Grid-Interactive Efficient Buildings: Value Propositions and Sectoral perspectives

NASEO 2019 Annual Meeting

September 16, 2019

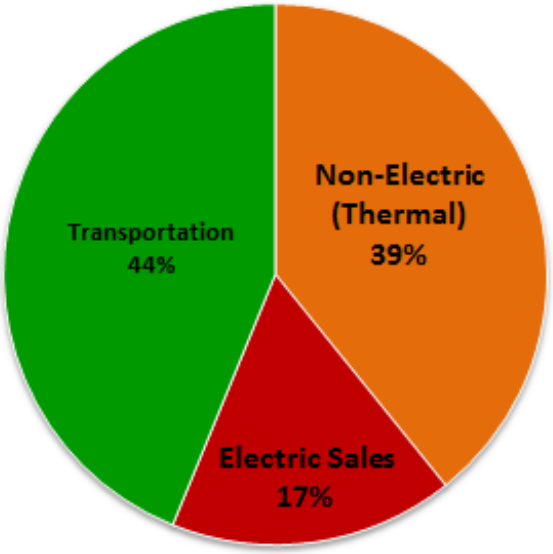
Massachusetts Department of Energy Resources

Deputy Commissioner Joanne Morin

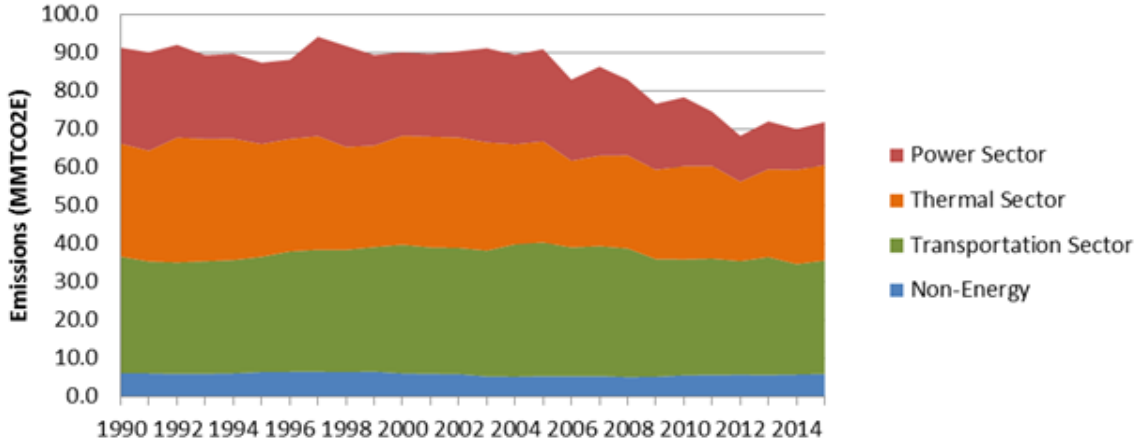
Massachusetts
Energy Use and Emissions by Sector

Massachusetts Energy Demand

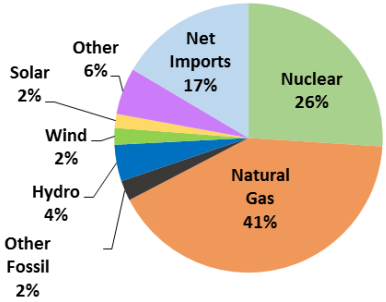
Total: 1,074 Trillion BTU in 2016



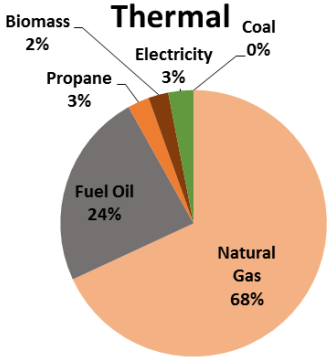
Massachusetts Greenhouse Gas Inventory



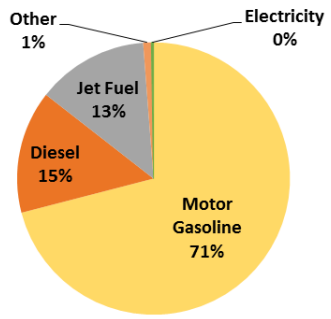
Electric - ISO-NE



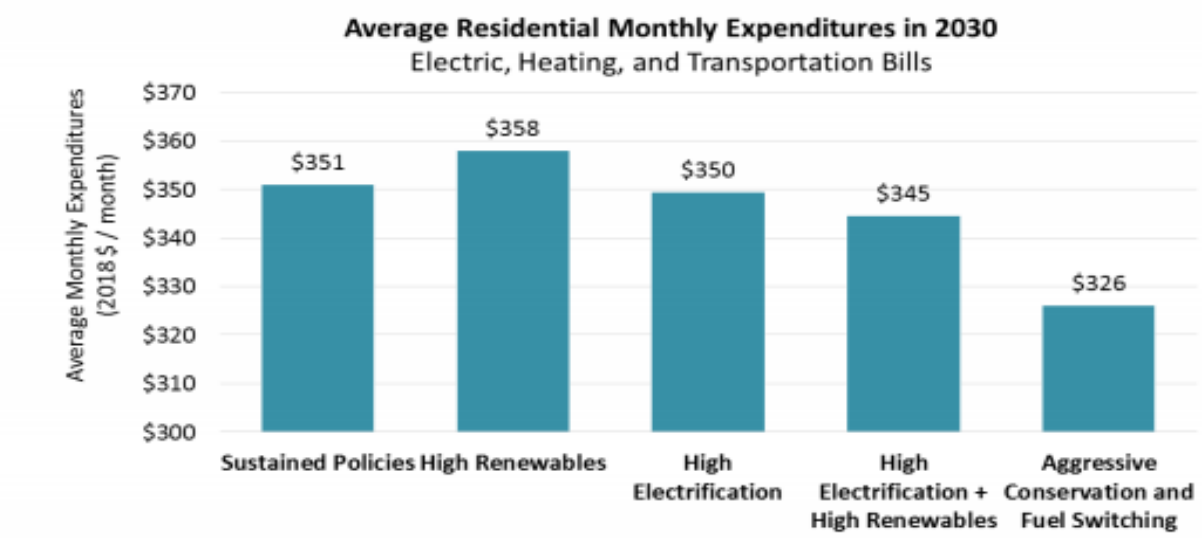
Thermal

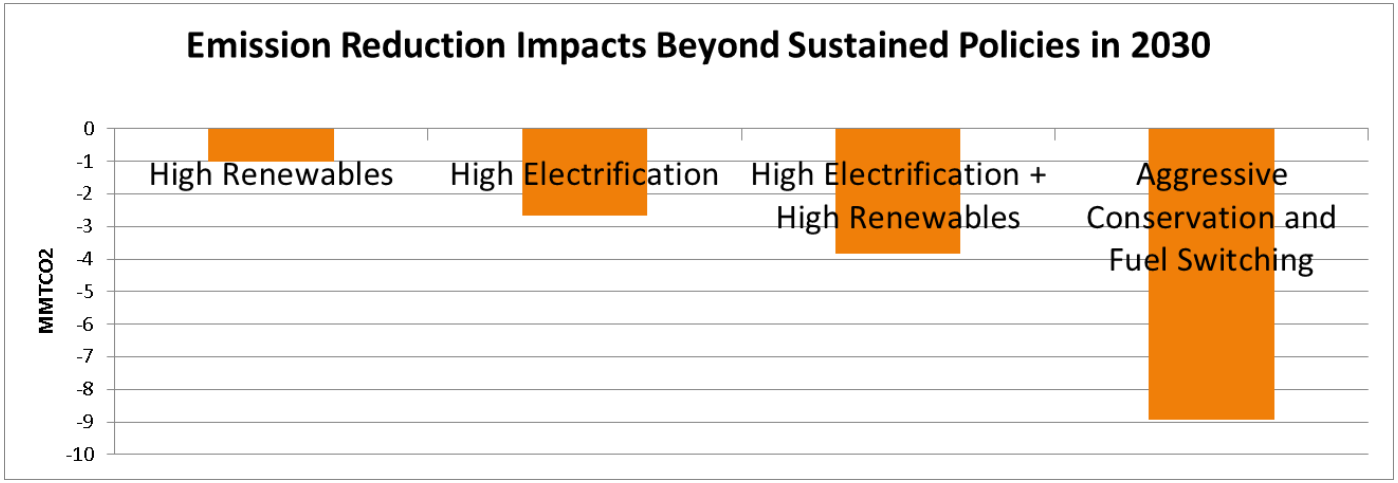


Transportation



CEP Findings:
Impact on Emissions and Rates





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Electric Vehicles Grid Impact

Figure 45. Electric load in the Sustained Policies scenario compared with the Baseline

In the Sustained Polices scenario, we assume that policies are implemented such that the charging of electric vehicles is focused in two main periods: while Massachusetts residents are at work and school, and again at night. Figure 46 displays the assumed load shape for electric vehicle charging.

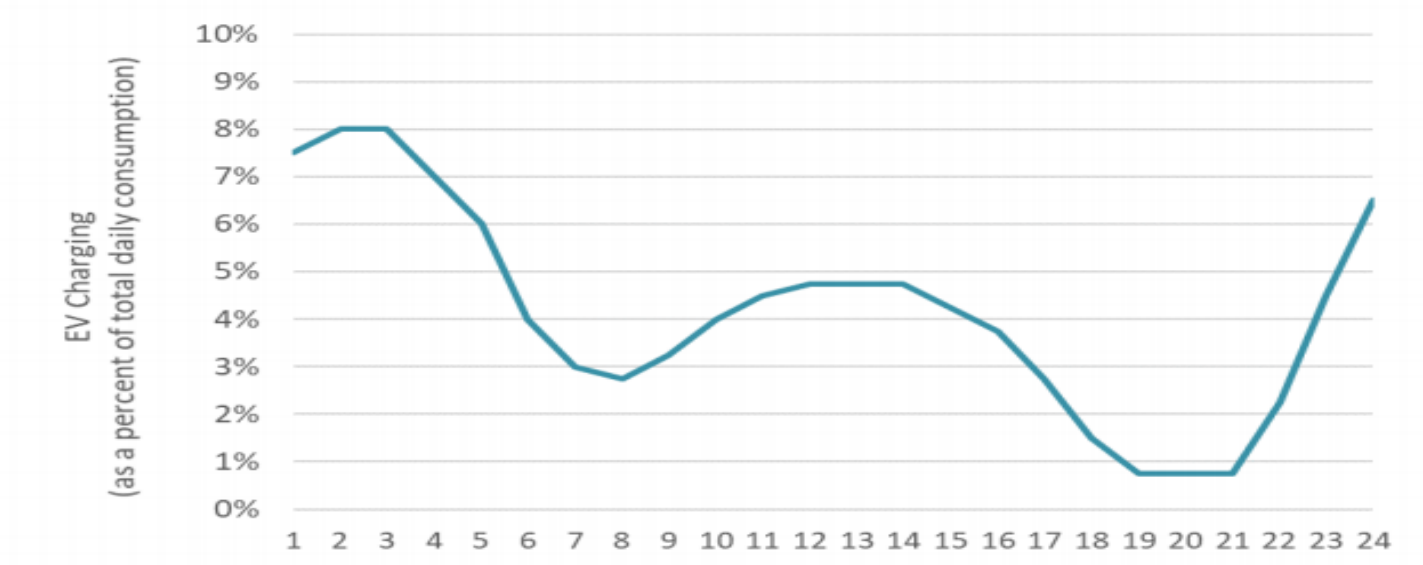


Figure 46. Assumed load shape for electric vehicle charging

CEP Policy Priorities and Strategies

Thermal Sector

- Leverage investments made in the clean energy sector through **electrification**
- Promote **fuel switching** from more expensive, higher carbon intensive fuels to (electric air source heat pumps and biofuels)
- **Reduce** thermal sector **consumption**
- Drive market/consumer demand for **energy efficiency measures and fuel switching**
- Invest in R&D for **clean heating fuels** such as renewable gas and biofuels that can utilize investments already made in heating infrastructure

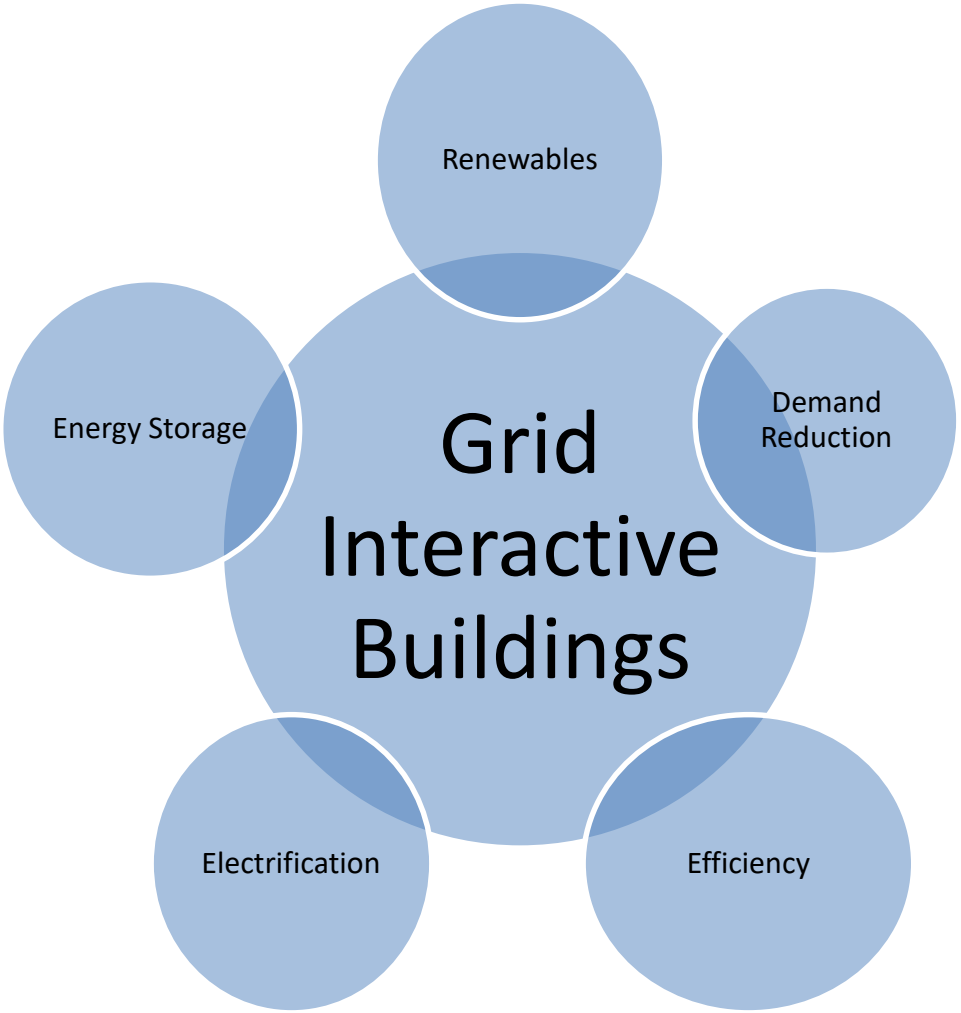
Electric Sector

- Prioritize electric energy efficiency and peak demand reductions, including **Clean Peak Standard**
- Increase cost-effective **renewable energy supply**
- Support grid modernization and **advanced technologies**, including microgrids and storage
- Develop policies to **align new demand** from the charging of EVs and heating/cooling with the production of clean, low-cost energy.
- Include cost-effective **demand reduction** and **additional energy efficiency initiatives** in our nation-leading energy efficiency programs and plans

Transportation Sector

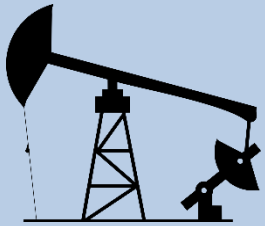
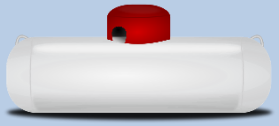
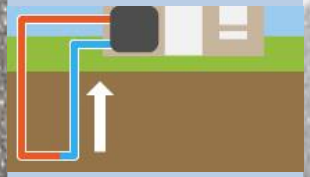
- Increase the **deployment of EVs** and charging infrastructure

Non-Linear Pathway toward Decarbonization



Clean Energy

- Renewable Portfolio Standard 55% by 2050
- Alternative Portfolio Standard 12.5% by 2050
- Clean Energy Standard 80% by 2050
- After SMART incentive program is completed, over 4,000 MW of solar in Massachusetts
- Clean Energy Procurements
  - Hydroelectric - New England Clean Energy Connect 1200 MW / 9.5 TWh
  - Offshore wind - Vineyard Wind 800 MW Selected
  - Bids for Second solicitation for offshore wind under evaluation
  - DOER recommended another 1600 MW of offshore wind

OIL	PROPANE	GAS	ELECTRIC RESISTANCE	ELECTRIC COLD CLIMATE AIR SOURCE HEAT PUMP	ELECTRIC GROUND SOURCE HEAT PUMP
					

Pounds of emissions to deliver 1 MMBtu of heat into a space

170	145	120	205	65	45
170	145	120	60	20	15

2020

2050

85% Less

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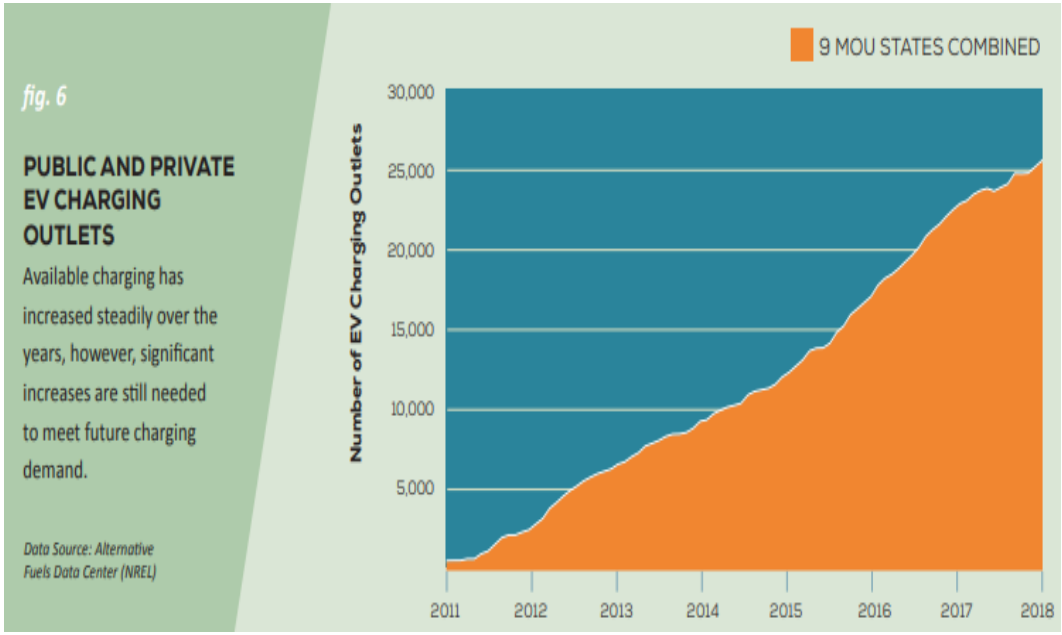
Electrification of Buildings & Transportation

fig. 6

PUBLIC AND PRIVATE EV CHARGING OUTLETS

Available charging has increased steadily over the years, however, significant increases are still needed to meet future charging demand.

Data Source: Alternative Fuels Data Center (NREL)



BUILDING ELECTRIFICATION -ZNE

2008 ZNEB **Task Force Report**

- ❑ Enhance Energy efficiency
- ❑ Expand renewables incentives
- ❑ Asset rating pilots
- ❑ Education and workforce development
- ❑ State Government Pilots

Pathways to Zero Grant Program

- ❑ $1.9 million for feasibility studies, integrated design, construction
- ❑ 16 new and existing residential and C&I building projects

State Buildings Designed to be Zero Net Energy Buildings

(buildings designed to generate as much energy from clean on-site renewable sources as they consume in a year)

North Shore Community College Health Professions & Student Services Building, Danvers (2011): *58,000 SF*	
Division of Fisheries and Wildlife Field Headquarters, Westborough (2014): *45,000 SF*	
Bristol Community College Sbrega Health & Science Building, Fall River (2016): *50,600 SF*	
Department of Conservation and Recreation Walden Pond Visitor Center, Concord (2016): *6,500 SF*	
UMass Amherst Crotty Hall, Amherst (2017): *16,800 SF*	

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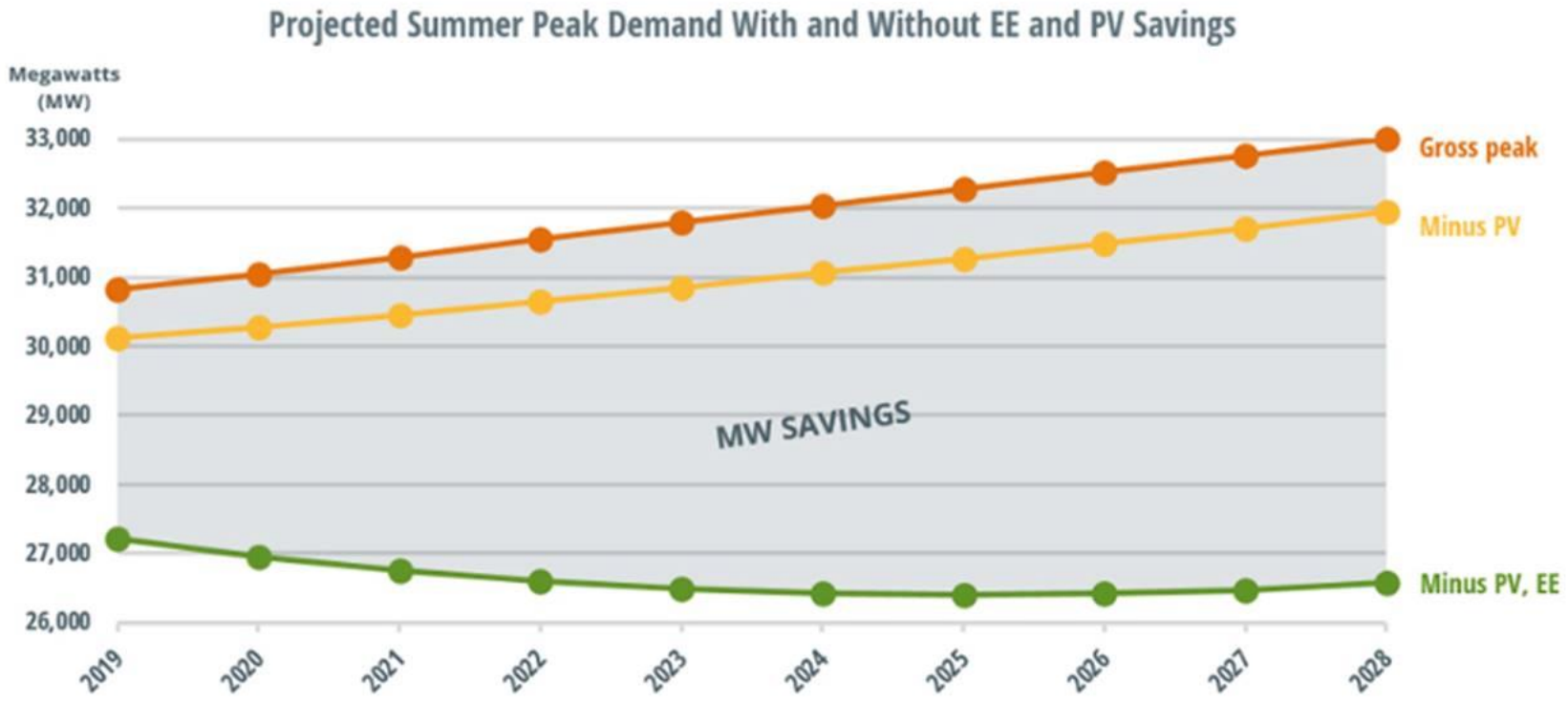
PEAK DEMAND: ENERGY EFFICIENCY



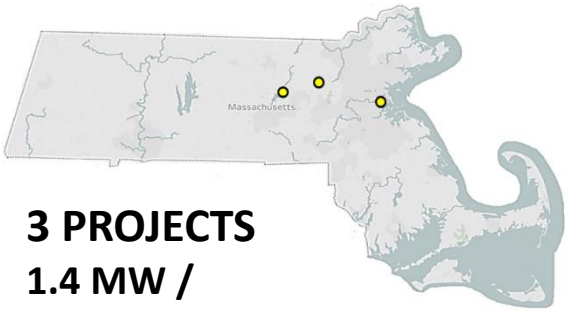
Note: Summer peak demand is based on the "90/10" forecast, which accounts for the possibility of extreme summer weather.

Source: ISO New England, *2019 CELT Report* (May 1, 2019)

PEAK DEMAND: ENERGY STORAGE

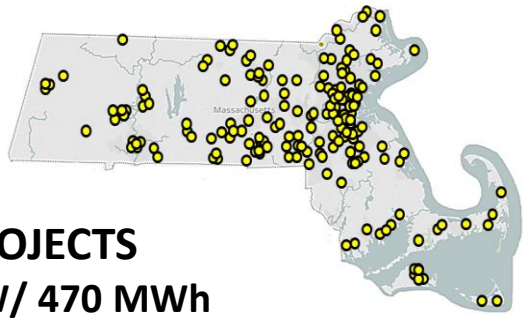
- **Energy Storage Initiative**
  - 2016 State of Charge Study
  - $20M Advancing Commonwealth Energy Storage (ACES) Grant
  - 26 projects for 32 MW / 85 MWh

2015



3 PROJECTS
1.4 MW /
0.45MWh

2019



232 PROJECTS
190 MW/ 470 MWh
(operating & in development)

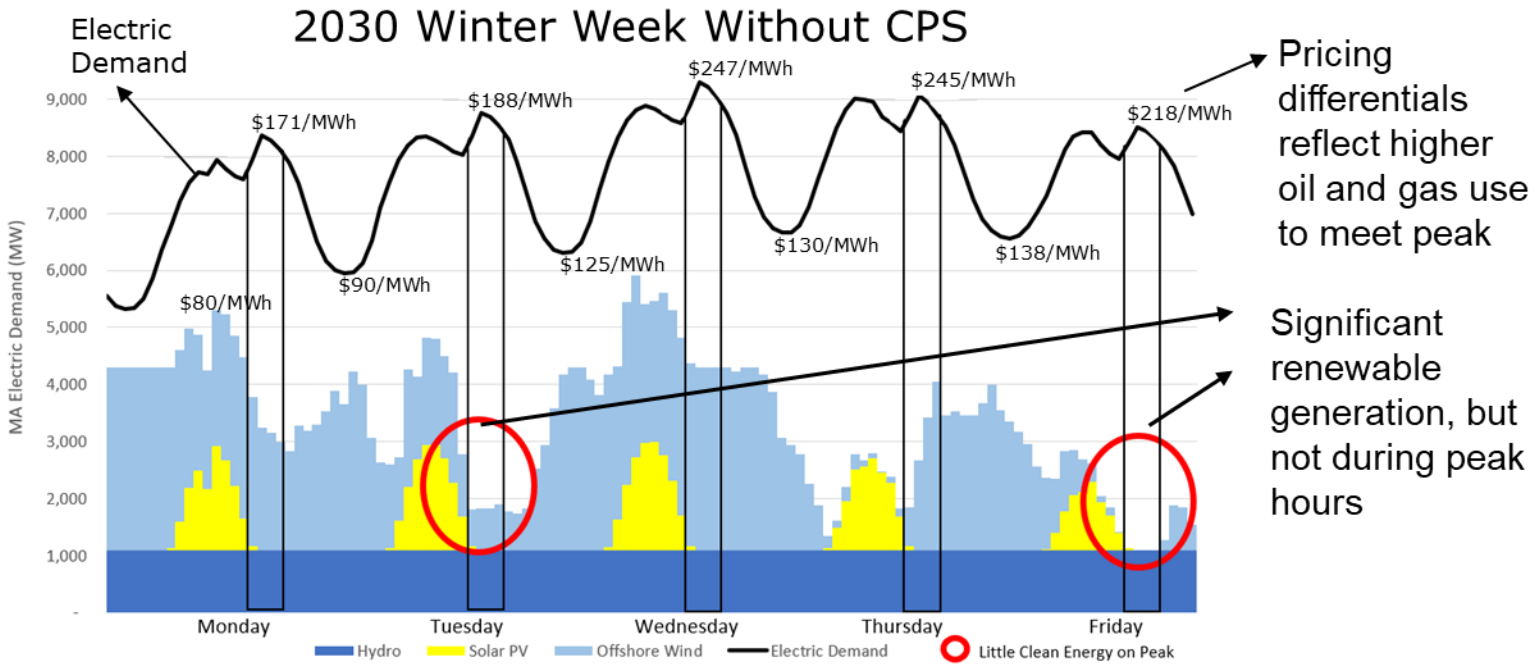
New Solar Incentive Program

- **1st in the nation – solar + storage incentive**
- Launched November 2019
- Storage compensated via
  - variable adder based on ratio of storage to solar capacity
  - Duration of storage
- Long term certainty with 10 – 20 years of fixed revenue streams
- Alternative on-bill credit mechanism
- Incentives for projects on brownfields, landfills, parking lots, rooftops
- $4.7 billion in cost savings to ratepayers when compared to previous solar programs

STATUS QUO CHALLENGE TO RESOLVE

By 2030, Massachusetts will have a substantial clean energy, however generation will not necessarily coincide with peak demands. The highest cost and emissions hours are not being addressed.

Massachusetts will remain dependent on gas and oil generation to meet our peak demand, resulting in high costs and emissions, despite our substantial investment in clean energy resources

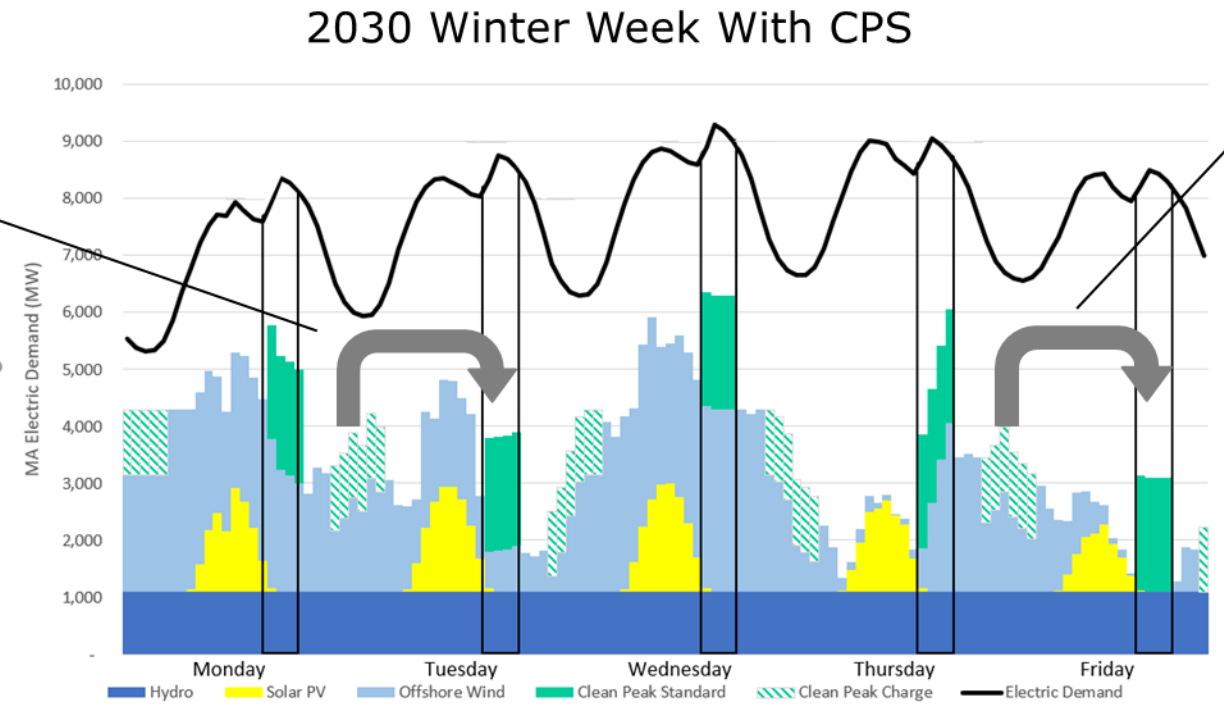


Production profile for 1,090 MW Hydro, 3,200 MW Offshore Wind, 5,000 MW Solar PV

CLEAN PEAK AS A SOLUTION

The CPS will send a market signal to clean energy generation to invest in storage technologies to deliver energy to load users to reduce demand during peak periods, thereby reducing the emissions and costs associated with these periods

Opportunity to shift clean energy to peak periods through storage



CPS shifted wind energy generated overnight when prices and demand are lower to evening peak when demand is high

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

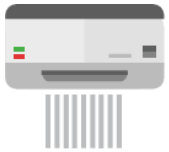
CLEAN PEAK STANDARD

- Qualified Clean Peak Resources eligible to generate CPCs during Seasonal Peak Periods until 2051
- New RPS Class I eligible resources in operation on or after 1/1/19
- Qualified Energy Storage Systems
- Demand Response Resources
- Existing RPS Class I / Class II resources that are paired with a Qualified Energy Storage System on or after 1/1/19

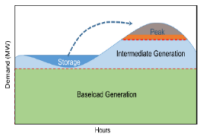
Massachusetts Energy Efficiency Overview

- **Green Communities Act (2008)** requires all cost-effective energy efficiency and demand reduction
- **An Act to Advance Clean Energy (2018):**
  - **Expands allowable energy efficiency investments** to include active demand management (including storage), strategic electrification, and fuel switching to clean energy sources
  - Broadens electric efficiency plans to **"energy" efficiency plans**
  - Changes Department of Public Utilities **cost-effectiveness review** to sector-level

Key Changes to Energy Efficiency Plan



Fuel Switching: customers will be provided information on cleaner fuel options for heating with new incentives for customers to fuel switch to air source heat pumps and other renewable heating options.



Active Demand Reduction: Programs that help offset the most expensive hours of the year through load reduction and active dispatch including energy storage.

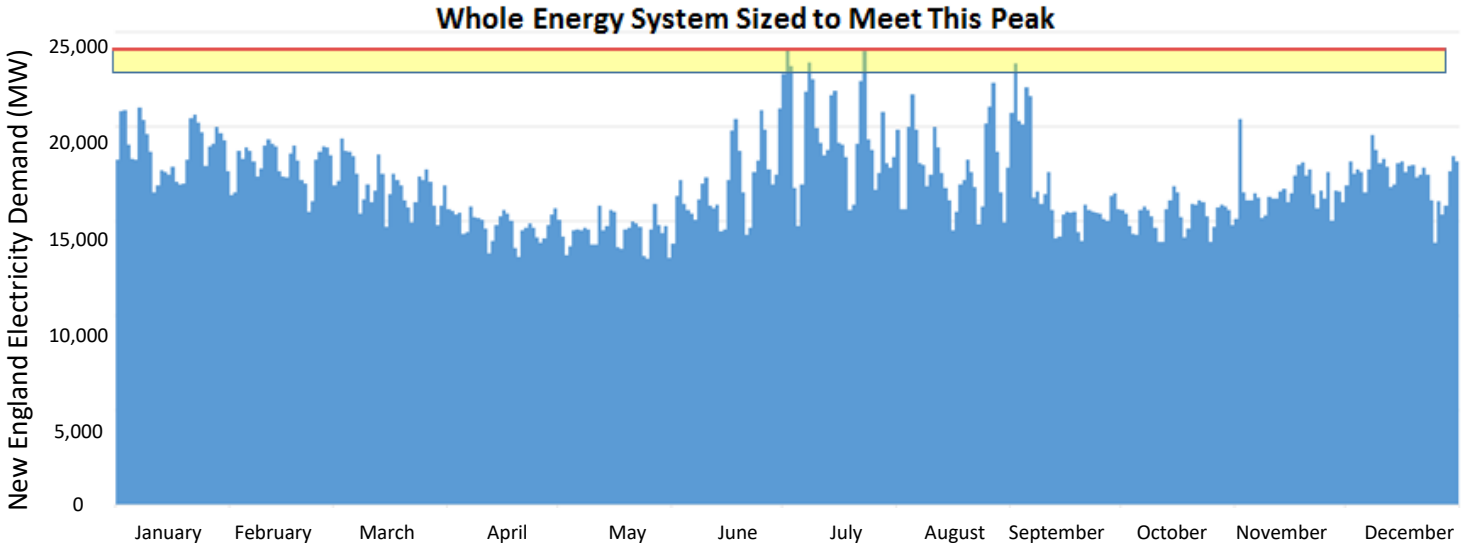
Electric Efficiency Plans
MWH Reduction
MW Reduction

Energy Efficiency Plans
MMBtu Reduction (electric, oil, propane, etc.)
MWH Reduction (excluding fuel switching)
Peak Demand Reduction (Summer, Winter), including ***active*** demand

Active Demand Reduction

- Continue to focus on energy efficiency, while pivoting reducing energy usage during times when **demand** and costs are highest
- **Active Demand Reduction Programs** include residential direct load control, energy storage, C&I load curtailment

Statewide Goal	2019-2021
Summer MW Total	693
Winter MW Total	544
Active Summer MW	200
Active Winter MW	50



In 2015 :
The top 1% of Hours accounted for 8% of MA Spend on Electricity

Top 10% of Hours accounted for 40% of Electricity Spend

Active Demand – Residential Strategies

Devices

Connected Thermostat

Battery

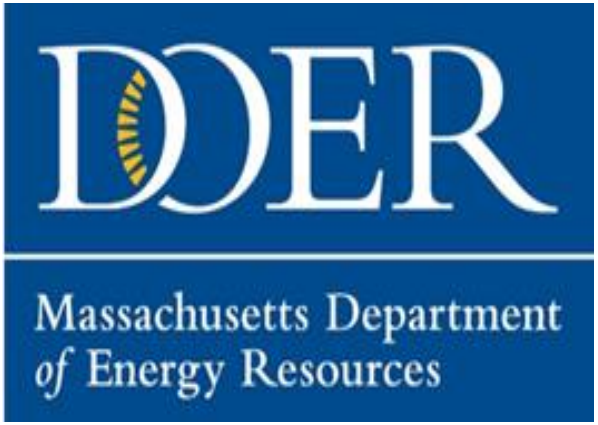
Electric Vehicle

Active Demand – C&I Strategies

		Typical Application
Targeted Dispatch	• Usually Manual • Temperature setback ~3F • VFD speed limiting • Early setback • Process Changes • Rarely Lighting • Generators • Combined Heat and Power	
Daily Dispatch	• Usually Automatic • Batteries • Flywheels • Thermal Storage • Industrial Freezers	
Winter Dispatch	• Usually Manual • Snowmaking • Industrial Processes • Generators	

CHALLENGES

- Upfront Costs vs. long-term benefits
  - e.g. TLEDS vs. lighting fixtures with controls
- Higher cost of electricity
- Complexity and cost of retrofitting existing buildings, esp. C&I
- Getting price signals right for dispatchable assets
  - e.g. upfront vs. performance based incentives
- C&I Building Operator skillset related to advanced controls/technologies
- Consumer awareness and resistance
  - e.g. new technology and privacy perceptions



THANK YOU