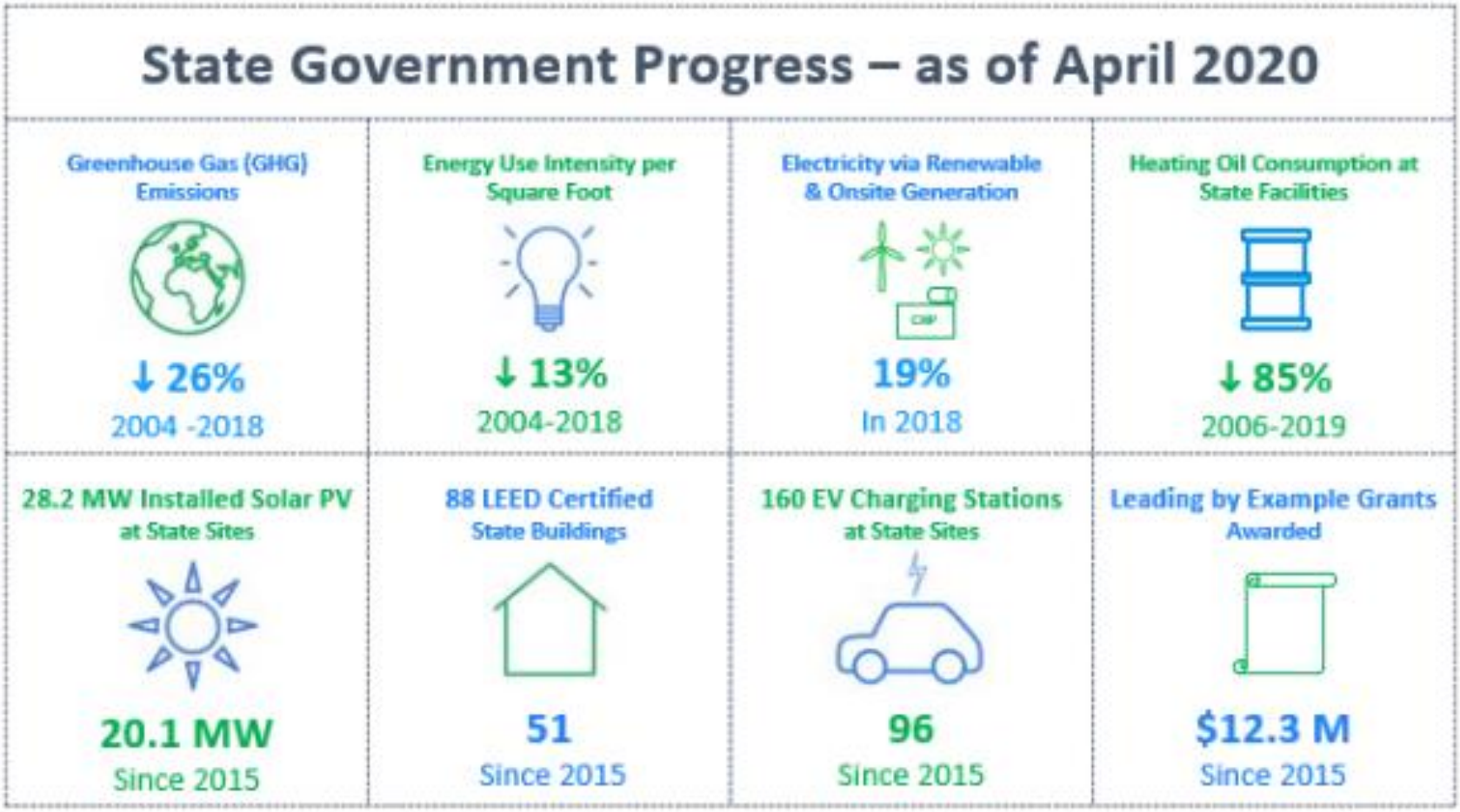
MA Leading by Example Council

May 12, 2020

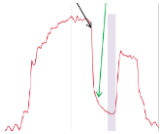
Location: Everywhere



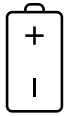
Agenda

Welcome, MA Policy and LBE Updates

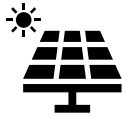
Intro to Peak Demand Reduction: Grid and Environmental Benefits



Peak Demand Reduction in Action



MA Clean Peak Standard Overview



Nexus of Renewables, Energy Efficiency, Resiliency, and Peak Demand

Baker-Polito Administration Issues Formal Determination Letter Establishing 2050 Emissions Target

- Sets new legal emissions target of "net zero" by 2050 as part of the Global Warming Solutions Act (GWSA)
- **Net zero emissions** defined as:

"A level of statewide greenhouse gas emissions that is equal in quantity to the amount of carbon dioxide or its equivalent that is removed from the atmosphere and stored annually by, or attributable to, the Commonwealth..."

"...in no event shall the level of emissions be greater than a level that is 85% below the 1990 level."

- Later this year, EEA will release a **2050 Roadmap** outlining pathways to achieve the emissions limit

Source: Mass.gov

Important Dates for SMART

- April 15, 2020
  - SMART Publication Date
- May 13, 2020
  - Virtual tutorial from 10:30 AM to 12:00 PM
- May 18, 2020
  - Portal anticipated to reopen for new applications
- May 22, 2020
  - Virtual public hearing from 10:00 AM to 12:00 PM
  - Public comments accepted until 5:00 PM

SMART Regulations

- Capacity Expansion to 3,200 MW
- Land Use and Siting
- Energy Storage Requirement
- Pollinator Adder of $0.0025/kWh
- Public Entity STGUs
  - Definition expansion
  - Adder increase
  - Moved to Category 1
  - Early application submittal

Virtual SMART Program

- Register for virtual events
  - www.mass.gov/info-details/smart-emergency-rulemaking
- Submit new applications
  - www.masmartsolar.com
- Submit Public Comments
  - Email doer.smart@mass.gov with “SMART Public Comment”
- Subscribe to “SMART Program” email list
  - www.mass.gov/forms/subscribe-to-doer-email-lists

LBE Feasibility Study Grants for Campus Master Energy Plans

$100,000 LBE Feasibility Grants awarded to Salem State University, UMass Dartmouth, and UMass Lowell

Salem State University

- High-level energy study of North Campus fossil-free heating/cooling options
- Assessing opportunities for heat pumps, clean biomass, geothermal, energy efficiency

UMass Dartmouth

- Comprehensive Energy Master Plan
- Roadmap will help UMD understand investment and implementation requirements to 1) meet EO 484 targets and 2) reach carbon neutrality by 2030

UMass Lowell

- Renewable Energy Master Plan
- Comprehensive strategic plan will focus on achieving carbon neutrality by 2050 and develop interim carbon reduction targets

More information about LBE grants can be found here

In one word, what has been a silver lining for you amidst current events?

Massachusetts Department of Energy Resources

Intro to Peak Demand Reduction: Grid and Environmental Benefits

Will Lauwers

Director of Emerging Technology

Department of Energy Resources

Classic Peak Reduction Considerations

Cost Savings; Avoid Infrastructure Additions

- Infrastructure is sized to meet anticipated future peak demand plus contingencies
- Planning horizons are coordinated with investment and construction horizons, the further out, the higher the need for conservative overestimates
- Demonstrating we can reduce peak demands enables infrastructure planners to reduce generation and transmission additions
  - In past years, nearly $2B of cost were allocated across Massachusetts based on a single hour of demand, and that was just for the powerplant (capacity) side of the equation.

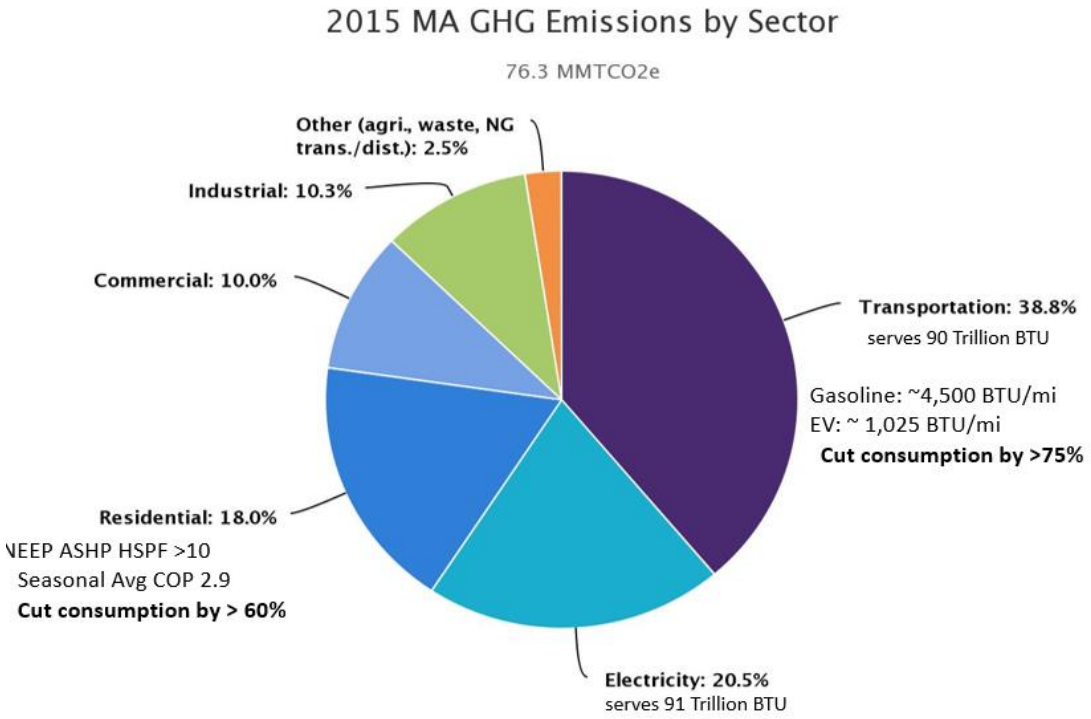
Reduce your costs today (Demand or ICAP & RNL charges)
and help us reduce everyone's costs in the future

Emissions Savings; Avoid High Heat Rate Plants

- Heat rate is the amount of energy input it takes to produce 1 kWh of electricity
- 'Peaker' plants are often simple cycle and/or burn diesel, with higher heat rates, meaning higher emissions per kWh of electricity produced
- Peaker plants are typically cheaper to build/own/maintain for low capacity factor operations and as such are built to operate infrequently for peak demand
- Additionally, high and narrow peaks require more plant posturing and spinning to align energy markets with powerplant operational requirements (e.g. startup time)

Emerging Peak Reduction Considerations

- **Hosting electrification**
  - To meet GWSA we need to electrify the thermal and transportation sectors
  - To do this cost effectively, need to coordinate load so we don't increase peak demand in the process
  - EVs are very flexible, thermal not so much
- **Hosting intermittent renewables**
  - The inverse of peak demand is also a challenge on infrastructure
  - The more we can shift load to match renewables production and shift renewables production to match load, the less the infrastructure impact



A lot of energy will shift to electricity to reduce emissions.
Goal: keep it off peak

Massachusetts Department of Energy Resources

Peak Demand Reduction in Action: State Programs, Successes, and Lessons Learned at State Facilities

DIVISION OF CAPITAL ASSET MANAGEMENT & MAINTENANCE

Statewide Demand Response Contract Overview

FAC89

Dave Lewis, DCAMM

DIVISION OF CAPITAL ASSET MANAGEMENT & MAINTENANCE

Current Statewide Contract Participation

- FAC89 is a Designated DCAMM Statewide contract available to multiple agencies and authorities to use without having to go through a complicated bidding process

- Current Executive Offices participating include:
  - EOPS, Sheriff's Departments, EOTC, Higher ED, EOHHS

- Municipalities, Cities and Authorities also using the contract

- OSC authorization allows for other states to use the contract

Incentives for Participation

- Participating Departments and facilities get paid for load removed during peak demand events
  - Combination of emergency generators, automatic load curtailment and renewable (solar or wind) or energy conservation measures.

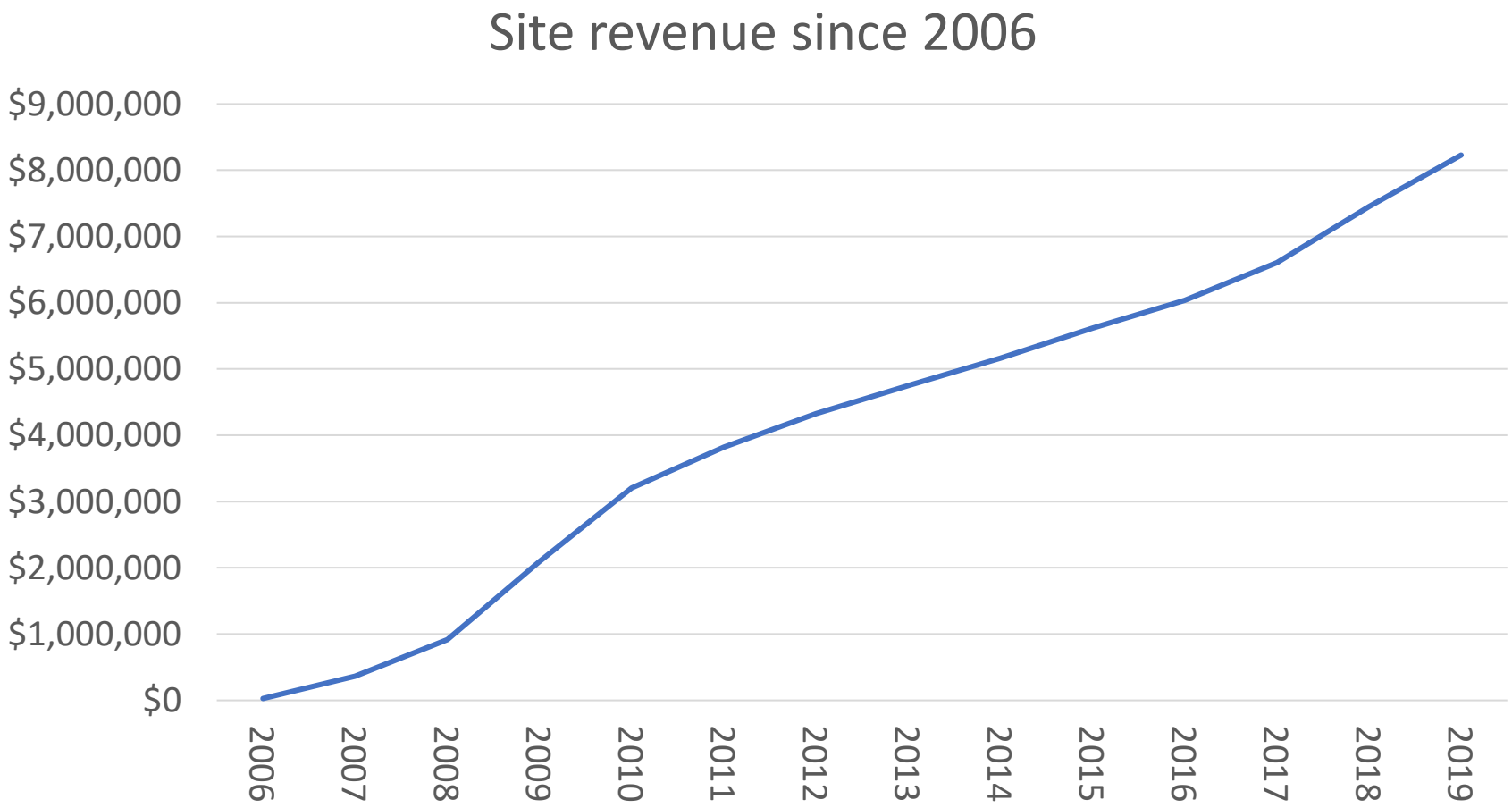
- Includes stacking of different programs (more on this later):
  - ISO NE program incentives
  - Utility Peak programs
  - Cap tag benefits
  - Daily Dispatch

- Can result in multiple revenue streams for facilities $$$

Program Revenue History

- Sites get paid for electrical demand that they reduce at their locations during a scheduled event.
- Since 2006 agencies have been sent $8.3 million dollars for their participation.
  - *Agencies have earned nearly $800 thousand dollars for 2019*
- Funds get transferred through an expendable trust fund established at DCAMM. Funds get transferred using an ISA.
- The ISA establishes a 10-year term ISA for which funds are transferred to facility (does not require renewal each year)
- Funds can be used for facility projects for maintenance upgrades or other projects that result in operational efficiencies and savings.

Program Revenue History

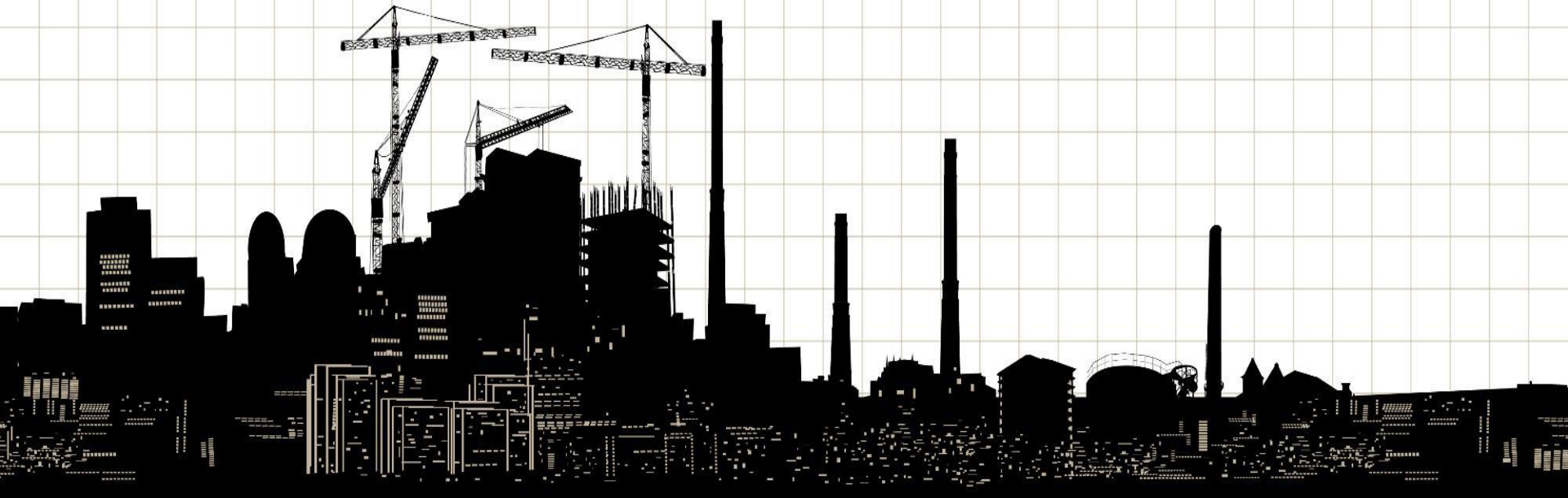


CPower Statewide DR vendor

- CPower is the current Statewide Demand Response vendor
- Provide program updates, Engineering and Metering expertise
- ISO New England Lead Market Participant
  - Notify facility contacts on upcoming peak day demand events
  - Keep track of ongoing ISO program requirements
  - Send proceeds direct to DCAMM for disbursement to agencies quarterly

Reducing for Revenue: Lessons in MA Peak Demand

Solving Peak Demand Challenges in Massachusetts



Presenters

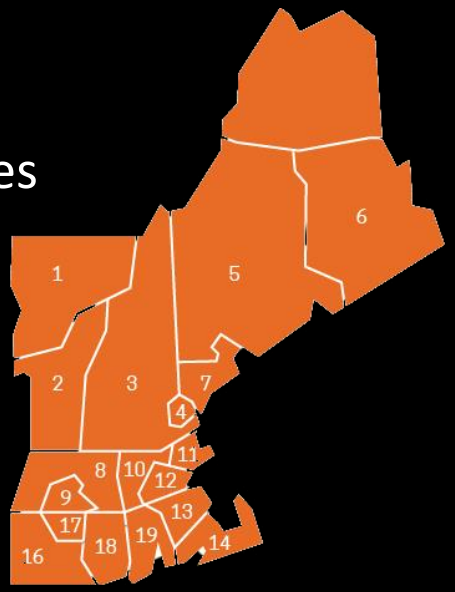
Paul Wassink
Sr. Engineer
National Grid

Phil Ciulla
Account Executive
CPower

Challenges in the New England Electric Grid

What are the peak usage problems we are trying to solve?

- Utility challenges
- Grid operator / Power plant-related challenges



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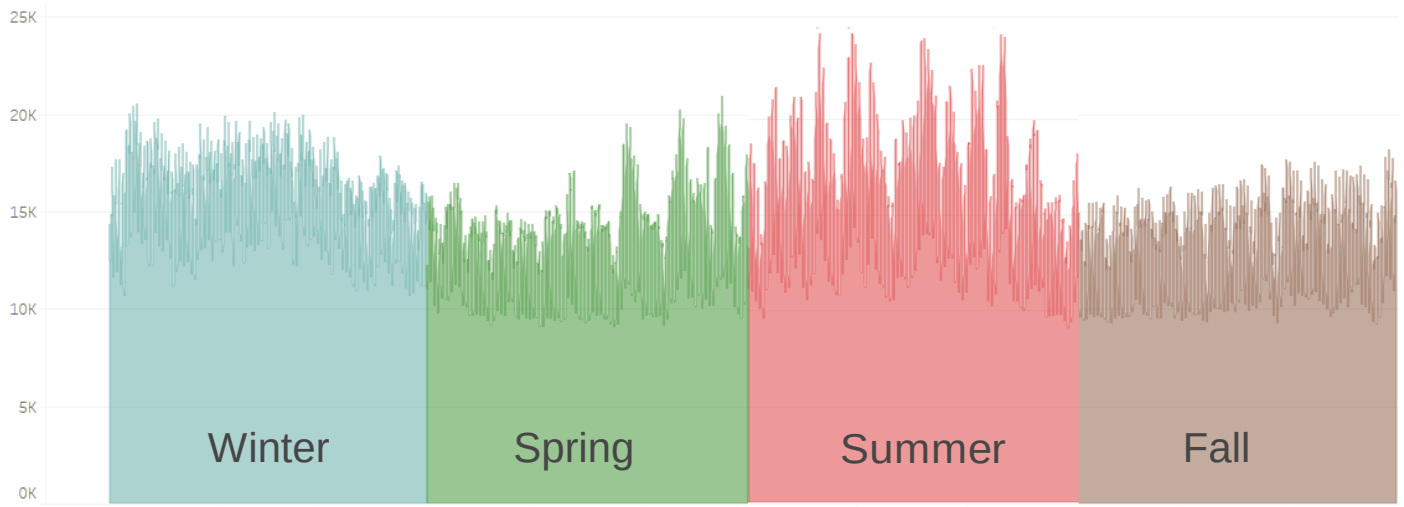
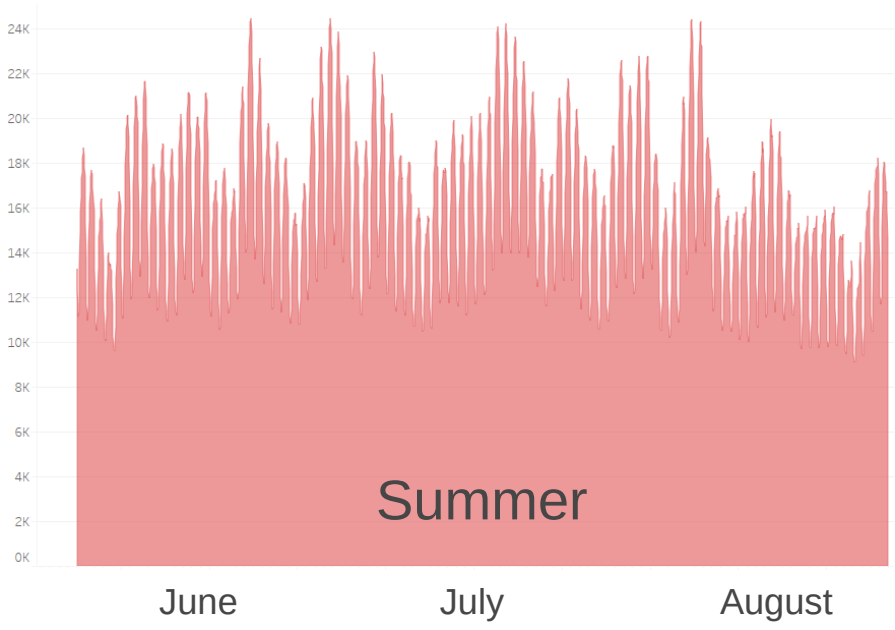
What is Demand Response



The whole grid is sized to meet the peak.

“The top 10% of hours during these year, on average, accounted for 40% of the annual electricity spend…”

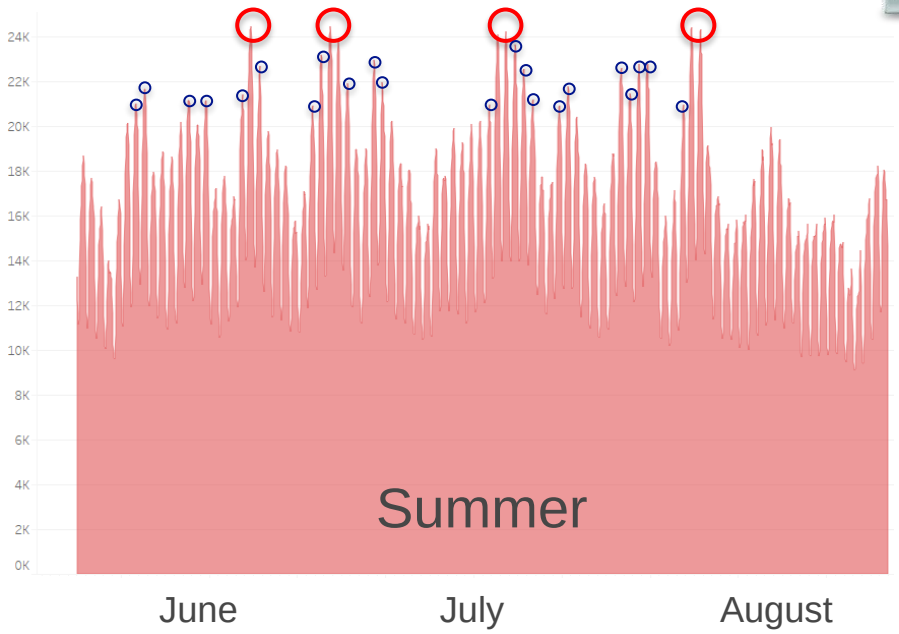
Source: State of Charge – MA Energy Storage Initiative


24K
22K
20K
18K
16K
14K
12K
10K
8K
6K
4K
2K
0K
Summer
June
July
August

Commercial Programs

Targeted Dispatch

C&I Daily Dispatch



Residential Programs

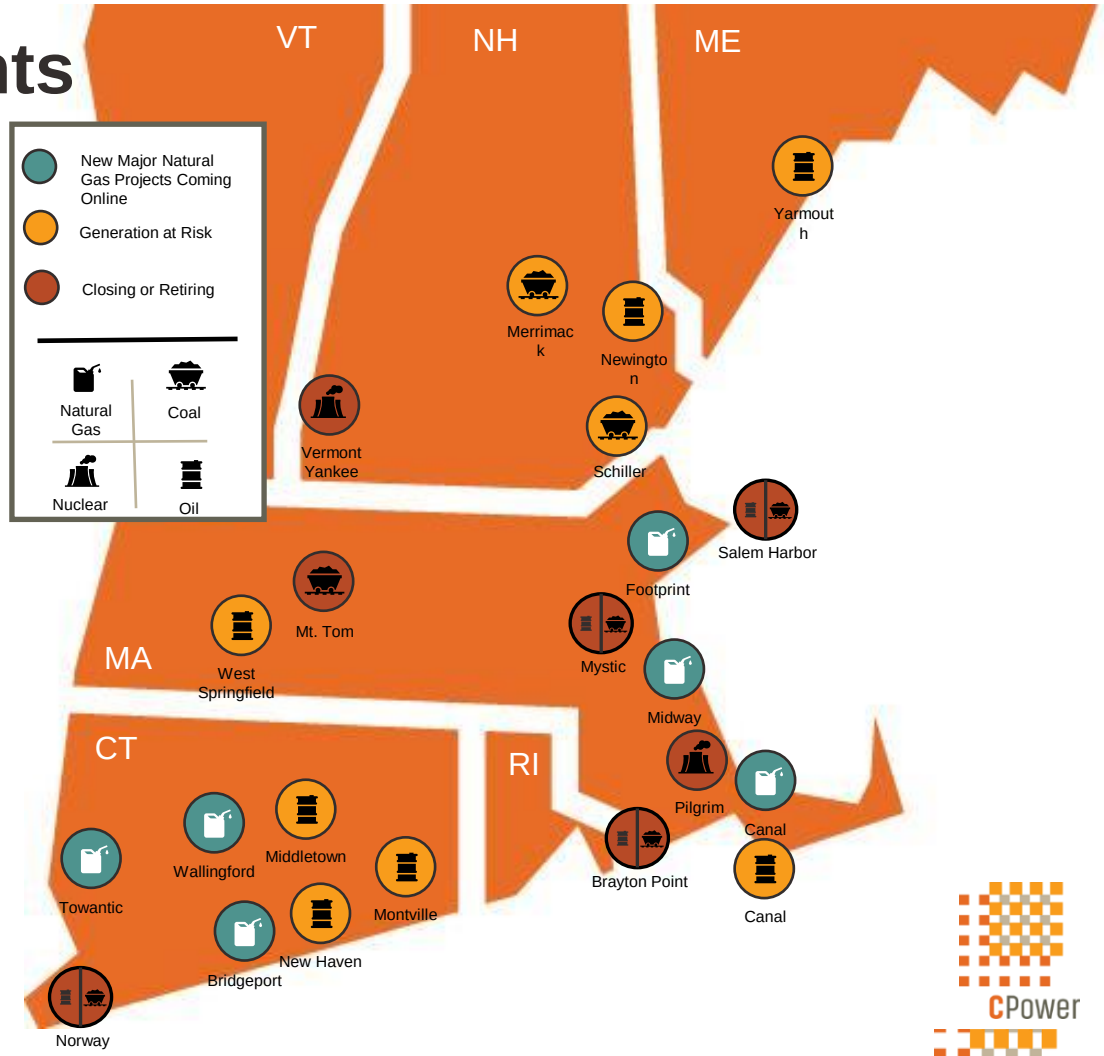
Thermostats

Residential Batteries

Power Plant Retirements

Capacity Prices are decreasing

- Drivers:
  - Wind & Solar Penetration increasing capacity
- 30% of generation at risk for decommissioning
- More to close or retire
  - Will constrain capacity and potentially offset new capacity and drive up pricing



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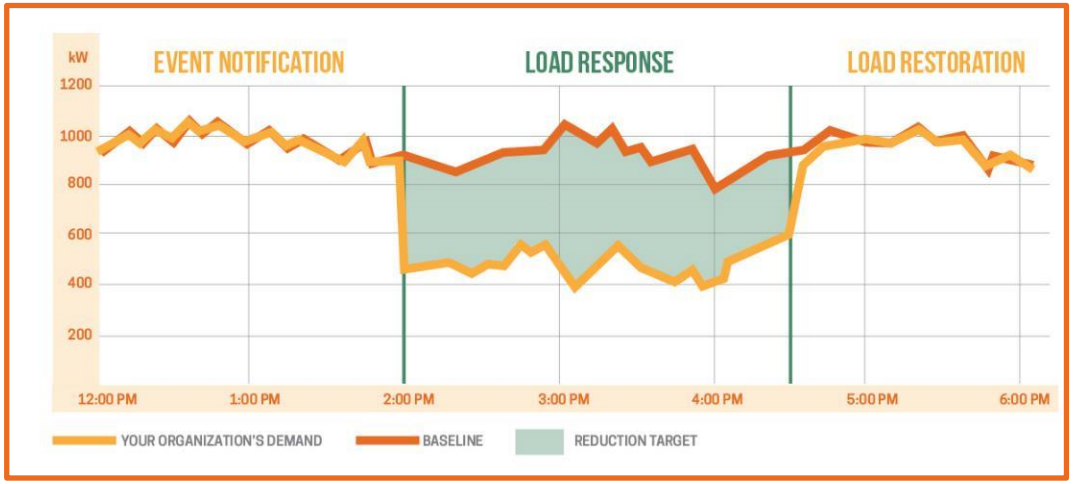
Demand Response
Definition

Programs that pay organizations to reduce energy load during times of grid stress or high energy prices.

Provides energy users the ability to earn revenue and lower net energy costs.



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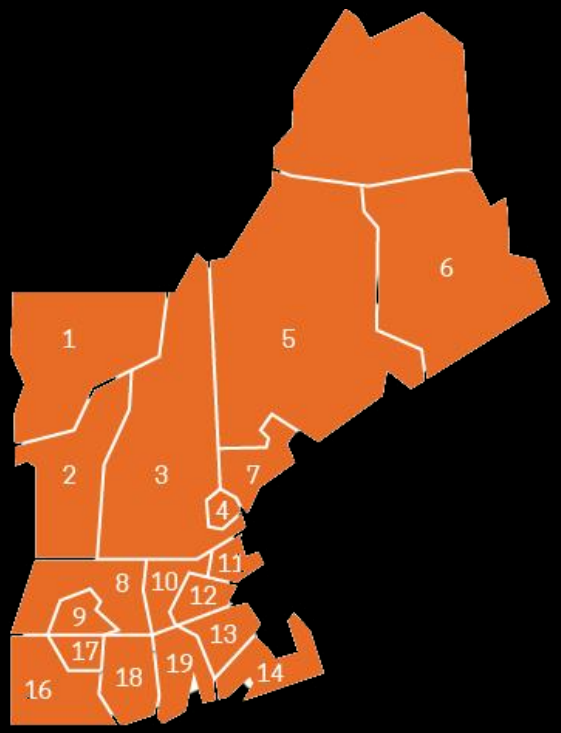
Program Education



New England Demand Response Options

Program name	Program Type	Customer Obligation Hours	Notification lead time	Performance Season	Typical Curtailment Frequency	Administrator
Active Demand Capacity Resource	Capacity	24/7/365	30 minutes	Summer (June-Aug) & Winter (Dec-Jan)	2 x 1 Hour Mandatory Tests	ISO-NE
Connected Solutions	Targeted Dispatch	June-September 2pm – 5pm 3pm – 6pm 4pm – 7pm	Day Ahead	Summer (June-Sept) Winter (Dec-March)	4-6 calls per season	Utility
Peak Demand Management (Cap Tag)	Energy Bill Cost Avoidance	Voluntary	Day Ahead & Day Of	Summer	2-7 calls per year	CPower

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Active Demand Capacity Resource (ISO)

Two participation seasons

- Summer: Apr. – Nov.
- Winter: Dec. – Mar.

Each season, tests WILL occur, and events MAY occur.

- Test: 1 Hour Minimum
- Actual Event: Based on Grid Needs

Year	# of Events	Hours
2010	1	2:45
2011	2	6:45
2012	0	0
2013	3	13:10
2014	0	0
2015	0	0
2016	1	3:30
2017	0	0
2018	1	3:45
2019	0	0
AVG	1	3:30

Utility Program

One Season

- Summer: Jun. – Sep.
  - Typically between 2 pm and 7 pm on a weekday

Summer Events	Number of Events	
Year	Eversource	NGRID
2017	-	2
2018	-	6
2019	3	1

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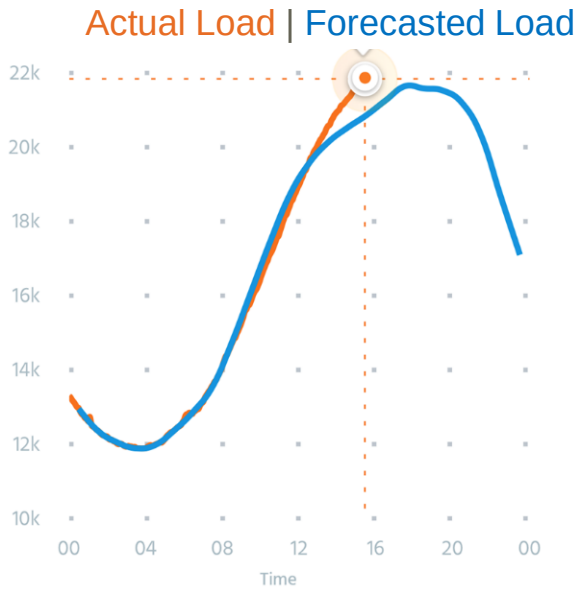
Summer Event

September 3, 2018

ADCR Event

Triggers:

- Load was running significantly higher than forecast by over 2500 MW
- Several generation resources had significant outages and reductions totaling approximately 1,600 MW
- The peak temperature and dew point for the daytime hours in Boston were 94 and 73 with a forecast of 89 and 70
- ISONE declared an Emergency Alert at 3:15p, just before the DR dispatch took effect at 3:41 pm



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How to Succeed at Demand Response

Where Do the Loads Come From

HVAC

Process Motors

Heating and Cooling

- Manual or Automatic Load Drop
- Energy Management Systems
- Load Shedding Strategies
- Lighting Control Strategies
- Permitted Generation

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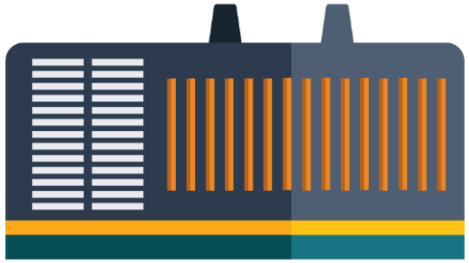
Generator Eligibility

Non-emergency Generators are Eligible

- Needs to meet Federal and state non-emergency emission levels
- Tier 4 emission standards (diesel)
- Tier 2 emission standards (gas)
- Non-emergency permit



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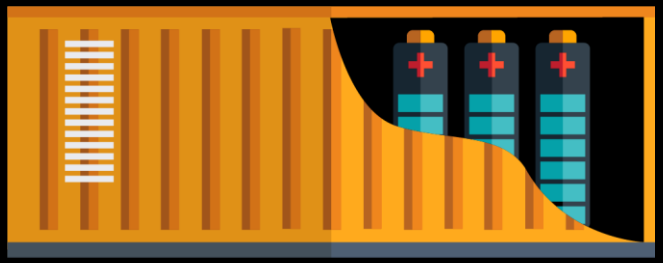
Battery Storage

Program name	Program Type	Customer Obligation Hours	Notification lead time	Performance Season	Typical Curtailment Frequency	Administrator
Connected Solutions	Dispatch Dispatch	July-August Typically 4-6 pm OR 5-7 pm	Day Ahead	Summer (June-Sept)	30-60 calls per summer	Utility



Pricing:

- $200/kW in Massachusetts per summer

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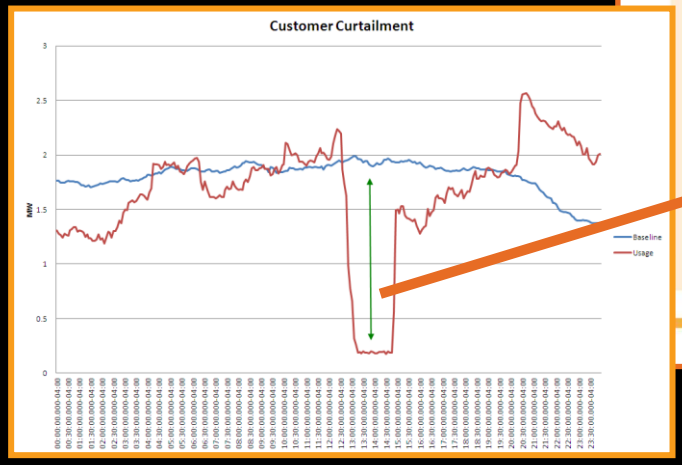
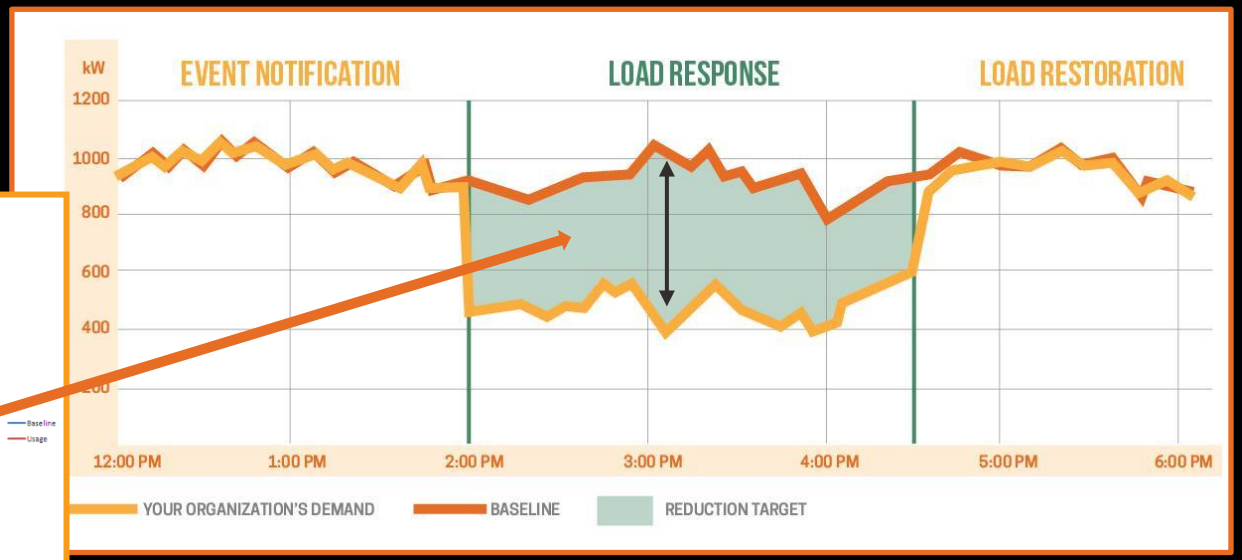
Performance on Utility Meter

Performance is determined as the average hourly difference between baseline and actual load





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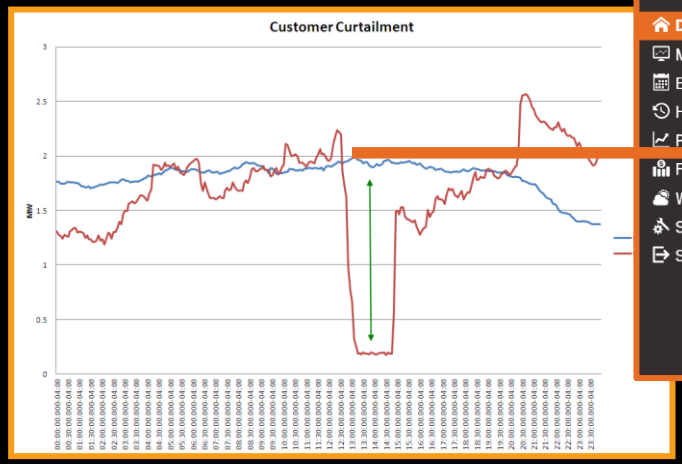
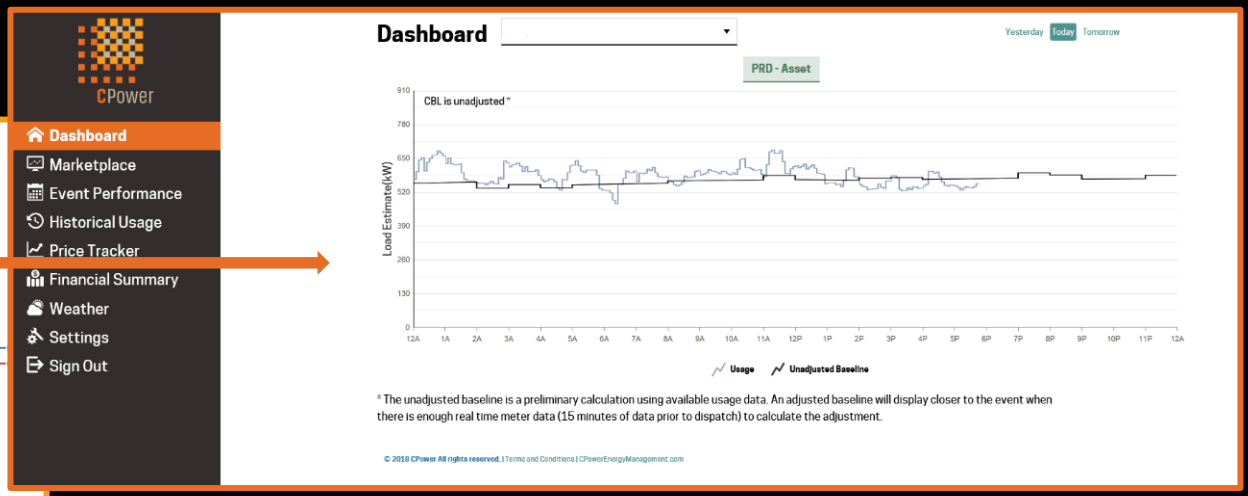
Real-time Usage

See real-time performance data in the CPower app for DR programs



Meter Data



CPower app

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Stacking Benefits

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ISO-NE Capacity Values

Program Values for Active Demand Capacity Resource (30-minute)

Program Revenues For
Active Demand Capacity Resource

Commitment Period	ISO-NE kW Reduction		ISO-NE Payments	
	Summer (8 months)	Winter (4 months)	$/kW-mth	Annual Gross
June 1, 2020 - May 31, 2021	1,000	1,000	$5.30	$ 63,564
June 1, 2021 - May 31, 2022	1,000	1,000	$4.63	$ 55,560
June 1, 2022 - May 31, 2023	1,000	1,000	$3.80	$ 45,600
June 1, 2023 - May 31, 2024	1,000	1,000	$2.00	$ 24,012
June 1, 2024 - May 31, 2025	1,000	1,000	$3.30*	$ 39,600
		Total Benefit		$ 228,336

*Projected

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Connected Solutions Values

Formula for Revenue (Day-Ahead)

EARN With Connected Solutions

Capacity Payment = $35 per kW year

CURTAILED LOAD X **CAPACITY PAYMENT** = **REVENUE EARNED**

1000 KW (performance)
X
$35 (capacity/performance)

=

Summer 2020- $35,000
Summer 2021- $35,000
Summer 2022- $35,000
Summer 2023- $35,000
Summer 2024- $35,000

=

$175,000 over 5 Years

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Capacity Tag Management

What is the Value of Managing Your Cap Tag?

SAVE WITH PEAK DEMAND MANAGEMENT

Cap-Tag is set summer of this year	ISO-NE Zone	Cap Tag Power Year	Cap-tag Value $/kW
2020	WCMA	2021-2022	$55.57
2021	WCMA	2022-2023	$45.60
2022	WCMA	2023-2024	$24.00
2023	WCMA	2024-2025	$30.60 (expected)

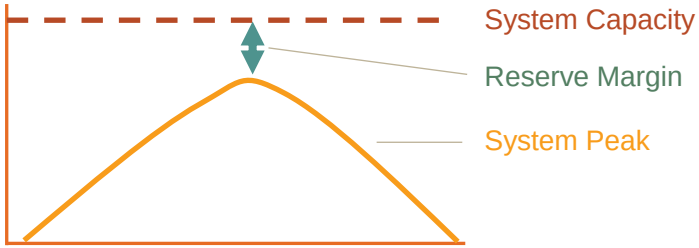
Cap Tag value drops by 1000 KW in summer 2020

Value is realized from June 2021 through May 2022*:

- 1000 KW x $55.57 x RM = $82,015 over 12 months
- 22-23= $67,313
- 23-24= $35,428
- 24-25= $58,456

Total = $243,212

*assuming capacity is passed through on your power contract



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Stacking Benefits

EARN With ADCR

+

EARN With Connected Solutions

+

SAVE With Cap Tag Management

=

June 2020 – May 2025

ADCR (ISO)
- Year 1 - $63,564
- Year 2 - $55,560
- Year 3 - $45,600
- Year 4 - $24,012
- Year 5 - $39,600

Connected Solutions (Utility)
- Year 1 - $35,000
- Year 2 - $35,000
- Year 3 - $35,000
- Year 4 - $35,000
- Year 5- $35,000

Peak Demand Management (Cap Tag)
- Year 2 savings - $82,015
- Year 3 savings - $67,313
- Year 4 savings - $35,428
- Year 5 savings - $58,456

Offset Revenues [$403,336] +
Capacity Savings [$243,212] =

Year 5 Total Gross Energy Benefit = $648,323

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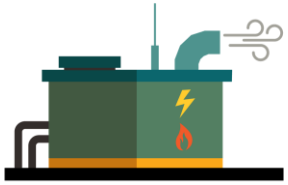
Case Study:

University of Massachusetts Amherst

BATTERY STORAGE

Automation

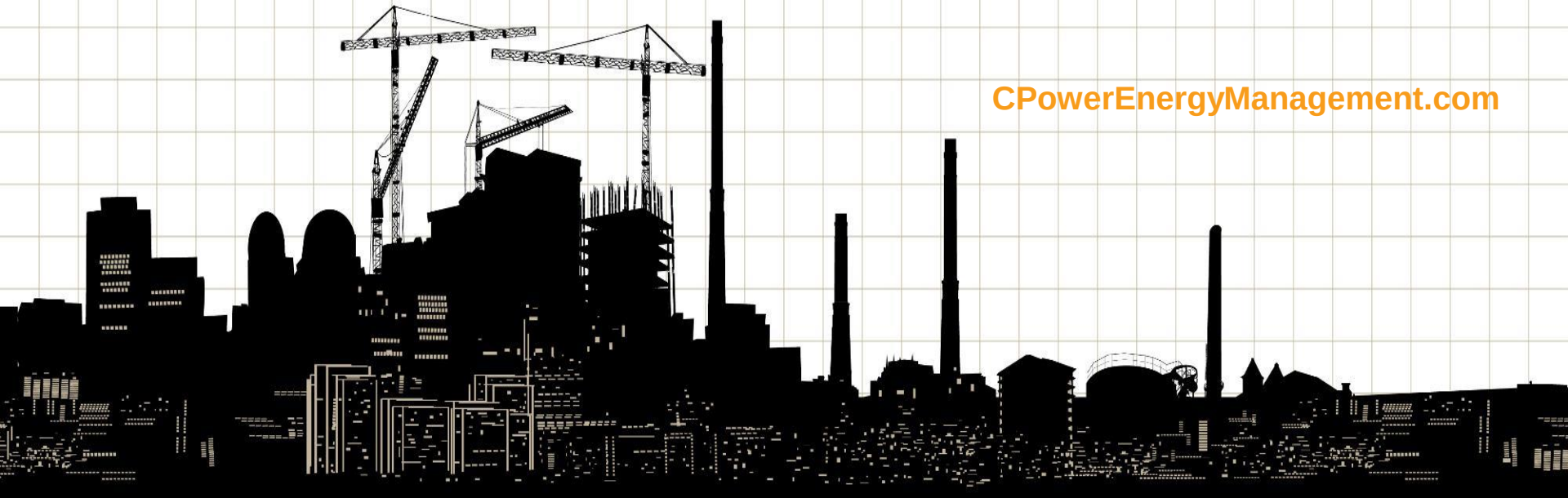


CPower

THANK YOU!

Phil Ciulla
Philip.Ciulla@CPowerEnergyManagement.com
781-214-7519

CPowerEnergyManagement.com



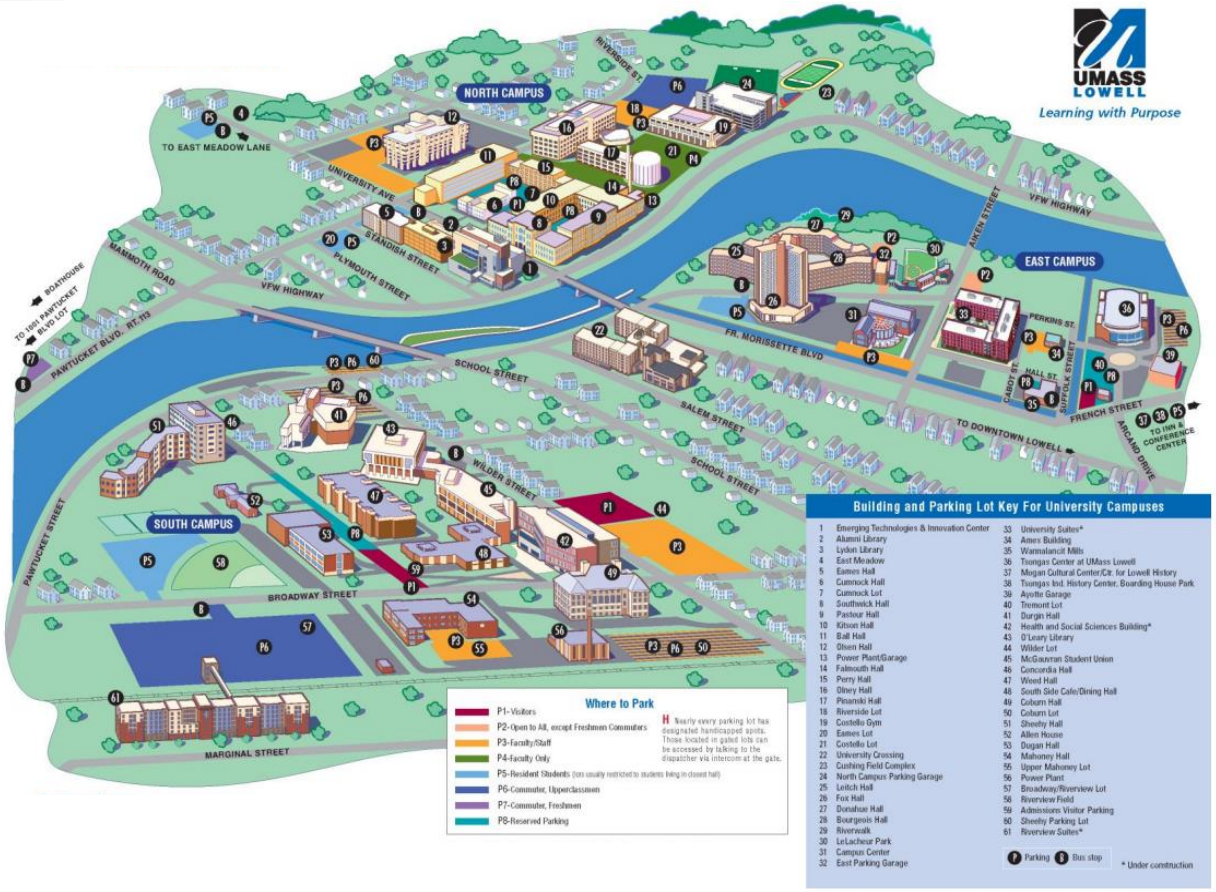
UMASS LOWELL DEMAND RESPONSE

DANIEL ABRAHAMSON, ENERGY MANAGER
OPS FACILITIES DEPARTMENT

RUAIRI O'MAHONY, DIRECTOR OF SUSTAINABILITY
SUSTAINABILITY DEPARTMENT

UMASS LOWELL DEMAND RESPONSE

CAMPUS PROFILE



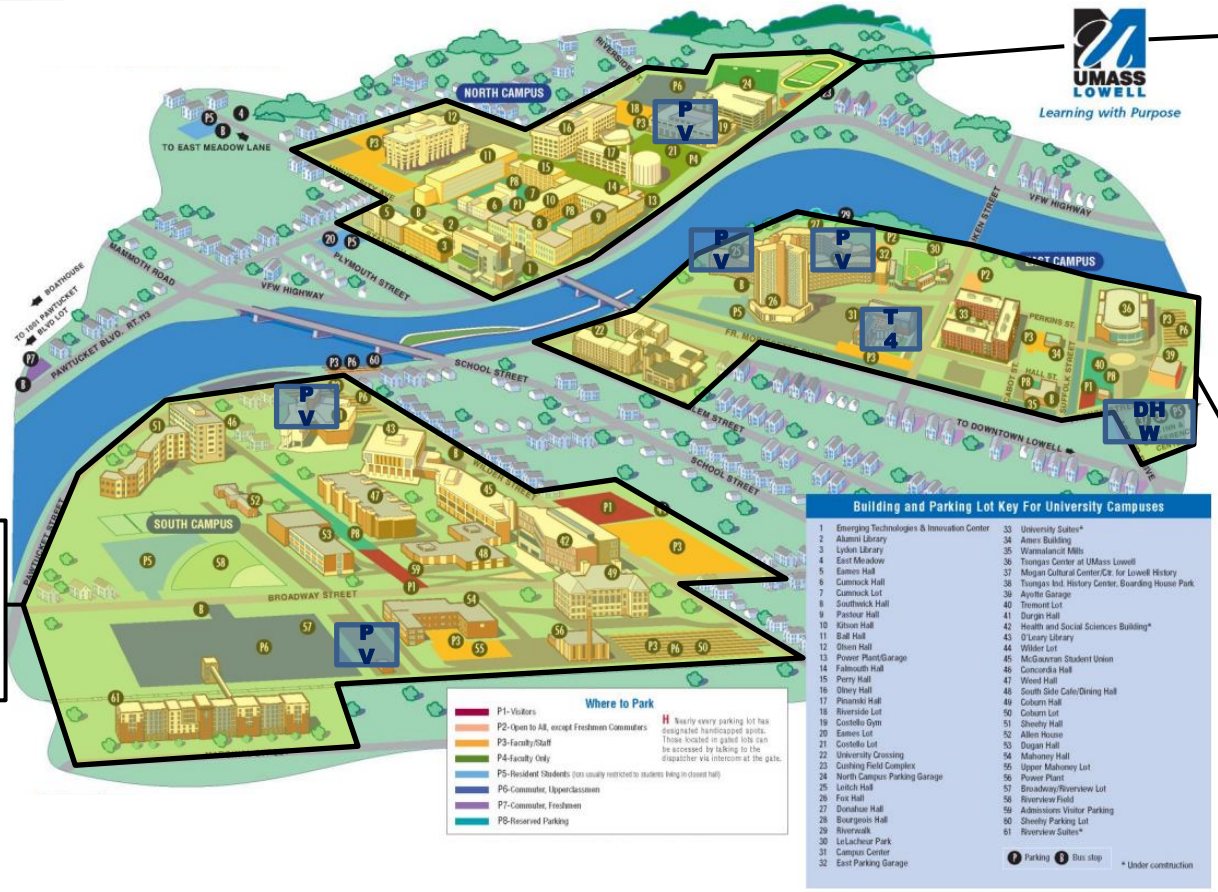
UMASS LOWELL DEMAND RESPONSE

CAMPUS PROFILE

- Academics, Business Centers, Labs, Recreation
- Main electric feed from North Power Plant
- 19.6 MWh annual MWh
- 2.5 MW avg. peak demand
- 3.2 MW 2019 peak

- Business Centers, Dormitories, Labs, Recreation
- Each bldg. has its own electric feed
- 19.5 annual MWh
- 2 MW avg. peak demand
- 2.5 MW 2019 peak

- Academics, Dormitories, Labs
- Main electric feed from South Power Plant
- 12.3 annual MWh
- 1.5 MW avg. peak demand
- 2 MW 2019 peak



UMASS LOWELL DEMAND RESPONSE

PROGRAMS & PARTNERS

nationalgrid

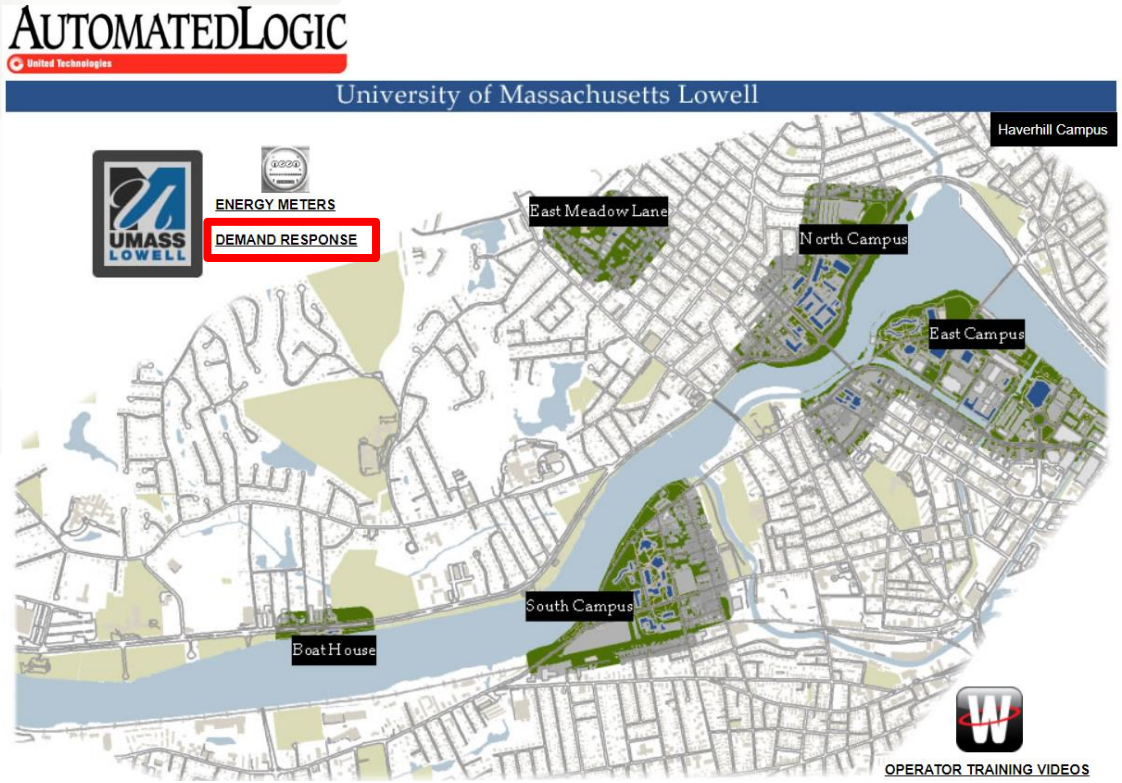
ISO new england

CPower

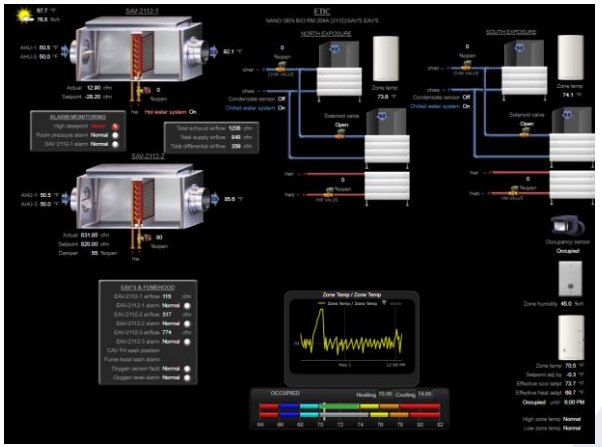
Competitive Energy SERVICES

UMASS LOWELL DEMAND RESPONSE

EVENT S.O.P.



- Temperature setbacks
- Tier 4 generator
- Campus-wide engagement



UMASS LOWELL DEMAND RESPONSE

AWARENESS, USER BEHAVIOR, & ENGAGEMENT

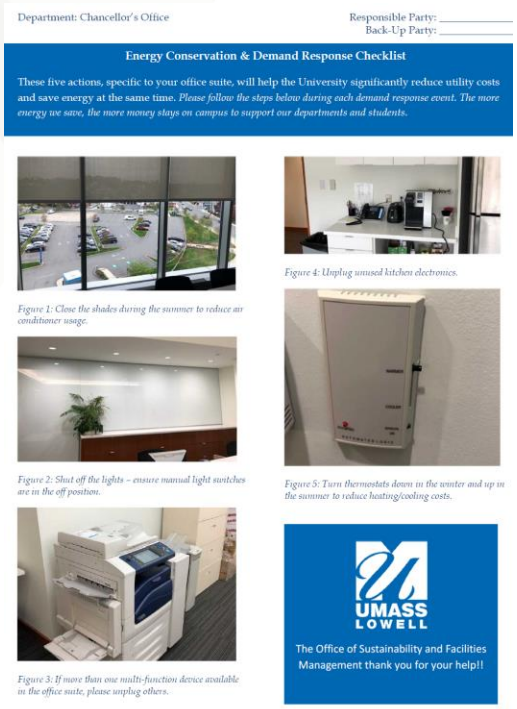
- *"The cheapest and cleanest energy is that which is not used"*

- Targeted approach to increasing awareness of the campus-wide benefit to demand response events & energy conservation:
  - Sustainability Goals
  - Emissions Reductions
  - Fiscal Savings

- Worked with Admin Network Council on department specific energy audits

UMASS LOWELL DEMAND RESPONSE

AWARENESS, USER BEHAVIOR, & ENGAGEMENT



Department: Chancellor's Office

Responsible Party: _____
Back-Up Party: _____

Energy Conservation & Demand Response Checklist

These five actions, specific to your office suite, will help the University significantly reduce utility costs and save energy at the same time. *Please follow the steps below during each demand response event. The more energy we save, the more money stays on campus to support our departments and students.*

Figure 1: Close the shades during the summer to reduce air conditioner usage.

Figure 2: Shut off the lights – ensure manual light switches are in the off position.

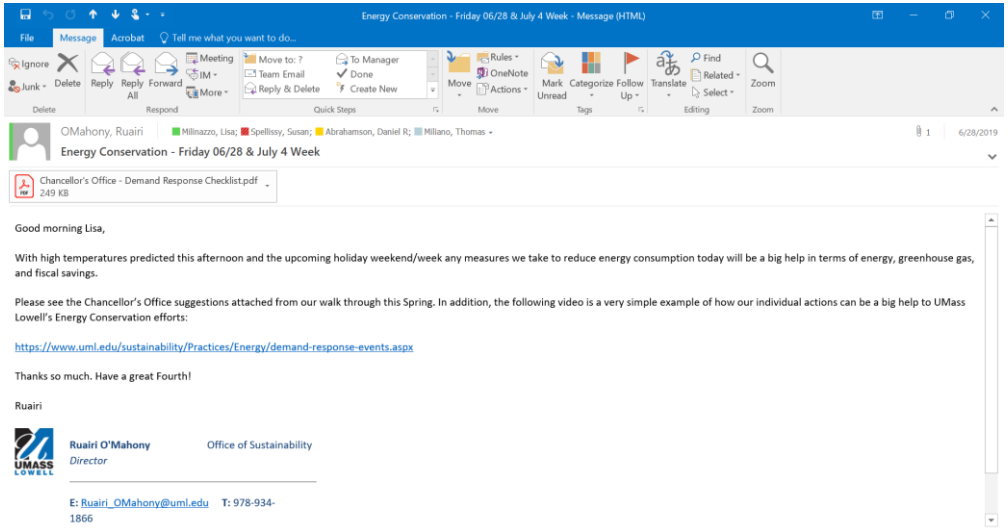
Figure 3: If more than one multi-function device available in the office suite, please unplug others.

Figure 4: Unplug unused kitchen electronics.

Figure 5: Turn thermostats down in the winter and up in the summer to reduce heating/cooling costs.

UMASS LOWELL

The Office of Sustainability and Facilities Management thank you for your help!!



Energy Conservation - Friday 06/28 & July 4 Week - Message (HTML)

File | Message | Acrobat | Tell me what you want to do...

Ignore | Junk | Delete | Reply | Reply All | Forward | Meeting | IM | More | Move to: ? | Team Email | Reply & Delete | To Manager | Done | Create New | Move | Rules | OneNote | Actions | Mark Unread | Categorize | Follow Up | Translate | Find | Related | Select | Zoom

OMahony, Ruairi — Milinazzo, Lisa; Spellissy, Susan; Abrahamson, Daniel R; Miliano, Thomas — 6/28/2019

Energy Conservation - Friday 06/28 & July 4 Week

Chancellor's Office - Demand Response Checklist.pdf
249 KB

Good morning Lisa,

With high temperatures predicted this afternoon and the upcoming holiday weekend/week any measures we take to reduce energy consumption today will be a big help in terms of energy, greenhouse gas, and fiscal savings.

Please see the Chancellor's Office suggestions attached from our walk through this Spring. In addition, the following video is a very simple example of how our individual actions can be a big help to UMass Lowell's Energy Conservation efforts:

https://www.uml.edu/sustainability/Practices/Energy/demand-response-events.aspx

Thanks so much. Have a great Fourth!

Ruairi

UMASS LOWELL

Ruairi O'Mahony Office of Sustainability
Director

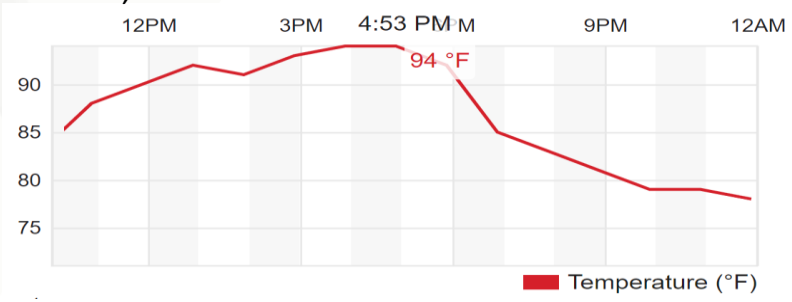
E: Ruairi_OMahony@uml.edu T: 978-934-1866

https://www.uml.edu/sustainability/Practices/Energy/demand-response-events.aspx

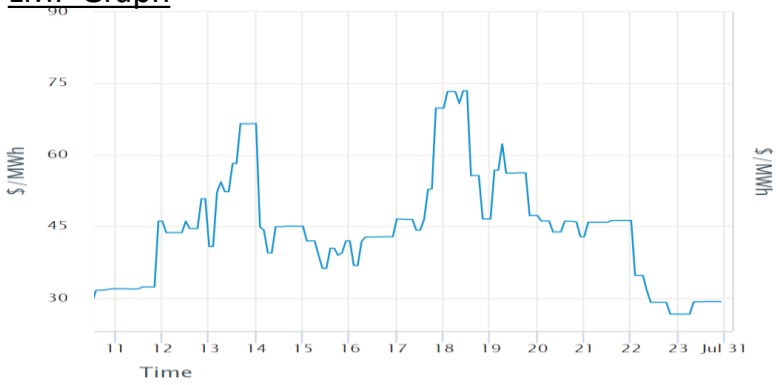
UMASS LOWELL DEMAND RESPONSE

JULY 30, 2019

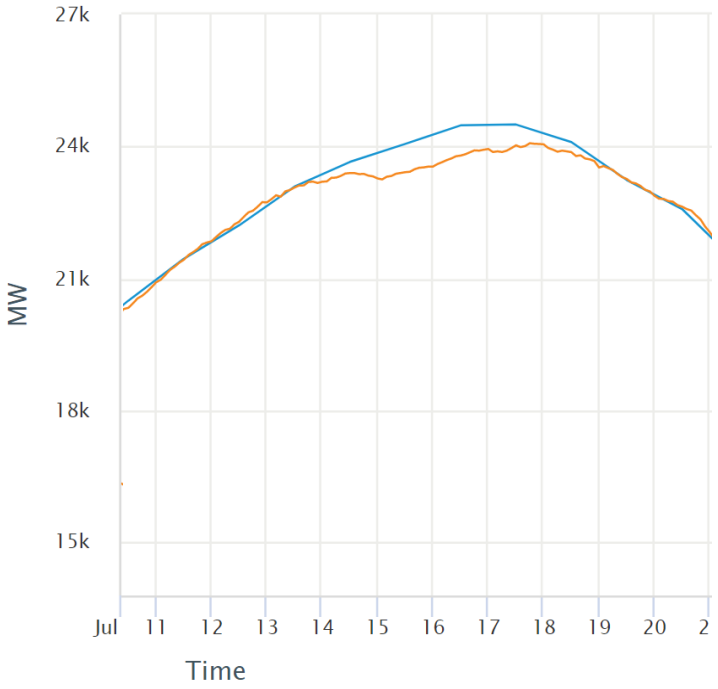
Lowell, MA



LMP Graph

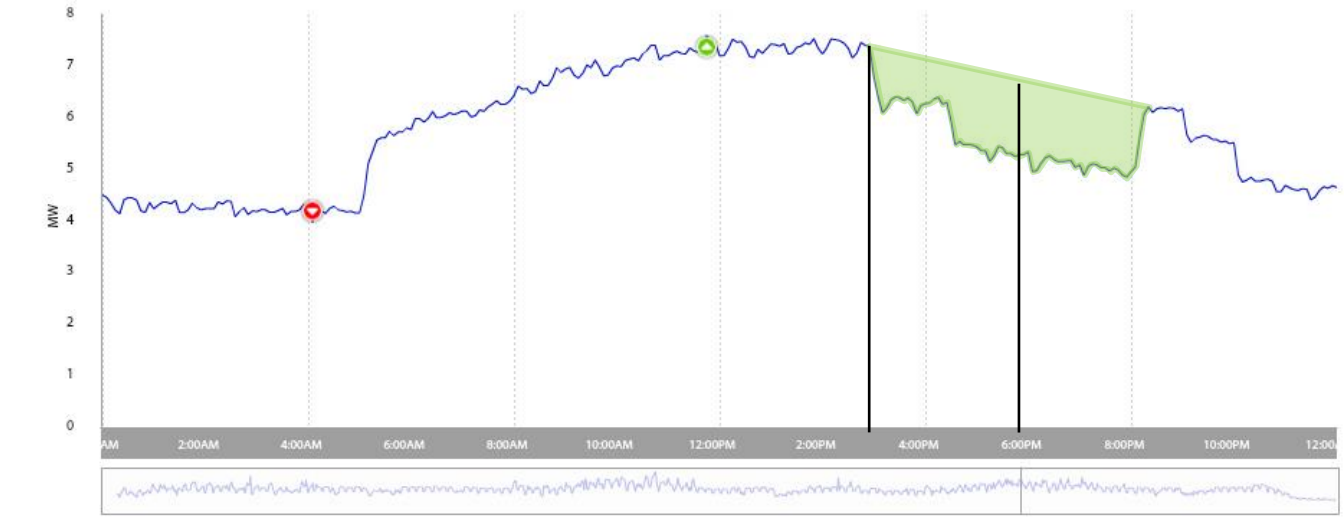


ISO NE System Demand



UMASS LOWELL DEMAND RESPONSE

JULY 30, 2019 – UML RESPONSE



Viewing data as 5 Minutes Interval Weekend Minimum Maximum

Energy Profiling: UMass > UMass Lowell

Electricity Electricity Demand (kW)

Max:	7,591.17 Jul 30, 2019 11:45AM
Min:	3,968.78 Jul 30, 2019 4:05AM
Avg:	5,734.13
Load Factor:	0.76

UMASS LOWELL DEMAND RESPONSE

DAN ABRAHAMSON, ENERGY MANAGER
DANIEL_ABRAHAMSON@UML.EDU

RUAIRI O'MAHONY, DIRECTOR OF SUSTAINABILITY
RUAIRI_OMAHONEY@UML.EDU

Responding to Summer Peak Demand at Bristol C.C.

Jo Ann Bentley

Interim Associate Vice President - Administration and Facilities

Karen Parker

Director of Facilities

ATTLEBORO
FALL RIVER
NEW BEDFORD
TAUNTON
ONLINE

BRISTOL
COMMUNITY COLLEGE

Reasons for Implementation

- Student engagement while setting an example
- Sustainable goals
- Contribution to grid reliability for our community
  - We reduce stress on the electrical grid in the region which helps keep the lights on and reduces the need for new power plants
  - Reduce the need for some of the more inefficient (and often dirtiest) power plants during a time of poor air quality.
- Fiscal bottom line
  - Our electric utility pays us for our participation
  - Negotiated special electricity supply contract that will reward us with lower energy costs next year

BRISTOL
COMMUNITY COLLEGE

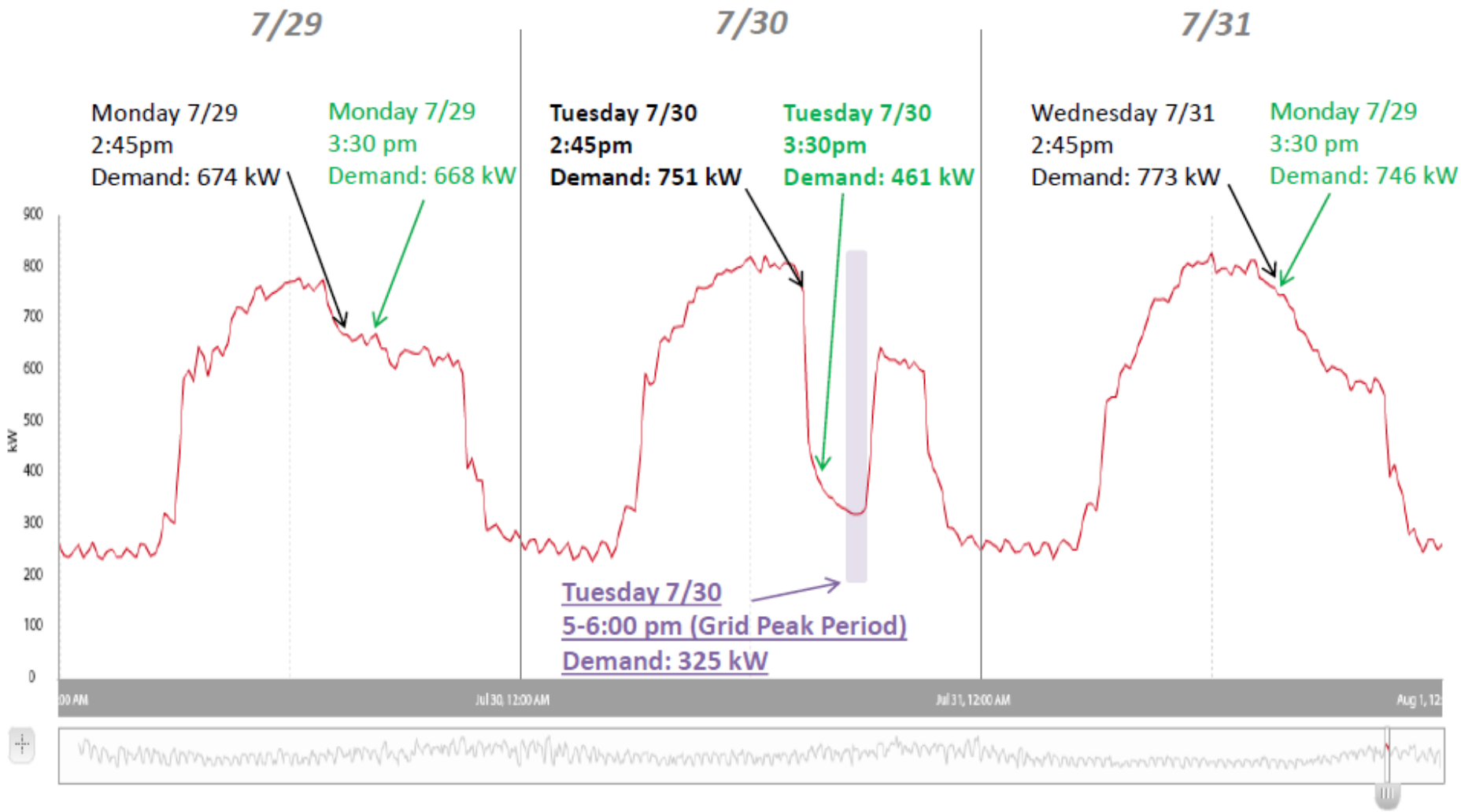
Responding to Peak Demand Periods

- **Notification**
  - Start of season article, Bristol Weekly Article
  - College wide notification approx. 24 hours in advance
    - Message informing all of an impending peak demand day, and the effective time period when our participation is most needed

- **Curtailment Plan Implementation**
  - Building Management System (BMS), System Brownouts
    - 5 Separate Systems
  - Systems to Manually Power Down
    - Location, including panel and breaker identification

BRISTOL
COMMUNITY COLLEGE

Peak Demand Reduction 2019



Challenges

- Avoiding any negative impacts to the learning atmosphere.
- Full support from faculty and staff.

Lessons Learned

- BMS schedule 10-15 minutes before for FULL system communications
- Identify items that are not on BMS brownout schedule and assign staff for shut downs

BRISTOL
COMMUNITY COLLEGE

BRISTOL
COMMUNITY COLLEGE

ATTLEBORO FALL RIVER NEW BEDFORD TAUNTON ONLINE

Creating a Clean, Affordable and Resilient Energy Future for the Commonwealth

Massachusetts Department of Energy Resources

Clean Peak Energy Standard (CPS):
Overview and Relevance for State Entities

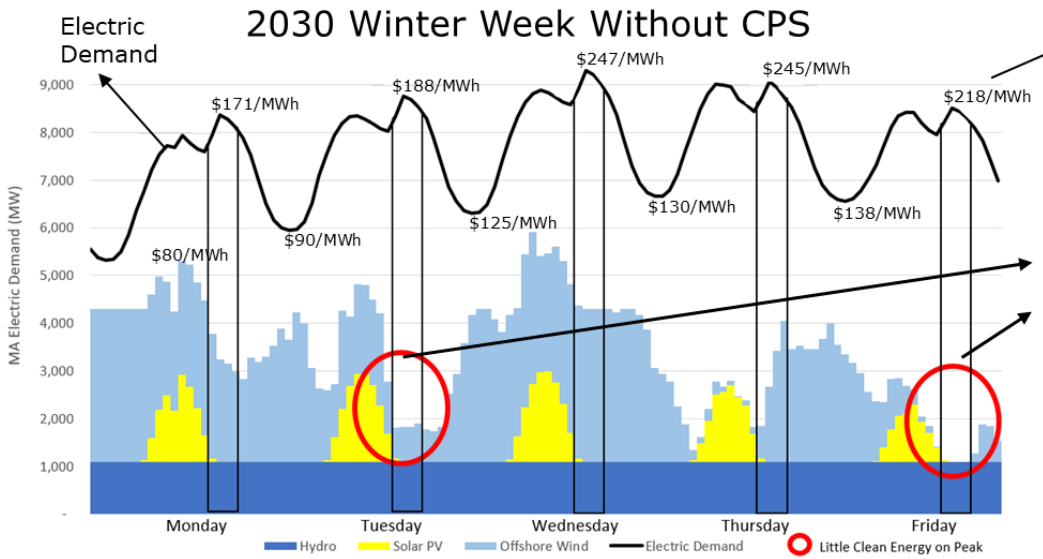
May 12, 2020

Amy McGuire
MA DOER
Deputy Director - Emerging Technology Division
amy.mcguire@mass.gov

Overview

- Clean Peak Standard will be the Administration's signature energy shifting policy enhancing Massachusetts' existing clean energy policies
  - It is a market mechanism
  - It is designed to address the impact of peak demand
  - It will send a signal to clean energy generation to invest in storage technologies
- How it works?
  - CPS creates a requirement on all electricity suppliers to purchase a certain amount of Clean Peak Energy Certificates (CPECs)
  - Eligible resources that generate, dispatch or discharge energy during Seasonal Peak Periods will generate CPECs
  - An Alternative Compliance Payment (ACP) rate will bound the market price of CPECs

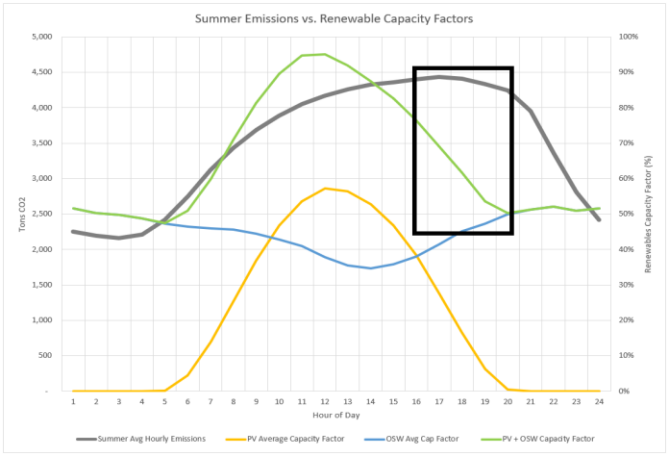
Status Quo Challenge to Resolve

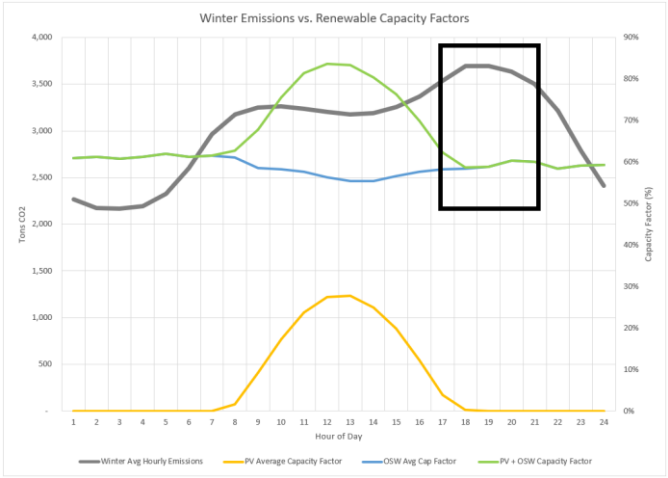


Pricing differentials reflect higher oil and gas use to meet peak

Significant renewable generation, but not during peak hours

Production profile for 1,090 MW Hydro, 3,200 MW Offshore Wind, 5,000 MW Solar PV





Regulation Summary

- Authorized in statute – MGL Chapter 25a, Section 17
- Compliance obligation began 1/1/19 (0%)
- 2020 compliance obligation is 1.5%
  - Load exemptions for contracts
  - Can report any saved data on production to 1/1/19 to receive certificates
- Mirrors other portfolio standards (RPS, APS)
- The Alternative Compliance Rate (ACP) and compliance obligation are set in regulation for the duration of the program (until 2050)

Eligible Resources: Project Eligibility Criteria

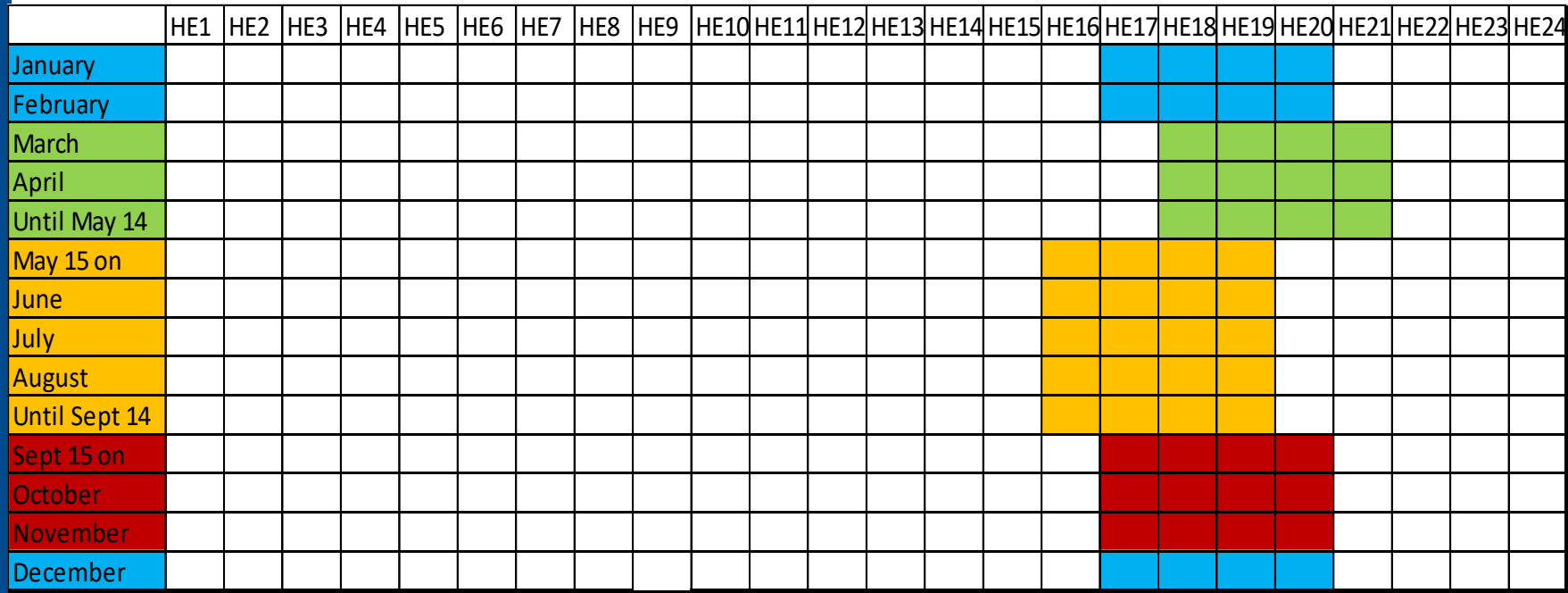
- Four types of eligible resources:
  1. **New RPS Class I** eligible resources in operation on or after 1/1/19
  2. **Existing RPS Class I / Class II resources that are paired with a Qualified Energy Storage System**
  3. **Qualified Energy Storage Systems** operating to primarily store and discharge renewable energy
  4. **Demand Response Resources**
- Resources must be interconnected with the Distribution System or Transmission System in the Commonwealth of Massachusetts.
- Resources interconnected with the Transmission System must be delivered to the Commonwealth of Massachusetts
- Resource performance must be directly measurable and verifiable

Clean Peak Seasons

- The statute requires that daily time windows be established for each of the four annual seasons for when net demand of electricity is the highest
- Stakeholders suggested matching seasons with weather and peak demands instead of strictly following the meteorological seasons
- The DOER established the CPS seasons as:
  - Spring: March 1 – May 14
  - Summer: May 15 – September 14
  - Fall: September 15 – November 30
  - Winter: December 1 – February 28

Seasonal Peak Periods

- The DOER establishes the following initial Seasonal Peak Periods, with each totaling 4 hours:
  - Winter: 4pm – 8pm
  - Spring: 5pm – 9pm
  - Summer: 3pm – 7pm
  - Fall: 4pm – 8pm



Clean Peak Certificates: CPEC Generation

- A qualified Clean Peak Resource will generate Clean Peak Energy Certificates (CPECs) according to the performance of the Clean Peak Resource over the duration of the Seasonal Peak Period of a particular day, with appropriate multipliers applied
- On a day which has the Actual Monthly System Peak, the performance of the resource in the Hour of Actual Monthly System Peak demand is used to calculate the number of additional CPECs
- All CPECs are minted following the receipt and verification of the performance of qualified participating facilities for the month

CPEC Multipliers

- DOER is proposing the use of "multipliers" to align generation of CPECs with time periods and resource attributes of highest impact
  - Multipliers adjust the number of CPECs a resource receives for each MWh of energy generated during the peak
- Seasonal Multiplier
  - Summer/Winter 4x, Spring/Fall 1x
- Actual Monthly System Peak Multiplier
  - 25x for performance coincident with highest single hour of demand in the month
- Resilience Multiplier
  - 1.5x provided to resources which increase energy resilience to outages

CPEC Multipliers

- Existing Resource Multiplier
  - 0.1x applied to existing renewable resources
- Contracted Resource Multiplier
  - 0.01x applied to state contracted renewable resources
- SMART ES Resource Multiplier
  - 0.2x applied to SMART ES resources
- Future Consideration: Distribution Circuit Multiplier
- Five-year built-in multiplier review starting in 2025

Annual Program Requirements

- No change proposed to the original Minimum Standard
- No change proposed to the Clean Peak Target

Year	Forecasted Load (TWh)	Minimum Standard (%)	Compliance Obligation (TWh)	Forecasted Peak Demand (MW)	Clean Peak Target (MW)	Clean Peak Target (% of Peak)
2020	45.2	1.5%	0.4	11,591	100	1%
2021	44.8	3.0%	1.3	11,682	300	3%
2022	44.6	4.5%	2.0	11,773	450	4%
2023	44.6	6.0%	2.7	11,864	800	7%
2024	44.8	7.5%	3.4	11,955	1,050	9%
2025	45.3	9.0%	4.1	12,045	1,200	10%
2026	46.2	10.5%	4.8	12,136	1,450	12%
2027	47.4	12.0%	5.7	12,227	1,700	14%
2028	48.6	13.5%	6.6	12,318	2,000	16%
2029	50.0	15.0%	7.5	12,409	2,400	19%
2030	51.9	16.5%	8.6	12,500	2,750	22%

Expected to achieve 2,750 MW of clean peak in 2030 which aligns with the most cost-effective scenario in DOER's Comprehensive Energy Plan

Cost Benefit Analysis

- With recommended changes, CPS maintains cost and emissions **savings** to ratepayers
  - ACP rate of $45, held for 5 years before declining
  - Net ratepayer savings after year 6
  - $390 million and 560K metric tons CO_2 savings in the first ten years

Year	ACP Price ($)*	Max Ratepayer Cost ($/kWh)	Max Ratepayer Cost ($ Million/yr)	Ratepayer Savings ($ Million/yr)	Net Ratepayer Savings ($ Million/yr)	Net Ratepayer Cost ($/kWh)	Emissions Savings (metric tons CO2/yr)
2020	$ 45.00	$0.0007	($20)	$5	($15)	$0.0005	1,026
2021	$ 45.00	$0.0014	($60)	$8	($52)	$0.0012	1,482
2022	$ 45.00	$0.0020	($86)	$13	($74)	$0.0017	4,696
2023	$ 45.00	$0.0027	($108)	$51	($57)	$0.0013	16,011
2024	$ 45.00	$0.0034	($127)	$97	($30)	$0.0007	29,816
2025	$ 43.46	$0.0039	($142)	$147	$5	($0.0001)	46,038
2026	$ 41.92	$0.0044	($156)	$207	$51	($0.0011)	61,566
2027	$ 40.38	$0.0048	($174)	$255	$81	($0.0017)	76,109
2028	$ 38.84	$0.0052	($191)	$313	$121	($0.0025)	94,193
2029	$ 37.30	$0.0056	($207)	$374	$166	($0.0033)	108,622
2030	$ 35.76	$0.0059	($229)	$421	$192	($0.0037)	123,572
TOTAL			**($1,500)**	**$1,889**	**$390**		**563,359**

*After first 5 years, ACP rate declines to contain program costs

Current CPS Status

Current State:

- Submitted to TUE and concurred by both the Senate and the House on 4/21/2020 – triggering the first 30-day TUE comment period

Remaining Milestones:

- TUE initial comment period ends 5/21/2020
- Resubmission to TUE for second 30-day review period anticipated by 5/22/2020
- File with Secretary of State by 6/26/2020 for publication by 7/10/2020
- Stakeholder training to coincide with publication – regulation, application, reporting, and guidelines
- NEPOOL GIS rule change and system updates 7/1/2020
- Application portal for resources to qualify goes live 7/15/2020
- Reporting platform goes live 10/15/2020

Relevance to State Entities

- State entities are eligible
- CPS itself is a revenue stream – for existing, upgraded, and new projects
- CPS incents investments (in energy storage) that can have other additional benefits
  - Reducing demand charges
  - Monetizing the resilience of paired solar plus storage systems
  - Enabling the integration of additional clean, distributed energy resources
  - Potentially avoiding or reducing interconnection upgrade costs for distributed energy resources
  - Resolving power quality issues
  - Preventing future curtailment
- CPS enables state entities to Lead By Example

DOER
Massachusetts Department of Energy Resources

The Nexus of Renewables, Energy Efficiency, Resiliency, and Peak Demand Reduction

LBE GRID STRATEGIES

Lessons Learned: UMass Battery & Solar + Storage Projects

MAY 2020

RFP OBJECTIVES

1. Evaluate business case of energy storage deployment at UMass campuses

2. Select partner(s) to develop effective ACES demonstration grant proposal(s)

Photo Credit: Convergent Energy & Power

ACES DEMONSTRATION GRANT

- $10M available in grant funding
- Awards from $100,000 - $1.25M
- Minimum 50% project cost share required
- Technical assistance for project monitoring and verification of non-monetizable benefits
- Projects must be located in Massachusetts

Selection Criteria:
- Diversity of customer benefits/revenue streams **and** non-monetizable/system benefits
- Readiness to proceed
- Project replicability

Eligibility Criteria:
- Project site must be located in Massachusetts
- A range of advanced storage technologies are encouraged to apply
- Projects must be grid-connected

	MassCEC Timeline	UMass Critical Path
Solicitation Released	Thursday, March 9, 2017	March 2017 - Short List & Interviews
Informational Webinar	Wednesday April 5, 2017	April 2017 - Financial & Legal Negotiations, Select Vendor(s)
Deadline for Written Questions	Friday, April 28, 2017	May 2017 - Finalize Grant Proposal
Application Deadline	Friday, June 9, 2017	
Grant Award Notifications	Friday, September 8, 2017	
Contracting Process	Within 1 month of award notification	
Project Installed	Within 18 months of contracting	
Project Performance Monitoring Ends	Three years from start of operation	

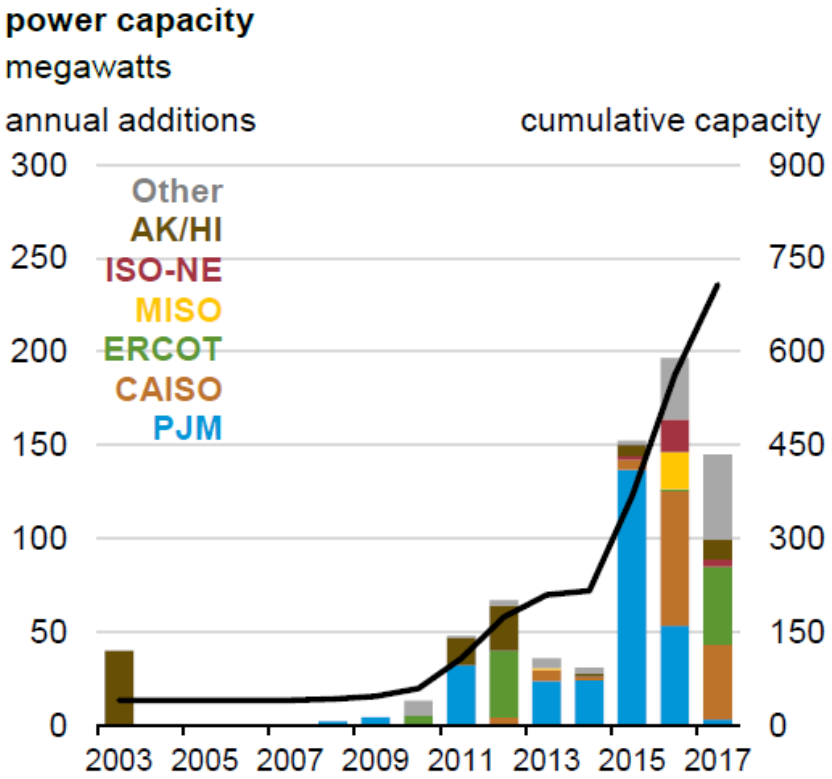
ENERGY STORAGE

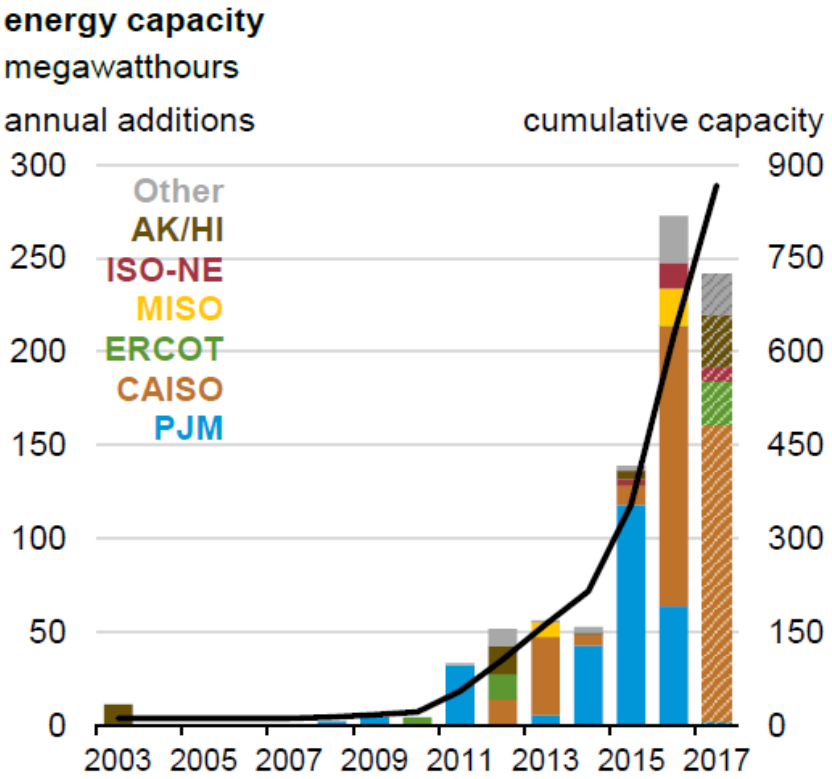
Technology & Applications

Competitive Energy SERVICES

Growth in stationary battery storage has several key drivers

State Mandates & Incentives ▪ Cost Decline ▪ Market Access (FERC Order 851)





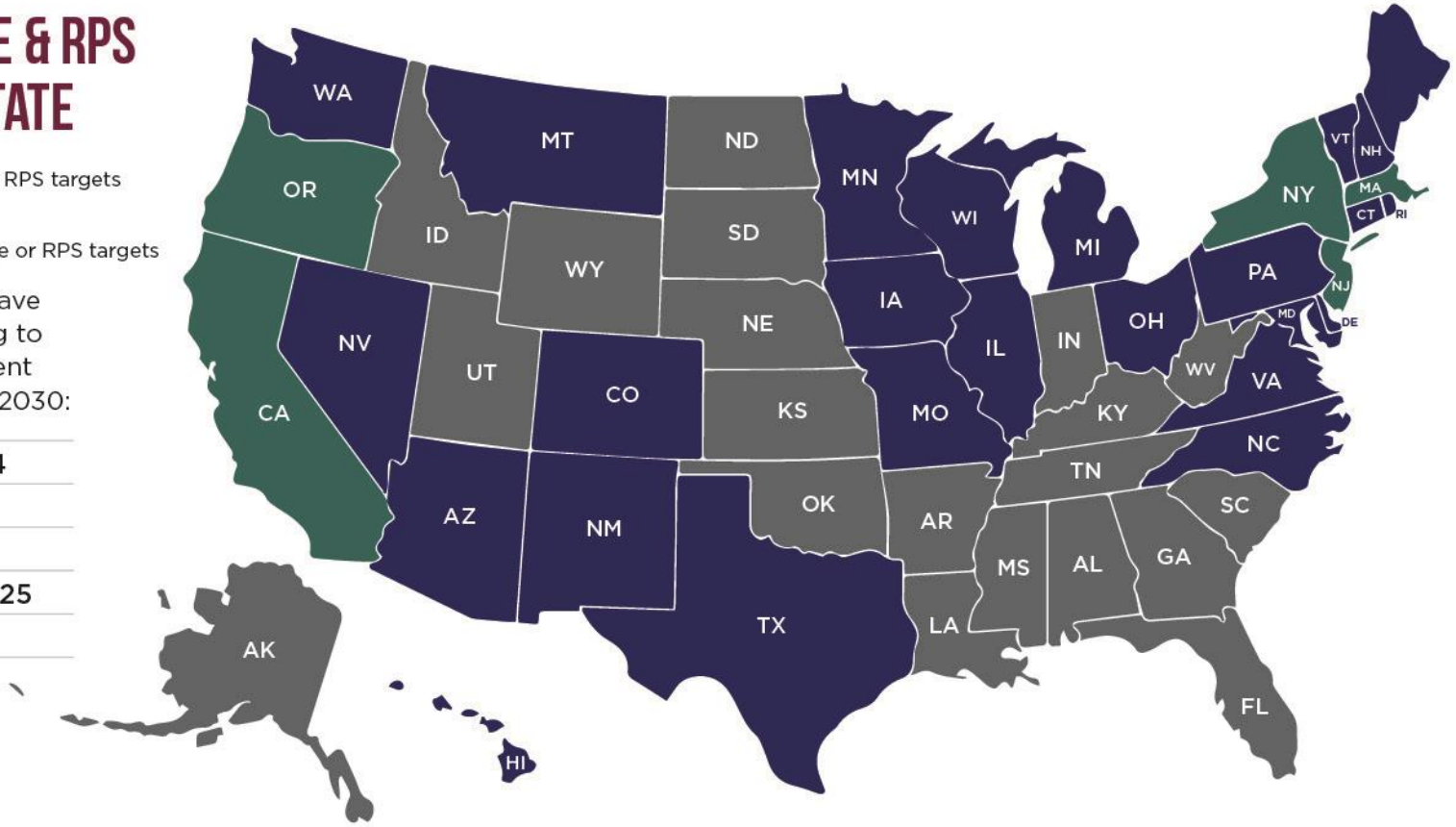
STORAGE | State Deployment Targets

ENERGY STORAGE & RPS MANDATES BY STATE

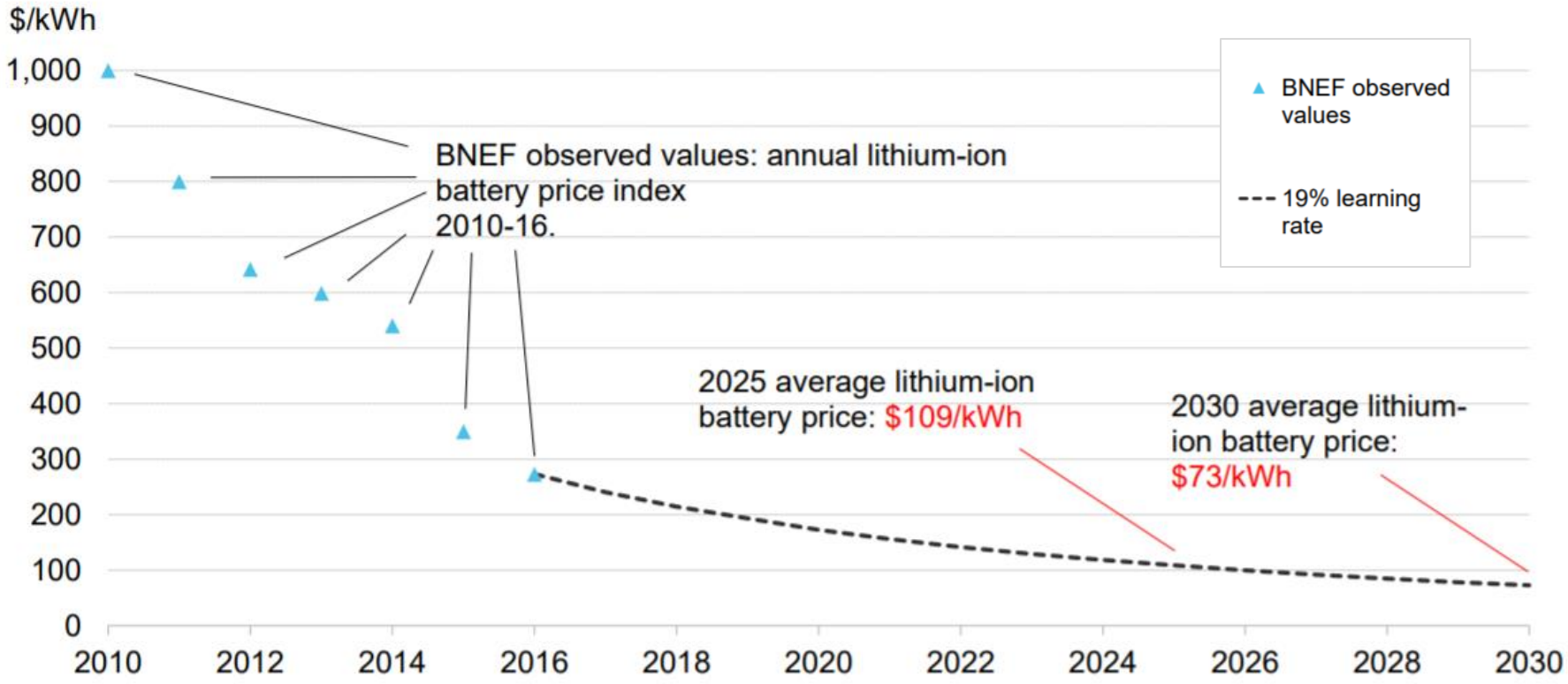
- States with energy storage & RPS targets
- Sates with RPS targets
- States with no energy storage or RPS targets

To date, five U.S. states have passed legislation leading to energy storage deployment targets between 2020 & 2030:

CA	1.825 GW by 2024
NY	3 GW by 2030
NJ	2 GW by 2030
MA	1,000 MWh by 2025
OR	5 MWh by 2020



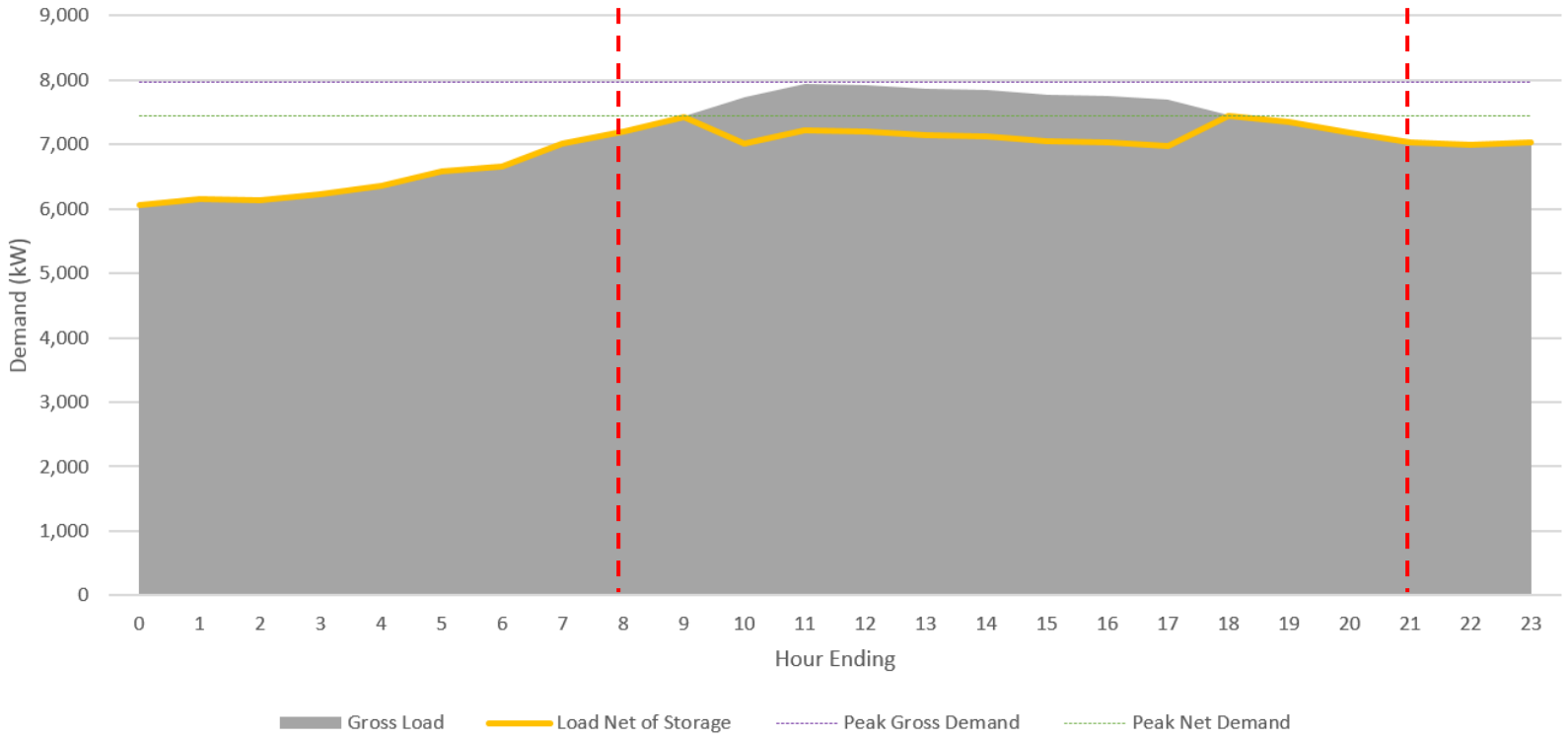
STORAGE | Learning Rate of Battery Storage



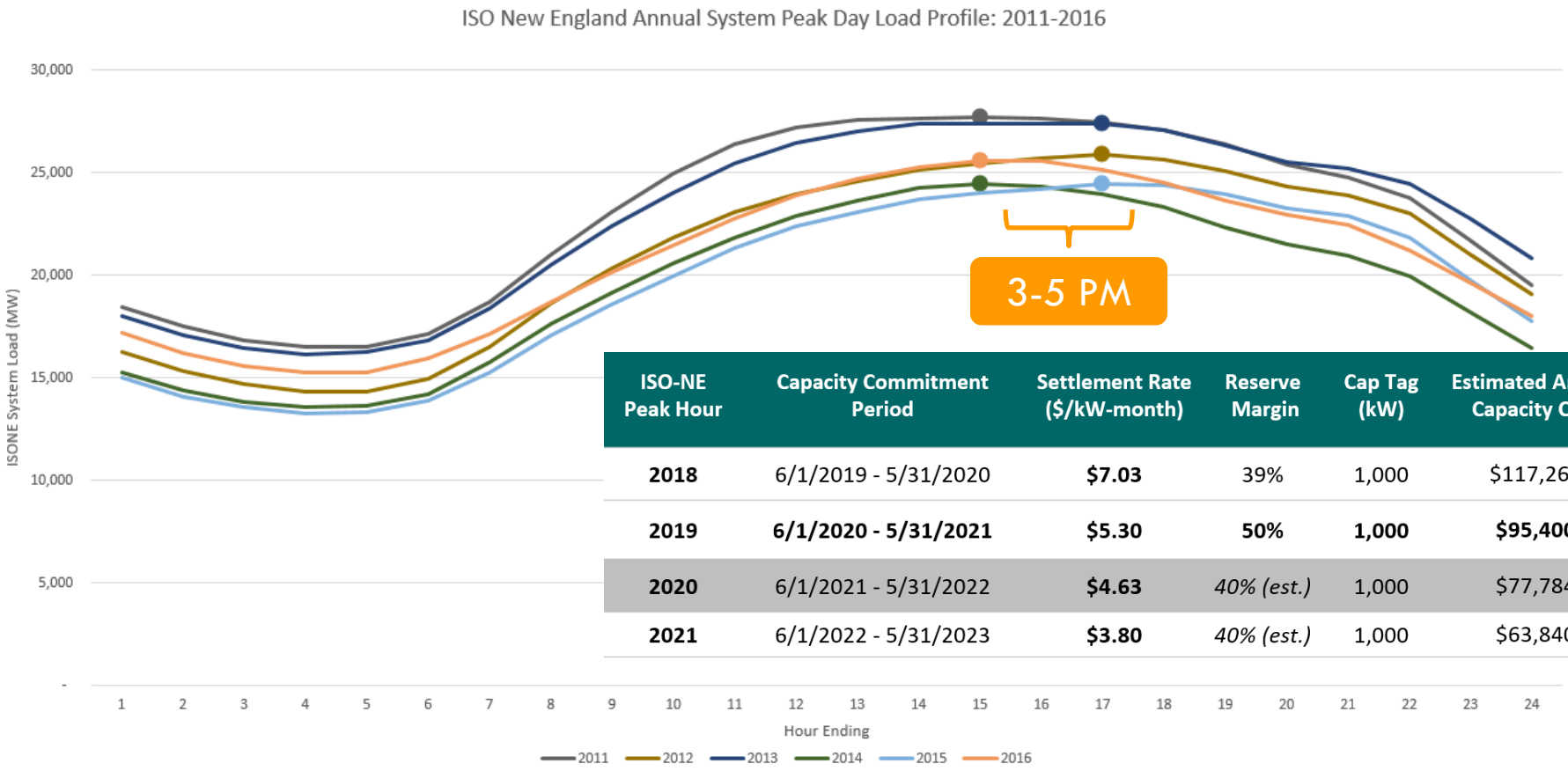
Source: Bloomberg New Energy Finance - Approaches for Using Scenarios in Strategic Decision Making

STORAGE | Electricity Rate Design

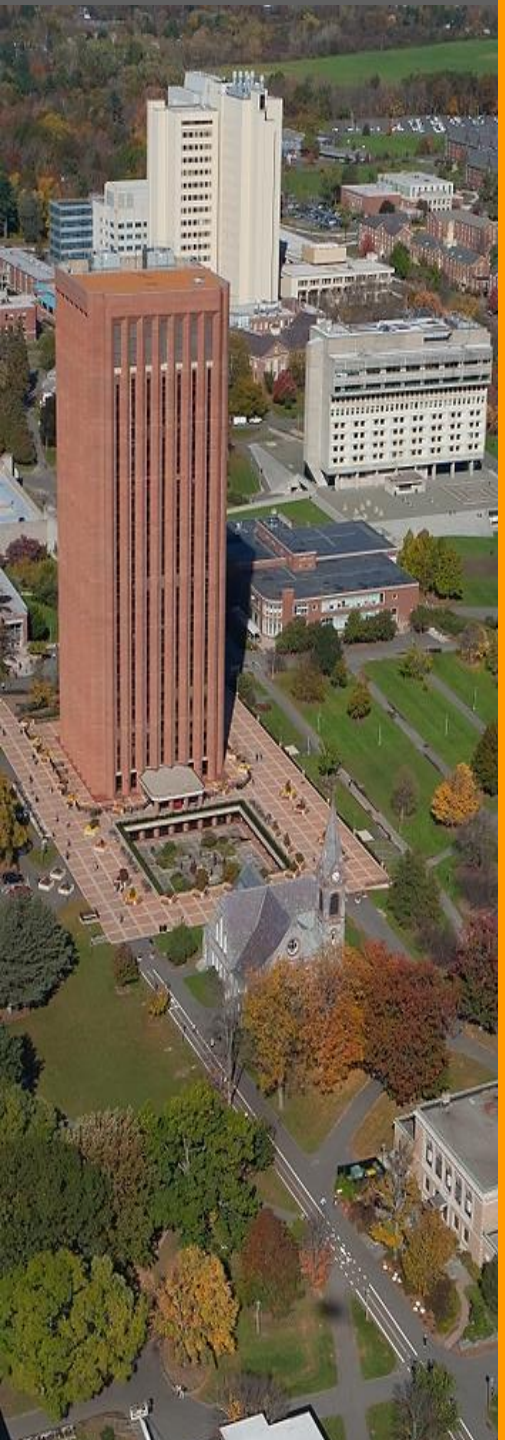
Coincident = Customer's Demand during the hour of System Peak (Utility, ISO New England)
Non-Coincident = Customer's Peak Demand over the course of a monthly Utility billing cycle



STORAGE | CAPACITY TAG REDUCTION



ISO-NE Peak Hour	Capacity Commitment Period	Settlement Rate ($/kW-month)	Reserve Margin	Cap Tag (kW)	Estimated Annual Capacity Cost
2018	6/1/2019 - 5/31/2020	**$7.03**	39%	1,000	$117,260
2019	**6/1/2020 - 5/31/2021**	**$5.30**	**50%**	**1,000**	**$95,400**
2020	6/1/2021 - 5/31/2022	**$4.63**	*40% (est.)*	1,000	$77,784
2021	6/1/2022 - 5/31/2023	**$3.80**	*40% (est.)*	1,000	$63,840



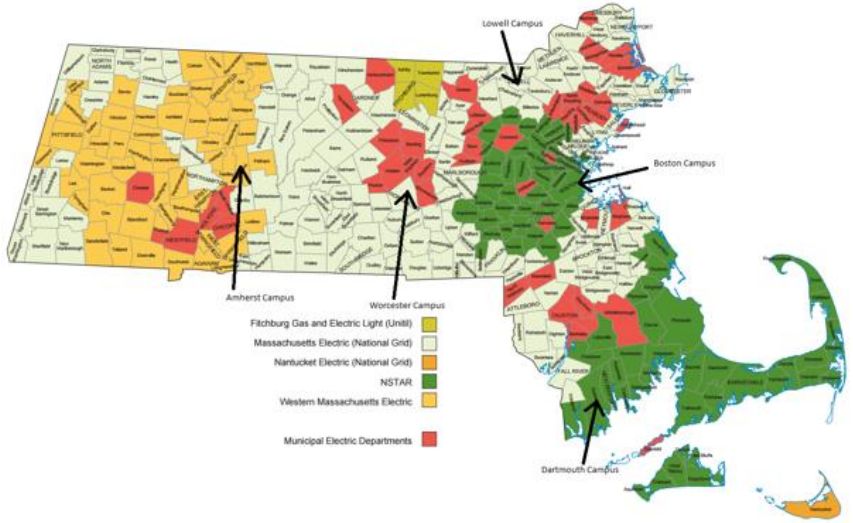
UMASS RFP RESULTS

Bid Analysis & Next Steps

Competitive Energy SERVICES

ELECTRICITY ACCOUNTS SELECTED

UMass Campus	Service Territory	Load Zone	Utility Account Number	Utility Account Rate Class
Amherst	Eversource	WCMA	54-354647018	0T5
Boston	Eversource	NEMA	2628-056-1007	B3 NEMA LG General TOU
Dartmouth	Eversource	SEMA	1221-032-0029	24 SEMA LG General TOU
Lowell	NGRID	WCMA	16084-84029	Time-of-Use G-3
Worcester	NGRID	WCMA	01659-45013	Time-of-Use G-3



BID SUMMARY

- 7 Developers Submitted Bids
- 3 Contract Structures Proposed
- Boston & Amherst Campuses Targeted

Developer Expects Net Savings Without Grant

Campus	Developer						
	Borrego	Constellation	Convergent	Enel	Green Charge	SolarCity	AMS
Amherst							
Boston							
Dartmouth							
Lowell							
Worcester							

Developer Expects Net Savings With Grant

Campus	Developer						
	Borrego	Constellation	Convergent	Enel	Green Charge	SolarCity	AMS
Amherst							
Boston							
Dartmouth							
Lowell							
Worcester							

CONTRACTS | Key Focus Areas

PERFORMANCE GUARANTEE

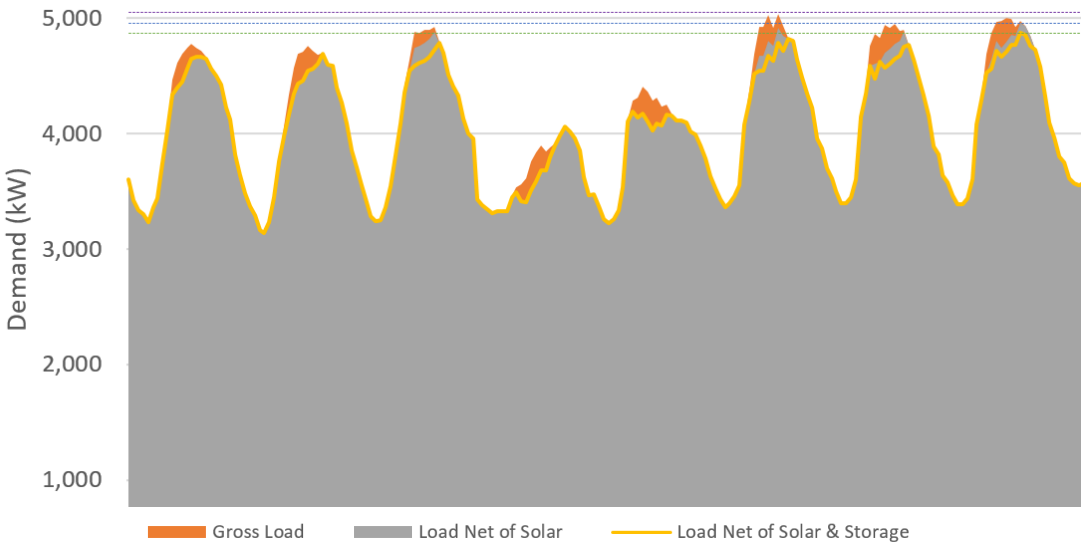
- Easy-to-understand performance validation
  - Calculations tied to utility bill
  - Calculations align with tariff structure
- Clear performance adjustment if guarantee is not met
  - $/kW payment
  - Performance ratio

RED FLAGS

- Future development restrictions
- Change in load provisions
- Change in utility tariff provisions
- Attribute ownership

MAX GROSS LOAD VS. MAX NET LOAD

- What would have demand charge been "but for" energy storage?
- Max Gross Load = Campus Load +/- Storage Flow + Solar (if applicable)
- Max Net Load = Campus Load
- Actual Demand Reduction = Max Gross Load – Max Net Load



INITIAL FINDINGS | No Grant Awarded

1. MA storage incentives are in flux, likely to change significantly over next 12-24 months
2. Boston offers the most attractive business case assuming acceptable performance guarantee
3. Guarantee would require UMass to accept risk of either change in load or tariff
4. Other four campuses require incentives to produce compelling business case
5. Dartmouth would become candidate if Eversource rate case proposal is approved

Photo Credit: Portland General Electric

RECOMMENDATIONS | Partner Selection

1. Enel proposal for Boston campus should be further evaluated
2. Borrego proposal for Amherst campus should be further evaluated
3. AMS proposal for UMD is being clarified, appears to offer best savings split with lowest risk
4. Assuming AMS proposal does not change, Amherst and Dartmouth (in this order) offer strongest business case behind Boston

Photo Credit: Seattle Times

End Result | Massachusetts Battery Demonstrations

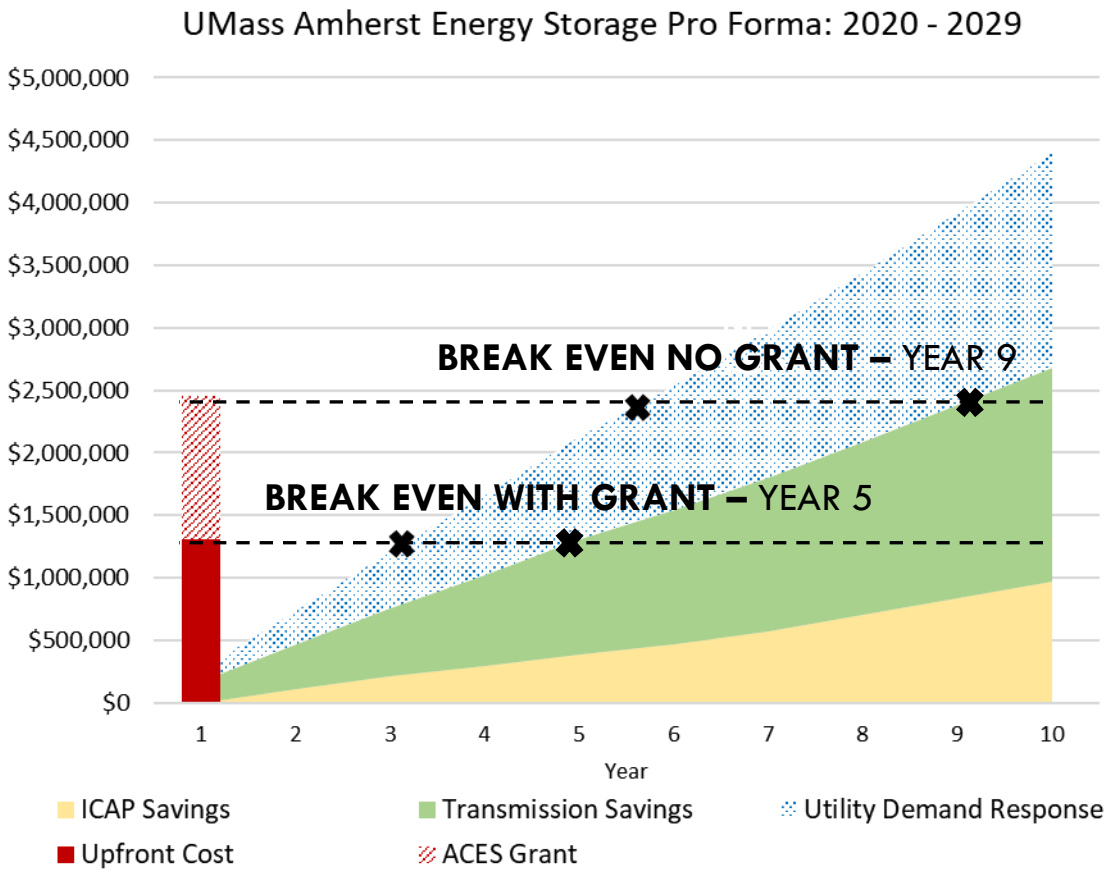
Behind-the-Meter Lithium Ion Case Studies

UMass Amherst – 1.32 MW/4 MWh storage
UMass Boston – 0.50 MW/2 MWh storage + 968 kW solar
UMass Dartmouth – 0.52 MW/1 MWh storage

		Project Grant Funding			State Legislation		Utility Demand Response	
Campus	Financing Mechanism	MassCEC ACES Grant	DOER Solar+ Storage Grant	Eversource Energy Efficiency Grant	SMART	Clean Peak Standard	Daily Dispatch (Summer)	Targeted Dispatch (Winter)
UMass Amherst	Own & Operate	Yes/$1.14m	No	No	No	Maybe	Yes	Yes
UMass Boston	Shared Savings	Yes /$850k	Yes/$625k	No	Yes	Maybe	Yes	No*
UMass Dartmouth	Shared Savings	No	No	Yes	No	Maybe	Yes	No*

End Result | UMass Amherst ACES Demonstration

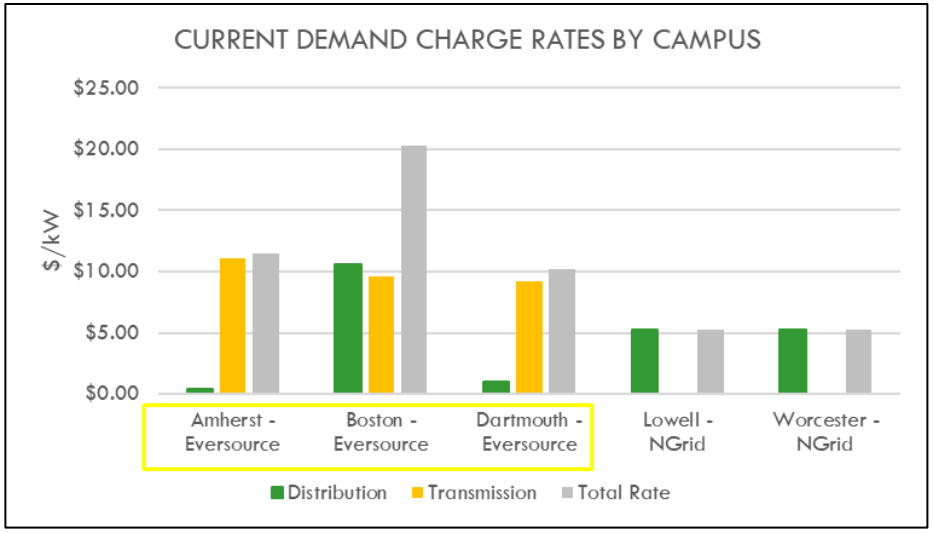
- 1.32 MW/4 MWh lithium ion battery commissioned in July 2019
- $1.1 million state grant awarded for the project, which covered nearly 50% of installation cost
- Main goals of battery operations to 1) shave campus peak demand and 2) help integrate onsite solar, not to "firm up" solar generation
- UMass Amherst's unique electric rate design and external funding enables payback under 10 years

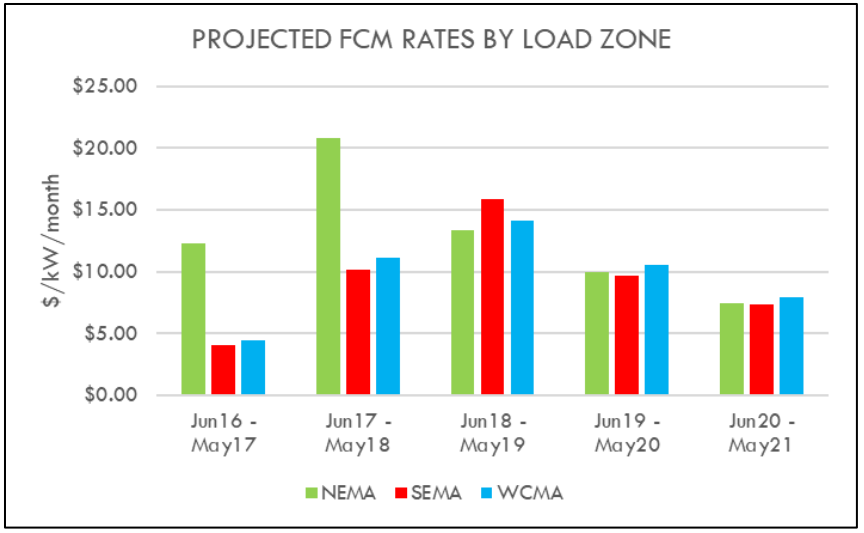


THANK YOU

Competitive Energy SERVICES

DEMAND CHARGE & FCM RATES





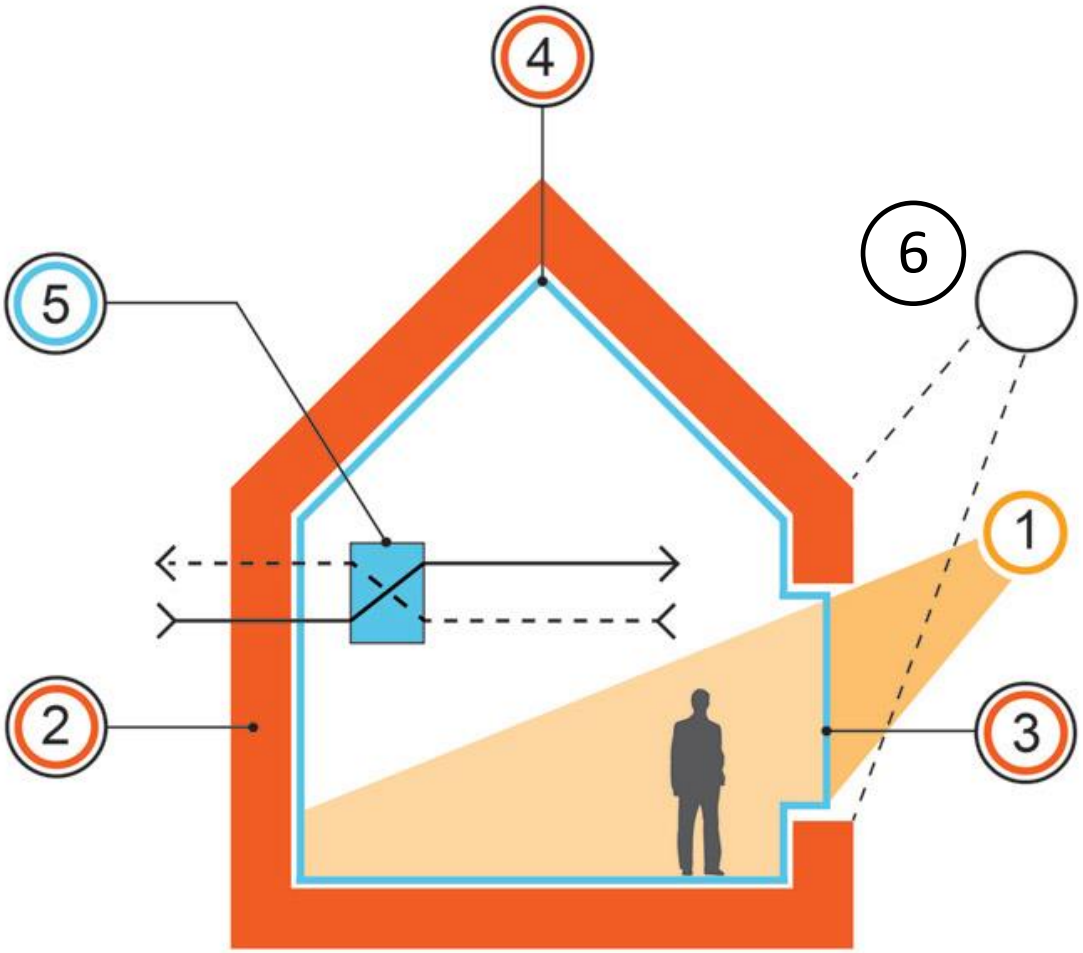
Passivehouse

efficiency, resilience, demand response

Paul Ormond, DOER

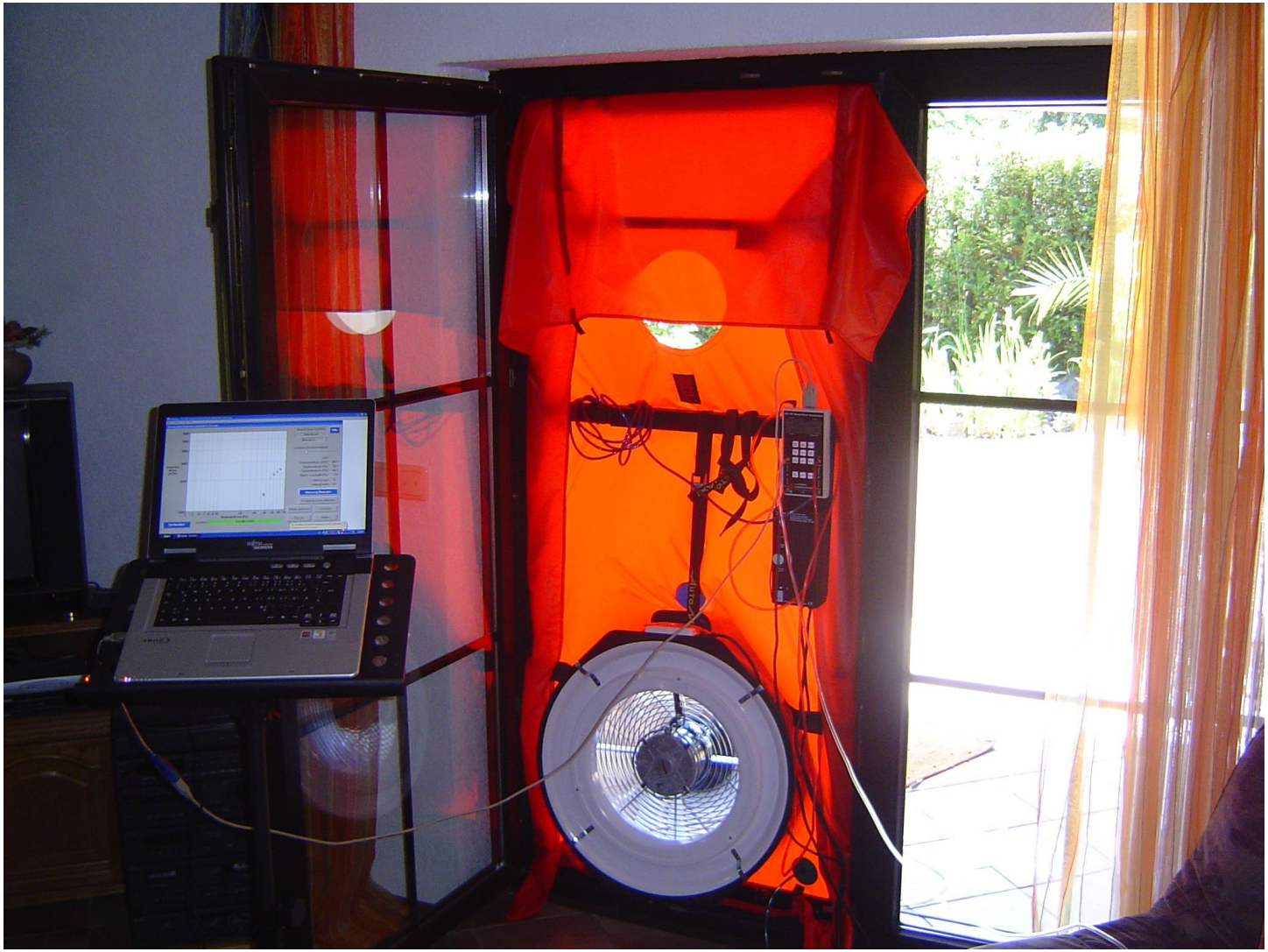
Can You Find the Passive House?

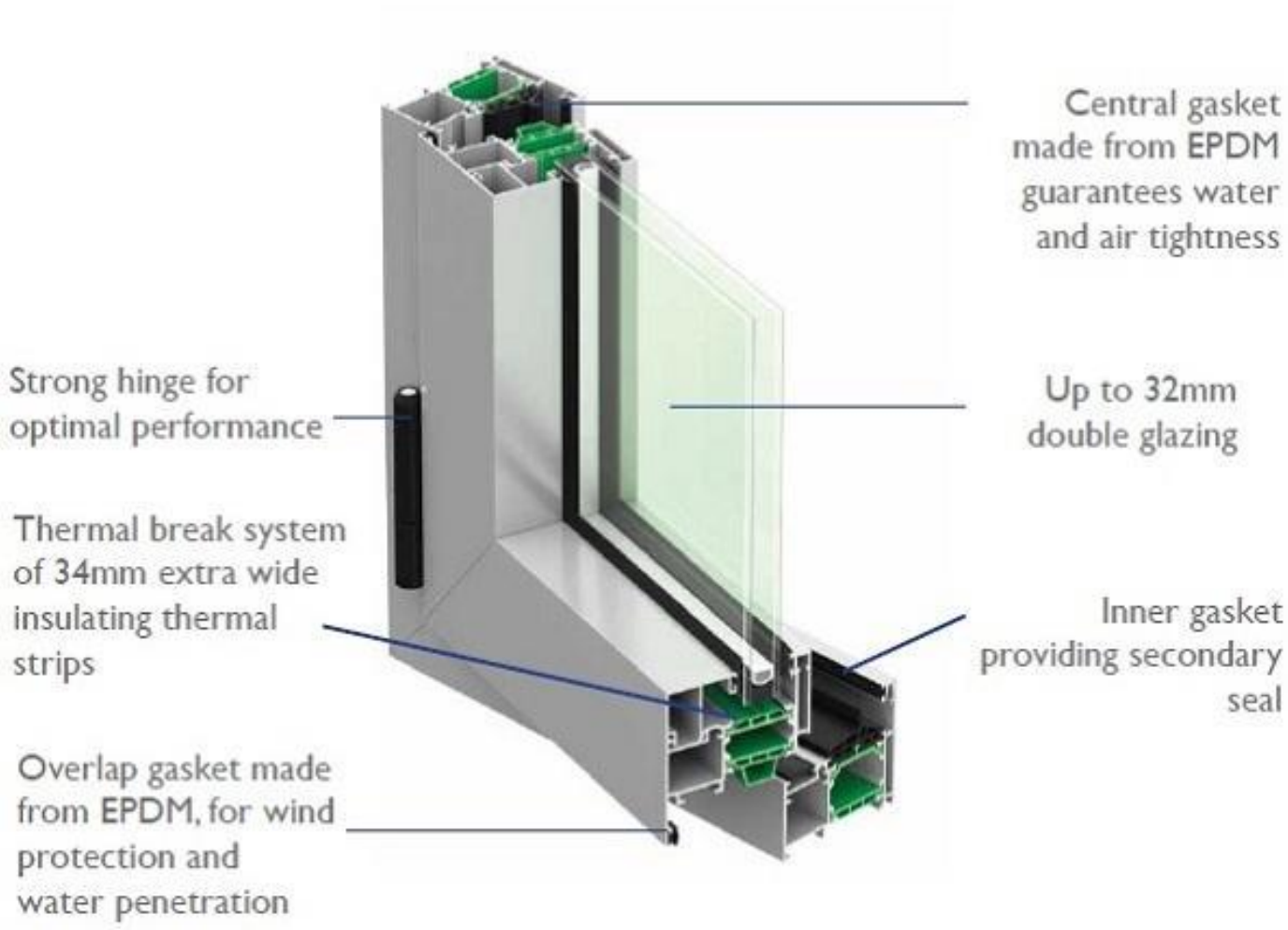
Can You Find the Passive House?



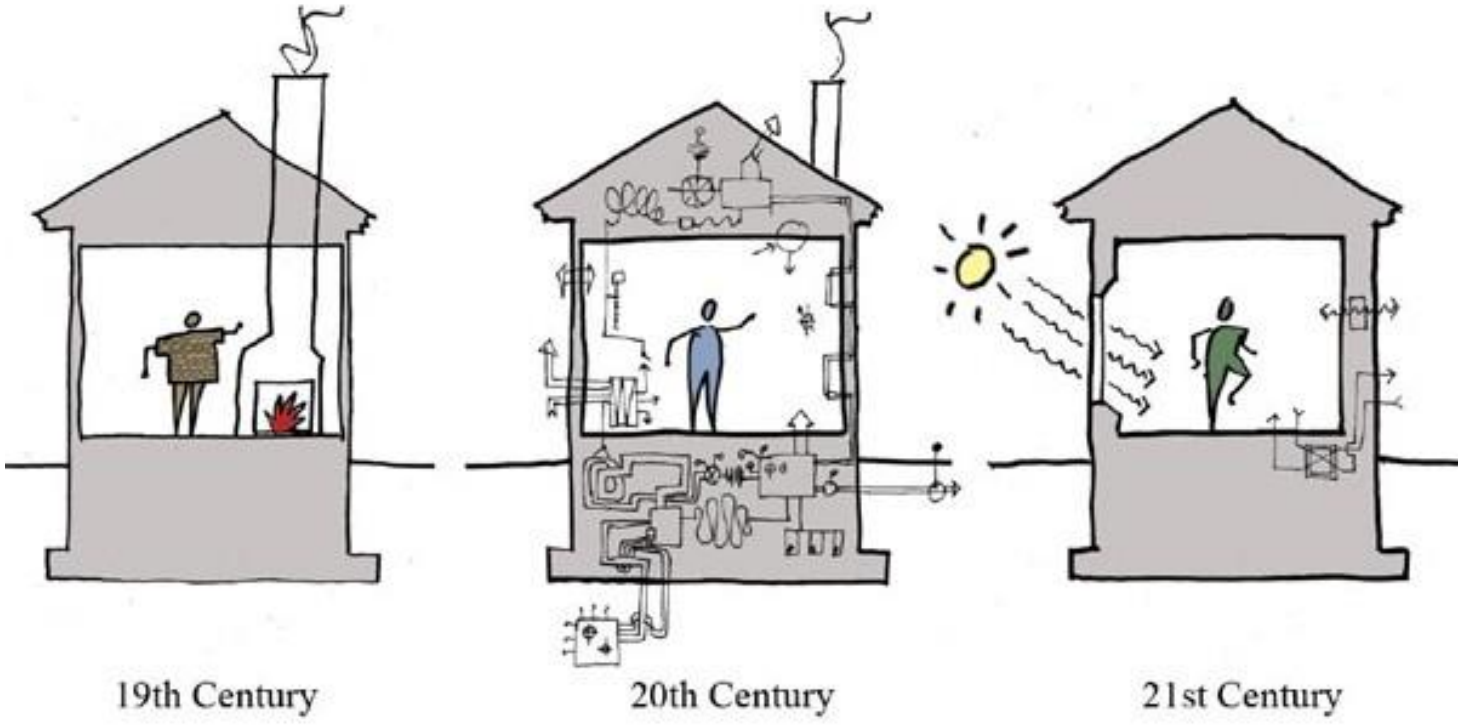
1. Solar gain
2. Envelope
3. Windows
4. Infiltration
5. Energy recovery
6. External Shading


ZIP System
ZIP
DOW




Central gasket made from EPDM guarantees water and air tightness
Strong hinge for optimal performance
Up to 32mm double glazing
Thermal break system of 34mm extra wide insulating thermal strips
Inner gasket providing secondary seal
Overlap gasket made from EPDM, for wind protection and water penetration

Passivehouse simplifies



PH: Important for Emissions Reduction

Less energy

Smaller peak loads

Easier electrification

Increased resilience

Improved comfort

All Buildings can be Passivehouse

Montessori School
Hollis, NH

Stone Fruit Farm
Westport, MA

170-Bed Dormitory
Wheaton College

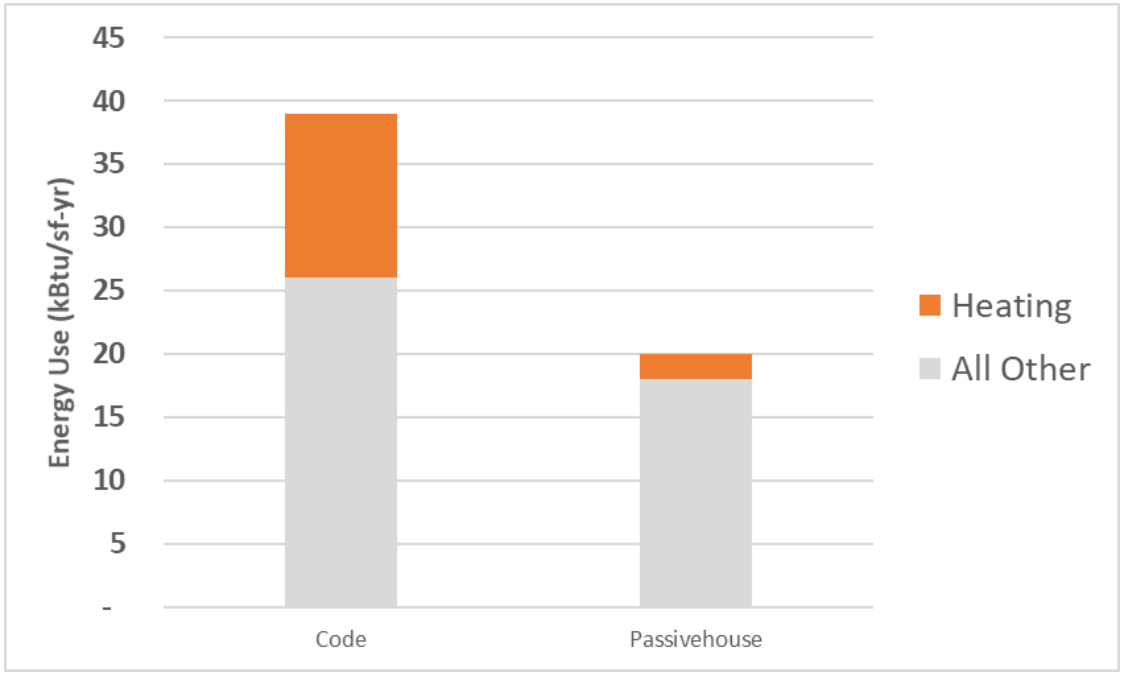
Carnegie Library
Pittsburgh, PA

268,000-sf Office Building
Chicago, IL

Lake Star Manufacturing Center
Colombo, Sri Lanka

Brussel, Belgium:
All buildings (housing, office, service buildings or schools) are required to be Passivehouse Standard or better.

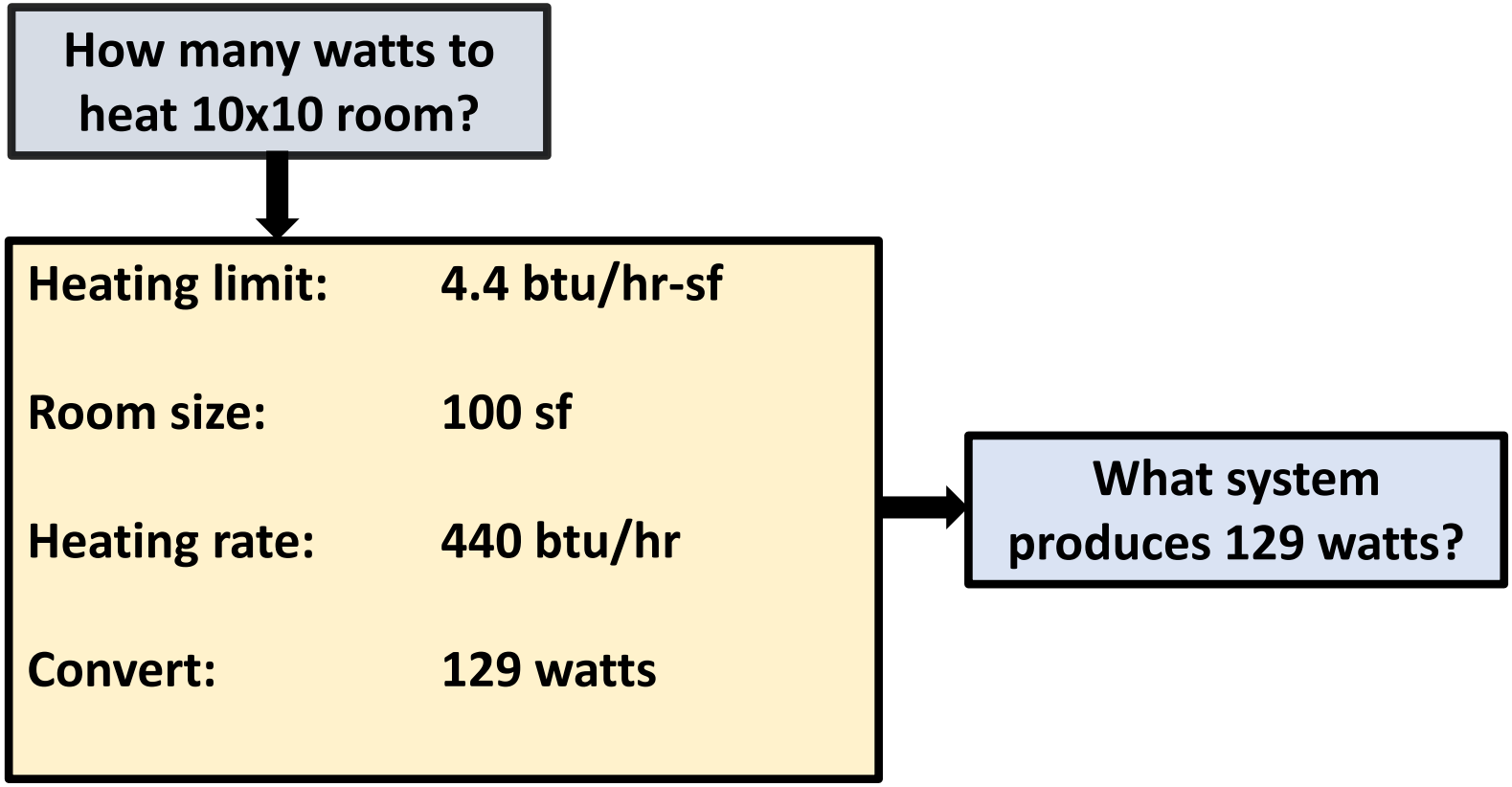
Superior Performance



50% less energy

85% less heating

Wicked small heating and cooling systems



100 watts

Too bad they stopped making incandescents…

These 2000+ sf units:

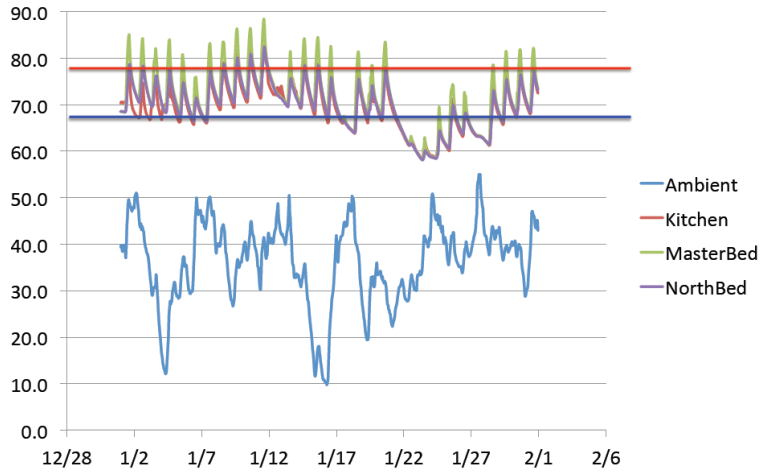
- **Small heat pump**
- **No perimeter heating**
- **Simple distribution**

This 26-story tower:

- **Just two 10 ton heat pumps per floor**
- **No perimeter heating**

Falmouth Passive House

January, 2012, Falmouth MA



Passivehouse buildings will maintain internal temperature without mechanical space conditioning for long periods. The implication is that passivehosue can also be a demand side management strategy.

Next LBE Council Meeting

Save the Date!

July 14, 2020

10:00 am–12:30 pm

Location TBD

Upcoming Tentative Meeting Dates:

Sept 8

Nov 10

Jan 12