MA Leading by Example Council Meeting

DOER Massachusetts Department of Energy Resources

July 16, 2019

Springfield Tech Community College

MASSACHUSETTS LEADING BY EXAMPLE PROGRAM
PUBLIC LEADERSHIP. STEWARDSHIP. COMMITMENT

State Government Progress – as of July 2019

Greenhouse Gas (GHG) Emissions

↓ 26%

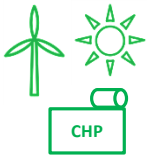
2004 -2018

Energy Use Intensity per Square Foot

↓ 13%

2004-2018

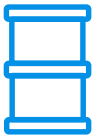
Electricity via Renewable & Onsite Generation



19%

In 2018

Heating Oil Consumption at State Facilities



↓ 82%

2006-2018

26.7 MW Installed Solar PV at State Sites

18.6 MW

Since 2015

86 LEED Certified State Buildings

49

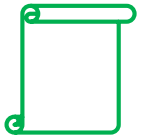
Since 2015

131 Electric Vehicle Charging Stations at State Sites

66

Since 2015

Leading by Example Grants Awarded



$11.2 M

Since 2015

Agenda

- Introductions and STCC Highlights

- News From Around the World

- Massachusetts News

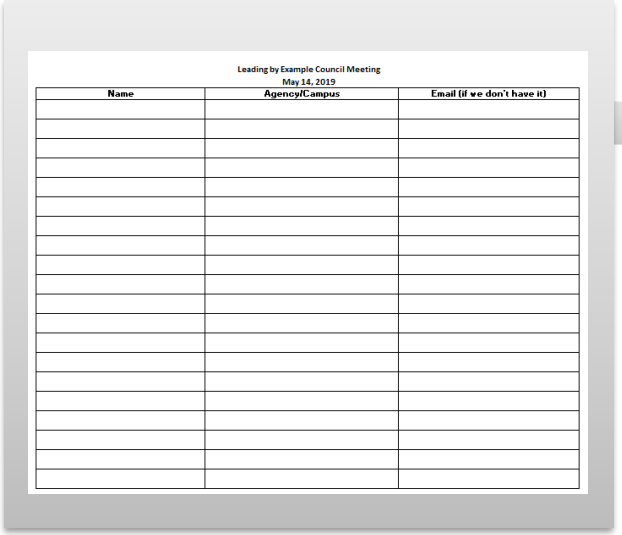
- Program Highlights: Mass*EVolves*

- LBE Updates

- Energy Storage

Welcome and Introductions

Share your name and organization



Leading by Example Council Meeting
May 14, 2019

Name	Agency/Campus	Email (if we don't have it)

Please make sure to add yourself to the sign-in sheet when it comes around

Sustainability Efforts at STCC

Springfield Technical Community College

Entire campus is designated HISTORIC

Energy

- 82 kW roof-mounted solar PV array
  - Produces an average of 92,000 kWh annually
- 20,000 sq. ft. ground-source heat pump system
- Decentralized and upgraded heating system in 2014
  - **44% reduction in thermal load** since FY11
  - Eliminated use of #2 fuel oil
- Ongoing replacement of lighting fixtures with energy efficient LEDs
  - Contributing to **12% reduction in electricity consumption** since FY11

All these efforts have contributed to a **42% reduction** in annual GHG emissions

Sustainability

- In 2017, Cosmetology Department became a "Green Circle Salon"
- All toxic chemicals for maintenance replaced with green alternatives
- Replacing all Styrofoam containers with recycled paper products
- Default double-sided printing resulting in cost savings of approximately $14,000/year

This summer, STCC has also done street, outdoor, auditorium, and T-LED lighting retrofits and installed a new variable frequency air handler

World News

US Solar and Renewable Energy Job Growth

There are now more than **2 million** solar installations across the US just 3 years after the industry completed 1 million installations (which took 40 years to reach)

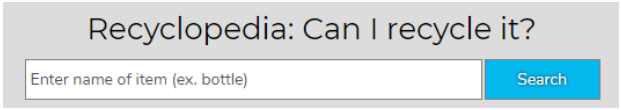
As renewable energy becomes cheaper than operating coal plants, renewable energy jobs are growing nationwide, with **3.3 million** Americans currently working in clean energy

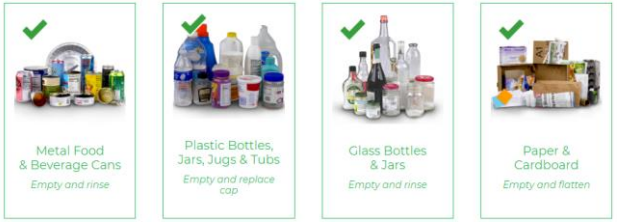
Sources: SEIA; Forbes

Plastic Waste Returned to US and Others

- Malaysia is returning **450 metric tons** of mislabeled plastic and nonrecyclable waste to countries including the US, UK, and others
  - Plastic in Malaysia is burned on roadsides in the open-air, dumped in unregulated or poorly regulated dump sites close to bodies of water, discarded in abandoned buildings or just left to degrade in the open

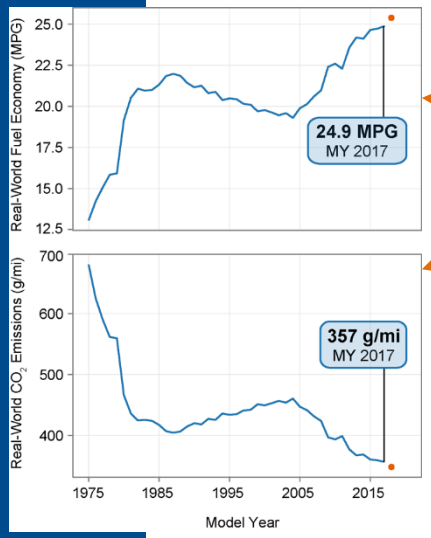
- According to MassDEP, half of MA residents are not recycling properly
  - Recycling contamination is costly and poses a potential threat to workers
  - Remember to empty and rinse all containers and no plastic bags or wrap
  - Visit **RecycleSmartMA.org** for guidance





Sources: Environmental Leader; WCBV Boston; RecycleSmartMA

Vehicle Emissions and Fuel Economy



- EPA-estimated vehicle CO_2 emissions at record low and fuel economy at record high
  - Between model years 2012 and 2017:
    - Fuel economy improved +1.3 mpg
    - CO_2 emissions improved by 21 grams per mile
  - Model year 2017 CO_2 emissions were 23% lower as compared to model year 2004 vehicles
  - Improvements expected for future model years
- Good driving behavior may increase vehicle efficiency by 20-30%, including:
  - Regular oil changes and tire inflation
  - Avoidance of idling, speeding, rapid acceleration, and abrupt braking
  - Most fuel-efficient speed: typically 55-60 mph

Sources: EPA Automotive Trends Report; NY Times

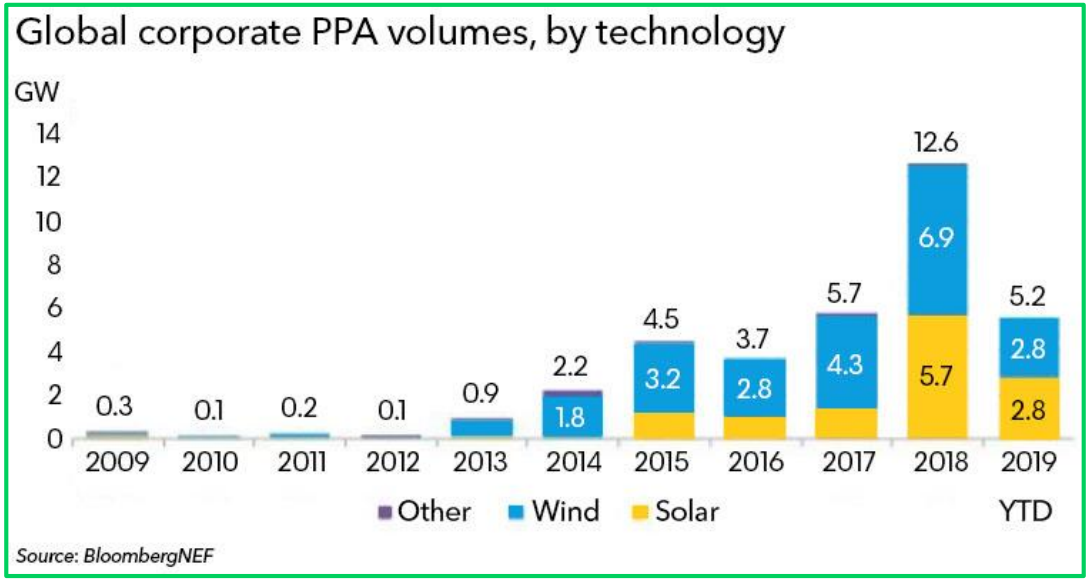
Other Energy Landscape Updates

U.S.

- Coal is now more expensive than other major electricity sources, including renewables
- Wind and solar are becoming competitive with natural gas, even as subsidies phase out
- Energy grids are getting better at moving power from renewable sources around due to advances in battery storage technology

Globally

- Wind and solar are neck and neck as the technology of choice so far this year among global corporations signing power purchase agreements for clean energy



Sources: USA Today; Bloomberg New Energy Finance

Massachusetts News

Creating A Clean, Affordable and Resilient Energy Future For the Commonwealth

DOER
Massachusetts Department of Energy Resources

Carbon-Free Boston Report

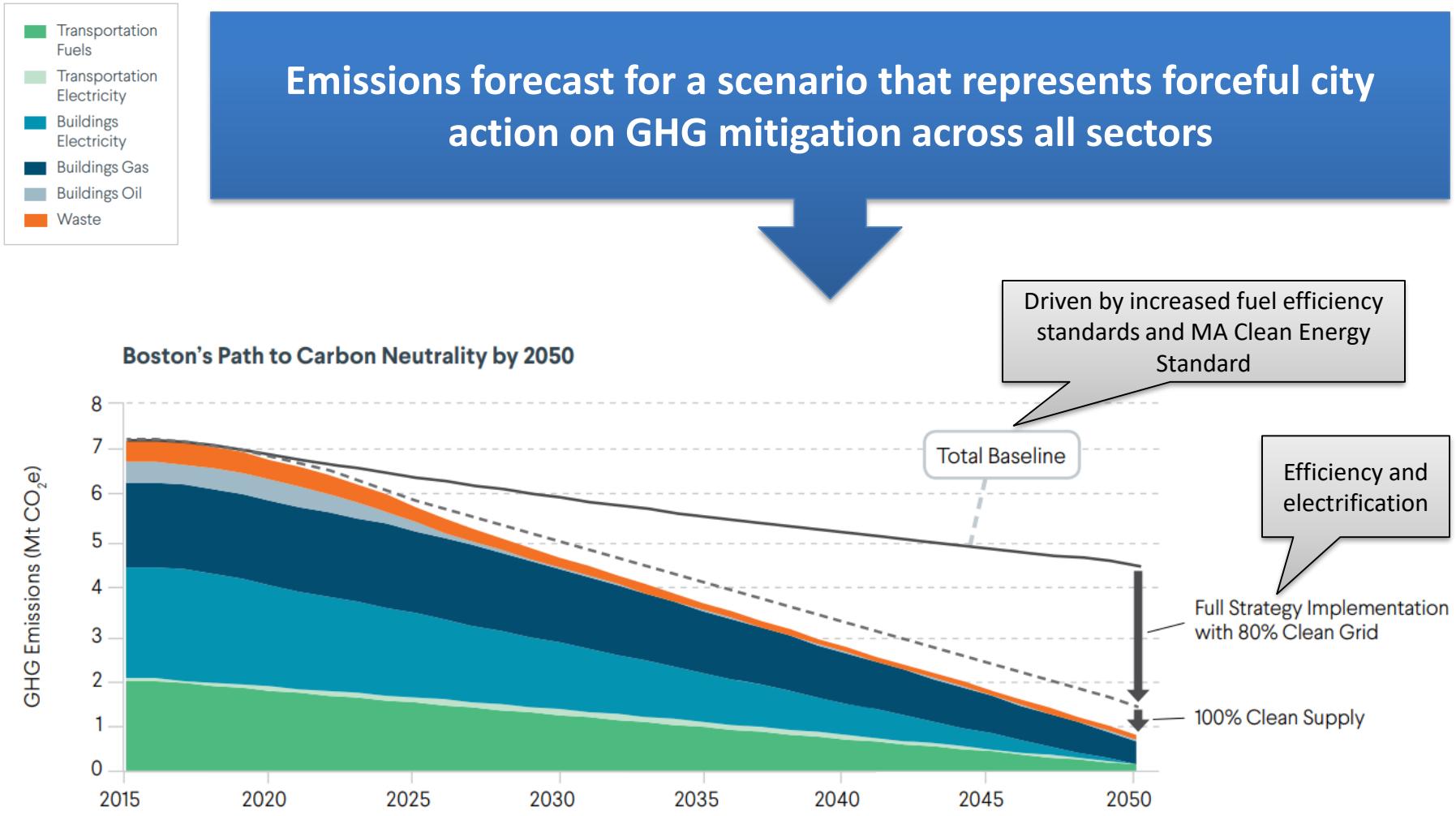
- Attempts to quantify **cost-effective and equitable** strategies to reduce GHG emissions across the energy, buildings, transportation, and waste sectors by 2050

- Modeling shows a great magnitude of change needed, including:
  - **Minimized energy demand** in new and existing buildings
  - Electricity grid fully **powered by renewable energy** sources
  - Large-scale **reduction in oil and gas** (**electrification**) for transportation, space heating, and hot water across sectors
  - Greater use of **public transit**, biking, and walking
  - **Zero waste** sent to landfills/incinerators

- Changes to the energy and transportation systems are difficult and will require time; early action is critical

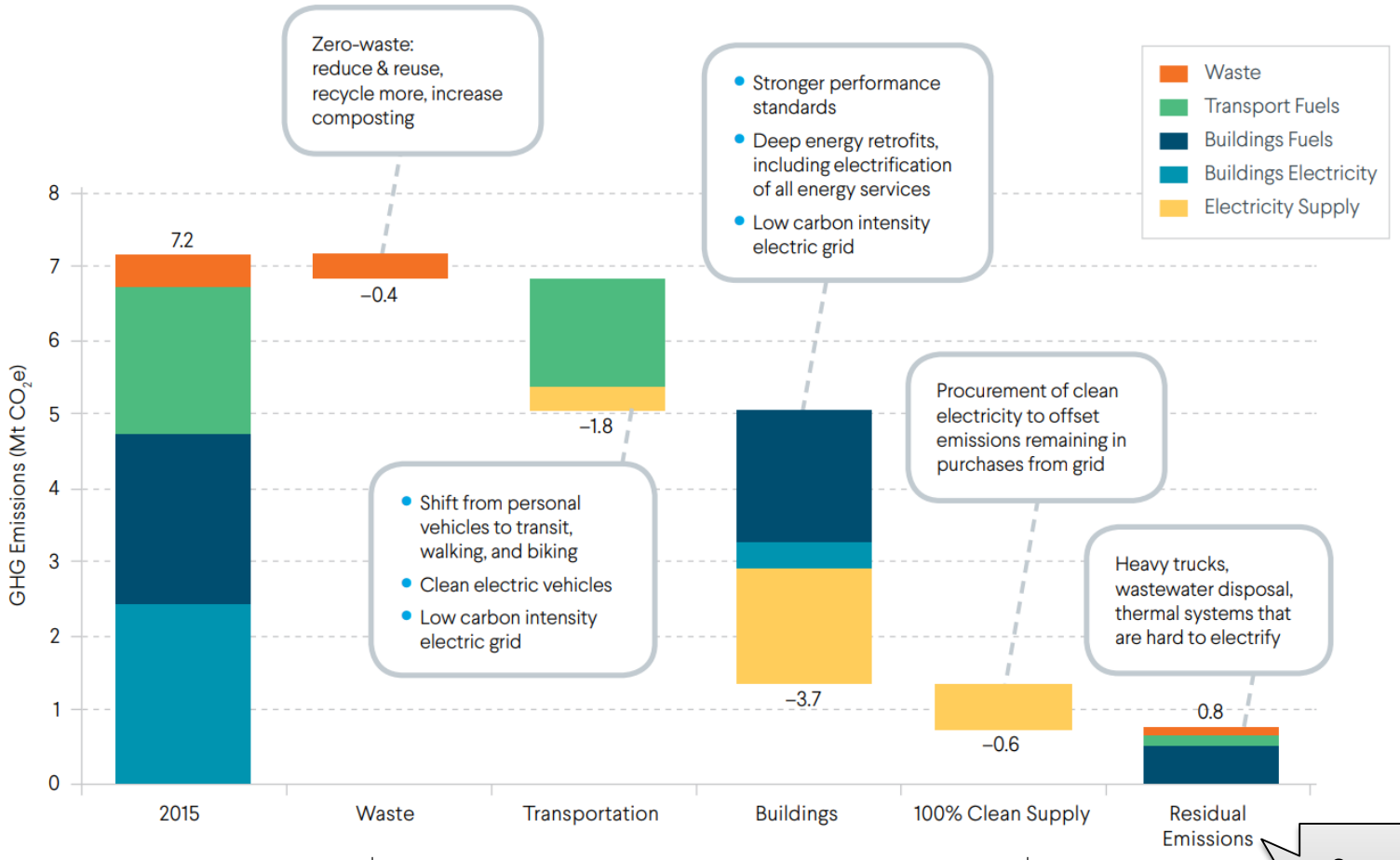
Source: Carbon Free Boston Report

Emissions forecast for a scenario that represents forceful city action on GHG mitigation across all sectors



Source: [Carbon Free Boston Report]

Some of the report's recommended steps to achieve carbon neutrality



Source: [Carbon Free Boston Report]

MA Building Code Updates

Residential

- Energy rating index (ERI) path encourages electrification
  - HERS 55
  - HERS 60 with heat pump space heating
  - HERS 60 with solar PV
  - HERS 65 with heat pumps and solar PV
- No EV readiness for 1-2 family homes

Commercial

- Envelope backstop will limit glass towers
- Added cold-climate heat pumps and mass timber construction to list of possible options to comply with code
- EV readiness
  - 1 charging point in new parking with 15+ spaces
- Solar readiness
  - Requirement increases from 3-stories to 5-stories or less

June Board of Building Regulation and Standards (BBRS) stretch code update:
Requested that Energy Advisory Committee develop a net zero stretch code framework

Additional Offshore Wind and Hydro

- DOER has published the Offshore Wind Study that outlines the "necessity, benefits, and costs" of pursuing additional offshore wind power
  - Study concludes it would be beneficial for ratepayers, the environment, and the economy
- Massachusetts electric distribution companies can proceed with an additional 1,600 MW of offshore wind generation solicitations
  - With additional procurements, **MA is on a path to meeting 60% of electricity needs** with clean energy

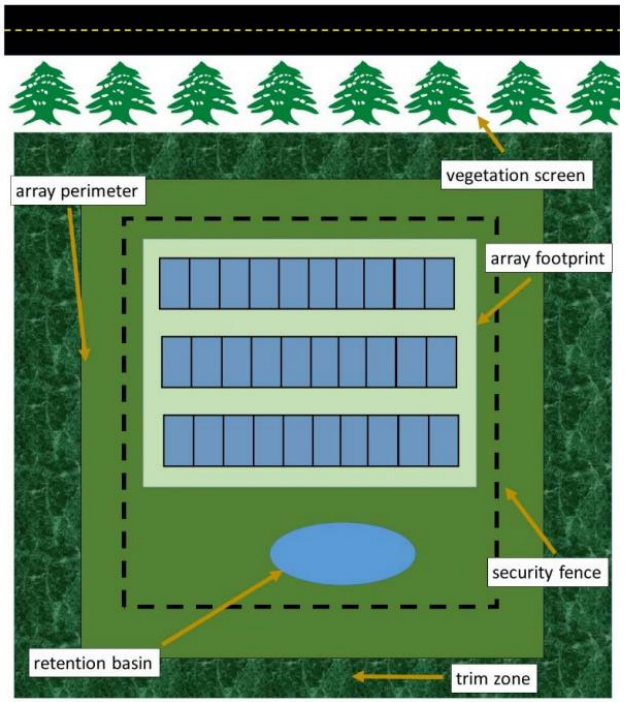
- The Department of Public Utilities has also authorized utilities to purchase over 9.5 million MWh (9.5 terawatt-hours) of hydropower annually from Hydro-Quebec
  - This makes it the **largest procurement of clean energy** in the Commonwealth's history!

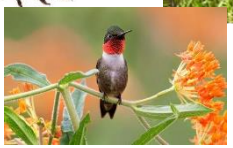
Sources: DOER; UtilityDive

PV and Pollinators

The UMass Clean Energy Extension has published new resources for establishing native vegetation in conjunction with solar installations to support pollinator habitats

- Pollinator-Friendly Best Management Practices for Solar PV Arrays (PDF)
- Pollinator-Friendly Voluntary Certification Criteria for Solar PV Arrays in Massachusetts (PDF)
- Recommended Plant Species List (Excel)





Did you know? Pollinator habitat support is required for ground-mounted projects under the LBE Solar Grant Program

Source: UMass CEE

Mass*EVolves*

Creating A Clean, Affordable and Resilient Energy Future For the Commonwealth

DOER
Massachusetts Department of Energy Resources

Leveraging Voluntary Recognition to Achieve Clean Air Goals in Massachusetts

MassEVolves

RECHARGE AMERICA

Three Barriers to ZEV Adoption

Awareness

- Consumers are unfamiliar with ZEV choices and charging

Vehicle Availability

- ZEVs can be hard to find and experience

Charging Options

- Consumers unsure if charging can meet their driving needs

Mass*EVolves:* Another Tool to Foster ZEV Market Growth

AWARENESS

VEHICLE AVAILABILITY

CHARGING OPTIONS

Who Participates?

Companies

Post-Secondary Education

Must be Willing to Make a ZEV Commitment, Share Progress, Help Others

Mass*EVolves:* How Does It Work?

Pledge to Participate

Create ZEV Action Team

Submit ZEV Action Plan

Report on Progress

Areas of Commitment

- Electric Vehicle Charging
- Employee and Community Promotion
- Fleets
- Supply Chain
- Other Commitments?

Program Elements – Mass*EVolves*.org

www.Mass*EVolves*.org for Program/Participation Information

Program Implementation Activities by Program Participants

Moderated Participant-only Collaboration and Technical Support

Reports on Progress (Individual Participants/Mass*EVolves* Program)

Model Implementation Activities / Class Case Studies

Annual Recognition Event

Participant Benefits

State Recognition – Pledge & Progress Report

Technical Assistance Collaboration

Mass Drive Clean Participation

Annual Recognition Event

Mass*EVolves*

Participants

ANALOG DEVICES

AstraZeneca

bxp Boston Properties

ELECTRIC BROADBAND BELD

CORCORAN MANAGEMENT COMPANY
Creating Communities Since 1951

EMD SERONO

ENE CONSERVE

MilliporeSigma

Program Goals

Bridge Individual Organization ZEV Actions to Statewide Clean Air Goals

Foster Participation from Hundreds of Entities Statewide

Mass*EVolves* 2019/2020 Outreach

- TDM Associations
- Industry Trade Groups
- Leadership Companies
- Leading Educational Institutions
- Community Groups (e.g., Chambers, Sustainability Contacts, etc.)
- State Agency Contacts
- Meetings/Webinars
- Others? (Discussion Section Later)

MassEVolves

Mass Drive Clean
Statewide ZEV Test Drive Engagement

	Engagement	Mobilization
AWARENESS	• 50+ site hosts and participation from 16+ partners (including sustainable communities like Newton) over the course of the 5 year program	• 300,000+ overall program exposures • Average of over 80% first time ZEV drivers
VEHICLE AVAILABILITY	• Event participation from more than 35 dealers with 30 OEM makes/models • 95% satisfaction rate from participating dealers • FCEVs available	• Over 10% conversion rate to sale/lease persistently over 3 years of data
CHARGING OPTIONS	• Charging and sustainability options on display at over 50% of events	• Average 90%+ improved perception of ZEVs after events • Utility participation provides link to emerging programs

Testimonials

MASS DRIVE CLEAN
ON THE ROAD TO CLEAN AIR

"We have attempted to have an event like this before, but it was never this successful. The number of vendors they brought to the event was impressive. They are very well coordinated." - AstraZeneca | Host

"My dealership has increased its sales month after month after beginning to participate in these events. They are knowledgeable about my products and state and federal incentives and make an easy transition for the customer to come test drive." - Quirk Chevrolet | Dealership

"The REACH team was a joy to work with. They were extremely helpful and they maintained their positive energy throughout the entire event; from delivering the test drive automobiles from surrounding dealerships, to setting up the displays, to entertaining questions, to cleaning up. Couldn't have asked for a better crew!" - Schneider Electric | Host

Mass*EVolves*

FEEDBACK?

RECHARGE AMERICA

CONTACTS:

Kirk Brown Kirkbrown@Recharge-America.org

Amanda Scarborough Amanda@Recharge-America.org

Leynah McGarghan Leynah@Recharge-America.org

RECHARGE AMERICA

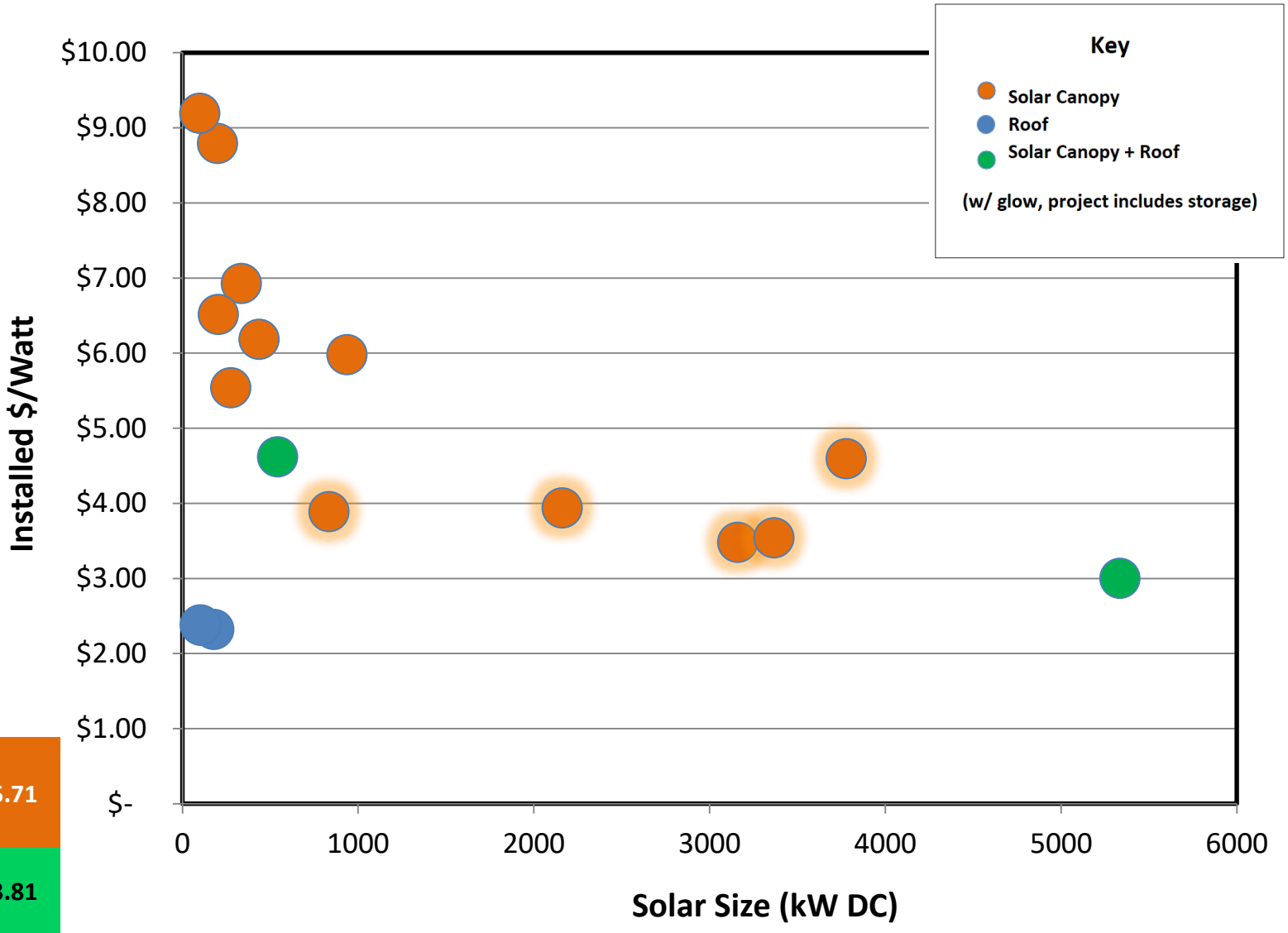
Recharge America mobilizes support for EV adoption at the community and state level to help keep energy dollars local, boost local economies, capture the benefits of clean transportation for local communities, and build a fresh narrative about American renewal rooted in positive community values.

LBE Updates

Creating A Clean, Affordable and Resilient Energy Future For the Commonwealth

DOER
Massachusetts Department of Energy Resources

State Solar Project Trends: Cost Per Watt



Solar Canopy (12)	**$5.71**
Canopy + Roof (2)	**$3.81**
Roof (3)	**$2.36**

LBE Solar Grant Impacts

Total 2014-2019 LBE Solar Grant Investment to Date: $3,143,080

An average of $0.40/Watt in grant funding

7.92 MW Solar PV

- 7 Owned, 3 PPAs
- 31 EV Charging Ports
- ↓ 3,180 Metric Tons Annual GHG Emissions Saved

Average Annual Electricity Cost Savings $623,451

Estimated 20-Year Electricity Cost Savings $16,833,639

\+

Estimated 20-Year Revenue Generation $7,928,473

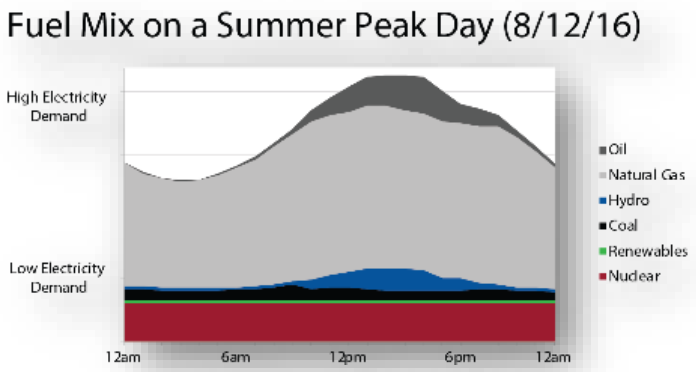
20-Year Project Benefits: $24,762,112

The LBE Solar Grant Program seeks to support the affordability of large-scale solar canopy, innovative solar projects, and all other solar installations at state facilities that will help reduce energy costs while also supporting aggressive clean energy targets for state government operations

Managing Summer Peak

Notifications

- ISO New England System Demand Forecast website
- MAPC peak load email alerts*
- Shave The Peak Program text alerts



The annual peak is LIKELY today.

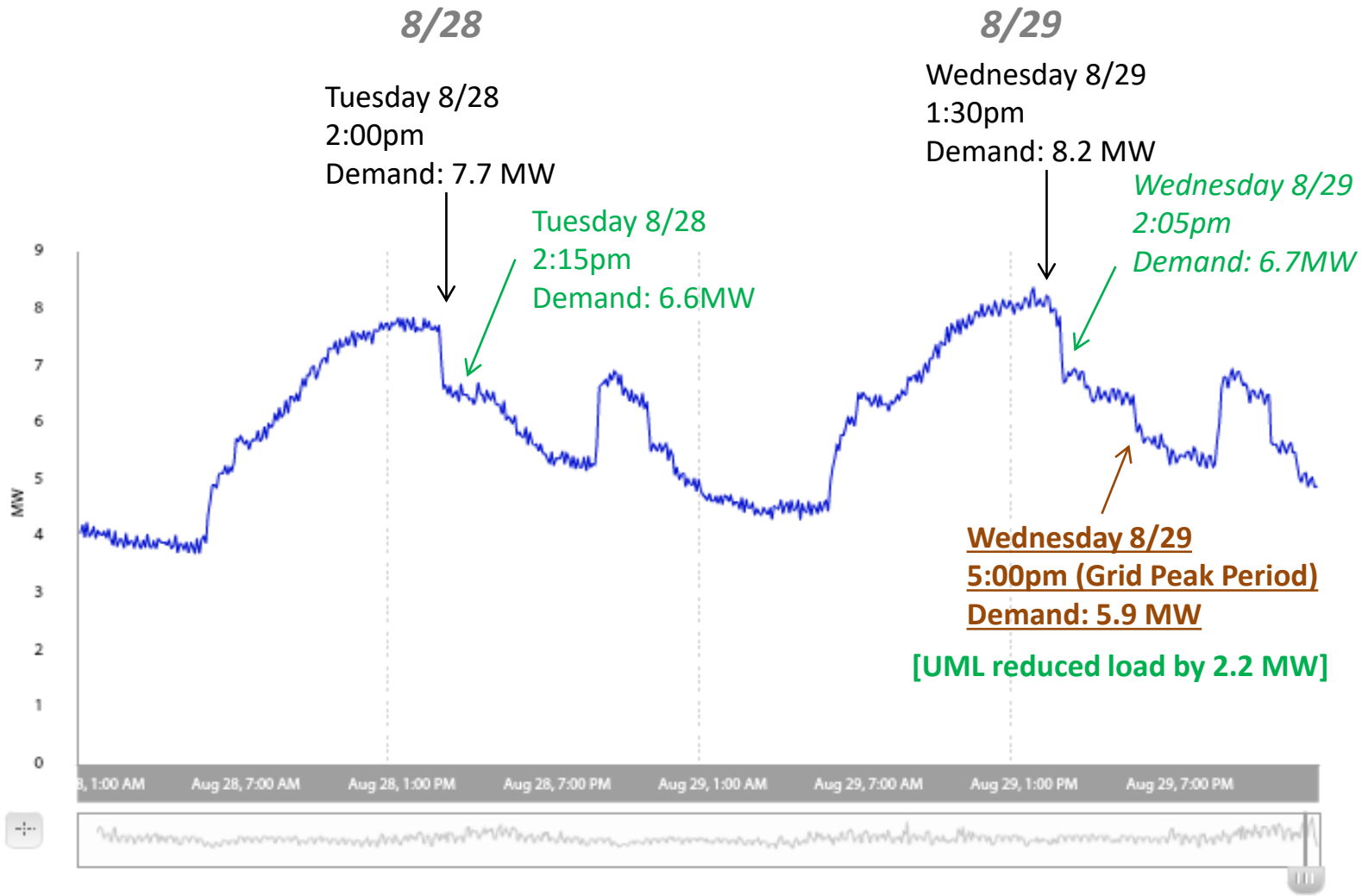
TODAY WED 27 JUL	THU 28 JUL	FRI 29 JUL	SAT 30 JUL	SUN 31 JUL	MON 01 AUG	TUE 02 AUG
High of 85 °F	89 °F	85 °F	81 °F	78 °F	79 °F	84 °F
Peak load 23.8 GW at 3 - 4 PM	23.9 GW	22.8 GW	18.9 GW	17.5 GW	19.7 GW	20.5 GW
LIKELY	LIKELY	POSSIBLE	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY

**If you'd like to sign up for the MAPC emails, please add a star to your name on the sign-in sheet before you leave!*

Example from UMass Lowell: shaved summer peak within minutes, significant savings achieved
(next slide)

Managing Peak Demand

UMass Lowell Peak Shaving: Afternoons of 8/28 – 8/29



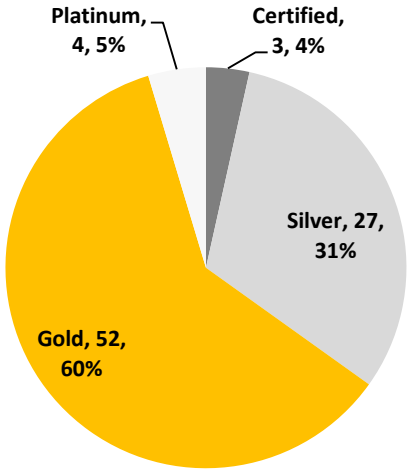
Estimated **$188,000 savings** in next year capacity tag charges
(or $15,000/month savings per monthly utility bills)

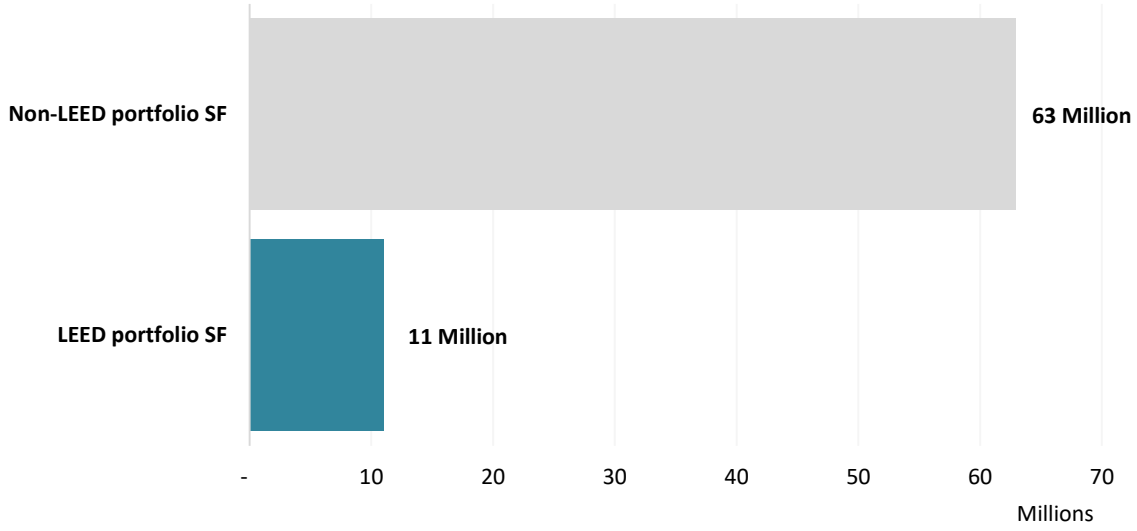
Preliminary LEED Building Analysis

Objective

Monitor and evaluate energy design and performance of state-owned, LEED-certified buildings

- **86** LEED certified buildings
- **15%** (11 million square feet) of state portfolio





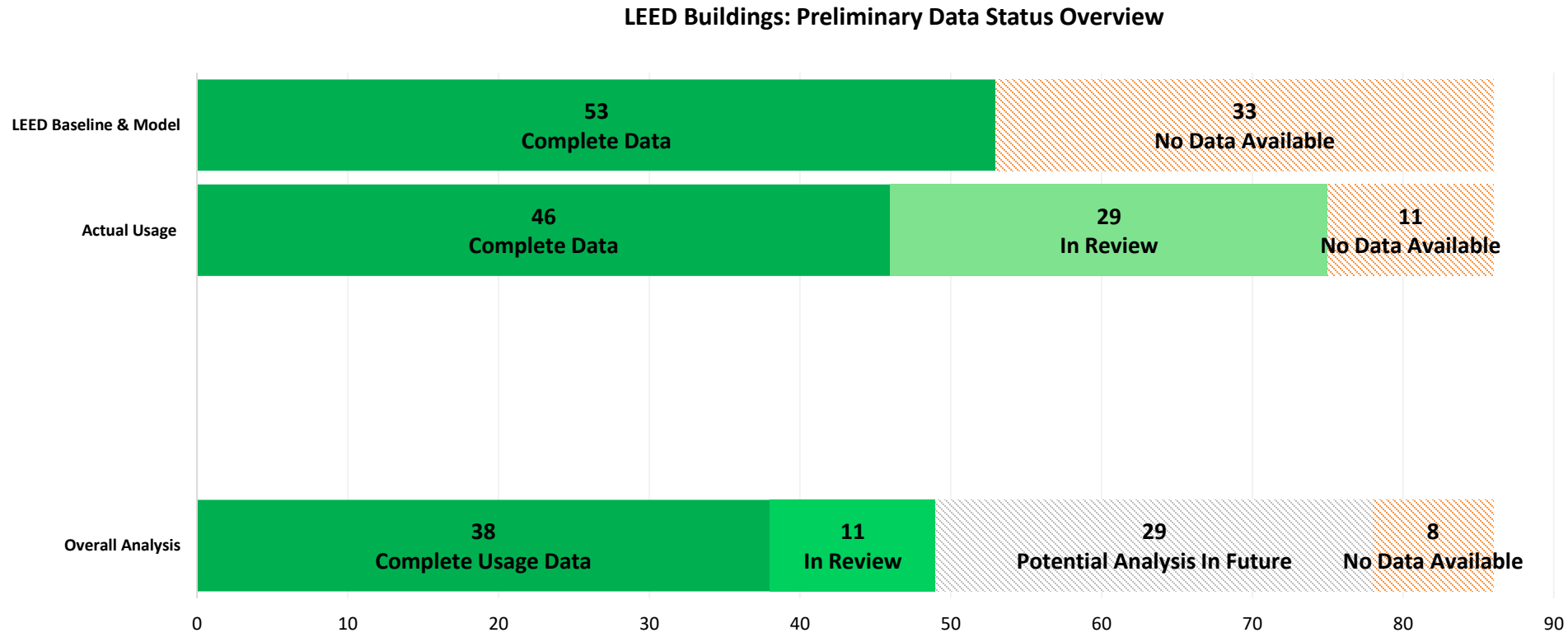
Preliminary LEED Building Analysis

Design Analysis	▪ Modeled EUI vs. Mass LEED Plus Standard
Performance Analysis	▪ Actual vs. Baseline EUI ▪ Actual vs. Mass LEED Plus EUI ▪ Actual vs. Modeled EUI ▪ Electricity vs. Heating EUI
Impacts Analysis	▪ GHG Emissions ▪ Performance Costs

Preliminary LEED Building Analysis

Next Steps

- **Finalize portfolio- and building-level analyses**
- **LBE working with sites to get energy usage and/or LEED data for additional buildings**



Commonwealth Building Energy Intelligence

- Previous contract expired 3/31/19
- 2-year contract renewal through March 2021 with existing vendor Enel X
- DCAMM managing contract and providing majority of funding with financial and technical support from LBE
- Potential new measures, including peak demand management and seasonal natural gas fluctuations

Image source: GovLoop

DOER
Massachusetts Department of Energy Resources

VEH102 Update

- Statewide Contract VEH102 reopened for additional vendors to bid in June
- Covers a wide range of Advanced Transportation Technology (ATT) equipment, supplies and services including:

Electric vehicle supply equipment (EVSE) hardware, software, and installation

- Level 1, Level 2 and DCFC Hardware
- Inductive Charging Hardware
- Network Software and Reporting Services
- Billing Services
- Site Assessment
- Installation and/or Commissioning
- Servicing and maintenance
- EVSE w/ clean energy generation or storage
- Vehicle to X software & services
- Demand management software & services
- Fleet charging software & services
- Portable EV Charger with & w/o solar

Anti-idling technologies

After-market conversion technologies (retrofits, upfits)

VEH102 on COMMBUYS

Energy Storage

Energy Storage:
Market Updates, Policy Mechanisms, and Considerations

July 16, 2019

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

Creating A Clean, Affordable and Resilient Energy Future For the Commonwealth

Massachusetts Department of Energy Resources

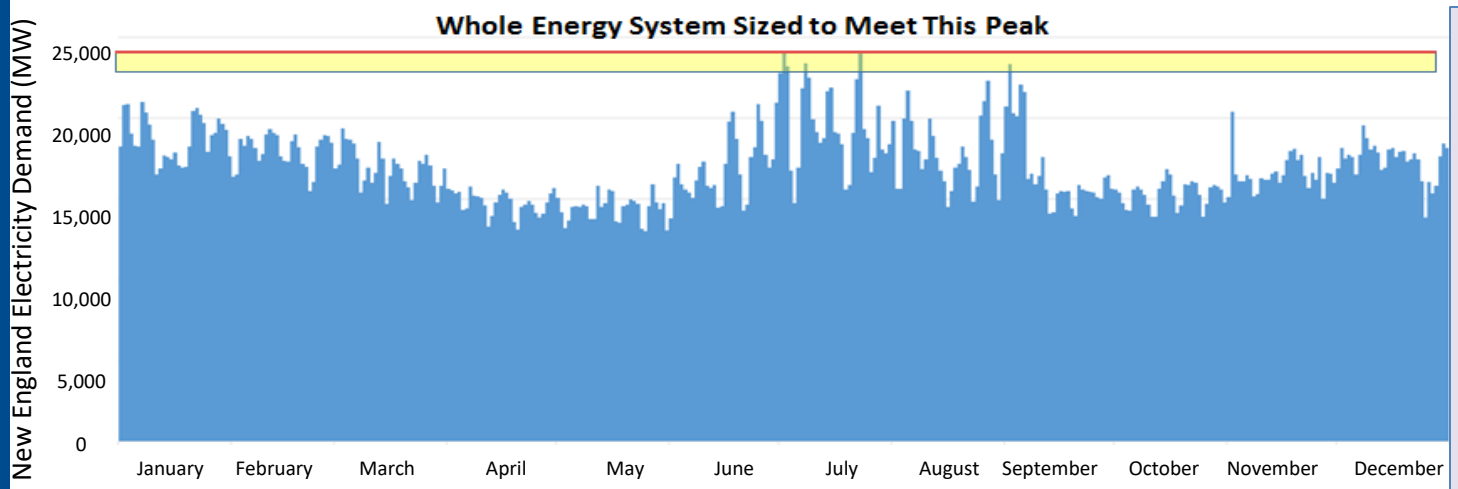
Energy Storage: Market Updates, Policy Mechanisms, and Considerations

- Energy storage technologies are rapidly developing and the market for them is growing exponentially
- Historically, the inability to store electricity required the grid to be sized for the highest annual peak demand resulting in inefficiencies, under-utilization of assets, and high cost

Storage is a **Game Changer**

Storage as a Solution

- Allows **use of energy generated during low cost periods** to serve load during expensive peak
- **Defers investment** in transmission and distribution wires, reduces need for peaker plants
- **Enables wind and solar energy** to be used when the sun isn't shining and the wind isn't blowing
- **Enables integrating additional distributed energy resources**
- **Provides resiliency** during severe weather
- **Resolves intermittency**-based power issues
- **Prevents future curtailment**



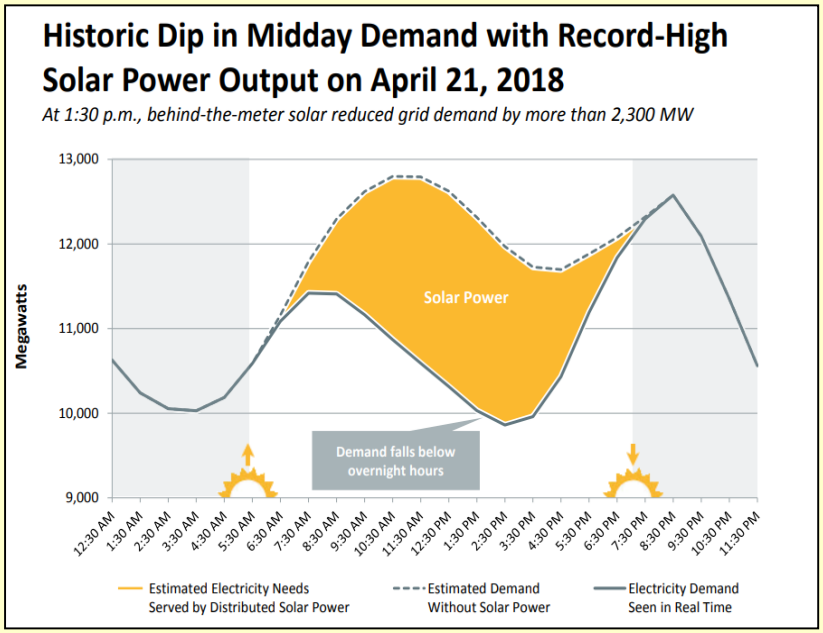
In 2015 :
The top 1% of hours accounted for 8% of MA spend on electricity

Top 10% of hours accounted for 40% of electricity spend

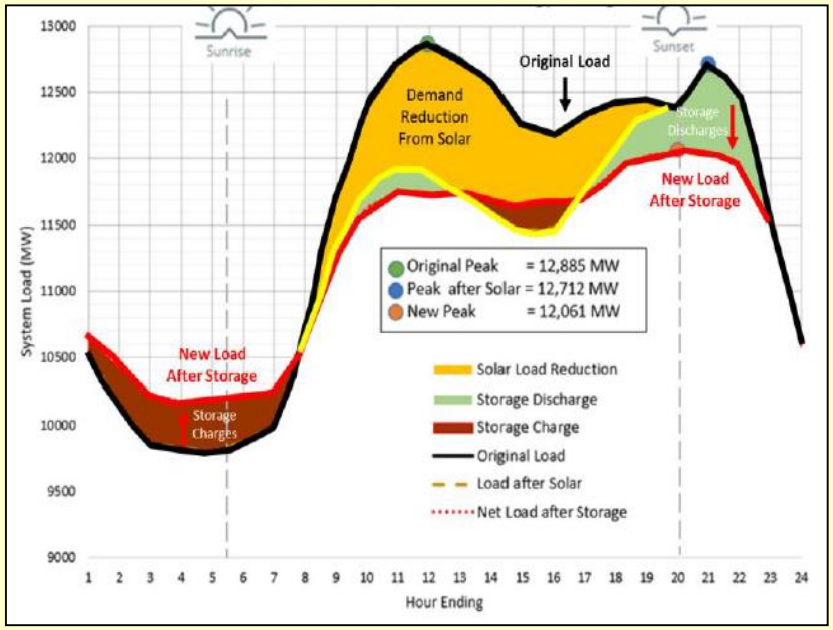
Clean Resource Integration and Utilization

- MA has peak load of approximately 12,000 MW and minimum daytime load of approximately 6,000 MW
- By 2030, MA is forecast to have over 9,000 MW of renewable energy (hydro, wind and solar) – storage will enable the full utilization of these resources

ISO-NE Data



MA State of Charge Storage Study



Market Updates

- The US energy storage market set a growth record in Q1 2019, deploying 148.8 MW
  - 232% increase from Q1 2018
  - Deployments expected to surpass 4.5 GW by 2024
- Storage playing a bigger role in energy markets
  - Grid balancing
  - Replacing conventional power generators
  - Providing power-quality services
  - Supporting renewables integration, EV charging
- Continually declining costs
  - From $1,000/kWh in 2010 to $187/kWh in 2019

Sources: McKinsey & Company; Utility Dive; Bloomberg New Energy Finance

Technology Highlights

- Lithium-ion continues to rule the day
  - 4-hour battery configurations are currently the standard for performance optimization and cost-effectiveness
- New battery options and configurations emerging
  - Nano silicon, sulfur, other components being explored as alternative to graphite lithium-ion batteries
  - Special wires to withstand continual recharging
  - Solid state batteries able to charge/discharge more rapidly
  - Long duration batteries
  - Seasonal storage technology
- Advances in inverter technology, e.g. “SolarEdge” designed specifically for resilient PV + battery systems

Sources: Pocket-lint; Targray; GreenTech Media

Why invest in storage?

- Enabling onsite renewable generation with variable outputs
- Energy cost savings
  - Peak demand reduction
  - ICAP and RNS charge reductions
- Revenue generation
  - Wholesale capacity, reserve, and frequency market participation
  - Clean Peak Standard performance
- Greenhouse gas emissions reduction
- Resiliency and power backup
- Microgrids

Ownership Models

- Direct ownership
  - Can be with or without operations and maintenance contract
- Power and/or storage purchase agreements
  - May be separate or stacked; some vendors looking into how to integrate storage PPAs with existing solar PPAs
- Energy Storage-as-a-Service – ESaaS
  - Combination of advanced energy storage system, energy management system, and service contract

- There are pros and cons to each option
- Combining two or more might be the best solution

Publicly-owned battery storage systems not eligible for federal tax credit (ITC)

MA Policy Drivers

- MA Energy Storage Initiative (ESI) launched in 2015
  - Energy storage study – State of Charge Report
  - Aims to accelerate innovation and technology development; expand markets; develop policies and regulations, and programs
    - $20M allocation from ACP
    - 1,000 MWh energy storage target by 2025
- Energy storage within MA DPU rulings
  - In 2017, DPU approved electric distribution companies proposals for utility-owned energy storage
  - DPU 17-146 defined eligible configurations of net metering facilities paired with energy storage systems
  - Energy storage included in utility EE 2019-2021 plan for Active Demand reduction

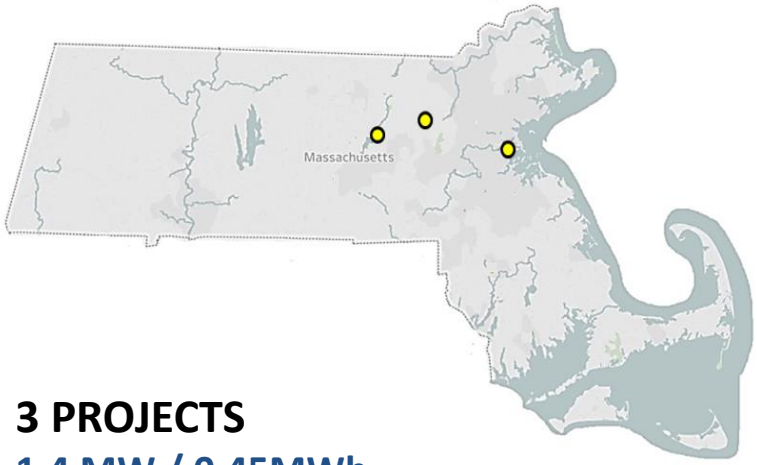
Energy Storage Initiative; energy storage and net metering

MA DOER Incentive and Grant Programs

- Community Clean Energy Resiliency Initiative (CCERI) technical assistance and implementation grants
- Advancing Commonwealth Energy Storage (ACES) demonstration program grants
  - 26 projects across the Commonwealth
- Solar Massachusetts Renewable Target (SMART) Program
  - Additional revenue for solar installations that include storage
- LBE Solar & Feasibility Study Grant opportunity
- Green Communities grants open to energy storage projects
- Clean Peak Standard (in development)
  - 1st in nation
  - Draft regulation Q3 2019
  - Large anticipated role for storage under CPS

Energy Storage Success in MA

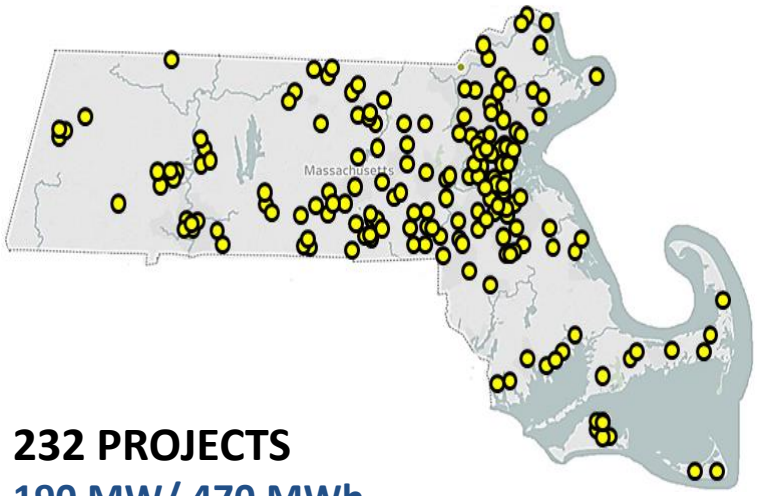
2015



3 PROJECTS

1.4 MW / 0.45MWh

2019



232 PROJECTS

190 MW/ 470 MWh

(operating and in development)

Clean Peak Standard

- Clean Peak Standard will be the Administration's signature energy storage policy enhancing Massachusetts clean energy policies
  - It is a **market mechanism** that will create revenue for resources, like energy storage, that can shift energy usage from the peak
  - Designed to **address the impact of peak** on price and emissions
  - **Will send a market signal** to clean energy generation to invest in storage technologies to deliver energy during periods of peak demand, thereby reducing reliance on oil and gas generation, and reducing the emissions and costs associated with them
- 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

Considerations and Challenges

- Asset Usage
  - Considerations:
    - What are your goals, objectives and needs?
  - Challenges:
    - How do you prioritize those use cases?
    - How do you maximize benefits from each use case?

- Financing
  - Considerations:
    - What are potential revenue streams, procurement options and funding sources?
  - Challenges:
    - Meshing different ownership models for different project aspects
    - Incentive program uncertainty
    - Quantifying or monetizing benefits
    - Upfront capital costs (equipment, interconnection, and installation)
    - Ongoing operational and maintenance costs

Considerations and Challenges con't

- Project Development and Installation
  - Considerations:
    - What size system? Which system(s) should be integrated? What is the project timeline?
  - Challenges:
    - Optimizing the project design – size, technology type, system integration
    - Zoning, siting, and permitting requirements
    - Interconnection complexities – process, timeline, and cost
- Operation and Maintenance
  - Considerations:
    - Who will operate and maintain the system?
  - Challenges:
    - Establishing charge and discharge times
    - Targeting and reconciling revenue streams
    - Timing demand peaks
    - Managing a lack of standard guidance and trainings

Discussion

- What core questions do you have related to energy storage?
- Have you had experience with feasibility, implementation, or operation of energy storage at your site, either standalone or as part of solar generation?
  - What are your takeaways?
- How can DOER/LBE support state storage at state facilities and campuses?

Next LBE Council Meeting

Save the Date!

September 17, 2019

10:00 am–12:00 pm

UMass Lowell