



DIVISION OF
CAPITAL ASSET
MANAGEMENT &
MAINTENANCE



ENERGY AND SUSTAINABILITY GROUP

METRICS Q3-Q4 '15 (JULY-DECEMBER 2015)

6 | 21 | 2016

METRICS PROCESS AND OVERVIEW

Metrics were selected, through a collaborative strategic planning process, based on their ability to succinctly portray the direct and indirect outcomes of our team's work.

Strategic Planning Process:

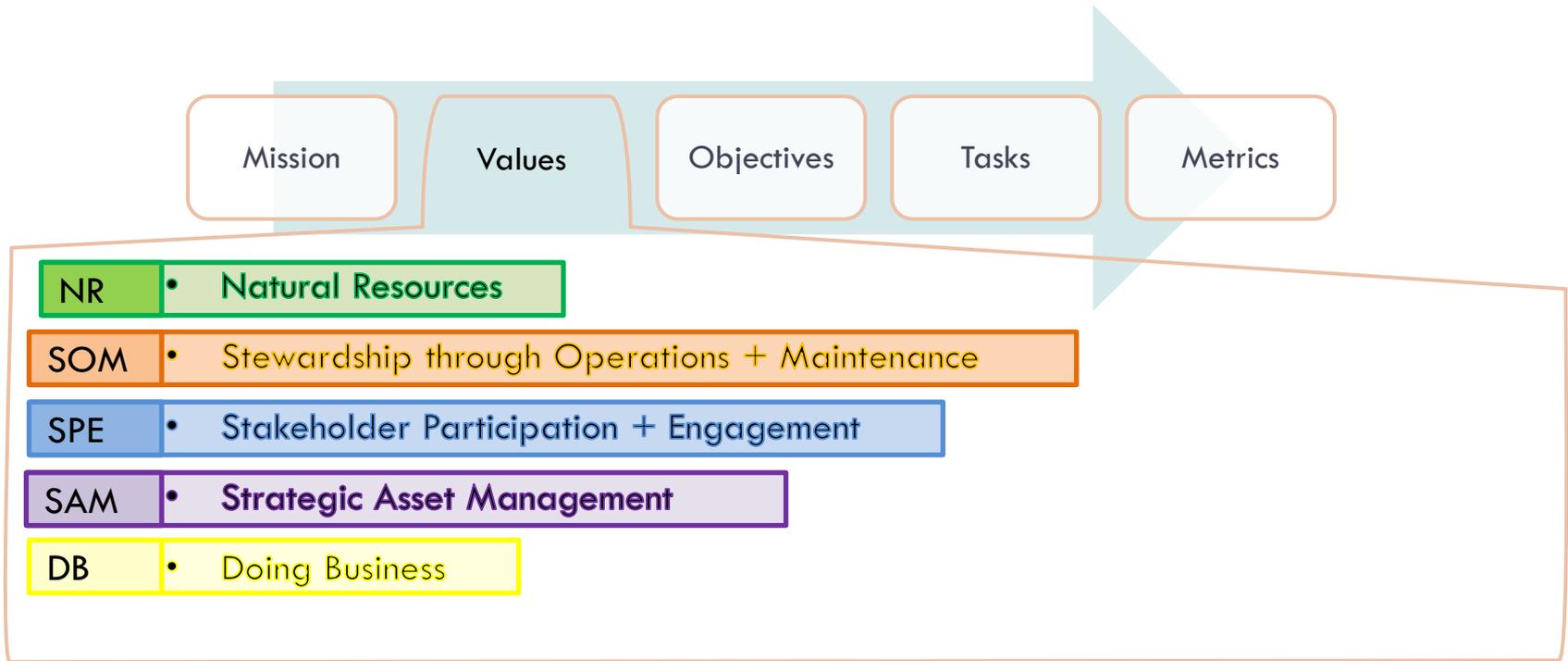
Team members identified the core **values** comprising our **mission**, the **objectives** we sought to fulfill with our work, the **tasks** that would embody our work towards our objectives, and the **metrics** that would allow us to measure our progress.

Roadmap for planning and measuring success:

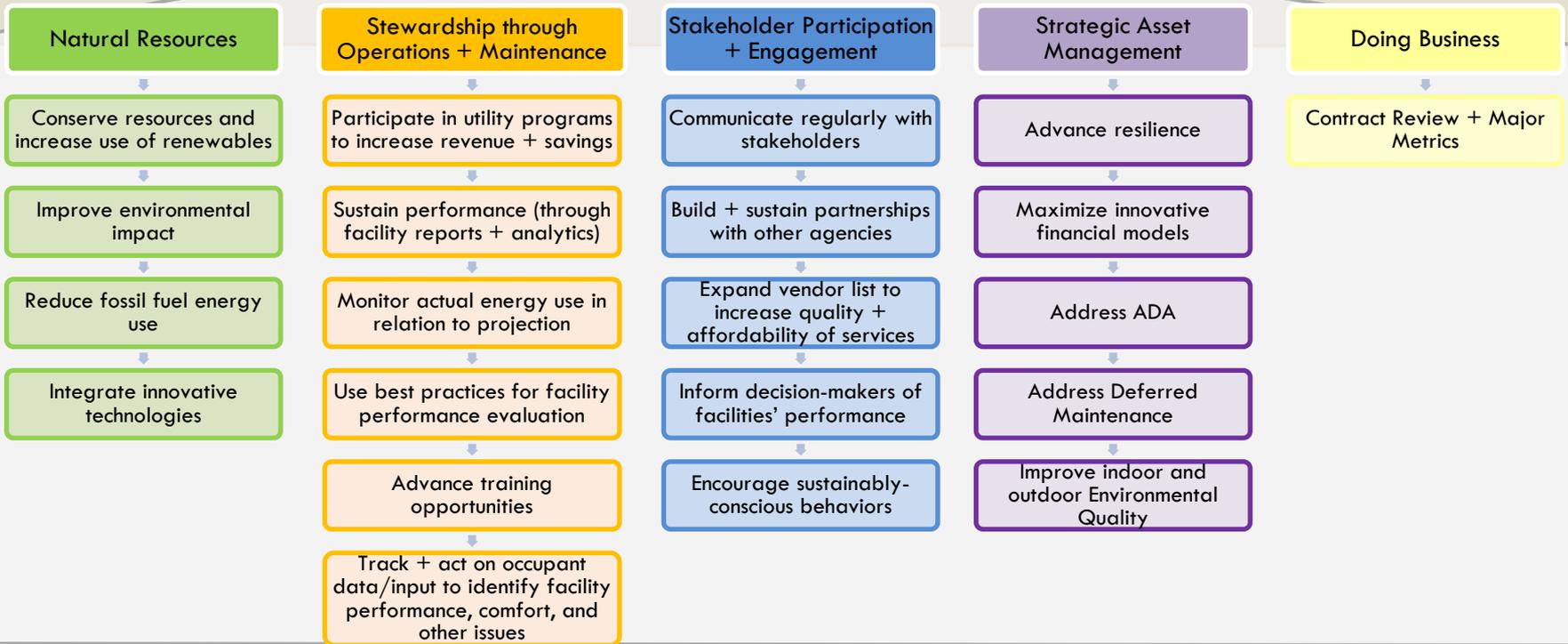


METRICS TAXONOMY

Each metric measures progress within a value identified during the strategic planning process. The values are listed below, and have been attributed a color for coding purposes, which can be seen in subsequent slides.



STRATEGIC PLANNING ELEMENTS: VALUES + OBJECTIVES



KEY METRICS

Active Energy Projects

Energy Project Type	# of Sites	Estimated Project Cost	Projected Savings
Comprehensive (Comp)	103	\$ 381,922,102	\$ 25,712,288
Towards Zero Net Energy (TZNE)	10	\$ 57,094,269	\$ 3,298,039
Retro-Commissioning (Rx)	30	\$ 19,797,547	\$ 1,843,792
Utility Vendor (UV)	455	\$ 12,305,500	\$ 2,861,807
New Review (New Rev.)	22	\$ 12,728,021	\$ 1,212,811
Other	33	\$ 639,300	\$ 2,779,525
Evaluated NA (N/A)	105	\$ -	\$ -
Total	758	\$ 484,486,739	\$ 37,708,262

All projects in AEP or started since 2012. For Phase I, original 700 sites, see page 9. For project type descriptions, see Appendix.

Q3-Q4 2015 Results

Project Progress

- **2** sites reached Substantial Completion
- **16** sites began Implementation
- **8** sites Completed Audits
- **2** sites began Procurement
 - Fitchburg State University (Fitchburg)
 - Roxbury Community College (Boston)

Major Accomplishments

New Facility Advisors Contract

- 70 companies selected for statewide contract

New Solar PV Maintenance Contract

- 2 companies selected for statewide contract

New House Doctor Contract

- 4 new companies selected

New Fisheries and Wildlife HQ Awarded LEED Platinum

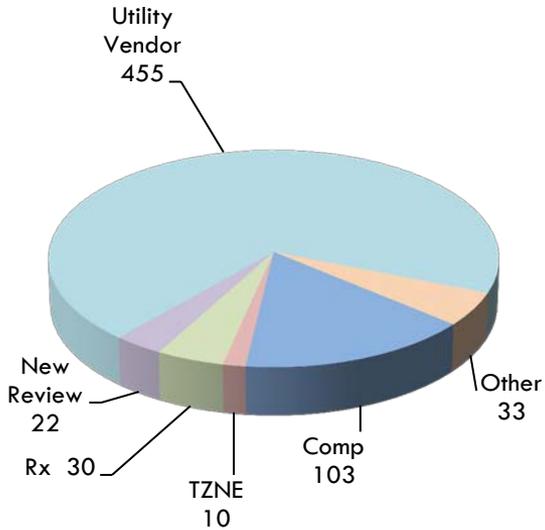
2nd Round of CoFFEE Project Proposals Received

New Memorandum of Understanding Signed with Utility Providers for ECM Incentives

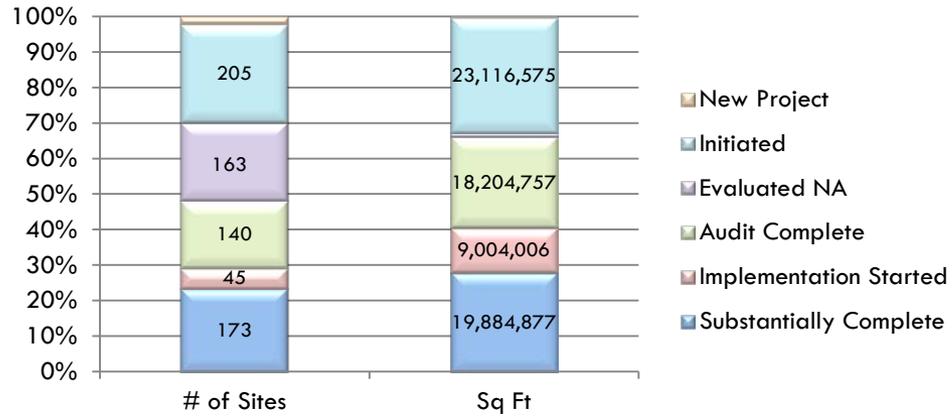
KEY METRICS

Active Energy Projects

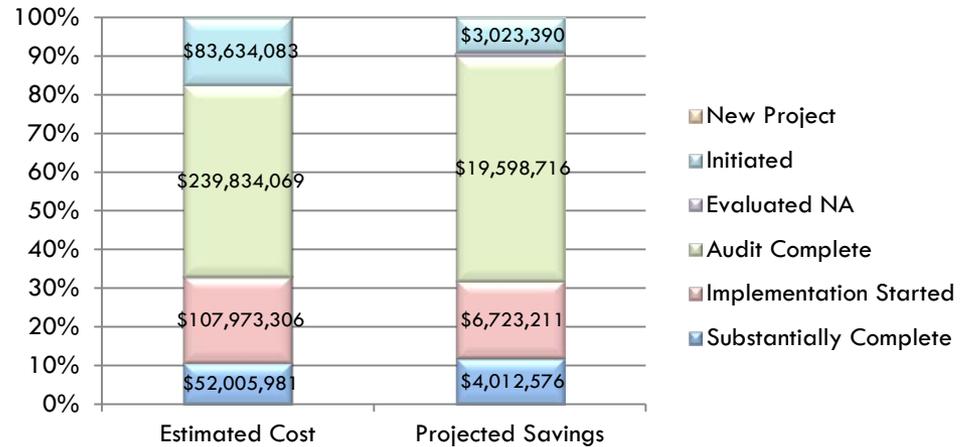
of Sites by Implementation Method



Status



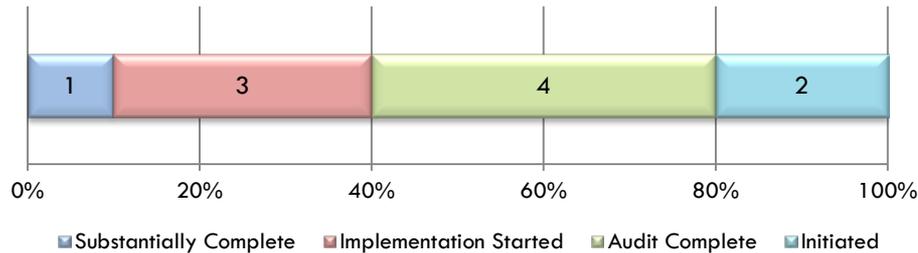
Financials



KEY METRICS

Toward Zero Net Energy

TZNE Project Status



Project Spotlight – North Central Correctional Institute – Gardner

Wind Turbines - \$10.3 million TCV, \$1.3 million annual generation

Construction Complete April 2013

- Two 1.65 MW Wind Turbines, produce more electricity than facility uses annually

Fuel Switching and efficiency measures - \$13.4 million TCV, \$1.1 million annual savings

Construction Complete August 2015

- Oil-fired boilers switched to efficient natural gas
- Low-Flow showerheads installed
- Laundry dryers replaced with more efficient models

Overall, NCCI Gardner is **80% towards zero net energy** and **97% towards being carbon neutral**

What is ZNE?

> The Massachusetts Zero Net Energy Buildings (ZNEB) Task Force defines a Zero Net Energy Building as: "one that is optimally efficient and, over the course of a year, generates energy onsite, using clean renewable resources, in a quantity equal to or greater than the total amount of energy consumed onsite."

> Benefits of ZNE projects can include:

- Reduced energy consumption & utility costs
- Lower operating & maintenance costs
- Reduced emissions/pollution
- Waste reduction & resource conservation
- Improved working environments
- Potential Resiliency

2015 ZERO NET ENERGY CHARRETTE

- California Title 24 Code (2013 Edition)
- EO 13693 – Federal Sustainability in the Next Decade (2015)
- Net Zero Cambridge Action Plan (2015)

Report following TZNE Charrettes held in summer 2015, delivered in November 2015.

KEY METRICS

Utility Vendor Program

There are **455** Sites in the Utility Vendor program

We have initiated work at **all 455** Sites

We are currently auditing **158** Sites

We have drafted audits at **100** Sites in the program

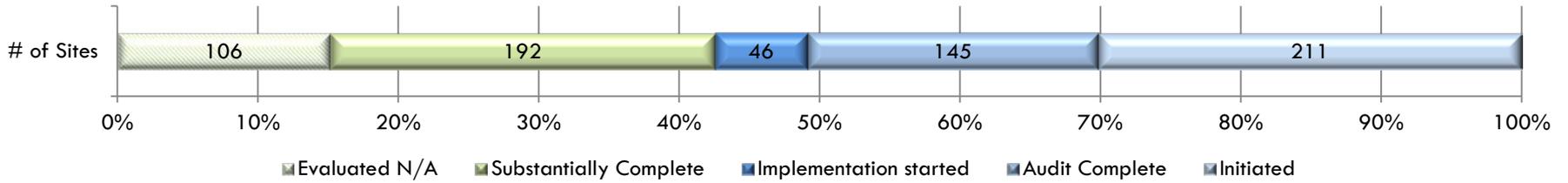
We have evaluated and deemed **57** Sites Not Applicable

We are in construction at **25** Sites

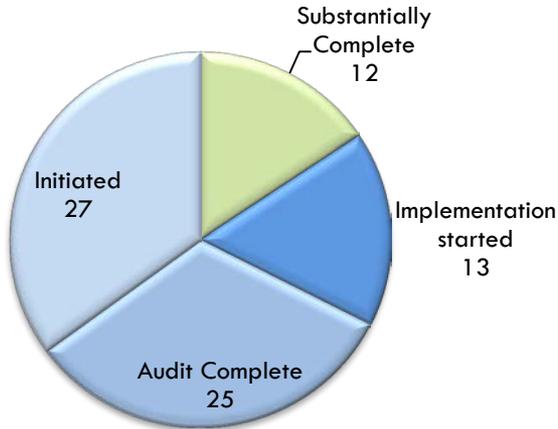
And now have **115** Sites with **Completed** projects

KEY METRICS

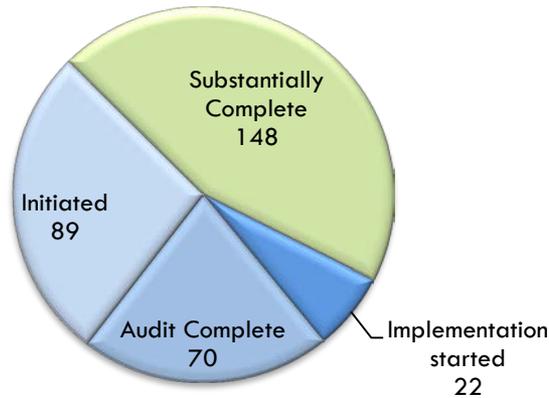
AEP Phase I Sites Status – Original 700 sites



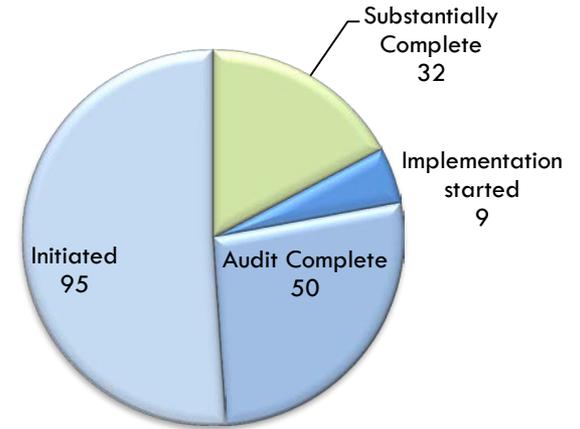
Large Sites



Small Sites



Occasional Use Sites



STRATEGIC ASSET MANAGEMENT

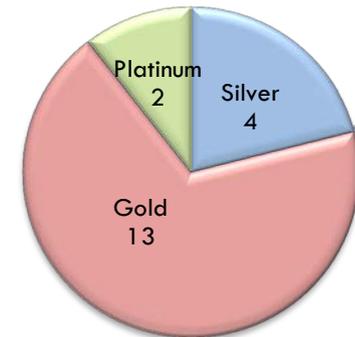
LEED



Fisheries and Wildlife Headquarters – Westborough

- Received LEED Platinum certification in December 2015
- 300 kW roof PV system
- Ground Source Heat Pump system
- Onsite stormwater recharge
- Designed for net zero energy usage

DCAMM LEED certified projects since 2007



DCAMM has approximately 30 more buildings in queue to be certified, to push total over 50

INNOVATIVE FUNDING

CoFFEE Program 2nd Round Projects

4 Projects at 12 sites

Western Trial Courts - \$218k

- LED lighting retrofits at 7 county/district courts
- Utility incentives and annual savings over **\$50k each**

Boston Area Courts - \$112k

- Various ECMs at 3 courts including EMS upgrades, LEDs, and AHU controls
- **\$10k** in utility incentives and annual savings over **\$40k**

Tewksbury Hospital - \$73k

- Lighting upgrades and steam trap replacement in the Saunders Building
- **\$22k** in utility incentives and annual savings of **\$28k**

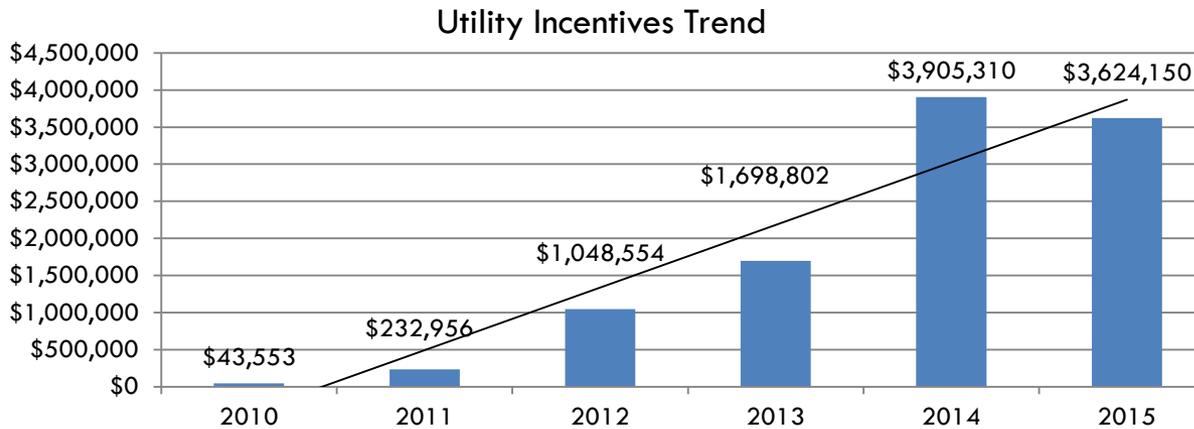
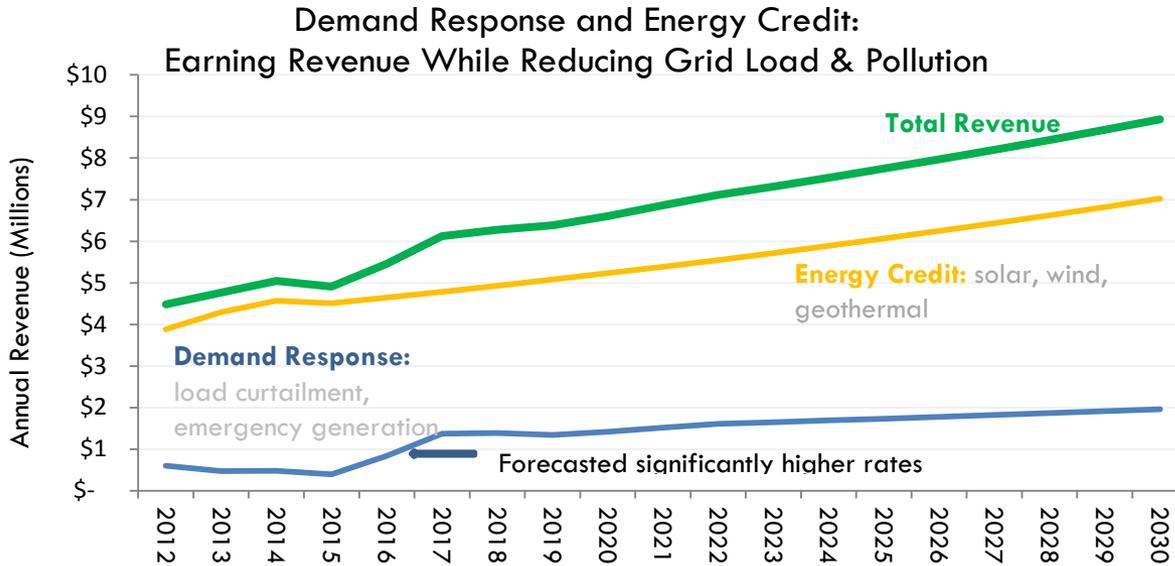
National Guard Field Maintenance Shop - \$33k

- LED retrofits, programmable thermostats, boiler controls
- **\$14k** in utility incentives and annual savings of **\$6k**



INNOVATIVE FUNDING

Demand Response, Energy Credits, and Utility Incentives



STAKEHOLDER ENGAGEMENT

DCAMM Brown Bag Speaker Series: Resilience in the Public Sector

- 5-week speaker series featuring experts from Massachusetts Emergency Management Agency (MEMA), Kleinfelder, Inc., the City of Cambridge, Linnean Solutions, MassPort, and Simpson Gumpertz & Heger Inc.
- Series covered a wide range of topics, including regional/statewide approaches all the way down to building-level strategies

DCAMM Presents a New Brown Bag Speaker Series!



Resilience in the Public Sector: Strategies for Advancing the Adaptive Capacity of Commonwealth Facilities and Communities

The steps we take today to prepare for the challenges we may face tomorrow are essential to our mission. This five-part series will introduce you to the leading climate change adaptation and resilience theories and practices currently being executed in the field today. Each of the sessions features a different focus area and/or scale. All are invited to attend:

The Five Sessions:

- November 12, 2015, 12:00 PM - 1:00 PM**
Statewide and Regional Approaches to Climate Adaptation and Resilience
Marybeth Groff & Sarah White, Massachusetts Emergency Management Agency (MEMA)
Video Conference Room, McCormack Bldg., 10th Floor, One Ashburton Place, Boston, MA
This session will focus on the regional scale, outlining the role of the Massachusetts Emergency Management Agency as facilitator of the Commonwealth's Statewide Hazard Mitigation Plan. Presenters will discuss methodologies used in regional risk assessment planning, agency partnerships, and potential funding sources available for resilient planning, design, and construction at the state level.
- December 10, 2015 12:00 PM - 1:00 PM**
Local Approaches to Climate Adaptation and Resilience
Nathalie Beauvais, Kleinfelder, Inc. and John Bolduc, City of Cambridge
Video Conference Room, McCormack Bldg., 10th Floor, One Ashburton Place, Boston, MA
At the local scale, the City of Cambridge is planning to permanently reduce or alleviate the injuries, loss of life, and property damage resulting from natural hazards through long-term strategies. The Metropolitan Area Planning Council (MAPC) and Kleinfelder have been working to assist the City of Cambridge in these efforts, and this presentation will discuss the municipal approach and lessons learned, as well as outline issues and opportunities in the Charles River Basin.
- January 21, 2016 12:00 PM to 1:00 PM**
Future Thinking: Thriving with Climate Change and Championing Resilience
Jim Newman, Linnean Solutions
McCormack Conference Rooms 2 and 3, 22nd Floor, One Ashburton Pl, Boston
Looking beyond a focus purely on resilience (the ability to recover and stabilize) as a mitigation strategy, this session invites attendees to embrace the possibility that we do not have to resign ourselves to merely living with the impacts of climate change. Instead, we should envision a future where design provides the opportunity for communities to thrive with climate change and that the environment can thrive with us. By leveraging the considerable influence and resources of DCAMM, the goal is to create regenerative relationships between the Commonwealth, the communities in which we are embedded, the public, and the living systems that support us.
- February 25, 2016 12:00 PM to 1:00 PM**
The Role of the Owner: Perspectives and Issues to Consider
Robbin Peach, MassPort
McCormack Conference Rooms 2 and 3, 22nd Floor, One Ashburton Pl, Boston
As an agency of the Commonwealth, MassPort has been at the forefront of resilience planning due to the susceptibility of its infrastructure to hazardous coastal impacts and man-made threats. In response to these risks, they have launched a robust resilience initiative, making resilience principles, planning, and implementation an integrated part of their business strategy and operations. This session will describe their organizational goals, strategies, and outcomes as a case study of integrating resiliency into everyday agency operations.
- March 24, 2016 12:00 PM to 1:00 PM**
Building-level Strategies to Enhance Resilience
Alec Zimmer, Simpson Gumpertz & Heger Inc.
McCormack Conference Rooms 2 and 3, 22nd Floor, One Ashburton Pl, Boston
Much like "sustainability" before it, the term "resilience" has come to the forefront of discussion about the built environment and communities. This presentation will explore how resilience is defined, why it is now "a national imperative," according to the National Academy of Sciences, how risks are evaluated, and methods to mitigate risks from a structural engineering perspective. It will also look to the future in assessing the resilience of our building stock. Most importantly, the presentation will challenge us all to consider resilience in the buildings we design and to have candid discussions with building owners and users about their expectations for building performance when faced with extreme events.

For questions and registration contact [Elaine Barton](mailto:Elaine.Barton@state.ma.us) at Lorraine.Barton@state.ma.us or at 857.204.1313

STRATEGIC ASSET MANAGEMENT

Facility Improvement

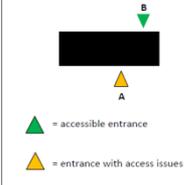
MAAB – Accessibility Projects

- 5 projects in Construction/Implementation
- 4 projects in Final Design and/or Procurement
- 3 projects in Study
- 4 projects in Evaluation
- Nearly **\$250,000** spent on accessibility upgrades to date

Indoor Air Quality/Occupant Comfort Improvement

- The AEP has thus far invested **\$26 million** in Energy Conservation Measures (ECMs) that help improve occupant comfort across **127** sites
- ECMs include:
 - Window replacement and sealing
 - Door replacement and weather-stripping
 - Air Sealing
 - Energy Management Systems, including Programmable Thermostats
 - Insulation

Building 9 – Enrollment Center (continued)

BUILDING 9 – ENROLLMENT CENTER	
ENTRANCE	The Enrollment Center has two primary entrances on the north and south sides of the building. Entrance "B" on the north side fully complies with 521CMR. The south entrance, closest to accessible parking, has accessibility issues as listed below. Entrance "B" satisfies the requirements of 521CMR, Section 3.3.1 for an accessible entrance.
Entrance A	59. The automatic door button is located on the architectural column at the top of the sloped surface ("5%). There is no level landing (<2%) provided at this control. Building controls must be located at level surfaces (521CMR, Section 39.2)
Entrance B	
	<p>▲ = accessible entrance ▲ = entrance with access issues</p> <p>Image 32 - North and south entrance are provided to this building. Entrance B is the most accessible.</p>
	<p>Image 33 - Entrance A is on the south side of the building near parking. This entrance has accessibility issues including a slope of 5% at the automatic door button.</p>
	<p>Image 34 - Entrance B is on the north side of the building. This entrance complies with 521CMR.</p>

32-page Accessibility Audit Report for 5 buildings at Middlesex Community College



Air sealing at Uxbridge District Court

STEWARDSHIP THROUGH OPERATIONS + MAINTENANCE

Ongoing Performance Verification

North Central Correctional Institute – Gardner

- Currently exploring methods to ensure energy projects are achieving the savings outlined in contracts after construction
- Working with consultant on pilot monitoring and verification (M&V) program

Methods being explored include:

- Interviewing facility personnel and boiler plant operators to assess their understanding of new systems and get ideas for customizing them
- Gathering as-built documentation and trends from the new Building Automation System (BAS) to determine if equipment is operating according to design intent
- Identifying facility operating changes to impact baseline energy usage
- Reconciling utility bills
- Identifying changes to BAS sequence of operation to generate more energy savings



STEWARDSHIP THROUGH OPERATIONS + MAINTENANCE

Integrated Pest Management (FAC92)

- Contract awarded, set to launch Q2 2016
- 25 firms covering all of Massachusetts
- All vendors offer a Board-Certified Entomologist and/or Associate Certified Entomologist for expert pest identification
- Around-the-clock coverage with Night Inspection Service options
- Online Pest Logging to record incidences as they occur and properly target problem areas
- For more information, go to COMMBUYS



Environmentally Preferable Products (Executive Order 515)

- EO 515 requires all Commonwealth Executive Departments to reduce their impact on the environment and enhance public health by procuring Environmentally Preferable Products and services (EPP)
- MA's Operational Services Division (OSD) has procured dozens of statewide contracts to facilitate the use of products/vendors that provide recycled or sustainable products, LEED/Energy Star certification, and many more “green” categories

METRICS COMING SOON

Facility Performance Evaluations (FPE)

- Measuring building performance to several metrics of occupant comfort
- FPE methodology to be established in 2016
 - Survey of appropriate length targeted to proper audiences
 - M&V, continuous commissioning efforts

Integrating Innovative Technologies and Ideas

- Definition - a new idea, method or device
 - Incremental, semi-radical and disruptive Innovative Technologies
- MA as 1st Customer Pilot Program
 - Commercially Ready Technology List (CRT) is now referenced in RFP
 - Will track these measures

METRICS COMING SOON

Life Cycle Cost Analysis Tool

- DCAMM-developed tool in summer of 2015
 - Currently being tested on projects, results coming in 2016

Construction Year		2015		Assumptions											
Analysis Performed By		Hye Min Park		Study Period (Years)	Discount Rate	Escalation Rate						Price of Carbon	Price of RECs		
Date		2015				Electricity	Fuel Oils	Natural Gas	Others	Steam	Water			Materials	Carbon Cost
				30	4%	3%	3%	3%	0%	0%	0%	0%	-5%	\$ -	\$ -

	Base Case I		Base Case II		Passive House			
Costs								
Initial Costs								
Total Cost	\$	1,917,514	Total Cost	\$	1,943,823	Total Cost	\$ 2,138,503	
Expected life (years)		50	Expected life (years)		50	Expected life (years)	50	
Incentives			Incentives			Incentives		
Net Costs	\$	1,917,514	Net Costs	\$	1,943,823	Net Costs	\$ 2,138,503	
End yr Equip. Residual Value	\$	767,006	End yr Equip. Residual Value	\$	777,529	End yr Equip. Residual Value	\$ 855,401	
							\$ -	
Non Energy Cost								
One Time OM&R		One Time OM&R		One Time OM&R		One Time OM&R		
Description	Year	Cost	Description	Year	Cost	Description	Year	
HVAC Replacement	21	\$ 370,375	HVAC Replacement	21	\$ 358,375	HVAC Replacement	21	
Overhaul	20	\$ 244,448	Overhaul	20	\$ 179,188	Overhaul	20	
Annual O&M Cost			Annual O&M Cost			Annual O&M Cost		
Annual Energy & Water Consumption								
Electricity (kWh)	101,000		Electricity (kWh)	88,600		Electricity (kWh)	53,000	
Renewable Electricity (kWh)			Renewable Electricity (kWh)			Renewable Electricity (kWh)		
#2 Fuel Oil (Gallons)			#2 Fuel Oil (Gallons)			#2 Fuel Oil (Gallons)		
#4 Fuel Oil (Gallons)			#4 Fuel Oil (Gallons)			#4 Fuel Oil (Gallons)		
#5 &6 Fuel Oil (Gallons)			#5 &6 Fuel Oil (Gallons)			#5 &6 Fuel Oil (Gallons)		
Natural Gas (Therms)			Natural Gas (Therms)			Natural Gas (Therms)		
Other (MMBtu)			Other (MMBtu)			Other (MMBtu)		
Propane Gas (Gallons)			Propane Gas (Gallons)			Propane Gas (Gallons)		
Steam (Pound)			Steam (Pound)			Steam (Pound)		
Water/Sewer (Ccf)			Water/Sewer (Ccf)			Water/Sewer (Ccf)		

A-1. Baseline
Code minim
similar clim
A-2. Option A
20% improve
A-3. Option B
Passive Hou

Example case testing cost-effectiveness of a Passive-House building design