

# Massachusetts Leading by Example: Fiscal Year 2016 Progress Report



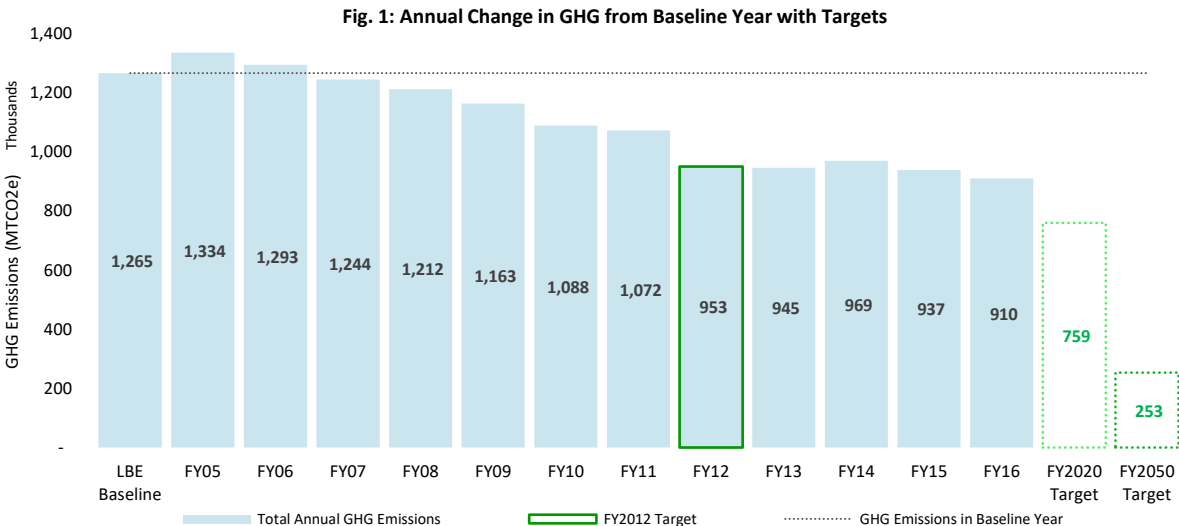
The Leading by Example Program works collaboratively with state agencies and public colleges and universities to advance clean energy and sustainable practices that reduce the environmental impacts of state government operations. This includes reducing greenhouse gas emissions, increasing renewable and on-site generation, improving energy efficiency, and much more. Through strategic partnerships, technical assistance, grant funding and nation leading best practices, LBE serves as a trusted resource, helping transform policy into action. This update details annual progress towards LBE goals and highlights key recent accomplishments.

## Greenhouse Gas Emissions

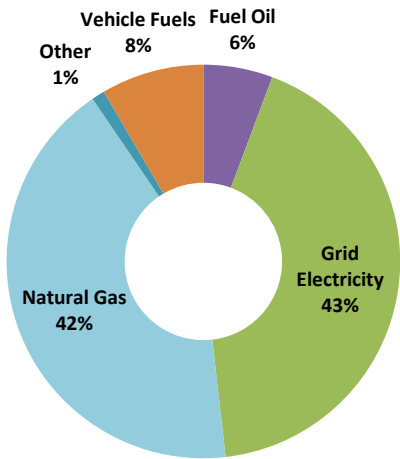
In FY16, overall GHG emissions associated with state operations decreased by 355,328 metric tonnes of CO<sub>2</sub>e equivalent compared to the LBE baseline\* (see Figure 1), equivalent to a 28 percent reduction\*\*. In order to reach the FY20 target, GHG emissions will need to decrease by an additional 100,818 metric tonnes annually.

\* The LBE Baseline uses a 3-year average from FY02-FY04.

\*\* LBE GHG emissions calculations do not account for the sale of RECS, thus, overall emissions reductions at state facilities contribute to overall reductions in statewide emissions and not to facility specific reductions.



**Fig. 2: Emissions Contribution by Fuel -- FY16**



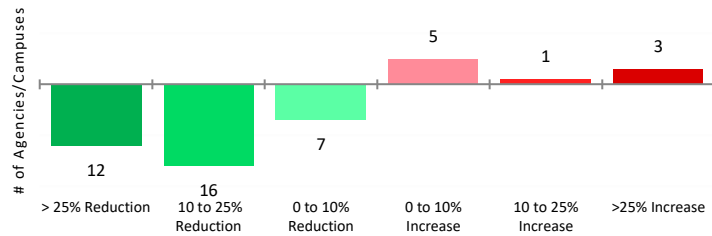
As shown in Figure 2 above, in FY16, natural gas comprised 45 percent of total emissions, with emissions from electricity just below at 41 percent. Together, fuel oils #2, #4 and #6 contributed 4 percent of total emissions, while vehicle fuels contributed 8 percent.

# Energy Use

Overall energy use intensity (kBtu/per square foot) decreased 15 percent from the Leading by Example FY04 baseline through FY16 for the 44 Leading by Example partners whose energy use\* is tracked using this metric. Annual EUI will need to decrease by an additional 20 percent to reach the FY20 35 percent reduction target (see Figure 3).

\*LBE does not track square footage or energy use intensity for 5 of the 49 state partners, due to the nature of energy and facility use at these sites.

Fig. 4: Agencies/Campuses by EUI % Change from Baseline



Overall fuel oil consumption in buildings\* has decreased 84 percent from FY06 through FY16 (see Figure 5), a reduction of more than 19 million gallons. LBE continues to pursue opportunities to eliminate fuel oil consumption by transitioning to cleaner fuels and technologies.

\*Oil consumption for non-building use is not included, such as for vehicles, maritime vessels, flood control, etc.

Fig. 3: Annual Energy Use Intensity (EUI)

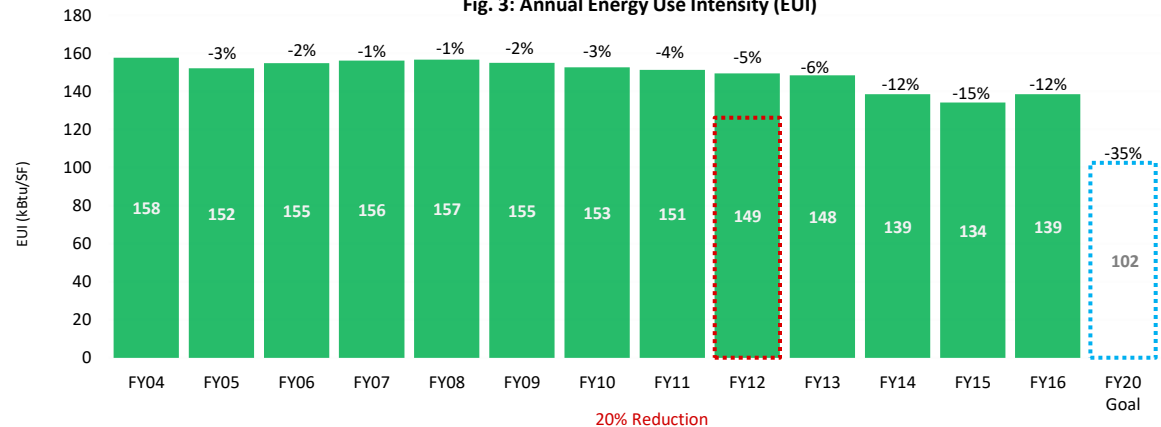
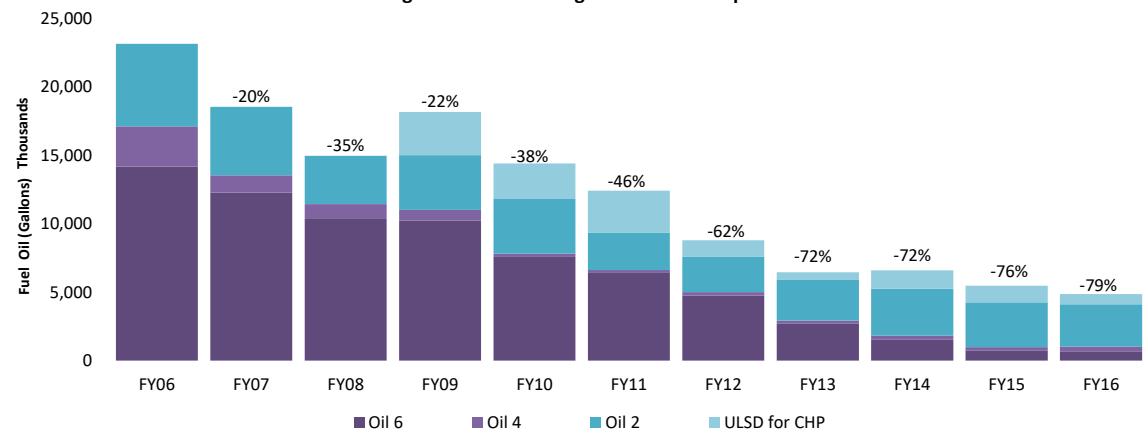


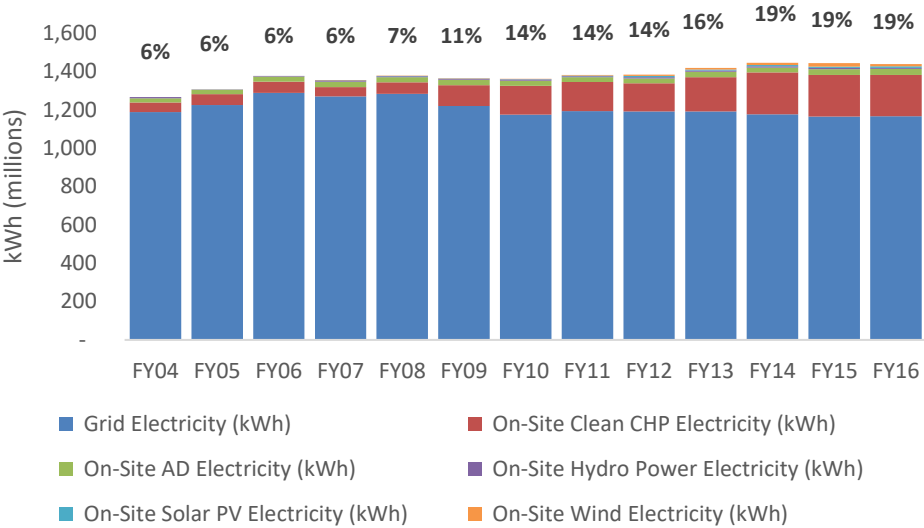
Figure 4 shows overall energy use intensity (kBtu/per square foot) *decreased* more than 25 percent for 12 Leading by Example partners (agencies/campuses), 10-25 percent for 16 partners, and 0-10 percent for 7 partners. Conversely, overall energy use intensity *increased* by 0-10 percent for 5 partners, 10-25 percent for 1 partner, and more than 25 percent for 3 partners.

Fig. 5: Annual Building Fuel Oil Consumption from FY06-FY16



# Renewable & Onsite Generation

Fig. 6: Grid Electricity Consumption vs. Clean Onsite Generation (w/ % of clean generation)



As of FY16, state partners reduced grid electricity consumption by 22 million kWh compared to the FY04 baseline, with onsite generation contributing a total of 272 million kWh (compared to 77 million kWh in FY04).

As seen in Figure 6, of the roughly 1.4 billion kWh of electricity consumed, 57 million kWh (equivalent to 4 percent of total) were generated by onsite renewable power and 215 million kWh (equivalent to 15 percent of total) were generated by onsite clean CHP.

\*Renewable and on-site clean generation includes anaerobic digestion, hydro power, clean combined heat and power (CHP), solar photovoltaic, and wind power.

A significant contributor to growth of onsite renewable power at state facilities has been solar PV. As of FY16, there are 21 MW of installed solar capacity at state facilities, up from less than 150 kW a decade ago (as shown in Figure 7). These installations generate an estimated 24 million kWh of solar power a year, equivalent to the annual electricity use of 3,198 Massachusetts homes.

Additional to onsite renewable power, renewable thermal technologies provide facilities the opportunity to move away from dirtier heating fuels, such as oil, particularly in cases where existing systems are reaching their end of use. As of FY16, 33 renewable thermal systems were installed at state facilities, including:





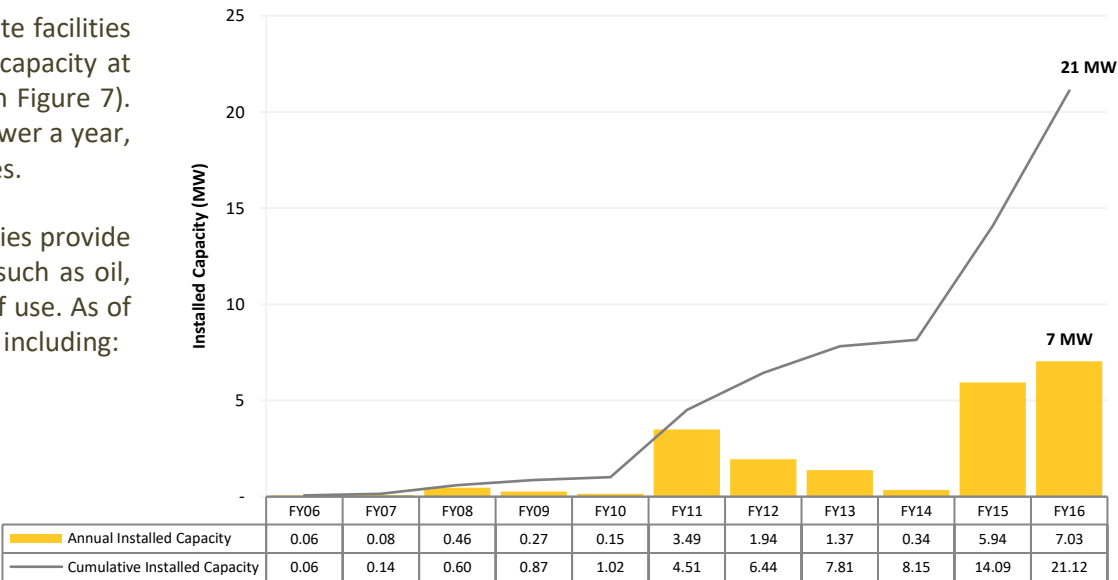
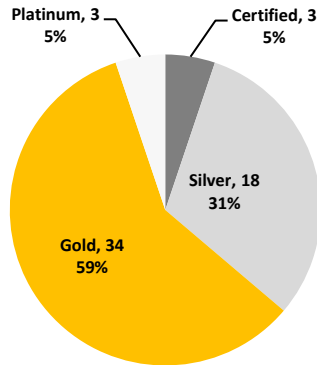
-  13 solar thermal installations
-  8 biomass systems
-  9 ground-source heat pumps
-  3 air-source heat pumps

Fig 7: Solar Installations at State Facilities



## Green Buildings

As of June 2016, the state portfolio included 58 LEED certified buildings, with 37 at the top two levels of Gold and Platinum (64 percent).



In FY16 alone, 12 buildings received LEED certification, with 2 buildings at the Platinum level, 2 at the Gold level, 7 at the Silver level, and 1 at the Certified level. Building sizes ranged from 11,000 to 1.7 million square feet and included residence halls, academic and laboratory buildings, maintenance and office buildings, a data center, and a convention center.

Agency	Project	Level
DCAMM	Springfield Data Center	Gold
Division of Fisheries & Wildlife	DFW Field HQ Westborough	Platinum
Fitchburg State University	Science Center	Silver
Mass. College of Liberal Arts	Feigenbaum Center for Science and Innovation	Gold
MA Convention Center Authority	Boston Convention & Exhibition Center	Silver
Mass. Maritime Academy	Library Modernization	Platinum
Mass. Maritime Academy	Cadet Housing, Company 4	Silver
MassDOT	Andover Maintenance Facility	Certified
Salem State University	Gassett Fitness Center	Silver
UMass Amherst	Commonwealth Honors College Residential Complex	Silver
UMass Lowell	Health and Social Sciences Building	Silver
UMass Lowell	University Suites	Silver

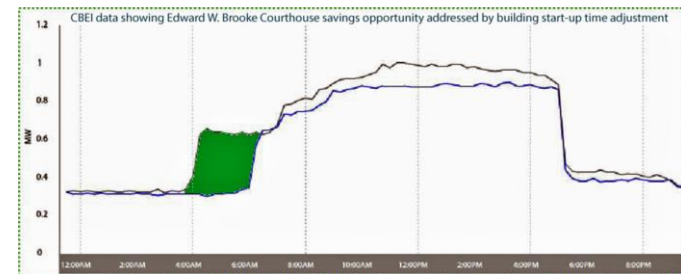
## FY16 Highlight: Building Energy Intelligence

The State's Enterprise Energy Management System (EEMS) project, awarded to EnerNOC in April 2010, was the first-phase of the largest public sector undertaking to measure real-time energy use information at 25 million square feet of buildings.

The innovative program's second-phase, known as Commonwealth Building Energy Intelligence (CBEI), is working to build upon previous efforts and revamp the way state buildings use and respond to energy information. CBEI includes technological and strategic enhancements for advanced building energy metering tracking and analytics to drive operational efficiencies at state facilities.

In 2016, the Commonwealth signed a \$5.6 million, three-year contract with EnerNOC to provide these and other advanced energy intelligences services for millions of square feet of Commonwealth facilities. The primary goals of CBEI are to:

- Improve building energy management practices
- Drive operational efficiencies
- Lower energy consumption and costs
- Assist in identifying capital needs for energy-using systems



The contract is managed by the Division of Capital Asset Management and Maintenance (DCAMM) in close collaboration with DOER. The contract provides substantial advancements in energy intelligence approaches, with the goal to significantly reduce energy use and costs at state facilities.

# Key LBE Accomplishments

## Energy Efficiency

Greenfield Community College replaced 392 lights with LED technology through the DCAMM CoFFEE program (Commonwealth Fund for Energy Efficiency), a state revolving loan fund for energy projects. Annual savings are projected at \$14,000 per year and the college partnered with a local technical school, where students were involved in the installation process.

## Renewable Thermal

The Department of Conservation and Recreation began two renovation projects at Scusset Beach Reservation and Halibut Point State Park, which include the replacement of oil-burning furnaces with air-source heat pumps. The new, high-efficiency thermal systems will provide both heating and cooling needs for the facilities and are complimented by high-efficiency lighting and solar thermal for hot water-heating, all helping to reduce onsite greenhouse gas emissions. The heat-pump installations received an \$86,000 LBE grant to support renewable thermal technologies at state facilities.



### 7.2 MW of solar capacity were installed at state facilities, including:

## Solar Installations

- 5.8 MW at UMass Amherst
  - Three solar canopies, totaling 4.8 MW, at Robsham Visitor Center and parking lots 25 and 44
  - Five roof-mounted arrays at various buildings, totaling 1 MW
- 937 kW solar canopy at Roxbury Community College
- 100 kW solar canopy at Department of Conservation and Recreation’s Walden Pond Visitor Center
- 200 kW solar canopy at UMass Lowell’s South Garage
- 303 kW ground-mounted array at Berkshire County Sheriff’s House of Correction



## LBE Awards

In November of 2016, the 10th annual Leading by Example (LBE) Awards Ceremony was held at the State House, where eight award recipients were recognized for a diverse set of policies and initiatives that demonstrate public sector leadership and innovation in reducing the environmental impacts of government operations, many of which also reduce public facility energy costs. The FY16 LBE Award Recipients are listed by category type below.

Agency	Public Higher Education	Municipality	Individual
Soldier’s Home Holyoke	Springfield Tech Community College	Town of Winchester	Julia Wolfe, Operational Services Division
MA Electric Vehicle Incentive Program (MassEVIP)	UMass System	Town of Needham	Matt Coogan, Gloucester & Essex