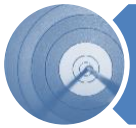
Leading by Example Executive Order 594

New Construction and Existing Facilities

June 10, 2021

LBE Executive Order 594

- Signed by Governor Baker on Earth Day
- Effective date: July 1, 2021
- Supersedes LBE Executive Order 484



Interim and long-term targets

New construction standard

Decarbonization of existing buildings

Fleet electrification and EV charging

Renewables, other sustainability directives, and more

State Entities Covered by EO 594

EO 594 applies to all "**executive branch agencies and all public institutions of higher education**."

Section 5: Vehicle Efficiency and Fossil Fuel Reduction requirements "**apply to all vehicles owned or leased and operated by agencies subject to this Order, as well as to all non-revenue vehicles under the jurisdiction of the MBTA**."

Key Elements of EO 594

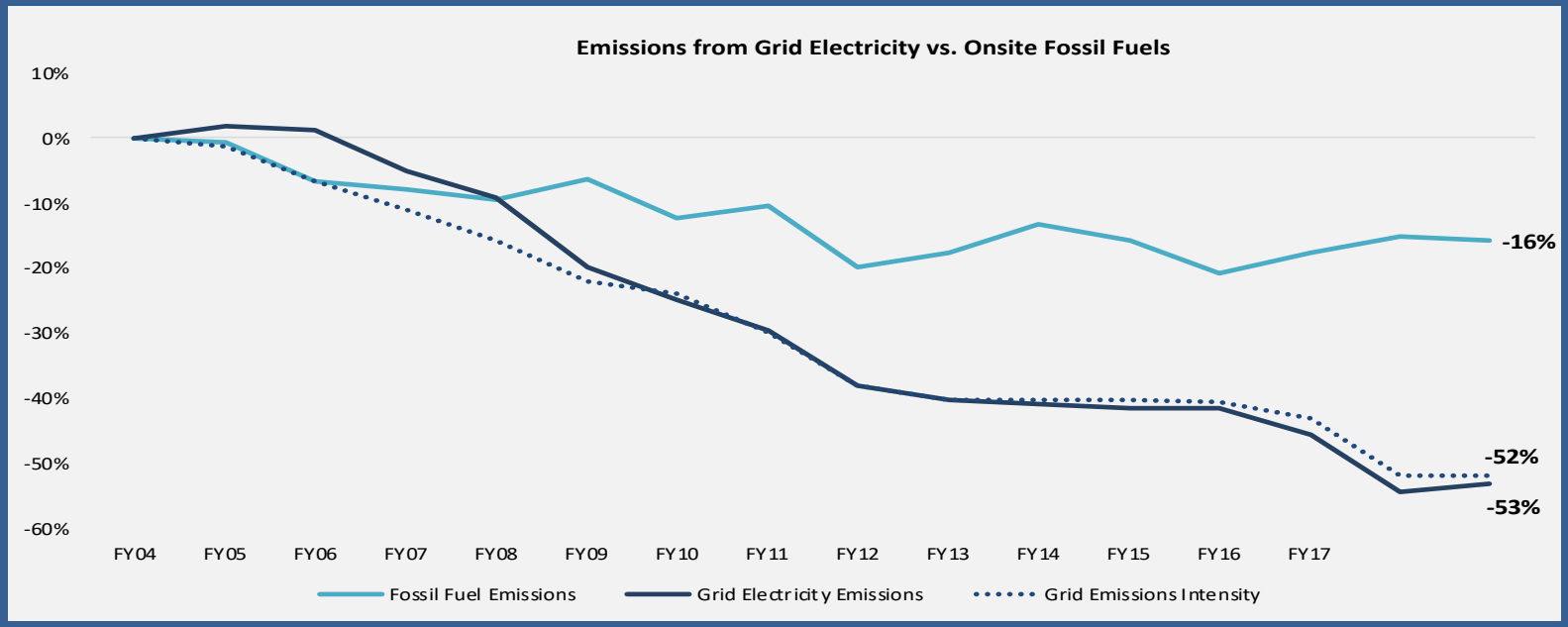
- ❑ GHG goals specifically for fossil fuel emissions
- ❑ EV goals and acquisition requirements
- ❑ Mass. LEED Plus 2.0 for new construction
- ❑ Existing building decarbonization focus
- ❑ Emissions in capital and master plans
- ❑ Minimum biofuel requirements
- ❑ Deployment of new renewable resources
- ❑ Energy storage, and resilience planning
- ❑ Other sustainability strategies

Summary of EO 594 Targets

Objective	2025	2030	2040	2050
↓ emissions from onsite fossil fuels	-20%	-35%	-60%	-95%
% of state fleet as zero-emission	5%	20%	75%	100%
↓ fuel oil consumption	-90%	-95%	*TBD*	*TBD*
↓ site Energy Use Intensity (EUI)	-20%	-25%	TBD	TBD
total # of EV charging stations	350	500	*TBD*	*TBD*

Focus on Fossil Fuel Emissions

- 75% of current state government emissions reductions can be attributed to changes in the grid emissions intensity
- Fossil fuel emissions are most challenging to address, under the direct control of state action, and constitute the majority (and growing) portion of emissions within the state portfolio



A Challenging LBE Portfolio

Targets largely set to ramp-up over time with significantly more progress expected post-2030

GHG Emissions	Large facilities, central power plants complex distribution systems, 24/7 operations, variable building age, lots of newer equipment
Zero Emission Vehicles	State fleet mostly comprised of pickup trucks and vans with slow vehicle turnover
Planning	Long-term horizon for budget and capital planning

Guidelines for State Buildings

- Executive Order 594 directs LBE and DCAMM to create guidance
- Expect to post draft new construction guideline for stakeholder comments in coming weeks
- Existing buildings guideline tentatively slated to be released in early fall

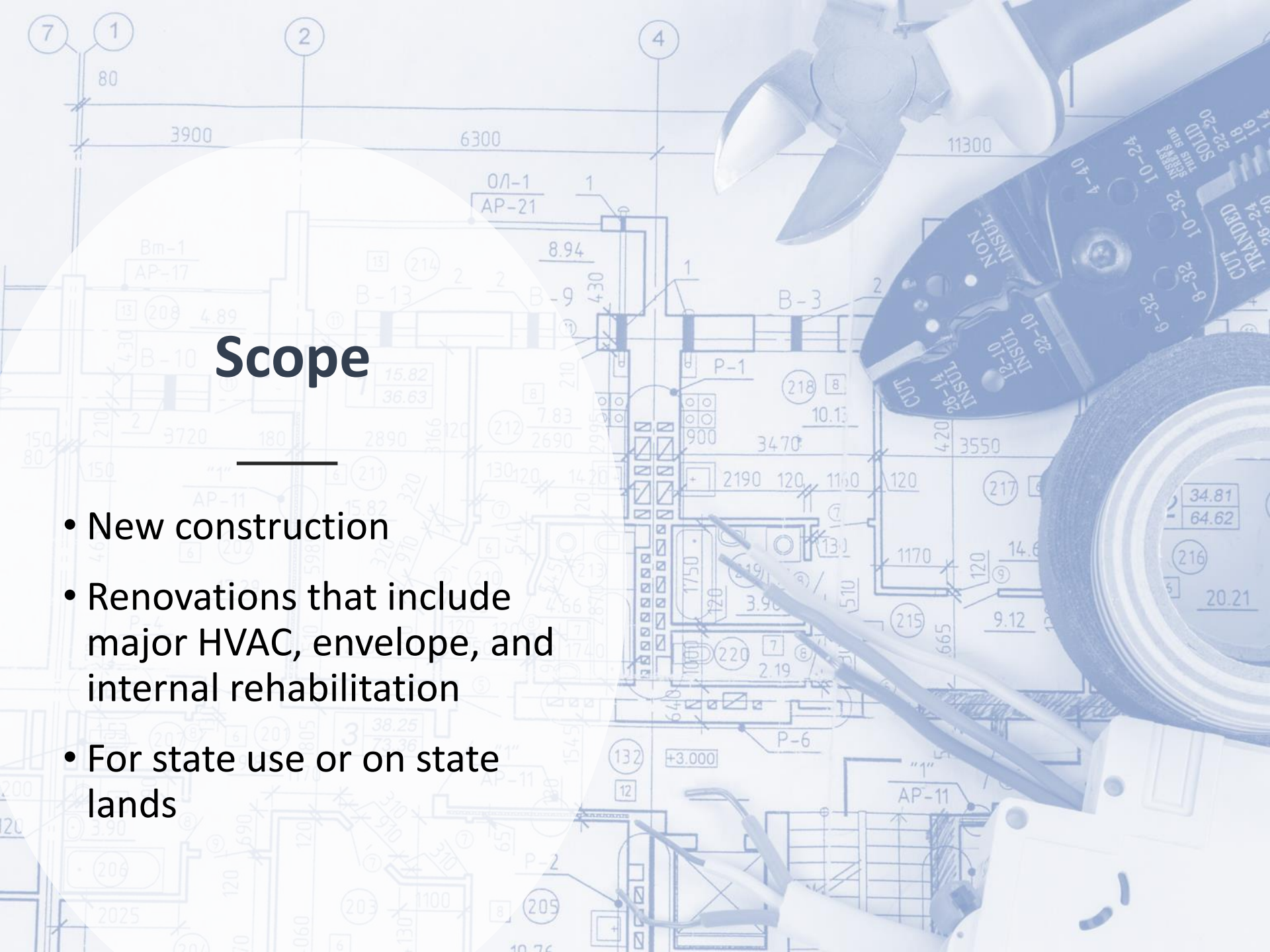
DRAFT Preliminary considerations/guidance

Massachusetts LEED Plus 2.0 Standard

New Construction and Substantial Renovations

Scope

- New construction
- Renovations that include major HVAC, envelope, and internal rehabilitation
- For state use or on state lands



1a. LEED Certification

Certify buildings to the **Silver Level or higher** of the most recent version of LEED Standard.

95th state LEED building

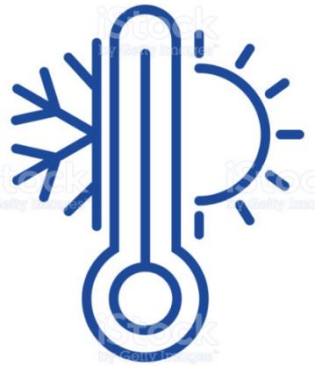
1b. EUI Reduction (→ Specialized Stretch Energy Code)

In accordance with *An Act creating a next-generation roadmap for Massachusetts climate policy*, DOER will develop and adopt a municipal opt-in specialized stretch energy code by the end of 2022 that will be an appendix to the MA building code.

Upon its promulgation, the
Specialized Stretch Energy Code
will replace this EUI requirement.

2. Space Heating and Cooling

- Prioritize electrified/non-combustion solutions that meet APS specs (air- and ground-source heat pumps, solar thermal)
- When not feasible, seek other APS compliant tech (woody biomass systems, biofuel, biogas systems, compost heat exchange)



3. Water Heating

- Efficient electric heat pump water heaters (ENERGY STAR®)
- Geothermal systems (APS equipment requirements)
- Solar thermal (OG-100 rated solar thermal collectors)
- High-efficiency electric point of use water heaters

4. EUI Target-Setting

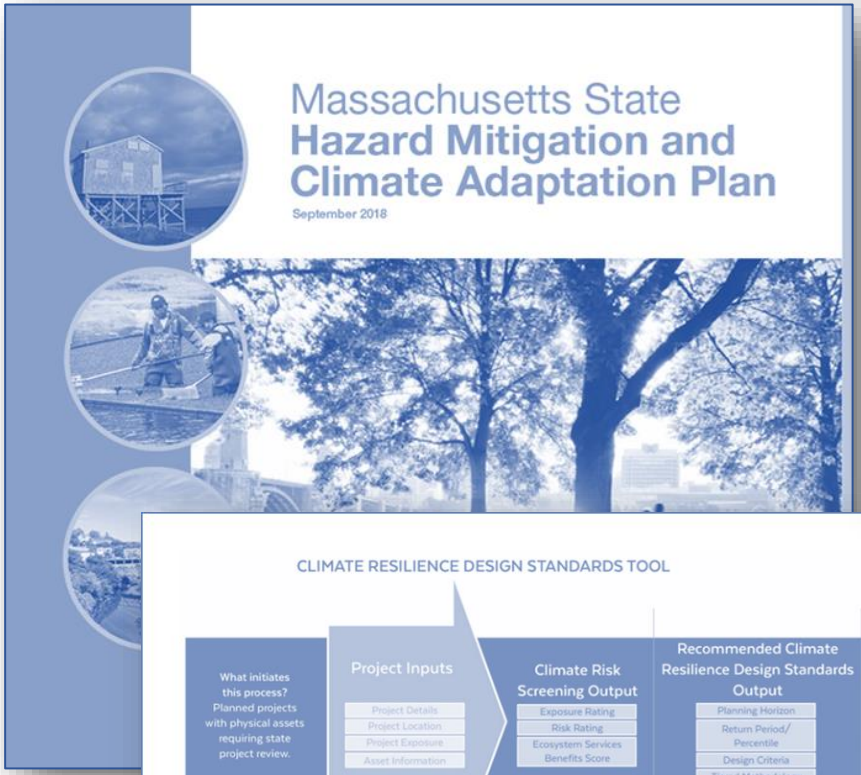
- Establish early in design process
- Base on achieved EUI ratings of other projects that are similar in type, size, and end use in the same or similar climate zone

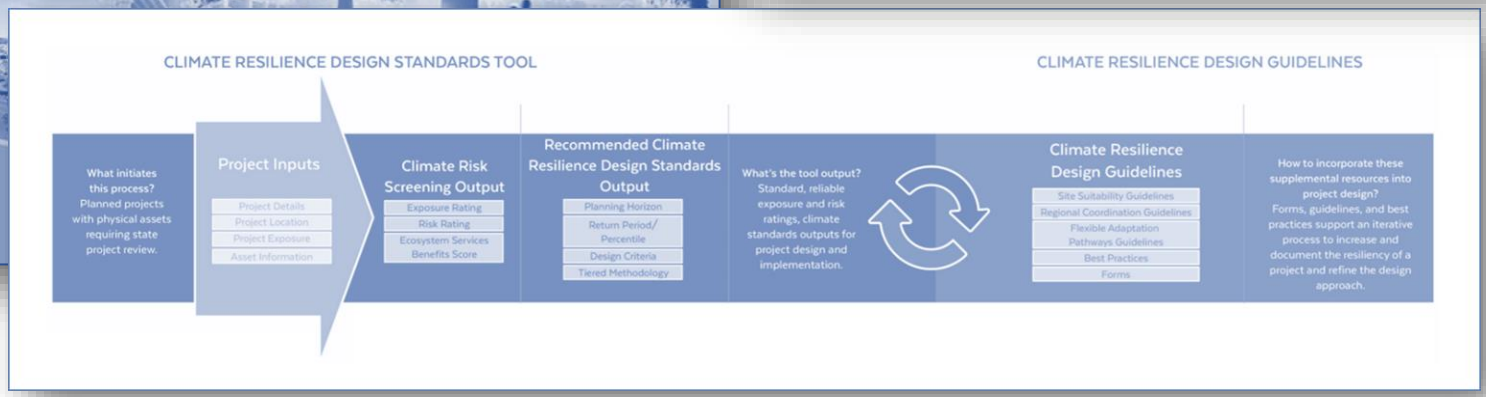
5. Onsite Renewables

- Install renewable technologies during or right after construction
- Emphasis on solar PV
- When not technically or fiscally feasible for project, must make solar-ready
- Follow EPA best practices for making renewable energy claims

6. Climate Resilience

Incorporate long-term climate resiliency into design and siting decisions.





7. Electric Vehicle Charging Infrastructure

For all **new or fully reconstructed** parking areas:

- ❑ ≤ 25 spaces = 1+ EV charging port
- ❑ > 25 spaces = 2+ EV charging ports

- May be public, employee, or fleet charging stations
- Level 1 or 2 chargers, but may vary by site needs
- Adhere to any state and federal requirements

Substantial Renovations and Smaller Buildings

Mass. LEED Plus 2.0 requirements apply to substantial renovations that are similar to new construction.

Major heating, ventilation, and air conditioning (HVAC) renovation; significant envelope modifications; and extensive interior rehabilitation

All building projects under 20,000 square feet must meet the Mass. LEED Plus 2.0 requirements except LEED certification.

Maximize GHG Emissions Reductions

- Strive to achieve zero net energy
- Implement energy storage
- Access to public transportation and alternative modes of transportation
- Reduce embodied carbon contained in building materials

Maximize GHG Emissions Reductions

- Strive to achieve zero net energy
  - Optimize efficiency and maximize energy from renewable resources
- Implement energy storage
  - Target sites with significant energy demand and costs
- Access to public transportation and alternative modes of transportation
  - When selecting new sites, access should be key part of evaluation
- Reduce embodied carbon contained in building materials
  - Target most carbon-intensive materials first and seek substitutions (e.g., concrete)

Existing Buildings

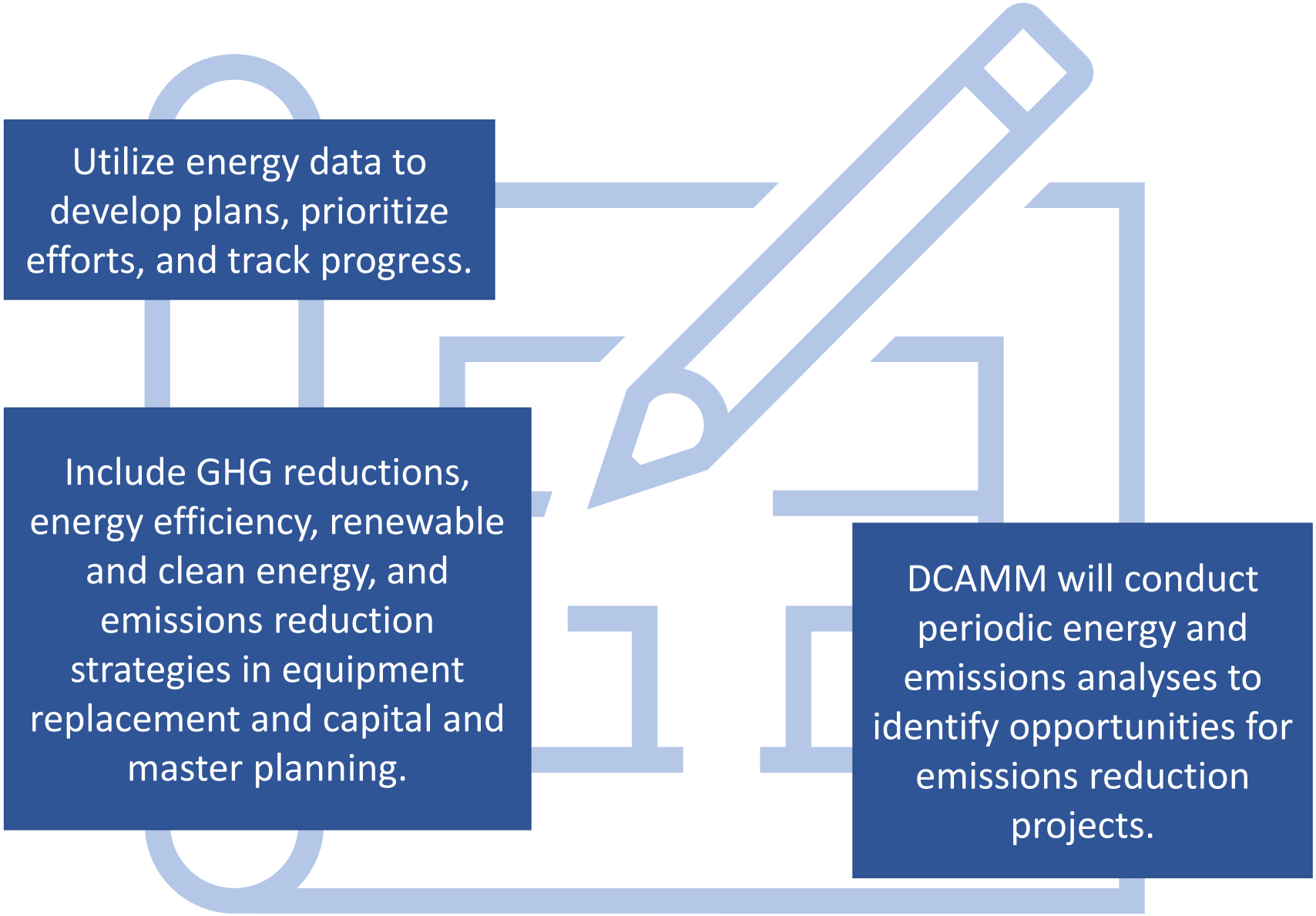
Projects that Affect Energy Use

Directives

When planning for, designing, and deploying projects that affect energy use, agencies must prioritize…

1. Substantial reduction or elimination of emissions from onsite fossil fuels
2. Optimized building performance through efficient operations
3. Participation in all available energy efficiency and clean energy incentive and rebate programs
4. Regular monitoring of building energy performance
5. Installation of highest efficiency equipment
6. Incorporation of energy performance into leasing decisions

A. Planning



Utilize energy data to develop plans, prioritize efforts, and track progress.

Include GHG reductions, energy efficiency, renewable and clean energy, and emissions reduction strategies in equipment replacement and capital and master planning.

DCAMM will conduct periodic energy and emissions analyses to identify opportunities for emissions reduction projects.

B. Renovations & Comprehensive Energy Projects

All comprehensive energy projects, including those that address district energy systems, and building renovations where electrical, heating, ventilation, or air conditioning infrastructure are included in the project scope, must:

- ✓ Include a design option for low- or zero-carbon fuels or alternative electricity technologies for thermal energy (or develop and incorporate plans to facilitate future transition)
- ✓ Evaluate and implement building envelope upgrades
- ✓ Establish and adhere to a low target site EUI
- ✓ Install renewable energy and energy storage or design for future incorporation
- ✓ Maximize resilient design

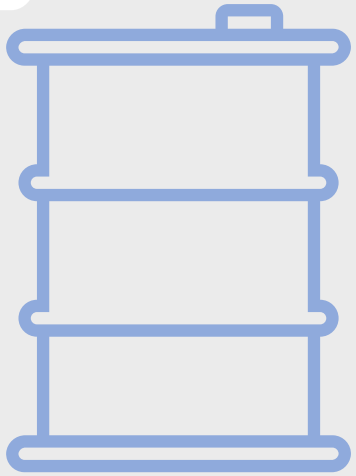
C. Operations

- Track energy performance of existing facilities/sites
- Take concrete steps to reduce building energy use through operational efficiencies
- DCAMM and MAFMA to provide regular training and professional development opportunities

D. Heating Oil

- As of July 1, 2021, agencies using heating oil must purchase at least a B10 biofuel blend

- B100 portion of fuel must meet APS requirements



Agencies may be exempt from this requirement if biofuels are not readily available or are cost prohibitive, or if a specific performance constraint is identified.

E. Leasing

DCAMM and others responsible for new leases for agency use must employ the specified selection criteria that address aspects such as:

- Energy code compliance
- Environmental certifications
- Energy disclosure ordinances
- State recycling requirements
- Access to electric vehicle charging stations
- Public transportation, pedestrian, and cyclist accessibility

DCAMM is Taking Action to Meet State Goals

DCAMM New Buildings & Substantial Renovations

LEED	✓	Silver or Better
Energy Efficiency	✓ ✓	EUI: 20% better than code Best-in-class
Space Heating & Cooling, Hot Water	✓	Efficient electric or renewable thermal technologies
Renewable Energy	✓ ✓	Solar ready Maximize on-site renewables
Resilience	✓	Incorporate resilience
EV Chargers	✓	EV chargers and EV-ready
Other	✓	Where possible: ✓ Zero-net target, Energy storage, Reduce embodied carbon, Site Near transit

Build for the Future

→**Make Efficiency the First Fuel**
→**Build Net Zero Buildings**
→**Select Clean Fuels**
→**Build Resilient Buildings**

MassBay CC Health Sciences
Target EUI = 30
High Performance Building Envelope

Meeting Goals: High Efficiency

Lowell Justice Center

Cape Cod Community College Science Building

Mass Bay Community College

Chelsea Soldiers' Home

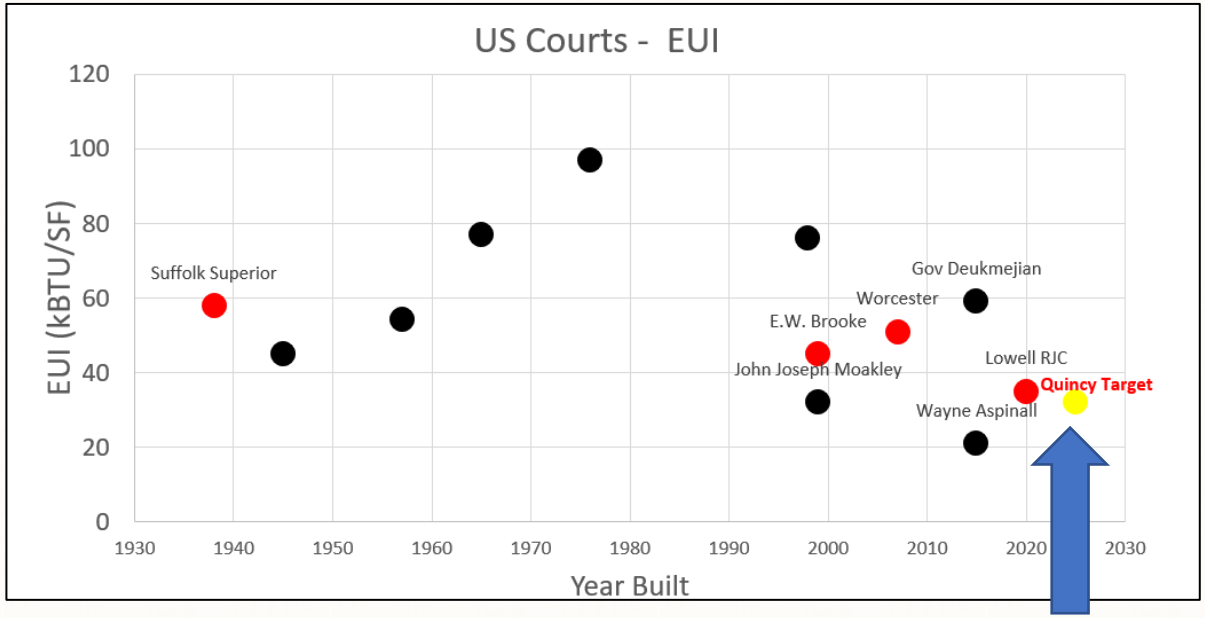
Bristol Community College Allied Health Center

Best-in-class energy efficiency is already a standard in DCAMM new buildings, renovations, and utility infrastructure projects.

Projects In Planning and Construction	EUI
• Bunker Hill CC Student Success Ctr	29
• Cape Cod Community College Science	56
• Chelsea Soldiers' Home	55
• DUA Brockton	44
• Facilities Maintenance Building	29
• Mass Bay CC Health Science Center	28
• Westfield State Parenzo Hall	29
Completed	
• Bristol CC Allied Health Center	50
• Fish and Wildlife Field Headquarters	25
• Lowell Justice Center	35

Accelerate Progress

- Best in Class EUI
- No Fossil Fuels
- Electric Basis of Design
- Reduce Embodied Carbon
- Certification: LEED Silver or better

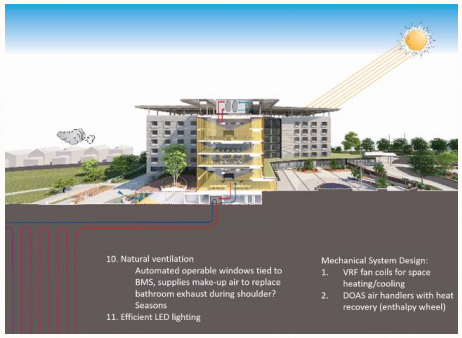


Meeting Goals: Low Carbon Fuels

Solar, Wind, Geothermal, Heat Pumps, and Biomass offer low carbon solutions and operational savings.

Solar installations generate 27 MW a year at state facilities.

Solar at Natick Readiness Center saves $33,000 year.



Ground source energy is in place at 11 state sites.

Chelsea Soldiers' Home uses ground source heat pumps for heating and cooling as well as solar PV.

Biomass is used at 9 state sites.

Biomass boilers at DYS Connelly are the lowest carbon solution for this site over a 30 year life.

Power purchase agreements (PPA) provide 3rd party ownership and maintenance of solar.

BCC's hosted solar parking lot canopy is one of the largest in New England and is a PPA.

Requirements for Renovations

Energy Efficiency	• Evaluate building envelope • Upgrade envelope where feasible • Target a low target EUI
Space Heating & Cooling **Domestic Hot Water**	• Evaluate low carbon solutions for thermal energy • Facilitate low- or zero-carbon fuels
Renewable Energy	• Where appropriate
Resilience	• Maximize resilient design

Decarbonization Studies - Underway

UMass Amherst

UMass Dartmouth

UMASS LOWELL

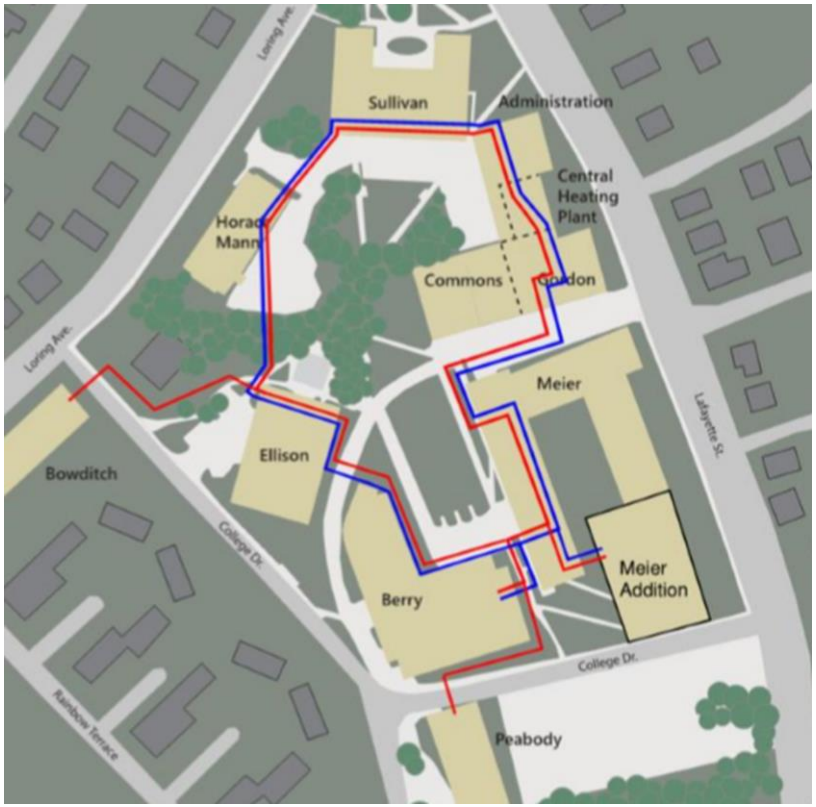
UMASS BOSTON

Salem STATE UNIVERSITY

MASSACHUSETTS MARITIME ACADEMY 1891

Challenges with Existing Facilities

- Central plants serving multiple buildings
- Natural gas systems: new
- Infrastructure and building envelopes
- Need to ready the buildings

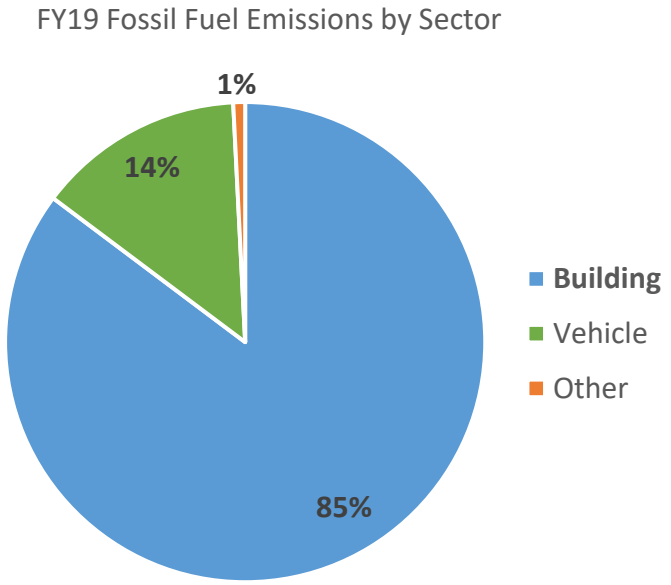


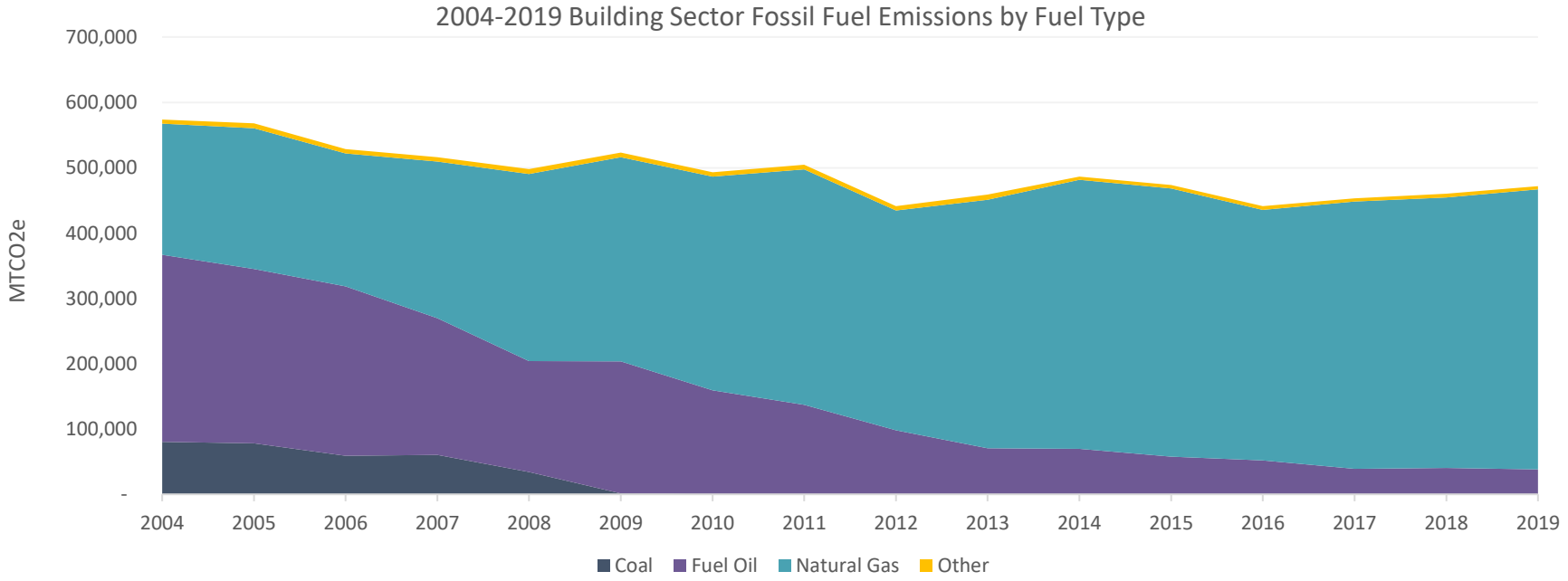
Implementation

Thoughts about EO 594 Mobilization, Q&A

Emissions from State Buildings

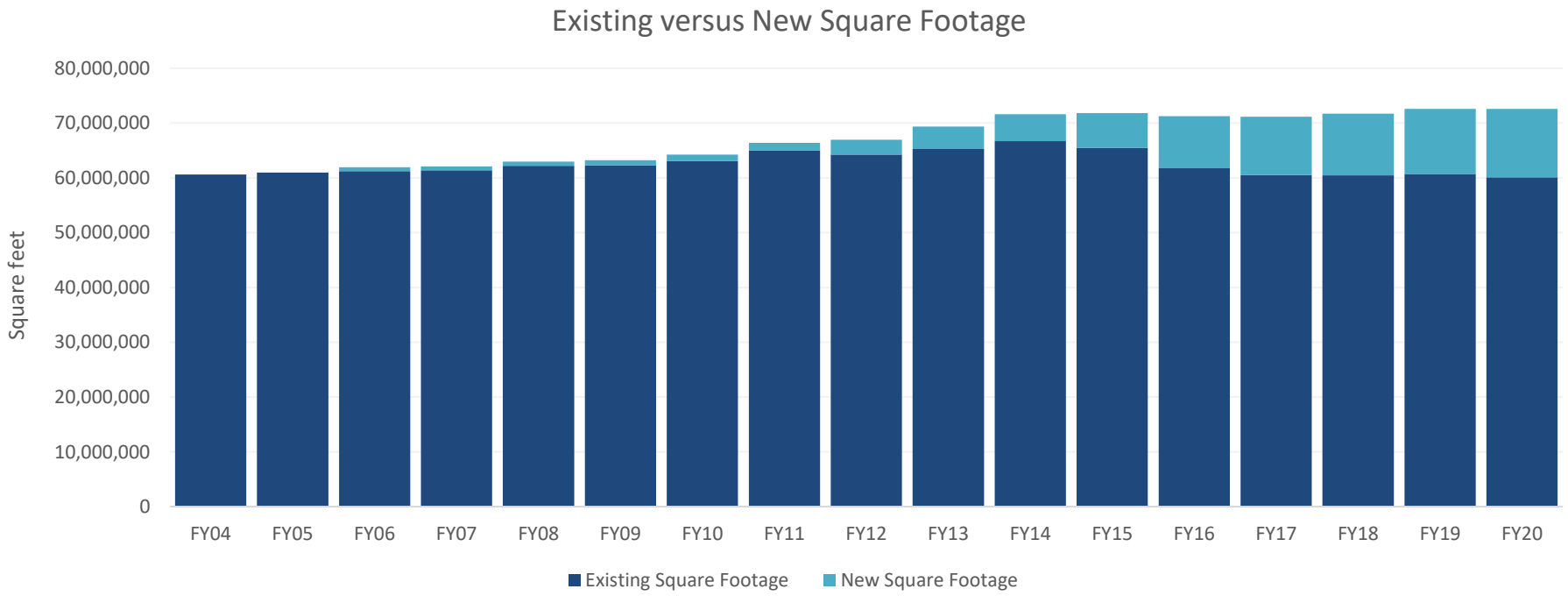
- State building sector emissions comprise 85% of total portfolio emissions from fossil fuels
- In the building sector, natural gas comprises over 90% of onsite fossil fuel emissions





Existing Buildings Matter!

- Relative to 2004:
  - 83% of portfolio building square footage is in existing buildings
  - 12.5M square feet are new, compared to 60M square feet of existing
- Annual new construction has averaged between 600,000- 1M square feet but likely to be less new construction in coming years



Decarbonization: Things to Consider

- Decarbonization will not all happen at once
- Do no harm (e.g., avoid creating new 30-year dependence on fossil fuels)
- Reasonable risks are appropriate
- Think incremental investment, not costs
- Don’t reinvent the wheel – learn from peers
- Take advantage of existing – and keep an eye out for future – incentives and resources

Other Thoughts on Meeting EO Targets

Effort	Goal
Decarbonization planning	❑ Incorporate emissions reduction into capital and master plan development ❑ What are the emissions impacts of our project and how can we mitigate them?
Building electrification	❑ Avoid any new fossil fuel systems in new buildings and wherever possible ❑ Prioritize air- and ground-source heat pumps for partial or full electrification in existing buildings
Fuel switching	❑ If electrification not appropriate or feasible, explore alternative decarbonization strategies for certain facilities ❑ Include modern wood heating, solar thermal, liquid biofuels
Energy efficiency	❑ Reduce fossil fuel use as much as possible ❑ Focus on envelope performance and air infiltration, then on replacing inefficient equipment ❑ Consider operational adjustments or ways to implement seasonal/ permanent space optimization strategies

Q&A

Questions?

Thoughts?

Advice for LBE?

Needs?

Summary: Requirements for New & Substantial Renovations

LEED Certification	Silver or Better
Energy Efficiency	EUI: 20% better than code Best-in-class Requirement will be replaced by Stretch Code, once adopted
Space Heating & Cooling **Domestic Hot Water**	Efficient electric or renewable thermal technologies
Renewable Energy	Solar ready Maximize on-site renewables
Resilience	Incorporate resilience
EV Chargers	EV chargers and EV-ready spaces will be required: the quantity will depend on number of spaces
Other	Exemption provision exists Where possible: Zero-net target, Energy storage, Reduce embodied carbon, Site Near transit

Summary: Requirements for Renovations

Energy Efficiency	Evaluate building envelope Upgrade envelope where feasible Establish a low target EUI & take steps to meet it
Space Heating & Cooling	Design teams will evaluate low carbon solutions for thermal energy
Domestic Hot Water	Designs will facilitate the future transition to low- or zero-carbon fuels
Renewable Energy	Where appropriate, design and install renewable energy, energy storage, and related infrastructure
Resilience	Maximize resilient design

Summary: Requirements for Existing Buildings

Energy Efficiency	• Participate in all incentive programs • Operate efficiently • Install highest efficiency equipment
Space Heating & Cooling **Domestic Hot Water**	• Reduce or eliminate emissions from onsite fossil fuels where possible • Eliminate heating oil • Use 10% biodiesel where oil remains
Other	• Monitor building energy performance • MAFMA will offer regular training and professional development for agencies