MA Leading by Example Council Meeting

March 20, 2018

Massachusetts Leading by Example
State Government Progress – as of March 2018

Greenhouse Gas (GHG) Emissions ↓ 28% 2004 -2016	**Energy Use Intensity per Square Foot** ↓ 12% 2004-2016	**Electricity via Renewable & Onsite Generation** CHP 20% In 2016	**Heating Oil Consumption at State Facilities** ↓ 79% 2006-2016
22.9 MW Installed Solar PV at State Sites 14.7 MW Since 2015	**76 LEED Certified State Buildings** 38 Since 2015	**111 Electric Vehicle Charging Stations at State Sites** 53 Since 2015	**Leading by Example Grants Awarded** $10.4 M Since 2015

Agenda

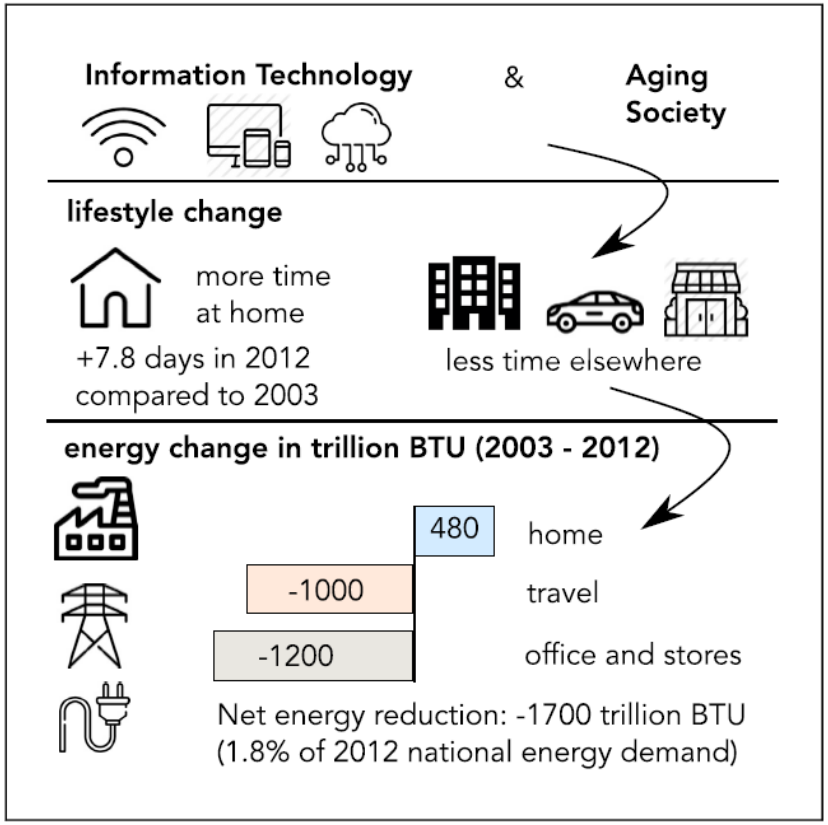
- Welcome & Introductions
- News From Around the World
- Commonwealth Updates
- Technology Spotlight: Biomass Systems
- Post 2020 LBE Targets Brainstorm
- LBE Updates
- 2018 Earth Day/Month Plans?

News From Around the World

Americans Saving Energy Staying at Home

Changes in Time Use and Their Effect on Energy Consumption in the United States
Ashok Sekar, Eric Williams, Roger Chen (2018)
University of Texas, Rochester Institute of Technology

- Technology enabling lifestyle shifts and influences energy use across sectors
- More time at home led to less time traveling to offices/stores
- **1.8% of 2012 national energy demand reduced due to activity tradeoffs**



China's latest energy megaproject shows that coal really is on the way out

Business Insider, 2018

- 40 MW floating solar farm above abandoned coal mine opened in 2017
- Electricity generated enough to power 15,000 homes
- A 150MW solar farm to come online in May

Wind Power Proposals Surpass Natural Gas Plans

WNPR, 2018

- As of March 2018, ISO New England received more wind proposals than NG
- Half would be in remote northern NE – requiring transmission upgrades

PRIVATE SECTOR INVESTMENTS CONTRIBUTE TO OVER 700 PERCENT GROWTH IN ZERO ENERGY BUILDINGS MARKET SINCE 2012

New Buildings Institute, 2018

- 482 buildings ‘verified’ or ‘emerging’ Zero Energy Buildings in US and Canada
- Totaling 45M square feet

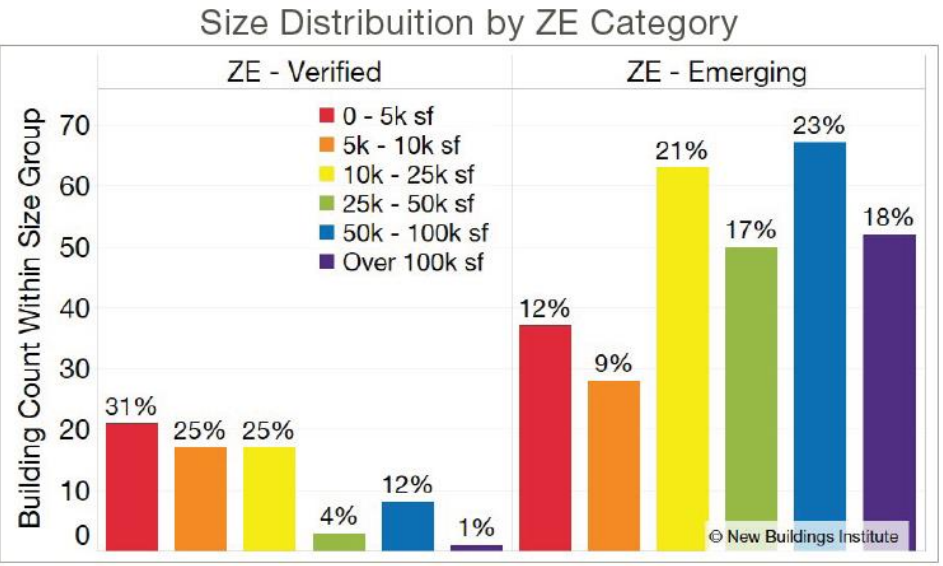


Fig 6. Nearly 30% of all buildings and 88% of the total floor space of ZE Emerging buildings are 50,000 sf or larger.

6 For existing buildings, CBECS 2012 provides For new buildings, California’s Title 24 2016 ene

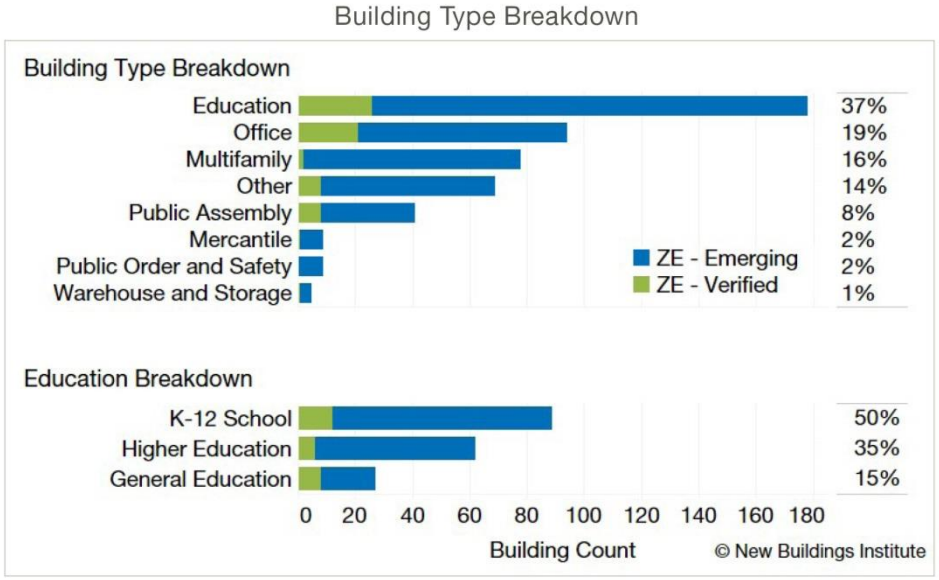


Fig 7. Zero energy buildings can be found across many different building types.

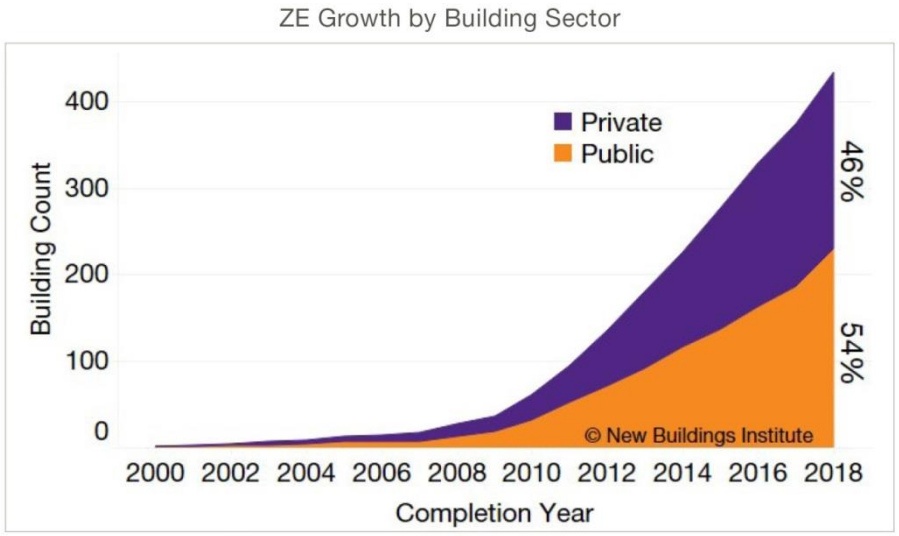
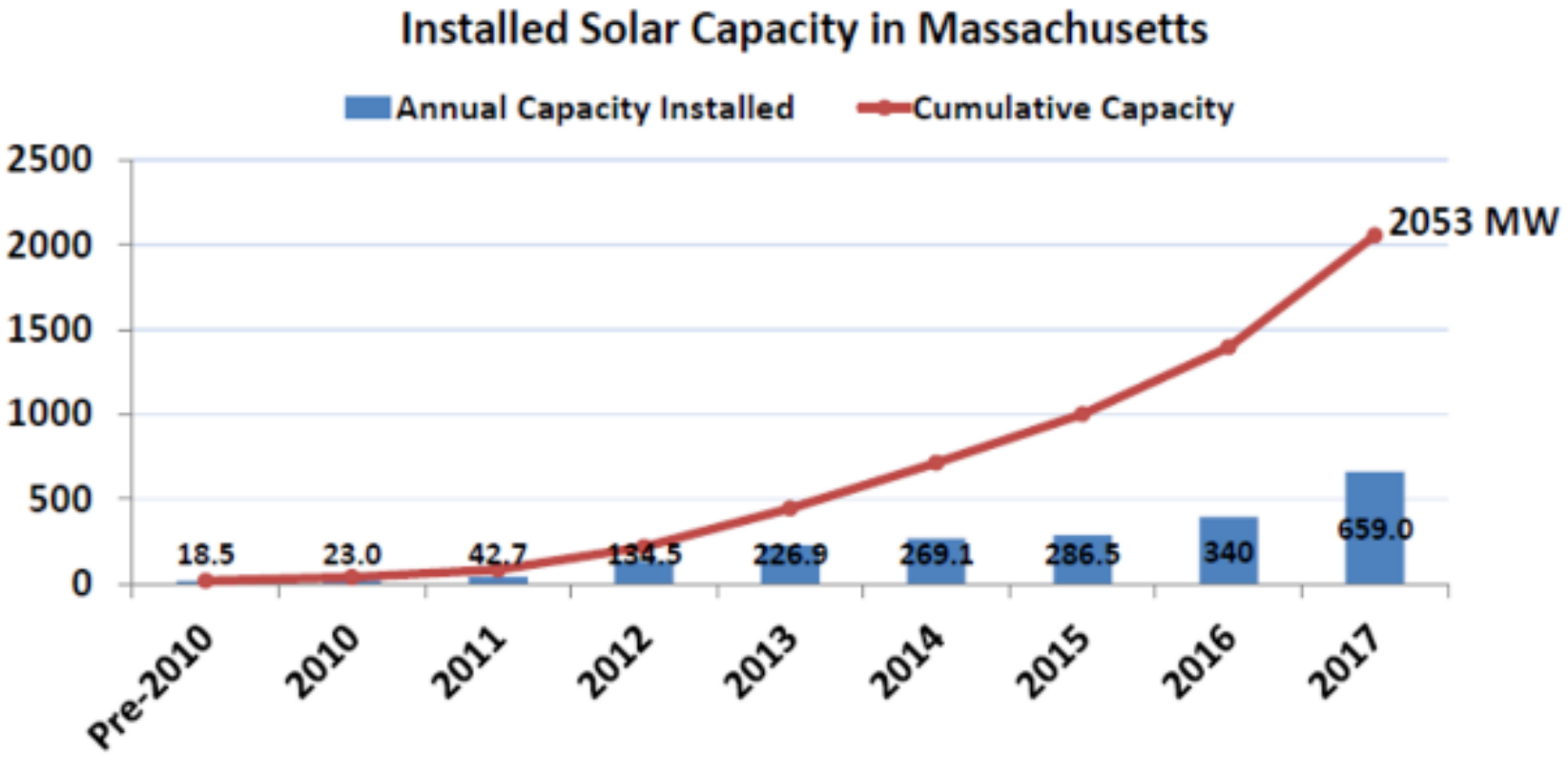


Fig 9. ZE Verified and ZE Emerging projects by ownership. Projects with missing ownership data are excluded

Commonwealth Updates

Commonwealth Reaches Solar Milestone

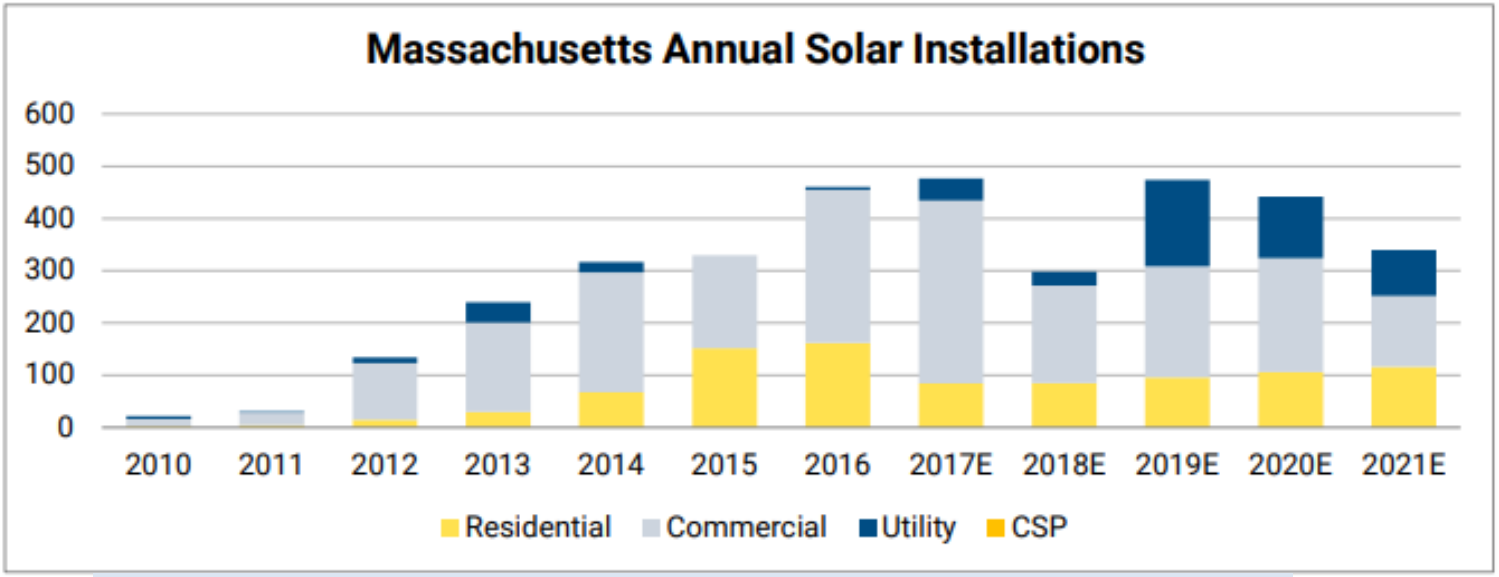
- >2,000 MW solar capacity in MA
  - Almost 50% installed in past two years
  - More than 79,000 projects
  - All 351 MA cities and towns have at least one installation



MA National Solar Rank (SEIA)

AT A GLANCE

- **Solar Installed:** 1,898.3 MW (153.4 MW in 2016)[i]
- **National Ranking:** 6th (8th in 2016)
- **State Homes Powered by Solar:** 312,000
- **Percentage of State's Electricity from Solar:** 7.42%[ii]
- **Solar Jobs and Ranking:** 14,582 (2nd in 2016)[iii]
- **Solar Companies in State:** 501 companies total; 83 Manufacturers, 194 Installers/Developers, 219 Others[iv]
- **Total Solar Investment in State:** $4,921.89 million ($1,002.13 million in 2016)
- **Price Declines:** 55% over last 5 years
- **Growth Projections and Ranking:** 1,834 MW over next 5 years (ranks 9th)



https://www.seia.org/sites/default/files/2018-01/Federal_2017Q3_Massachusetts1.pdf

MA Clean Energy Procurement Announced

- Northern Pass (NPT) Hydro project selected in January
  - Part of clean energy procurement authorized by *An Act Relative to Energy Diversity* signed by Gov. Baker in 2016

- If completed, hydropower from Canada expected to deliver 9.4 million MWh annually
- Selected proposal to increase MA energy supply to nearly 50% from clean energy resources

- *Eversource appealing NH initial rejection of project*

Clean Energy Legislation

Current Filed State Bills:

- Senate bill filed on 2/12: An Act to promote a clean energy future: *To protect our public health, create jobs and reduce greenhouse gas emissions*
  - *2050 target for 100% renewable energy*
  - *Efficiency, storage, electric vehicles, and more included*

- Governor Baker filed $1.4B *Climate Change Adaptation, Environmental and Natural Resource Protection and Investment in Recreational Assets bill* on 3/15 (Press Release)
  - *$4M for MA Electric Vehicle Incentive Program*
  - *DOER would be directed to create new clean peak standard for electricity suppliers*
  - *Environmental stewardship, resiliency and adaptation, state environmental agency programs, and more included*

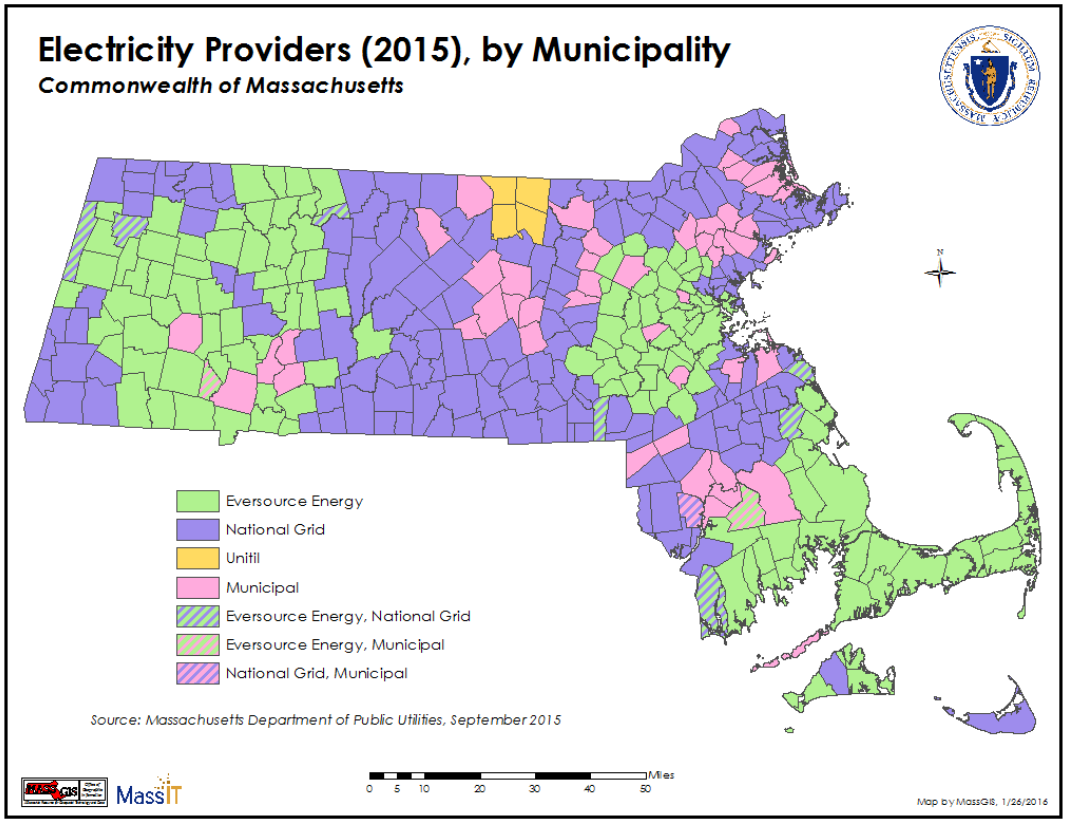
EV Charging Station Funding Updates
Volkswagen / Electrify America

- Greenlots won RFP for workplace and MUD EV charging in Boston area
- Looking to install stations at 15 sites by fall 2018 in various locations (Boston, Framingham, Newton, etc)
- Greenlots responsible for O&M – 8 year host agreement
  - 3 years for equipment
  - 8 years for software
- Several state sites being considered
- Electrify America looking at 3 highway locations and community depot for fast charging

EV Charging Station Funding Updates (2)

Utility Infrastructure Funds

- Eversource approved for $45 million over 5 years to cover infrastructure costs associated with EV charging
- Looking to complete 50 sites by end of CY2018
- Minimum 2 stations with pre-wiring for more
- LBE in discussions to provide list of potential state sites
- National Grid decision pending



EV Charging Station Funding Updates (2)
Utility Infrastructure Funds

Site Prioritization:

1. Public Access lots (garages, muni lots, beaches, parks, transit, community/state colleges)
2. Workplace charging
3. Multi Use Dwellings

Filtering Criteria:

- Size of customer
- 24/7 access
- Safe, well lit
- Visible
- Existing distribution service
- No public way crossing

EV Charging Station Funding Updates (3)
State Funding

- Governor's Environmental Bond Bill includes $4 million for DEP's MassEVIP Program
  - *Could include funds for EVs and chargers*
  - *Submitted to legislature last week*
- Volkswagen $70 million in settlement funds to DEP for diesel reduction
  - *Up to 15% can be used for EV charging infrastructure – no decision yet*
  - *DEP conducting listening sessions through March*

MassSave Listening Sessions

- 2019-2021 three year efficiency planning underway
- DOER has scheduled listening sessions for public comment on MassSave programs

PITTSFIELD Ralph Froio Senior Center 330 North Street, Pittsfield, MA 01201 **March 22 from 4:00 – 6:00pm**	**LOWELL** Lowell Senior Center 276 Broadway Street, Lowell, MA 01854 **April 12 from 6:00 – 8:00pm**
WORCESTER MA Department of Environmental Protection 8 New Bond Street, Worcester, MA 01606 **March 29 from 6:00 – 8:00pm**	**FALL RIVER** Bristol Community College **TBD**
SPRINGFIELD University of Massachusetts Center 1500 Main Street, Springfield, MA 01103 **April 5 from 6:00 – 8:00pm**	**SALEM** Salem State University **TBD**

- Contact Matt Rusteika at 617-626-7340 or Matt.Rusteika@.State.MA.US for more information

Innovate Energy Efficiency (InnovatEE) Grant Program

PON-ENE-2018-004

DOER seeking applicants for innovative Market Ready Energy Efficiency Technology Demonstrations or Innovative Energy Efficiency Program Delivery

Technologies include, but not limited to:

- Heat Pumps for generator block heaters
- Micro CHP
- Water/Wastewater Optimization
- Regression Modeling, EMIS, Sub metering to measure savings
- HVAC Integrated building control systems

Grants up to $700,000, proposals must demonstrate at least 50% cost share

See COMMBUYS for full information and submit all questions via the Bid Q&A process on COMMBUYS

Procurement Milestone	Due Date
Issue PON on COMMBUYS	February 23, 2018
Deadline to Submit Questions to COMMBUYS (Bidders)	March 23, 2018
Answers to Questions Posted on COMMBUYS (DOER)	April 4, 2018
PON Responses Submission Deadline[1]	**April 27, 2018**
Winning projects selected*	June 1, 2018
Contracts negotiated*	June 29, 2018

DOER
Massachusetts Department of Energy Resources

Technology Spotlight
Biomass

Jonathan T. Parrott, Ph.D.
Renewable Thermal Program Coordinator
Massachusetts Dept. Of Energy Resources

Biomass Within the APS

Fuel sources consisting of the following:

(a) Eligible Biomass Woody Fuel

(b) Dedicated Energy Crops

(c) Manufactured Biomass Fuel

(d) Eligible Biogas Fuel

(e) By-products or waste from animals or ag. crops

(f) Food or vegetative material

(g) Algae

(h) Organic refuse derived fuel

(i) Eligible Liquid Biofuel

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Woody Biomass Fuels

Wood Pellets

Wood Chips

Wood Logs *

Woody Biomass Fuels

Wood Pellets

Wood Chips

Wood Logs *

Not All Wood is Created Equal

Sources of Woody Biomass Fuel

Four Categories of Eligible Biomass Woody Fuels :

1. Forest-Derived Thinnings
2. Forest-Derived Residues
3. Forest Salvage (*Residues*)
4. Non-Forest-Derived Residues:
   - Forest products industry
   - Agricultural land use change
   - Wood waste
   - Agricultural wood waste

All Woody Biomass Fuel must be <u>Clean Wood</u>

Feedstock Requirement

100% of APS wood must be Eligible Biomass Woody Fuel, meeting sustainable forestry requirements.

DOER has established a minimum feedstock threshold of 30% forest-derived materials in order to support the local and regional forest product industry.

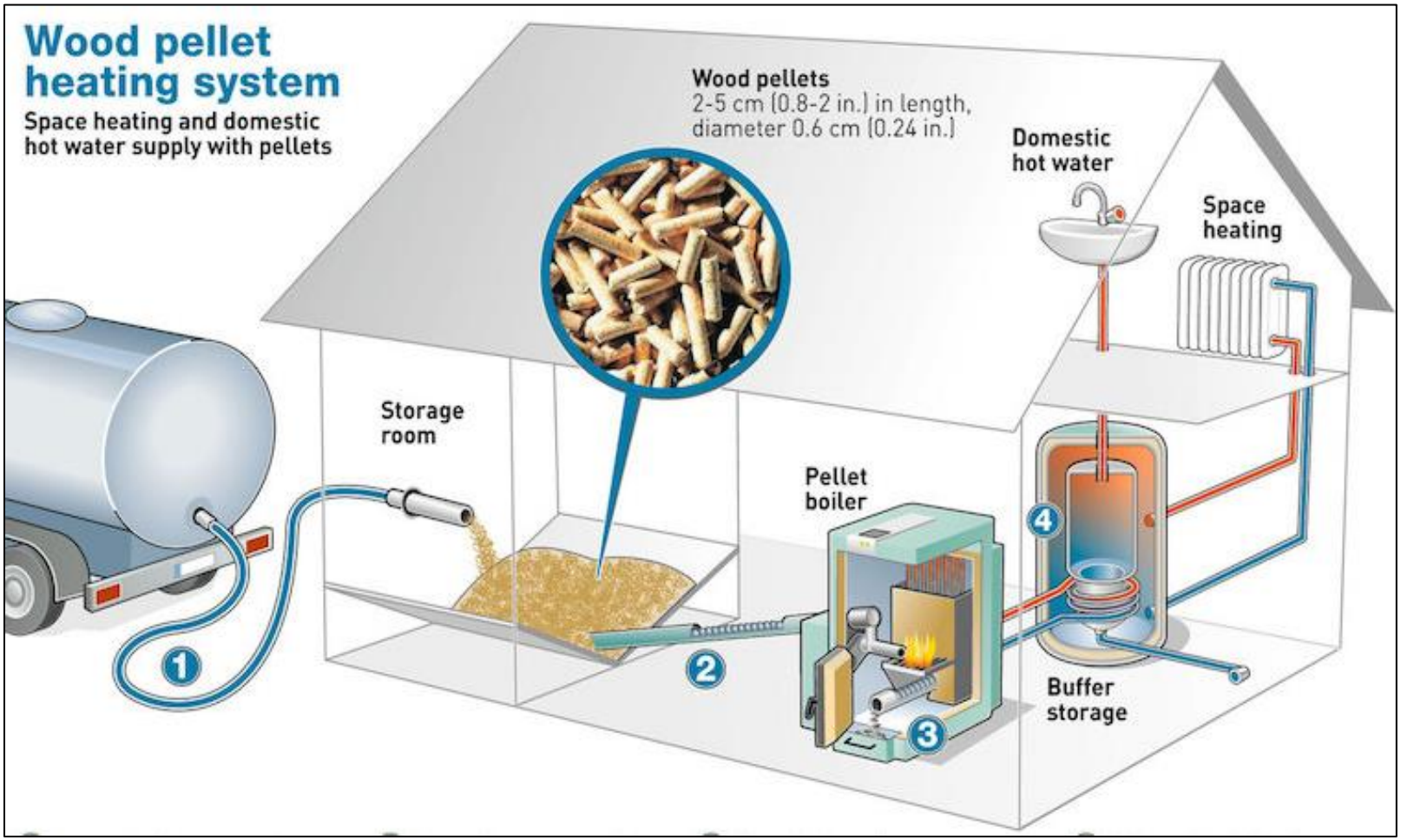
Included in the required 30%:

- Direct from forest
- Post manufacturing (mill waste)

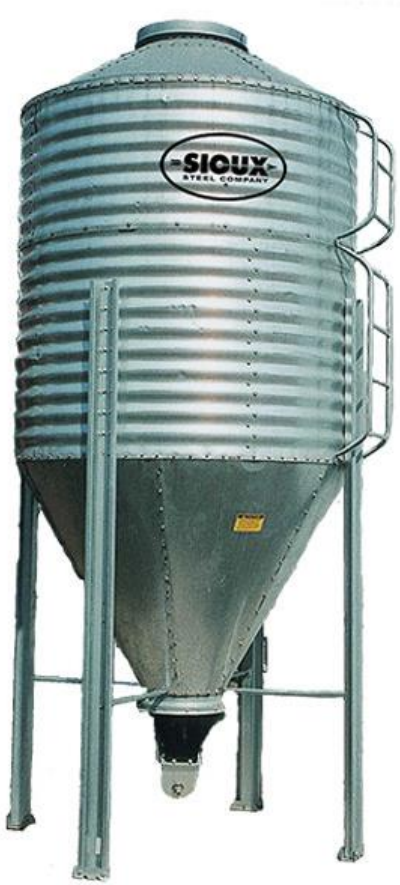
Not Included in the required 30%

- Utility-derived residues
- Agriculturally-derived residues
- Urban wood waste

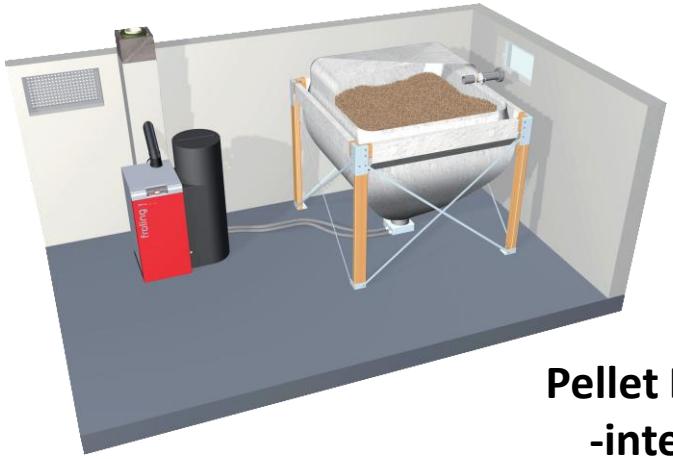
Simplified System



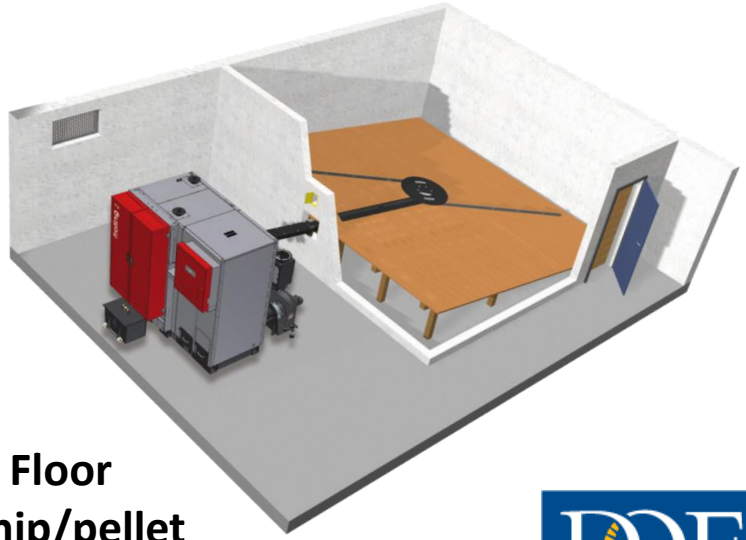
Fuel Storage Configurations



Exterior Silo



Pellet Bag
-interior



Live Floor
- chip/pellet

Heating Cabins

- Preassembled
- Time efficient
- Building code flexible

Fuel Quality Specifications

Type I.

A boiler or furnace of less than 3MMBtu/hr. (rated input) without an emission control device (e.g., electrostatic precipitator) must meet the following fuel quality specifications:

	Pellets	**Chips**
Calorific value	> 8,000 Btu per pound	≥ 5,500 Btu per pound
Moisture	≤ 8 percent	≤ 35 percent
Ash content by weight	≤ 1 percent	≤ 1.5 percent
Chip Size (percent retained by a ½ inch screen)	Not applicable	75 percent or adhere to manufacturer's protocol
Chlorides	≤ 300 parts per million	Not applicable

Fuel Quality Specifications

Type I.

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Moisture	≤ 8 percent	≤ 35 percent
Ash content by weight	≤ 1 percent	≤ 1.5 percent
Chip Size (percent retained by a ½ inch screen)	Not applicable	75 percent or adhere to manufacturer's protocol
Chlorides	≤ 300 parts per million	Not applicable

Fuel Quality Specifications Cont.

Type II

- A boiler or furnace of any size equipped with an emission control device (e.g., electrostatic precipitator) is not constrained to the afore mentioned fuel quality specifications (moisture content, sizing etc.).

This allows for green chips to be used.

Type III

- A boiler or furnace of greater than or equal to 3MMBtu per hour rated heat input must receive a MassDEP plan approval pursuant to 310 CMR 7.02(5), which shall dictate fuel quality specifications.

Forest Sustainability Verification

Massachusetts forest derived

a) DCR approved cutting plan

✓ attesting to 1. Best management practices (BMP's)

2. Forest Stewards Guild's biomass retention guidelines.

Non-Massachusetts forest derived

a) Have a cutting plan that is from a SAF or host-state forester

✓ attesting to 1. Best management practices (BMP's)

2. Forest Stewards Guild's biomass retention guidelines.

b) Independent third-party certification

Forest Stewardship Council (FSC)

Program for the Endorsement of Forest Certification (PEFC)

Sustainable Forestry Initiative (SFI)

American Tree Farm System (ATFS)

Self Supply of fuel is also permissible, with registration.

System Performance Standards

All systems must represent best in class commercially feasible technologies

Combustion Efficiency

- 75-85%

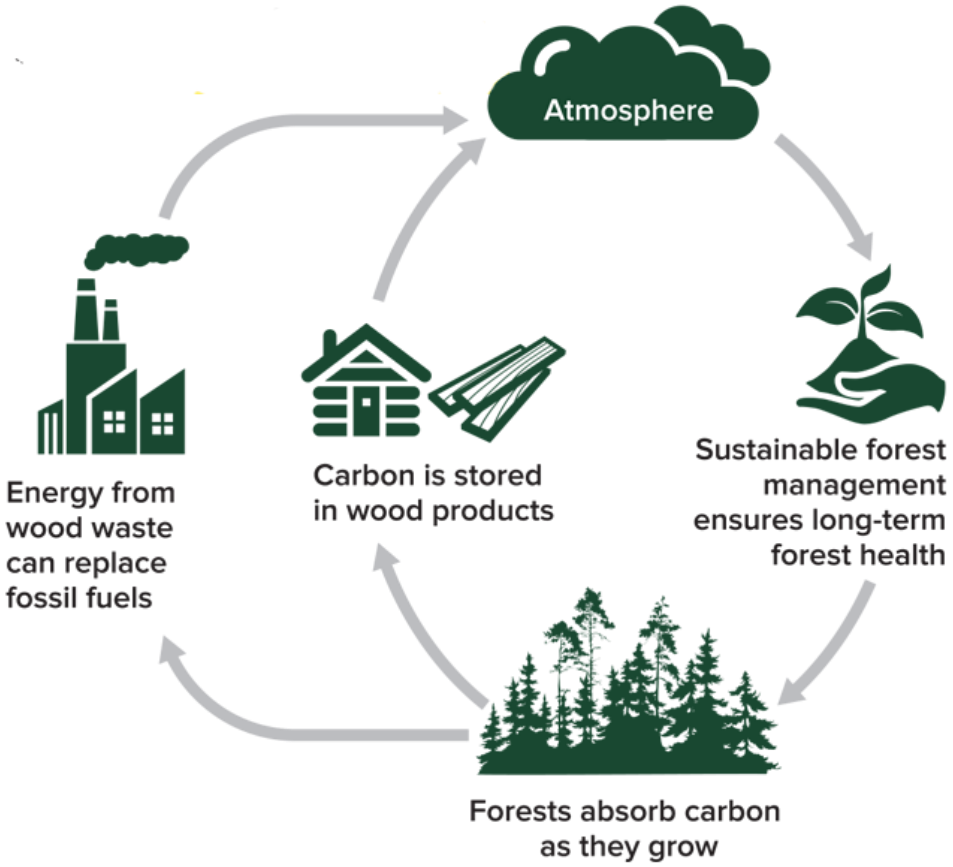
Particulate Emissions

- .08 to .1 lbs./MMBtu
- .03 lbs./MMBtu for sensitive populations

Thermal Storage

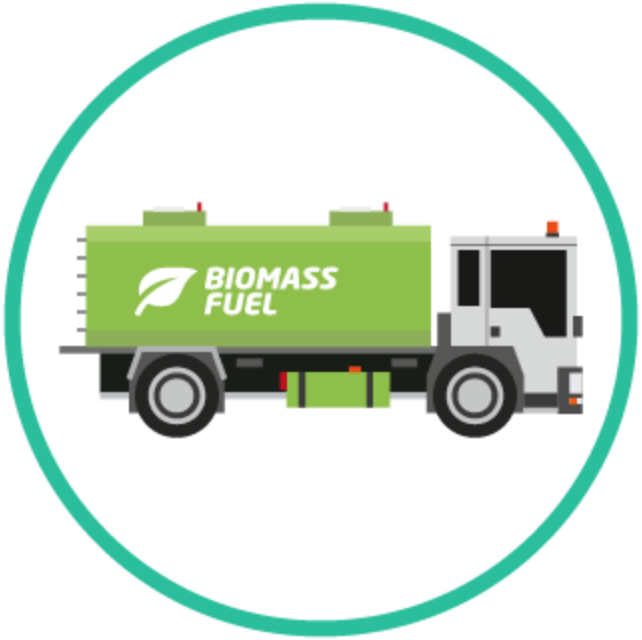
- Can be potable hot water
- Approximately 2gal/1,000Btu
- Can be waived

Lifecycle Greenhouse Gas Emissions Analysis



- 50% reduction in GHG emissions over 30-years
- Analysis relies closely on Manomet Study findings

Biomass Suppliers List



To ensure accountability and streamline fuel purchasing DOER established a pre-screened list of biomass suppliers.

AEC Income Calculator

Example

- *Wood Pellets- Boiler*
- *80 tons of fuel*
- *85% efficient*

Useful Thermal Energy

= (8,000 Btu/lb *85% * 160,000 lbs)/3,412,000 = 318.9 MWh

318.9 MWh = 318 AECs = **$6,360/yr**.

More information is available in Guideline on Metering and Calculating the Useful Thermal Output of Eligible Renewable Thermal Generation Units- Part 1

Valuing Biomass

	Cost	Moisture Content	MMBtu	$/MMBtu	Efficiency	Cost per MMBtu	AEC's per Ton	AEC % of Fuel Cost
Oil	$2.30	0%	0.138	$16.67	80%	$20.83	N/A	N/A
Propane	$2.59	0%	0.092	$28.15	90%	$31.28	N/A	N/A
Natural Gas	$1.10	0%	0.100	$8.00	90%	$12.22	N/A	N/A
Wood Pellets	$240.00	4%	16.1	$14.88	85%	$17.51	4.03	34%
Green chips	$30.00	50%	8.4	$3.57	75%	$4.76	1.85	124%
Semi-dry chips	$85.00	30%	11.8	$7.23	77%	$9.39	2.66	63%

Creating A Cleaner Energy Future For the Commonwealth

DOER

Massachusetts Department *of* Energy Resources

DCAMM'S UTILITY VENDOR PROGRAM AND DCR – A BUNDLED APPROACH

- Department of Conservation and Recreation (DCR) identified 24 "Priority Sites" needing energy upgrades – mostly pools.
- DCAMM's UV Program vendors audited and recommended Energy Conservation Measures (ECM).
- 7 sites identified for on-demand, natural gas hot water systems.
- Upgrades approved by DCAMM and DCR
- Construction began in July 2017
- Construction completion expected in April 2018 – all sites.
- **New tank-less units heat water on demand – increased energy savings, no more standby losses, reduced maintenance costs and faster hot water.**

FINDING COMMON GOALS IN ENERGY EFFICIENT PROJECTS… LET'S TALK

- Utility Vendor Team looking to perform more "targeted bundle" work.
- Streamlined approach
  - Audit
  - Quick review process
  - Agency contacts to help with review
  - Agreement
  - Notice to Proceed issued
  - Construction begins

4-5 months for a "bundle" of projects.

- Focus on one ECM across a range of sites that addresses the facilities needs and provides energy savings. Must be relatively straightforward ECM – no design or major complexities.
- Potential ECMs – motors, drives and variable frequency drives, REALice technology (ice rinks), wood biomass heating systems to replace oil, lighting and controls, insulation.
- **Some rules** – Each site under $100,000 Total Contract Value, max $500,000 total "bundle" of work. leverage utility rebates to maximize project paybacks – targeting 10 years or under simple payback.

COMMERCIAL & MULTI-FAMILY MODERN WOOD HEATING REBATE PROGRAM

MASSACHUSETTS CLEAN ENERGY CENTER

masscec.com/modern-wood-heating

System Requirements and Eligibility

1. Modern wood heating system must meet MassCEC's emissions and efficiency requirements.
2. System must be designed and installed by by MassCEC approved designer and installer.
3. Property must be located in the Massachusetts electric service territory of **Eversource**, **National Grid**, **Unitil**, Ashburnham MELP, Holden MLD, Holyoke Gas & Electric, Russell MLD, or Templeton Municipal Light.

Grant Formula

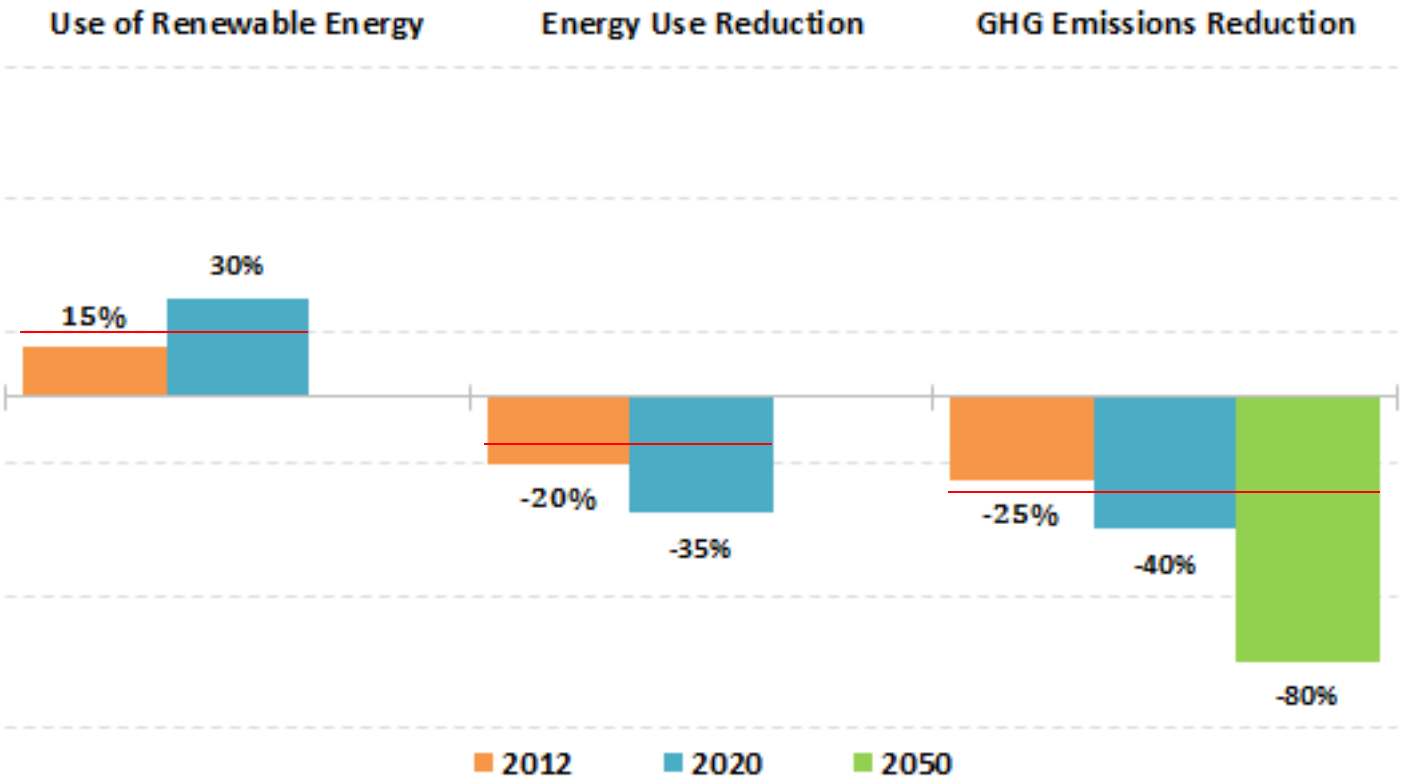
All grants are based on a percentage of eligible project costs, as defined in the program manual. The base grant is 35% of eligible project costs, up to $175,000. Many systems also qualify for bonuses, which may increase the grant up to $250,000.

Grant Component	Grant amount as a Percent of Total Eligible Project Costs	Maximum Dollar Value per Grant Component
Base Grant	35%	$175,000
Thermal Storage Bonus	5%	$25,000
Cascading Systems Bonus	2.5%	$12,500
Distribution System Efficiency Bonus	2.5%	$12,500
Public, Non-Profit, and Affordable	5%	$25,000
Maximum Grant	50%	$250,000

Post 2020 LBE Targets Brainstorm

DOER
Massachusetts Department of Energy Resources

EO 484 Targets



actual as of FY16

Issues

- Some LBE targets end in 2020, GHG only long-term
- Priorities, strategies, technologies, may have changed
- MA EO 569 directs expansion of existing strategies to lead by example in making new, additional reductions in greenhouse gas emissions from Government operations
- Be prepared for possible requests to establish interim targets

Higher Education Example Targets

Campus	Metric
UMass System	• Carbon neutrality, 2050
Worcester State	• 50% Emissions Reduction by 2030 (2008 baseline) • 75% Emissions Reduction by 2040 (2008 baseline) • 100% Emissions Reduction by 2030 (2008 baseline)
Harvard	• Fossil Fuel-Neutral by 2026 • Fossil Fuel-Free by 2050
Williams	• Producing/procuring 100% renewable/non-emitting electricity by 2020

Worcester Polytechnic	• 25% reduction over 5 years (FY14 to FY18)
	  ○ Electricity consumption (kWh/year/person)
	  ○ Heating per capita (BTUs & therms/year/person)
	  ○ Water consumption per capita (gallons/year/person)

UMass Dartmouth	• Zero waste by 2025

Other Targets

State	Metric
CA (2015)	• Statewide GHG emission reduction goals of 40% by 2030 to meet 80% target by 2050 from 1990 baseline • All appropriate state agencies shall implement measures to meet targets • State agencies shall take climate change into account in planning and investment decisions and employ life cycle cost accounting
EO B-18-12	• State agencies reduce GHG emissions 20% by 2020 from 2010 • All new bldgs and major renovations after 2025 meet zero net energy standard, 50% goal after 2020 • Zero net energy goal for 50% of existing buildings by 2025 • Reduce grid based purchases by 20% by 2018 from 2003 baseline • Any new/major renovation >10,000 SF use clean, on-site power • Any new/major renovation >10,000 SF obtain LEED silver • State agencies provide opportunities for EV charging • Reduce water consumption 10% by 2015 and 20% by 2020 from 2010

State	Metric
OR EO2017-20 (2017)	• High performance energy targets for bldg remodels, using ASHRAE 100 pathw • Carbon neutral operations for new buildings after 1/1/2022, including off-site renewables • Develop a statewide plug load management strategy • All equipment meets efficient energy and water standards • Solar ready buildings (statewide) • Amend code to require parking structure support EV stations
RI EO15-17 (2015)	• Established LBE Program • Reduce energy consumption 10% by 2019 from 2014 • Procure 100% of state gov't electricity from renewables by 2025 • 25% of light duty fleet purchases and leases will be ZEV by 2025 • Achieve high standard of green building O&M at all state facilities • Voluntary stretch code for state construction and renovation • Post state energy use data (2014 baseline)
U.S. EO (2015)	• Reduce EUI 2.5% annually from 2015 • Improve data center efficiency • 25% of total building energy come from clean renewable electricity and alterr energy by 2025 • 30% of building electricity from renewables by 2025 • Reduce fleet GHG emissions at least 15% by 2021, 30% by 2025 • By 2020, 20% of passenger fleet acquisitions are ZEVs or PHEVs • By 2025, 50% of passenger fleet acquisitions are ZEVs or PHEVs • Starting in 2020, all new federal bldgs >5000 SF are net zero

LBE Interim Target Brainstorm

- Are targets in general helpful?
- If yes, when should targets be set after 2020? For how long? What intervals?
- Should targets be in the same categories (e.g. GHG, EUI, renewables)? Should they be changed to reflect new priorities/strategies
- Should additional targets be added? If so, what and when?
  - E.g. electric vehicles, zero energy buildings, energy storage, recycling, etc.
- If new goals are established, how detailed should they be (e.g. broad direction vs. detailed instruction)?

LBE Updates

Energy Resiliency Feasibility Study – Update

Evaluation of 12 state-owned 24/7 medical care facilities for opportunities to use clean energy technologies to increase the site's energy resiliency

Department of Veteran's Affairs	1. Holyoke Soldiers' Home
Department of Mental Health	2. Corrigan Mental Health Center
	3. Danvers Cottages (10, 2 & 3)
	4. Quincy Mental Health Center
	5. Harry C Solomon Mental Health Center
	6. Taunton State Hospital
Department of Developmental Services	7. Hogan Regional Center
	8. Wrentham Development Center
Department of Public Health	9. Tewksbury Hospital
	10. Western Massachusetts Hospital
Department of Youth Services	11. Stephen French Multiservice Center
	12. Northeast Regional Youth Services Center

- Arup has completed:
  - By site, identification of energy resiliency gaps (Task 1) and clean energy technologies to be utilized to address gaps (Task 2)
- Arup is finalizing:
  - Detailed cost & benefit analysis of clean energy technologies per site (Task 3)
    Examples: solar plus storage, combined heat and power, microgrids
  - Energy resiliency guidance document for all agency partners (Task 4)
- Draft report expected early April 2018

LBE Solar Grant

- Coming very soon
  - All types of solar projects are supported
  - Per-watt incentive levels increased *(not yet finalized)*

State-owned Solar Canopies (>200kW)	$1.65/watt, up to $1 million per project
Third-party owned Solar Canopies (>200kW)	$1.10/watt, up to $750,000 per project
Innovative Solar	$0.65/watt, up to $350,000 per project
Conventional Roof/ground solar	$0.50/watt, up to $250,000 per project

  - Energy storage system adder – varies based on ownership structure and resiliency benefits

State-owned	$200/kWh, up to$250,000 per project
State-owned with islanding capabilities	$400/kWh, up to $400,000 per project
Third-party owned	$100/kWh, up to $125,000 per project
Third-party owned with islanding capabilities	$200/kWh, up to $200,000 per project

Awarded Grants

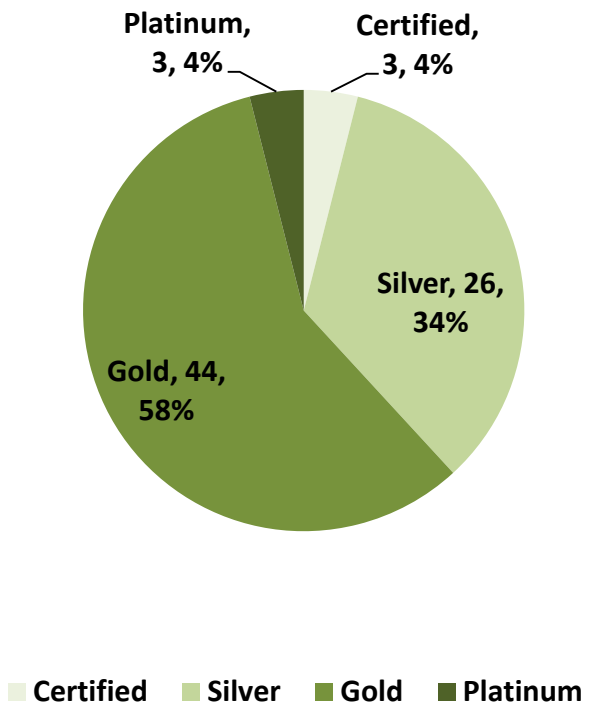
Recipient	Technology	Description	Amount Awarded
UMass Medical	Energy Storage	In 2018, UMMS was awarded a feasibility study grant for an energy storage study for the Combined Heat and Power (CHP) plant on campus. The includes a comprehensive economic analysis of an energy storage system in conjunction with the CHP to calculate the cost reduction and simple payback from peak demand decrease, energy arbitrage, and other operation efficiency optimizations.	$43,500
Div. of Fisheries and Wildlife *(DOER-managed consultant)*	Electric Vehicle Charging Station	DOER-managed feasibility study for electric vehicle charging station(s) at Division of Fisheries and Wildlife Field Headquarters (Westborough)	$2,400

LEED Buildings Updates

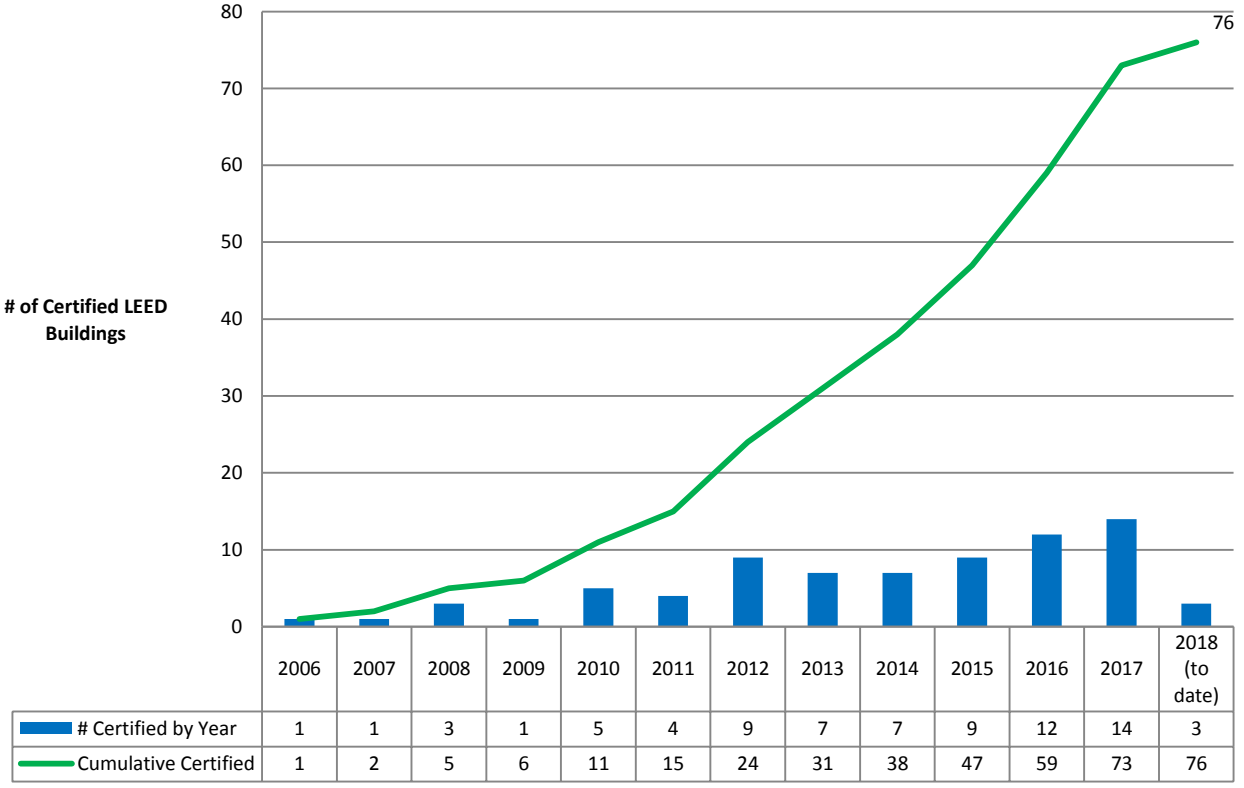
2018 Certifications:

Construction Organization	Agency	Project Name	City	Level	Building Type	SF
MassDOT	MassDOT	MassDOT Research and Materials Lab	Hopkinton	Gold	Laboratory	45,506
DCAMM	Mount Wachusett Community College	Haley Addition (Asquino Science Center)	Gardner	Gold	Academic (w/ Laboratory)	44,000
DCAMM	Northern Essex Community College	Allied Health & Technology Center	Lawrence	Silver	Academic (w/ Laboratory)	44,739

State Certified LEED Buildings



LEED Certified State Buildings by Year (as of February 2018)



Personnel News

- As of mid-April, and after 4 years with LBE, Jillian DiMedio will be leaving Massachusetts for the wilds of Oregon.
- Her passion, her creativity and her never-ending commitment to the team will be sorely missed!

2018 Earth Day/Month Plans?