Points/Questions:

- How to optimize dispatch to maximize benefits?
- What value streams sell a battery to customers?
- Is oversizing batteries to meet utility-called demand events a viable option?

Why Test Ice Storage?



Description	Uses HVAC equipment to create ice at night and then draws on that thermal mass during the day to reduce AC peak loads
Customer Types	Small and medium commercial customers with 3-20 ton AC units
Why Test	Can boost efficiency of cooling High peak coincidence

Key Points/Questions:

- What opportunities could PA programs help leverage?
- Is thermal storage appropriate for a wide range of customers?
- What value streams sell ice storage to customers?
- Can ice storage target peak loads later in the day?

Why Test Phase Change Materials (PCMs)?

http://www.vikingcold.com/cold-storage/

Description	PCMs absorb and release thermal energy in order to maintain a regulated temperature
Customer Types	Large commercial and industrial facilities, e.g., warehouses, with cold storage and/or freezers
Why Test	Innovative, targeted solution Small modular units easily adaptable to various locations

Key Points/Questions:

- What opportunities could PA programs help leverage?
- Will customers adopt this new technology?
- For which applications are PCMs best suited?
- How do PCMs interact with EMS and controls?

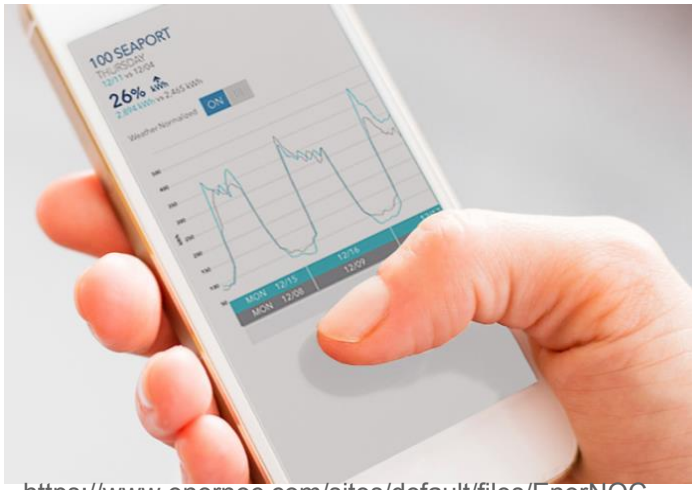
Why Test Software and Controls?

Description	Customer site control of BAS, HVAC, refrigeration equipment, & distributed energy resources
Customer Types	Big box retail, commercial refrigeration/cold storage, municipal, university, school and hospital markets, midsized businesses and industrial clients
Why Test	Get a better understand of customer acceptance and the extent of automation that will be tolerated

Key Points/Questions:

- Is software a viable approach to reducing demand? Are there associated energy savings?
- Can software solutions improve the demand and efficiency gains of other controls like BAS?

Why Test Active Demand Response for Large C&I?



https://www.enernoc.com/sites/default/files/EnerNOC-EIS_phone.jpg

Description	DR targeted toward ISO events AND peak shaving in order to lower ICR and ICAP tags
Customer Types	Large C&I customers
Why Test	Proven solution for reliability, however responsiveness to additional dispatches for economic/dispatch reasons is uncertain

Key Points/Questions:

- How many events before many customers begin to opt-out?
- With the advent of controls, do more DR participants have automated responses? Does this enhance their ability to respond?

Why Test Active Demand Response for Small C&I?

http://support.sensicomfort.com/customer/portal/articles/2022534-what-is-keypad-lockout

Description	Wi-Fi thermostat-based active demand response for central air conditioning
Customer Types	Small commercial customers
Why Test	Widely applicable Associated energy savings Solution concept being tested in residential, but not yet in small business

Key Points/Questions:

- Are energy savings and demand response incentives sufficient to sell thermostats?
- How many events before many customers begin to opt-out?

Proposed Budget for Technology-Based Approach

PP&A	Marketing	Participant Incentive & STAT	Evaluation and Market Research	Total Program Costs
$800,000	$400,000	$18,310,000	$1,951,000	$21,461,000

Budgets and demonstration project sizes were developed using vendor responses to PA issued RFI

Solution Technology	Total Participant Incentive + STAT	Year(s) of Testing	Anticipated # of Customers	Range of On-Peak Savings Per Project Per Year (MW)
Battery Storage	$5,000,000	2018	5-30	3.56-5.33
Thermal Storage	$3,900,000	2018	50-115	0.38-8.53
Software & Controls	$4,140,000	2017-2018	80-400	4.44-6.67
Active Demand Response	$5,270,000	2017-2018	840-1150	3.79-7.72
Large C&I	*$3,250,000*	*2017-2018*	40-150	*3.33-5.0*
Small C&I	*$2,020,000*	*2017-2018*	800-1000	*0.46-2.72*
Total	**$18,310,000**		**975-1,695**	**12.17-28.25**

Demand Solutions Timeline	
2016	
13- Oct	**RFP Released**
21-Nov	RFP Responses Due
2017 (All Subsequent Steps & Schedule Contingent on DPU Funding)	
4-Jan	Suppliers Selected
Jan - May	Customer recruitment, equipment installation
1-Jun	Demo projects begin
Fall	Initial Evaluation
2018	
Winter - Spring	Incorporate lessons learned into first draft of 2019-2021 EE plan
Spring – Summer	Continued Implementation, Expansion
Summer - Fall	Final Evaluation
Fall	Incorporate lessons learned into final 2019-2021 EE plan

Example Metrics for Evaluating Projects

Metric	Category	Type	Definition
Percent of load solution is applicable to	Scalability	Quant	Load solution is applicable to/total load
Achieved Savings	Reliability	Quant	MW achieved/MW called
Total Program Cost	Cost	Quant	Total $ spent on implementation
Solution Materiality - System	Materiality	Quant	Solution savings/system peak (or company)
Solution Savings	Savings	Quant	Total peak kWh reduced
Customer Satisfaction	Customer Satisfaction	Qual	Do customers like the program

Metrics subject to change based on availability of information

APPENDIX

Eversource has carefully researched opportunities to lower peak demand, and found that:

- Reducing peak demand produces a variety of benefits for customers, utilities, and the regional power grid as a whole, the most significant of which is to lower 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.
- Projects designed to reduce summer peak demand will have the greatest impact on reducing the maximum system load, and these projects may also create opportunities to reduce winter load.
- The type of solution needed to reduce peak demand varies by customer type.
- While the range of technologies available to manage demand is expanding, more information is needed to foster their adoption.

Eversource has developed a diverse set of demonstration projects that will:

- Begin to reduce peak demand for a broad range of customers in Eversource territory in 2017 – 2018
- Inform design of a full scale demand reduction program
- Address a wide range of customers that contribute to the system-wide summer peak, without duplicating approaches being tested by other PAs
- Test a broad range of solutions to reduce demand
- 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.
- Leverage the power of the market to gather the most effective solutions for demand reduction

How Will Demonstration Projects Pave the Way for a Successful 2019 -2021 Plan?

Demonstration projects will answer key questions that will determine if and how to adopt the technologies at scale, for example:

- 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?
- Are there technological, economical, or regulatory barriers to full-scale deployment of the solution?
- How does the solution complement or reinforce other efforts to increase energy efficiency and reduce peak demand?
- How should each technology be used (i.e., what is the optimal operating profile)?
- How should/can reductions be screened and measured?
- Under what screening model parameters are these solutions cost effective? Are there additional benefits streams that need to be quantified?

Summary of Demonstration Projects Included in Funding Request

Solution Technology	Description	Customer Types	Why Test
Battery	Customer sited, behind the meter batteries	Large commercial & big box retail, manufacturing	How to optimize dispatch to maximize benefits
Thermal Storage – Ice Storage	Uses HVAC equipment to create ice at night and then draws on that thermal mass during the day to reduce AC peak loads	Small and medium businesses with 3-20 ton AC units (e.g., small convenience stores, restaurants, strip malls, & college campuses)	Recent developments make this technology more viable for more customers
Thermal Storage – Phase Change Material (PCM)	PCM absorbs and releases thermal energy in order to maintain a regulated temperature	Large commercial and industrial facilities, e.g., warehouses, with cold storage and/or freezers	This technology is relatively easy to install, and recent developments may make it more viable for more customers

Summary of Demonstration Projects Included in Funding Request, continued

Solution Technology	Description	Customer Types	Why Test
Software & Controls	Customer site control of building automation system, HVAC, refrigeration equipment, & other Distributed Energy Resources (DERs)	Big box retail, commercial refrigeration/cold storage, municipal, university, school and hospital markets, midsized businesses and industrial clients	• This technology can now coordinate a wide range of customer assets and functions • Get a better understand of customer acceptance and the extent of automation that will be tolerated
Active Demand Response Large C&I	DR targeted toward ISO events and peak shaving in order to lower ICR and ICAP tags	Large C&I	Test adding utility-called economic and distribution events, which would be more frequent than ISO-called events
Active Demand Response Small C&I	Wi-Fi thermostat-based active demand response for central air conditioning	Small and Medium Business (SMB) customers	This solution is widely applicable and has not been tested in Massachusetts previously

Are demonstration projects necessary, given existing experience in other jurisdictions?

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- Massachusetts has different load profiles, rate structures, avoided costs, market costs, and climate than other jurisdictions.
  - For example, we cannot assume that demand reductions that primarily rely on reducing central AC use will be successful here
  - Customer acceptance rates cannot be inferred from elsewhere
- Demonstration projects will be used to test and adapt program designs so that they maximize peak demand savings and cost effectiveness in Massachusetts.
  - Not all projects will work as anticipated, need to learn from smaller scale demo projects in order to judiciously expend customer dollars on larger scale programs
  - RFP approach will allow us to get market rate savings during demand demo projects
- Hands-on experience will ensure that we design an optimal portfolio of demand reduction programs that reflect the mix of customers in our service territory

Timeline of Steps for Technology-Based Solutions

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RFI and RFP Schedule for Technology Based Solutions	
2016	
19-Aug	RFI Released
02-Sep	RFI Responses Received
13- Oct	Release RFP
24-Oct	RFP Questions Due
31-Oct	Responses to Questions Due
21-Nov	RFP Responses Due
2017 **(All Subsequent Steps & Schedule Contingent on DPU Funding)**	
4-Jan	Suppliers Selected
Jan - May	Customer recruitment, equipment installation
1-Jun	Demo projects begin
Fall	Initial Evaluation
2018	
Spring – Summer	Continued Implementation, Expansion
Fall	Final Evaluation

Battery

- Description: Customer sited, behind the meter batteries
- Customers: Large commercial & big box retail, manufacturing
- Why are we testing it: Batteries are a rapidly developing technology, and while costs have historically been high, they are starting to come down
- What are we testing (example questions):
  - 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 potential savings from dispatch in both summer and winter?
  - What value streams, e.g., reduced demand charges, increased resiliency, etc. are most important to customers? How can these be maximized?
  - Are customers willing to dispatch in response to grid needs?
  - What value do behind-the-meter batteries provide to all customers if deployed for grid needs? 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?
- What will the budget pay for: Equipment and installation for this high profile technology

Thermal Storage – Ice Storage

- Description: uses HVAC equipment to create ice at night and then draws on that thermal mass during the day to reduce AC peak loads
- Customers: Small and medium businesses with 3-20 ton AC units (e.g., small convenience stores, restaurants, strip malls, & college campuses)
- Why are we testing it: Recent developments make this technology more viable for more customers
- What are we testing (example questions):
  - 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?
- What will the budget pay for: Outreach and installation costs for this potentially under-utilized technology

Thermal Storage – Phase Change Material (PCM)

- Description: A phase change material (PCM) absorbs and releases thermal energy in order to maintain a regulated temperature
- Customers: Large commercial and industrial facilities, e.g., warehouses, with cold storage and/or freezers
- Why are we testing it: This technology is relatively easy to install, and recent developments may make it more viable for more customers
- What are we testing (example questions):
  - 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 is 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?
- What will the budget pay for: Customer outreach and installation for this relatively promising technology

Software & Controls

- Description: Customer site control of building automation system, HVAC, refrigeration equipment, and/or other DERs
- Customers: Big box retail, commercial refrigeration/cold storage, municipal, university, school and hospital markets, mid-sized and industrial businesses
- Why are we testing it: Software and controls can now coordinate a wide range of customer assets and functions, and may be relatively cost effective because on-site hardware installation may not be required
- What are we testing (example questions):
  - 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?
  - 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?
- What will the budget pay for: Customer outreach, software programming and, if needed, installation of controls

Active Demand Response – Large C&I

- Description: DR targeted toward ISO events and peak shaving in order to lower ICR and ICAP tags
- Customers: Large C&I
- Why are we testing it: Test adding utility-called events focused on peak shaving, which would be more frequent than ISO-called events
- What are we testing (example questions):
  - What size and types of large C&I customers, and what sectors, are most successful in reducing peak demand?
  - How many events are customers willing to participate in each year?
  - What value streams are most important to large C&I customers ?
  - How will a utility-run program interact with the ISO program?
  - What is an appropriate dispatch trigger based on load/system conditions?
  - How are savings quantified/what is the baseline? How will success be measured?
  - Could active demand response for large C&I customers help respond to winter pricing events as well as ICAP tags?
- What will the budget pay for: Incentives to enrollees willing to assume risk of non-ISO called demand response events and vendor costs

Active Demand Response – Small C&I

- Description: Wi-Fi thermostat-based active demand response for central air conditioning
- Customers: Small and Medium Business (SMB) customers
- Why are we testing it: This solution is widely applicable and has not been tested in Massachusetts previously
- What are we testing (example questions):
  - 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?
- What will the budget pay for: To launch a new, full-cycle vendor initiative (from marketing through installation through calling demand response events)

Potential Metrics for Evaluating Projects

Metric	Category	Type	Definition
Baseline calculation	Scalability	Qual	Hard to calc baseline?
How automated is the solution	Scalability	Qual	Scale of customization for each customer
% of load solution is applicable to	**Scalability**	**Quant**	**Load solution is applicable to/ total load**
YoY Participation Increase	Scalability	Quant	(2018-2017)/2017
Evaluability	Scalability	Qual	How hard to evaluate, calc savings?
Policy Hurdles	Scalability	Qual	Any regs that would complicate execution?
Enrollment Rate	Scalability	Quant	# of enrolled/# eligible
Opt-out Rate	Reliability	Quant	# opt-outs/program participants
Achieved Savings	**Reliability**	**Quant**	**MW achieved/MW called**
Peak kWh cost	Cost	Quant	Program cost/peak kWh saved
Cost of customer acquisition	Cost	Quant	$ on outreach(marketing)/# of participants
Total Program Cost	**Cost**	**Quant**	**Total $ spent on implementation**
Rate Impacts	Cost	Quant	Program cost per customer/avg monthly bill
Solution Materiality - System	**Materiality**	**Quant**	**Solution savings/system peak (or company)**
Solution Materiality – Customer Class	Materiality	Quant	Solution savings/customer class usage
Solution Savings	**Savings**	**Quant**	**Total peak kWh reduced**
Coincident peak savings	Savings	Quant	Peak kWh savings/total kWh savings
Customer peak savings	Savings	Quant	% of facility peak load reduced
Customer financial savings	Savings	Quant	$ savings on bill
Customer Satisfaction	**Customer Sat**	**Qual**	**Do customers like the program**
Operational Interference	Customer Sat	Qual	Level of operational interference

- **Metrics subject to change based on availability of information and not all metrics are applicable to all solution types**
- **Some metrics may be weighted more heavily than others**
- **Some solutions may need additional metrics not listed**