Welcome

Briony Angus

Chair, EBC Energy Resources Committee

Senior Project Manager / Associate, Tighe & Bond
Program Purpose & What You Will Learn

Briony Angus

Program Chair & Moderator

Senior Project Manager / Associate

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Massachusetts Bay Transit Authority

Daniel Abrahamson

Energy Conservation Specialist

MBTA
EBC Energy Resources Program:

Energy Program Developments at Massachusetts State and Regional Agencies

October 18, 2018

Daniel Abrahamson
MBTA
Energy Conservation Monitor
Energy Program Developments at Massachusetts State and Regional Agencies

• Agenda
  – Background
  – Energy Management
  – Distributed Generation
  – Clean Technology
  – Sustainability
  – Future Opportunities
Energy Program Developments at Massachusetts State and Regional Agencies

- **Background**
  - America’s First Subway System (1897)
  - 5th Largest Transit Authority
  - 175 Communities
  - 400 Million Trips Annually
  - 2,000 Revenue Vehicles
  - 275 Stations
  - 27 Maintenance Facilities
  - 48 Traction Power Substations
Energy Program Developments at Massachusetts State and Regional Agencies

- Energy Management
  - Utility Management
    - $38.0M 5 yr avg. utility spend
    - 420,000,000 kWh
    - Peak Demand: 76 mW
    - $0.047/kwh Generation
Energy Program Developments at Massachusetts State and Regional Agencies

• Energy Management
  – Energy Efficiency
    • 90 projects completed since 2010
    • Over 75M kWh saved
    • $6.5M saved to date
    • Avoided project costs of $6.1M
    • Average payback of 1.89 years
Energy Program Developments at Massachusetts State and Regional Agencies

![Map of energy program developments in Massachusetts with associated data and statistics.]
Energy Program Developments at Massachusetts State and Regional Agencies
Energy Program Developments at Massachusetts State and Regional Agencies

- **Distributed Generation**
  - Wind Turbines (2)
    - 100kW & 750kW
    - >1.5M kWh total annual output
    - $150,000 annual savings
    - 19 year payback
Energy Program Developments at Massachusetts State and Regional Agencies

• Distributed Generation
  – Solar
    • June 2016 Award
    • 39 locations, 39 MW
    • $51M in Revenue over 20 Year Term
Energy Program Developments at Massachusetts State and Regional Agencies

- Clean Technology
  - Hydrogen Bus
  - 254 Diesel Electric Hybrids

- Charging Station Quotas
Energy Program Developments at Massachusetts State and Regional Agencies

- **Clean Technology**
  - **Regenerative Braking**
    - Woojin Supercapacitor @ Airport Station
    - Helix Power Flywheel MOU
    - Viridity, ABB Energy Storage MOU
Energy Program Developments at Massachusetts State and Regional Agencies

• **Sustainability**
  – Recycling
    • Facilities
    • Transit Stations
  – ESMS ISO14001
    • Cabot Maintenance

– **Climate Resiliency**
  • Power System Vulnerability
  • Aquarium + Maverick Stations
Energy Program Developments at Massachusetts State and Regional Agencies

• Sustainable Design
  – Wollaston Station
  – Hingham Intermodal
  – Government Center Station
Energy Program Developments at Massachusetts State and Regional Agencies

• Future Opportunities
  – System-wide Energy Efficiency
  – System-wide Sub-metering
  – Regenerative Braking + Storage
  – IoT; Data Utilization
THANK YOU!

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EBC Energy Resources Program:

Energy Program Developments at Massachusetts
State and Regional Agencies
Massachusetts Department of Environmental Protection

James Doucett

Director, Clean Energy Results Program
MassDEP
An Innovative Partnership:
The Massachusetts Department of Environmental Protection
The Massachusetts Department of Energy Resources
The Massachusetts Clean Energy Center
Clean Energy Results Program

- Supports DOER and MassCEC in Achieving Commonwealth Clean Energy Goals
- Promotes Clean and Efficient Sources of Energy at MassDEP Regulated Sites (where we have authority or control)
- Utilizes MassDEP’s Unique Expertise to Overcome Permitting & Siting Obstacles
- Addresses Public Health Concerns Using Sound Science
Areas of focus

- Bureau of Water Resources policies
- Renewables on closed landfills
- Renewables on contaminated sites/brownfields
- Anaerobic Digesters and biogas
- Energy efficiency and renewables at water infrastructure
- Other MassDEP clean energy work
Wetlands and Drinking Water

- Wetlands Program Solar PV policy – approved 9/18/17
  - For review of ground-mounted solar PV systems subject to wetlands regs.

- Solar and Wind Energy Projects in Zone I Policy – Revised 4/18/18
  - Now a minimum 200 ft. no disturbance area around wellhead
  - No battery storage within the Zone I
Renewable Energy Projects on Closed Landfills

- **Post-closure Permits Approved to Date:**
  - Hit a big milestone in 2018 by exceeding 100 permitted projects. At 101 rated at 231 MW

- **Currently Operating:**
  - 69 Projects Generating 153 MW

- **Challenges:**
  - Diminishing number of good landfill sites
  - Installations on steep sideslopes
Renewable Energy at Closed Landfills
Renewable Energy Projects on Brownfields and Contaminated Sites

- Installed solar and wind – 29 sites @ 78.25 MW
- Pre-determination letter issued – 15 sites @ 48.5 MW

Challenges:
- Finding large enough sites suitable for development
- Liability concerns
Renewable Energy at Contaminated Sites

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Capacity (MW)</th>
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<tbody>
<tr>
<td>2006</td>
<td>0.00</td>
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<tr>
<td>2010</td>
<td>3.00</td>
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<tr>
<td>2011</td>
<td>10.00</td>
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<tr>
<td>2012</td>
<td>15.00</td>
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<td>2013</td>
<td>20.00</td>
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<td>2014</td>
<td>25.00</td>
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<td>2015</td>
<td>30.00</td>
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<tr>
<td>2016</td>
<td>55.00</td>
</tr>
<tr>
<td>2017</td>
<td>60.00</td>
</tr>
</tbody>
</table>
Anaerobic Digestion

- Farm AD Capacity Operating:
  - Jordan Farm, Rutland
  - Pine Island Farm, Sheffield
  - Barstow Farm, Hadley
  - Barway Farm, Deerfield

- Farm AD Under Construction or Preliminary Operation:
  - Crescent Farm, Haverhill
  - Rockwood Farm, Granville
  - Luther Belden Farm, Hatfield
  - Jordan Heifer Farm, Spencer (permit issued)
  - Whittier Farm, Sutton (in permitting)
Anaerobic Digestion

- Commercial and Food Manufacturing Capacity Operating:
  - Commonwealth Resource Management pilot, Crapo Hill LF
  - Stop & Shop Product Recovery Operation, Freetown
  - Ken’s Foods
  - Garelick Farms, Franklin
Anaerobic Digestion

- Wastewater Treatment Facilities:
  - Massachusetts Water Resources Authority (MWRA) Deer Island WWTP
  - Greater Lawrence Sanitary District (GLSD)
  - MWRA Clinton WWTP
  - Pittsfield WWTP
  - Fairhaven WWTP
  - Rockland WWTP
Anaerobic Digestion

- Greater Lawrence Sanitary District (GLSD):  
  - Construction essentially complete on expansion  
  - Pilot project has slowly ramped up  
  - Generating more gas than predicted with little to no increase in sludge volume – better volatile solids destruction and conversion to biogas

- Other Potential AD Projects in planning stage:  
  - Springfield WWTP, Yarmouth Septage Facility, CRMC full scale facility
Organics Management Capacity

- Depackaging capacity - Operating:
  - WM Boston CORe/Save That Stuff
  - EL Harvey
  - Parallel Products (liquids only)
  - RecycleWorks Inc.
  - Save That Stuff, Inc.
  - Troiano Trucking
  - FEED/Stop & Shop
Organics Management Capacity

- Depackaging capacity – Not yet operating:
  - Pine Island Farm
  - Vanguard Renewables
  - AgGrid – Granville

- Out of State capacity capable of sourcing Mass. organics:
  - CT (Quantum BioPower)
  - RI (Orbit)
  - ME (Exeter Agri-Energy)
2014 Gap Funding Grants for Water and Wastewater Facilities

State $1.7M in ‘Gap’ grants: move $11M of clean energy projects forward

21 facilities received grants: 13 drinking water & 8 wastewater

- $1,737,400, 16%
- $1,985,198, 18%
- $116,012, 1%
- $7,214,300, 65%

- Gap Grant Funding Approved
- Mass Save & MLP Incentives
- Other Grants
- Municipal Contribution min. 10%
Massachusetts’ Return On Investment: A Gap Funding Model for Success

Massachusetts is implementing a gap funding program that encourages utilities to invest in energy efficiency projects. This program provides funding for projects that reduce energy use and improve water quality. The program is expected to generate significant cost savings for utilities and reduce the overall cost of water and wastewater services. The benefits of this program include reduced energy consumption, improved water quality, and increased water efficiency.

FIGURE 3 Anticipated cost savings and funding by individual project

- Annual cost savings
- Mass SAVES incentives
- Gap grants

<table>
<thead>
<tr>
<th>Location</th>
<th>Annual Cost Savings</th>
<th>Mass SAVES Incentives</th>
<th>Gap Grants</th>
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<tr>
<td>Southbridge</td>
<td>29,243</td>
<td>128,300</td>
<td>64,400</td>
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<td>Rockport</td>
<td>19,457</td>
<td>57,070</td>
<td>80,000</td>
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<td>Holden</td>
<td>5,815</td>
<td>52,500</td>
<td>53,000</td>
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<tr>
<td>Greenfield</td>
<td>15,000</td>
<td>57,328</td>
<td>43,300</td>
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<tr>
<td>Tyngsborough</td>
<td>1,860</td>
<td>88,100</td>
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<tr>
<td>South Essex Sewage District</td>
<td>3,417</td>
<td>40,000</td>
<td>191,000</td>
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<tr>
<td>Peppermill</td>
<td>45,000</td>
<td>68,004</td>
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<tr>
<td>Middleborough</td>
<td>50,000</td>
<td>160,000</td>
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<tr>
<td>Medford</td>
<td>2,960</td>
<td>59,400</td>
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<td>Hudson</td>
<td>2,960</td>
<td>260,000</td>
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<td>Greater Lawrence Sanitary District</td>
<td>25,600</td>
<td>260,000</td>
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<tr>
<td>Deerfield</td>
<td>25,600</td>
<td>260,000</td>
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<tr>
<td>Egremont</td>
<td>1,900</td>
<td>2,100</td>
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<td>Woburn</td>
<td>2,960</td>
<td>46,000</td>
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<td>Stockbridge</td>
<td>10,778</td>
<td>39,000</td>
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<td>Millis</td>
<td>29,000</td>
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<tr>
<td>Marlborough</td>
<td>25,195</td>
<td>26,300</td>
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<tr>
<td>Chicopee</td>
<td>2,860</td>
<td>39,000</td>
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<tr>
<td>Cambridge</td>
<td>1,192</td>
<td>117,546</td>
<td>200,000</td>
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<tr>
<td>Andover</td>
<td>30,000</td>
<td>30,000</td>
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</tr>
<tr>
<td>Amherst/ Pynchon</td>
<td>916,300</td>
<td>27,000</td>
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</table>

SUMMARY

- The program is expected to generate significant cost savings for utilities.
- The benefits of this program include reduced energy consumption, improved water quality, and increased water efficiency.
- The program is designed to encourage utilities to invest in energy efficiency projects.

Investing in Water Utility Energy Efficiency Yields Big Savings

- MA Benefits are over 15x the MA Investment
- $2.5M Investment
- $40.2M Benefits
- $9,135,281
- $31,164,161

CLEANENERGYRESULTS
MassDEP Gap II Grant Funding (Requested)

- Received 48 grant applications, requesting $6.3M, representing $21.5M of projects
  - 17 water; 27 wastewater; 4 both water & wastewater
  - (24) National Grid; (13) Eversource; 11 Municipal Light Plants

- 75% for implementation of energy efficiency; 25% for renewable generation

- 19 applications requesting < $100,000 in gap grant funds
- 29 applications requesting > $100,000 in gap grant funds

Estimated Annual Cost Savings for Facilities: $1.6 million

Estimated Annual Savings /on-site generation: 10.5 MWh
$4M in Gap II grants move $17M of energy projects forward

36 Energy Efficiency & Generation
- Hydropower (10 kW)
- Solar (413 kW)

Approx. $1.2M in annual cost savings for facilities

Approx. 9.7M kWh in annual electricity savings or on-site power generation
Other Activities

- Climate change and resilience
- Food Manufacturing Initiative
- MassDEP Air Quality Grants and Assistance
  - MassEVIP – Fleets – public entities
  - MassEVIP – Workplace Charging – private entities
  - MassCleanDiesel: Clean Markets grants
- MassCEC’s Water Innovation Grant Program
Clean Energy Results Program Contacts

MassDEP:

James Doucett, James.Doucett@mass.gov, 617.292.5868

Michael DiBara, Michael.DiBara@mass.gov, 508.767.2885

Tom Potter, Thomas.Potter@mass.gov, 617-292-5628

Clean Energy Results Program Website:
http://www.mass.gov/eea/agencies/massdep/climate-energy/energy/
Massachusetts Department of Energy Resources

Eric Friedman

Director, Leading by Example Program
MassDOER
Leading by Example (LBE) Program
MA Dept. of Energy Resources

EBC Energy Resources Program
October 18, 2018
Mass. is # 1... Again!

Massachusetts Named Most Energy Efficient State in Nation – 8th Year in a Row

Massachusetts continues to receive top marks for its energy efficiency policies and programs, particularly the energy efficiency programs offered by the Commonwealth’s utilities under the Mass Save® brand, for leading by example with state buildings and for implementing a stretch building energy code for towns and cities....
Leading by Example - Scope

- Robust clean energy goals for state government operations

- Portfolio includes:
  - 80 million sq. ft. of buildings
    - 29 college and university campuses
    - 18 prisons, hundreds of armories
    - State hospitals, youth detention centers, office buildings, visitor centers, etc
    - 50+ state owned courthouses
  - 3,000+ light duty vehicles

- MA State government:
  - Consumes over 1 billion kWh of electricity
  - Uses more than 7 million gallons of gasoline & diesel
  - Emits almost 1 million tons of GHGs
### LBE Tools

#### Technical and Financial Assistance
- Feasibility studies
- Implementation grants
- Project guidance
- Technology exploration
- Financial analysis

#### Data Tracking & Analysis
- Collect annual energy & cost data
- Report on progress
- Identify priority sites for energy efficiency
- Demonstrate cost-effectiveness of strategies

#### Communications & Outreach
- LBE Council meetings
- Email updates
- Awards & recognition
- Information sharing
- DOER Energy Smart blogs
- Coordination with all state entities
Creating A Clean, Affordable and Resilient Energy Future For the Commonwealth

Annual Energy Use Intensity with Percentage Change from Baseline

Annual Building Fuel Oil Consumption from FY06-FY17

Annual Change in GHG from Baseline Year with Targets
Creating A Clean, Affordable and Resilient Energy Future For the Commonwealth

- 24 MW installed at state facilities, significant pipeline
- Previous solar canopy grants of $XX million
- $5 million grant program for SMART eligible projects
  - Targeting canopies, but also for roof and ground
  - Per watt incentives vary depending on type and ownership
  - Includes storage adder

Solar PV

Solar Installations at State Facilities

- Annual Installed Capacity (kW)
- Cumulative Installed Capacity (kW)
Creating a clean, affordable and resilient energy future for the Commonwealth.

- **UMA Lot 44**: 2.5MW
- **UMA Lot 25**: 1.9MW
- **Robsham Memorial Center for Visitors**: DCR Walden Pond – 100kW
- **UMA Visitors Center**: 292kW
- **Bristol CC**: 3.2 MW
- **UML**: 200kW
- **Roxbury CC**: 937kW
Resiliency and Storage

- Study at 12 state-owned 24/7 care facilities to identify clean energy technologies to increase energy resiliency.

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

- Storage adder in LBE solar grant program
  - Variable & determined by:
    1. Ratio of storage capacity to solar capacity
    2. Duration of the storage
    3. Ability to Island

**ENTER INFORMATION IN BLUE CELLS ONLY**

<table>
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<tr>
<th>Energy Storage Adder Block Tranche #</th>
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<tr>
<td>Solar PV Capacity (kW DC)</td>
<td>800</td>
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<tr>
<td>Storage Nominal Rated Power Capacity (kW)</td>
<td>800</td>
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<tr>
<td>Storage Hours at Rated Capacity</td>
<td>3</td>
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<tr>
<td>Adder Multiplier</td>
<td>0.0450</td>
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<tr>
<td>Storage Adder ($/kWh)</td>
<td>$0.0607</td>
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Renewable Thermal

- Installations at state facilities
- Targeting high emission, high cost fuels

Renewable Thermal Installations

- Biomass, 6
- Air Source Heat Pump, 3
- Solar Thermal, 12
- Ground Source Heat Pump, 6

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

- LEED Certification +20% better than energy code
- 78 LEED certified buildings in state portfolio
- Additional efforts to design to zero net energy

LEED Certified State Buildings: Certification Levels (as of August 2018)

- Gold 58%
- Silver 34%
- Certified 4%
- Platinum 4%

State Buildings Designed to be Zero Net Energy Buildings
(builtings 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

ZNEB Building Performance: Energy Use vs. Solar Production

- Sbrega
- DFW
- Walden Pond

- Energy Use
- Solar Generation
Commonwealth Building Energy Intelligence (CBEI)

- Collaboration between DCAMM and DOER
- Tracking energy data in real-time for electricity, NG, oil, steam
  - 39 sites
  - 20M+ S/F
  - 350+ buildings

- Annual estimated energy savings: ~388,000 kWh
- Annual natural gas savings: ~1,400 therms
- Annual estimated energy cost savings: ~$66,000
- Implemented from Aug. 2016 – Jan 2017
Electric Vehicles and Charging Stations

- Fuel Efficiency Standard for State Fleet
  - 55 vans with hybrid upfit
  - 6 EV Chevy bolts in fleet

- 119 EV Charging Stations at state facilities
  - Working w/ utilities & VW settlement funding to expand infrastructure
  - EVSE guidance for state facilities (drafting)

- Applies to Executive Branch Passenger Vehicle Acquisitions
  - All cars, passenger vans, cargo vans, pickup trucks, and SUVS with a GVWR < 10,000 lbs

- Two Key Requirements for New Acquisitions
  1. Average EPA-rated combined MPG of
     - 32 MPG for passenger cars
     - 22 MPG for light duty trucks, vans, SUVS
  2. Minimum of 5% of Acquisition must be AFVs, HEVs, PHEVs, BEVs

![EV Stations by Charger Type](image)
LBE Priorities – Landscaping

- **Pollinator friendly habitats** at agencies with large underutilized open space
- Less mowing, lower emissions and reduced staff time
- Pollinator habitat calculator

- **Battery Powered landscaping equipment**
  - Available on state contract
  - Environmental, cost, health, noise benefits
  - Calculator tool available
Feasibility Studies – Priming the LBE Pipeline

- $800,000 grant program to support the study of clean energy technologies at state facilities

<table>
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<tr>
<th>Recipient</th>
<th>Technology</th>
<th>Description</th>
<th>Amount Awarded</th>
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<tr>
<td>UMass Amherst</td>
<td>Alternative Fuels Analysis</td>
<td>Feasibility study for use of alternative fuels for expansion of Central Heating Plant &amp; campus electrical distribution system</td>
<td>$100,000</td>
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<tr>
<td>UMass Medical</td>
<td>Energy Storage</td>
<td>Feasibility study for energy storage at the Combined Heat and Power (CHP) plant on campus</td>
<td>$43,500</td>
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<td>Department of Correction</td>
<td>Solar Canopy</td>
<td>Feasibility study for solar canopy at DOC HQ in Milford</td>
<td>$30,300</td>
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<tr>
<td>UMass Amherst</td>
<td>Renewable Thermal</td>
<td>Feasibility study for clean heating and cooling technologies at UMass Amherst Memorial Hall</td>
<td>$4,400</td>
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<tr>
<td>Division of Fisheries and Wildlife</td>
<td>Electric Vehicle Charging</td>
<td>Feasibility study for EV charging stations at MassWildlife Field HQ in Westborough</td>
<td>$2,400</td>
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<td></td>
<td></td>
<td>Total: $180,600</td>
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Additional studies under consideration:
- Ground source heat pumps
- Solar canopy
Contact Information
www.mass.gov/eea/leadingbyexample

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  chelsea.kehne@state.ma.us
Massachusetts Department of Capital Asset Management & Maintenance

Betsy Isenstein
Director
Energy & Sustainability
DCAMM

Krista Lillis
Program Manager
Energy & Sustainability
DCAMM
What Is DCAMM?

• The Division of Capital Asset Management and Maintenance
• Within the Executive Office for Administration and Finance (A&F)
• Created by the legislature in 1980 to promote quality and integrity in the management and construction of the Commonwealth's capital facilities.
THE ENERGY & SUSTAINABILITY PROGRAM – SUPPORTING DCAMM’S MISSION

Creating and managing forward-thinking sustainable buildings that meet the needs of the citizens they serve

- energy & sustainability
- deferred maintenance
- water sewer reduction
- code and accessibility upgrades
- resiliency
DCAMM’S ENERGY PROGRAM WORKS ACROSS MA STATE FACILITY PORTFOLIO

- 66 million gross square feet of active space (excludes “authority owned”)
- Over 4,300 buildings
- Estimated annual energy costs of $240 million

MA State Sites by Size

- Total = 836 sites
- <10,000 SF, 335 Sites
- 10,000-100,000 SF, 393 Sites
- >1 million SF, 9 Sites
- 100,000-1 million SF, 99 Sites
PROGRAM OVERVIEW

1. Capital Projects
   • Large: Comprehensive Energy Design Build, Performance Contract
   • Medium: targeted ECMs
   • Small: Utility Vendor

2. Operational improvements
   • Commonwealth Building Energy Intelligence (CBEI)
   • Retro Commissioning (on-going commissioning)

3. Grid opportunities
   • Demand Response and load management
   • Forward Capacity Market
   • Repair and maintenance of solar assets

4. Advisory services
   • DCAMM staff
   • State agencies and offices
   • Utility incentive programs
   • CoFFEE (CFTEE) Program

NEW
ENERGY/WATER PROJECTS

- **Energy Design Build**
  - Comprehensive: ASHRAE Level 3-4 Audit to 30% schematic then DB contractor provides 100% DD, demo, equipment, and construction.
  - Targeted: ASHRAE Level 2 Audit to RFP, then DB contractor provides 100% DD, demo, equipment, and construction.

- **Performance Contract (ESPC)**
  - ASHRAE Level 2 Audit to RFP, RFP, IGA (ASHRAE level 3-4) then DB contractor provides 100% DD, demo, equipment, and construction.

- **Utility Vendor**
  - Audit and installation of simple fix measures (lighting, motors, thermostat and minor controls, weatherization, insulation, appliances, etc.)
  - < $100,000 per site

- **Retro CX**
  - All applicable buildings over 50,000 square feet undergo a “retro-commissioning” process to identify and implement low/no cost energy and water conservation measures with short paybacks. –E.O.484
TYPICAL MEASURES INVESTIGATED

- Lighting System Improvements
- Lighting Controls
- Motors
- Energy Management Systems
- Domestic Water Conservation
- Variable Frequency Drives
- Insulation
- New Boilers
- Combined Heat and Power
- Kitchen Hood Controls
- Electric to Gas Heat Conversion
- Geothermal Heat Pumps
- Wind
- Solar (PV and Thermal)
- Biomass
- Ice Storage

... and many more!
DEMAND RESPONSE PROGRAM

• Incentives for removing power from the utility grid

• Administered by the ISO New England

• DCAMM oversees a statewide contract (FAC89)
  ▪ Available to cities and towns, authorities, etc.
  ▪ Manages the assets and deals with ISO NE.

• DCAMM enrolls state facilities in the program
  ▪ The state facilities get incentives based on the amount of electricity they remove from the grid
  ▪ About 50 MW enrolled
LEED CERTIFICATION AND MASS LEED PLUS

- LEED certification has been a focus at DCAMM for over a decade.

- First state-owned LEED building, the Lorusso Applied Technology building at Cape Cod Community College (2006)

- Following the E.O. 484 (2007), DCAMM has accelerated the construction of certified buildings requiring all new construction and major renovation to meet Mass LEED Plus:
  - LEED Certification
  - 20% better energy performance than state building code
  - 3rd party commissioning
  - 50% outdoor and 20% indoor water reduction over baseline
COMMONWEALTH BUILDING ENERGY INTELLIGENCE (CBEI)

**Problem:** Decentralized energy and building data

**Solution:** Centralized metering platform

Tracks & records data for electricity, natural gas, steam, hot and chilled water, and oil usage.
- Typically called EIS (Energy Information system)
- Formerly EEMS
- New Procurement

**Goals/Benefits:**
- Improve building energy management practices; Drive operational efficiencies; lower energy costs; identify capital needs; measure & verify savings
- To date, over $3 million in savings opportunities identified.
- Other benefits:
  - Education/public outreach, equipment preventative maintenance, project planning, baseline analysis, and equipment sizing, M&V, reporting/alerting, utility chargebacks

**Next Focus:**
- Other states and feds (GSA, VA), have seen >10-20% savings or 20-40% savings with BMS integration.
- Focusing on M&V for Energy projects and Continuous Commissioning program
UNEXPECTED (AND SOME EXPECTED) CHALLENGES

1. Overtaxed facility staff
2. Changing facility mindsets from “it can’t do that” to “let’s try”
   • Fear of old buildings and old equipment
3. Justifying amount for meters at buildings without a “simple payback.”
4. Meters:
   • Removing meters
   • Reusing meters
5. Are “opportunities” really opportunities?
   • Custom Schedules
6. Company culture
   • The customer is right
CBEI BENEFITS (SINCE NEW CONTRACT)...
NOT ALL ABOUT $ 

**Implemented Savings by Measure Type**

<table>
<thead>
<tr>
<th>Measure Type</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Night Shutdown</td>
<td>$241,675</td>
</tr>
<tr>
<td>Building Start-Up</td>
<td>$195,620</td>
</tr>
<tr>
<td>Holiday Operation</td>
<td>$111,622</td>
</tr>
<tr>
<td>Load Cycling</td>
<td>$9,765</td>
</tr>
<tr>
<td>Weekend Operation</td>
<td>$16,033</td>
</tr>
</tbody>
</table>

Total: $894,112

**Implemented Savings by Agency**

<table>
<thead>
<tr>
<th>Agency</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin &amp; Finance</td>
<td>$185,263</td>
</tr>
<tr>
<td>Community Colleges</td>
<td>$105,122</td>
</tr>
<tr>
<td>HHS</td>
<td>$ -</td>
</tr>
<tr>
<td>Judiciary</td>
<td>$206,432</td>
</tr>
<tr>
<td>Public Safety</td>
<td>$ -</td>
</tr>
<tr>
<td>State Universities</td>
<td>$54,828</td>
</tr>
<tr>
<td>UMass</td>
<td>$23,120</td>
</tr>
</tbody>
</table>

Total: $894,112

**Savings Opportunities by Status (#)**

<table>
<thead>
<tr>
<th>Status</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implemented</td>
<td>170</td>
</tr>
<tr>
<td>New</td>
<td>45</td>
</tr>
<tr>
<td>Under Review</td>
<td>17</td>
</tr>
<tr>
<td>In Progress</td>
<td>23</td>
</tr>
<tr>
<td>Declined</td>
<td>98</td>
</tr>
</tbody>
</table>

Total: 353
CBEI: UNEXPECTED BENEFITS

1. Utility billing
   • Load shedding
   • Peak demand rates
   • Savings from identifying utility charges
   • Utility Incentives

2. Programmatic “cost avoided” ($50,000-$200,000)
   • Baselining
   • Utility bill collection

3. Identifying project savings
   • M&V for projects

4. Equipment and maintenance insight

5. Identify utility cost savings to save jobs
CBEI: FUTURE

1. Looking to expand through existing opportunities
   • Identifying existing meters and bring them into program
2. Energy data into Statewide asset database
   • Work orders
   • Program/project planning
3. Expand M&V program
   • Verifying savings from energy projects
   • Ensuring persistent savings from energy projects
4. Establish Continuous Commissioning Program
   • Begin to address issues before they happen
   • Systematically review preventative maintenance.
5. Explore additional opportunities for BMS integration
OPPORTUNITIES TO WORK WITH THE ENERGY GROUP
Statewide Contracts Available for Agencies and Municipalities

• Facility Advisor
  ▪ CommBuys - PRF 62
  ▪ Consultants under contract for wide variety of services
  ▪ See COMMBUYS for list of vendors and Procurement leader

• Solar Inspection Services (FAC89)
  ▪ For PVs, annual or as needed
  ▪ Limited (under 10k) repair
  ▪ See COMMBUYS for more information

• Potentially coming soon
  ▪ Turbine maintenance
  ▪ Solar Thermal Maintenance
  ▪ GSHP Maintenance
HOW TO GET INVOLVED

• Energy project bidding platform changing soon to DCAMM’s E-Bid Room (hosted by BidExpress)
• Track solicitations through COMMBUY (PRF62 and other goods and services after transition to E-Bid)
• Get COMMBUY training
• Attend pre-bid/pre-proposal meetings to make connections
• Energy consulting, design, construction and products are all procured differently. Know what you want to provide to Agencies and learn that process
• Join Energy Group’s Interested Party list serve for Lookaheads and project information
  E-Mail: stephen.white@state.ma.us to join
• Team with Prime contractors or consultants to learn process and get involved
• FOIA past proposals to see winning submittals
QUESTIONS?
Massachusetts Department of Corrections

Jeffrey Quick

Director Resource Management

DOC
Background

• Division of Resource Management

– Excellent Stewardship of the Commonwealth’s Physical Resources

– 18 Prisons; 10,000+ inmates; 5,300+ acres; 7,000,000+ square feet of buildings.

– All capital projects; new construction, upgrades, renovations, improvements, mission changes, emergency response, utilities, Intra/Inter Agency representation.

– 2 PEs, 2 Architects, 1 LSP, 10 PMs, 15 Tradespersons

– 5 WPCF, 7 Power Plants and 4 Water Systems Operations
Background

- Conservation
- ESCOs
- Sustainability Initiatives – Recycling, Pollinator Habitat
- Demand Response / DG / Forward Capacity
- MTC/CREBS/CEC /SMART – Renewables – PV Wind
Demand Side Revenue

- **Real Time Emergency Generation (Action Group 6)**
  - Every Prison has a generator
- **Forward Capacity Auctions for Power Generated by Cogens**
- **Renewable Energy Credits for Power Generated by Wind/Solar**
- **Alternative Portfolio Standards for incremental upgrades to existing Energy Efficiency Hardware**
- **MA DOC realizes almost $100k/quarter**
  - 2006 Award from ISO-NE
  - 2009 Energy Star for BCC Cogen
Renewable Energy

• 10 separate PV arrays (1.1MW) on existing lawns and old filter beds at waste treatment plants
• (2) 1.65+MW 80 meter Wind Turbines
• Solar/Thermal for staff gym hot water
• Small PV for out buildings
Innovative Financing

- Clean Renewable Bonds (IRS)
- ESCOs – financing through demonstrated savings
- FEMA – Pre Disaster Mitigation
- LBE Grants
- Rebates – GTG @ BCC, traps @ MCI-N
- ARRA
NCCI – Gardner
High Pressure Boilers
Norfolk and Walpole
Low Pressure Boilers Removal
Norfolk and Walpole
Low Pressure Boilers

Norfolk & Cedar Junction Boilers
Norfolk and Walpole Cogeneration

Norfolk & Cedar Junction Cogeneration units w/ heat recovery
Bridgewater Gas Turbine
NWCC WPCF Solar

Phase I – 106kW
NWCC WPCF Solar

Phase II – 150 kW
Concord WPCF Solar

64 Kw
Shirley Solar

200 kW
Cedar Junction #2 Solar

100 kW + 64kW (Phase I) = 164kW
BayState Solar

80kW
Revenue

- Since 2007 – Demand Response/RECs has earned $3,801,668.00
- Value of RECs & RTEG is subject to administrative fees by aggregators (14%+)
- Wind will generate $1.2MM per year – NCCI electric bill is ~$500k/yr.
Current Projects

- MCI Framingham/SMCC Energy Project
- Re-Enrollment of Emergency Generators under new emission requirements.
- Retro-fit/Update existing solar fields.
- Finalize Study for solar canopy at Milford Headquarters.
- Bridgewater and Shirley Power Plants retrofit.
- LED Lighting Retrofits

Pollinator Habitat Pilot program
MCI Framingham/SMCC Energy Project
Case Study: Massachusetts Department of Correction

With the assistance of National Grid and EnergySource, this project was successfully executed from start to finish. EnergySource was able to provide enhanced building lighting while creating a significant wattage reduction. EnergySource accomplished this by providing the newest technology (smart trifiles) along with the best incentive package.

Case Study: MA DOC HQ

Project Benefits
- Increased energy efficiency
- Improved lighting quality
- Cost savings

Opportunity
The Massachusetts Department of Corrections, located in Milford, MA, is responsible for overseeing several institutional facilities across the state. The facilities house inmates serving various sentences from short-term to long-term and are responsible for the safety and security of inmates and staff. The department is committed to providing a safe and secure environment for all inmates and staff. A major renovation project was requested by the department’s facilities management team to improve lighting within several existing buildings. The goal was to reduce energy consumption, improve the quality of lighting, and create a safer environment for all.

Solution
EnergySource worked closely with the Massachusetts Department of Corrections facilities management team to develop a comprehensive lighting strategy. First, an assessment of the existing lighting system was conducted. The team then developed an energy savings plan based on the assessment results. This plan included the installation of new LED lighting fixtures, which are more energy-efficient and provide better lighting quality. The project also included the upgrade of existing control systems to a fully automated solution, which allows for precise control of lighting levels and reduces energy consumption.

Turnkey Services
- Site development
- Budgeting
- Project management
- Incentive procurement

For more information, visit energysource.com or call 888-600-5063.
Bridgewater Correctional Complex Power Plant Boiler Replacement project. Removal of three existing boilers (includes asbestos abatement) and installation of three new Cleaver Brooks CBEX 800 boilers with natural gas, #2 fuel oil capabilities. Project also includes removal of existing UST and installation of new AST.
Milford Headquarters PV Study

Carport PV canopies at up to three Parking lots with over 1 MW of solar photovoltaic output including the potential for battery storage.
Option 3:  
1.1 MW AC/1.32 MW DC  
First year potential of 1,415,000 kWh  
Potential Block three profit of Approximately $2.2M over 20 year term ($2.0M in block four).
Pollinator Habitat:
This 3.5 acre site and another 2.6 acre site have been seeded using a Brillion seeder with a pollinator mix of; Virginia Wild Rye, Switch Grass, Big Blue Stem, Sweet Everlasting, Clasping Milkweed and Butterflyweed
QUESTIONS?
MWRA’s Climate Change Strategy: Energy Initiatives

Environmental Business Council
October 18, 2018

Stephen Estes-Smargiassi
Director of Planning and Sustainability
MWRA: Regional Wholesale Water and Sewer Service

- MWRA provides water and wastewater to over 2.5 million customers in 61 communities.
- On average, MWRA delivers about 200 million gallons per day to its water customers.
- MWRA collects and treats an average of 350 million gallons of wastewater per day, with a peak capacity of 1.2 billion gallons.
The treatment and transport of water and wastewater involves significant energy resources, and the use of fossil fuels can contribute to carbon dioxide (CO2) and other greenhouse gas emissions.

This presentation focuses on our efforts to utilize renewable energy, improve energy efficiency and reduce our greenhouse gas emissions.

Substantial MWRA effort has been devoted to adaptation efforts to prepare for a changed climate and continue to meet our environmental and public health mission.
Water And Sewer Is An Energy Intensive Business

- MWRA’s total annual energy purchases for FY17
  - Electricity $14.5 million
  - Diesel $2.9 million
  - Gas $460 thousand

- MWRA total annual energy purchased (equivalent of > 12,000 homes)
  - Electricity 140 million kWh
  - Diesel 1.7 million gallons
  - Gas 515k therms
Renewable Energy at MWRA

Renewable generation in FY17 = 29% of total MWRA total electricity usage

Renewable generation increased from 46.1 M kWh in 2006 to 53.9 M kWh in 2017, an increase of 16.8%
Deer Island Treatment Plant

- Deer Island is one of the largest electricity users in the Northeast

- Deer Island currently self-generates 28% of its electricity needs

- Over 60% of the plant’s energy demand is provided by on-site, renewable generation (heat and electricity)
Methane Utilization At Deer Island

• Deer Island utilizes 98% of the methane generated to power a steam turbine generator and backpressure turbine for plant heat and hot water
• Avoid purchase of about 5 million gallons in fuel oil annually
• Approximately 31 million kWh per year electricity production
• Approximately $3.3 million per year electricity savings and revenue
Hydroelectric Power

- Oakdale, Cosgrove, Loring Road, Deer Island
- Over 8 MW capacity
- Approximately 20M kWh per year in electricity production
- Over $1.4 million in annual savings and revenue
New 65 Kw Hydrogenerator provides multiple benefits
Solar Power - Deer Island Treatment Plant

- 736 kW capacity
- Over 890,000 kWh per year in electricity production
- Approximately $207,000 in annual savings and revenue
Solar Power – Carroll Water Treatment Plant

- 496 kW capacity
- Approximately 580,000 kWh per year in electricity production
- Over $120,000 in annual savings and revenue
Wachusett Aqueduct Emergency Pump Station – “Net Zero”
Wind Power – Deer Island Treatment Plant

- Two 600 kW turbines
- 1.9 million kWh per year in electricity production
- Approximately $225,000 in annual savings and revenue
Wind Power - Charlestown

- 1.5 MW capacity
- Over 2.2 million kWh per year in electricity production
- Approximately $413,000 in annual savings and revenue
Facility Energy Efficiency Audits

- MWRA has completed over 50 energy audits at most major facilities
- Implementation of audit recommendations and other process optimization efforts have saved over 25M kWh or $2.5 million annually
• From 2006 to 2017, MWRA’s purchases of electricity have been reduced by 19.5%, or 38 million KWh
MWRA undertook a comprehensive Green House Gas inventory to:

- Calculate historical GHG emissions to identify major sources and reveal trends
- Highlight successes to date regarding GHG emission reductions
- Manage GHG risks
- Identify emissions reduction opportunities
• From 2006 to 2016, Green House Gas emissions decreased by 32%
Questions or Comments?

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- www.mwra.com

This presentation represents the opinions and conclusions of the author and not necessarily those of the MWRA.