Zero Net Carbon Building Zoning

A Better City

boston planning & development agency

January 21, 2021

ZERO NET CARBON BUILDING ZONING INITIATIVE

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Boston Planning & Development Agency

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bostonplans.org/ZNCBuildingZoning

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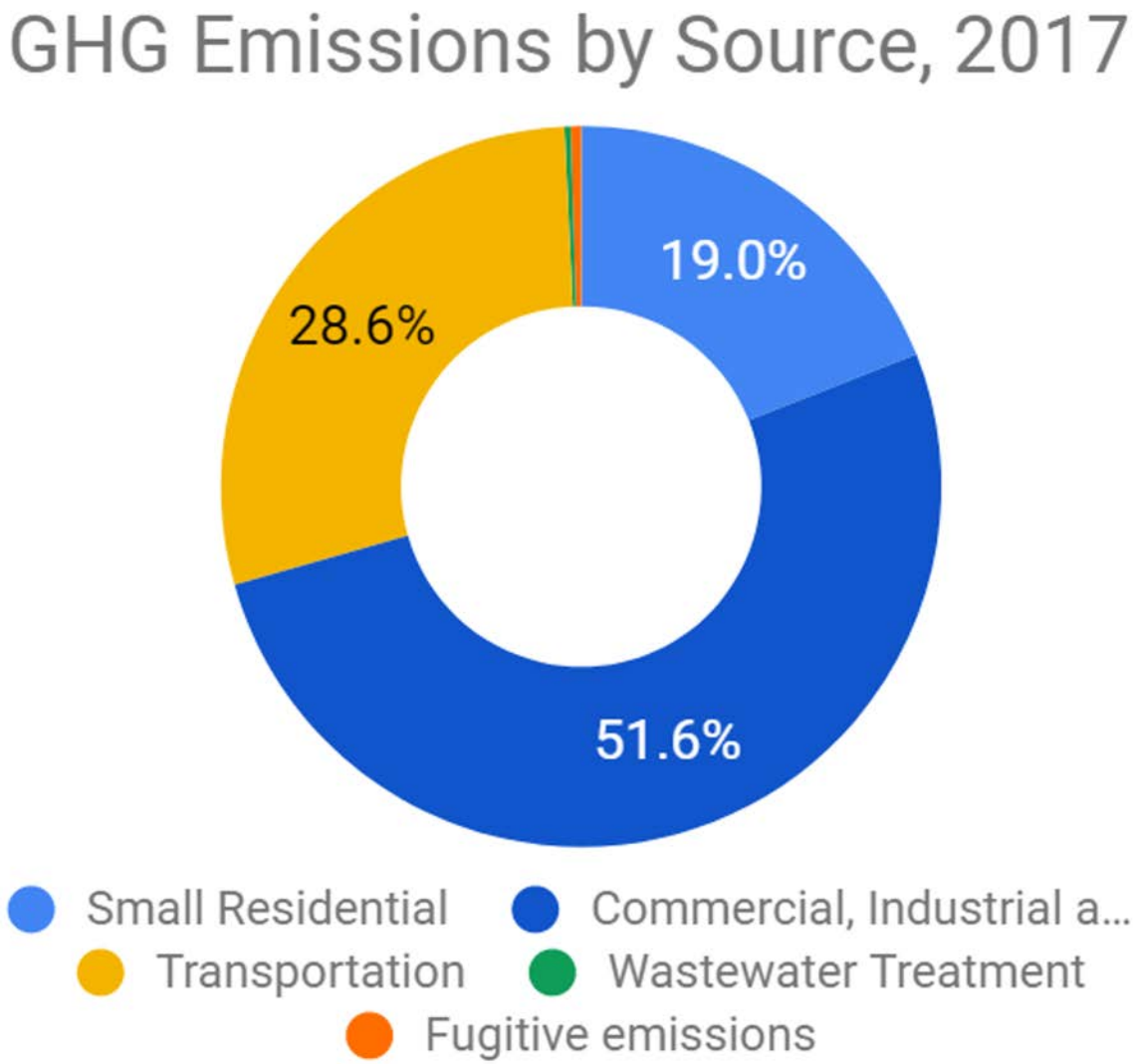
BOSTON'S CARBON FOOTPRINT

Boston's emissions have decreased by approximately 20% since 2005, but we are not on track to achieve our long-term goals.

Buildings represent 70% of Boston's emissions.

To reach carbon neutrality, we need to accelerate carbon reductions and decarbonize Boston's building sector.



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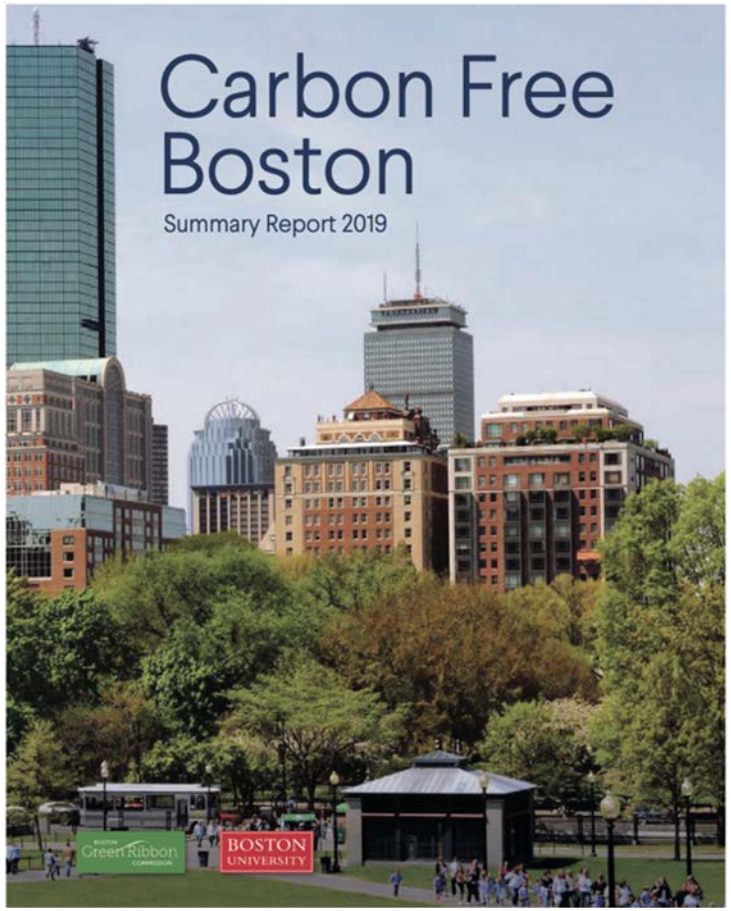
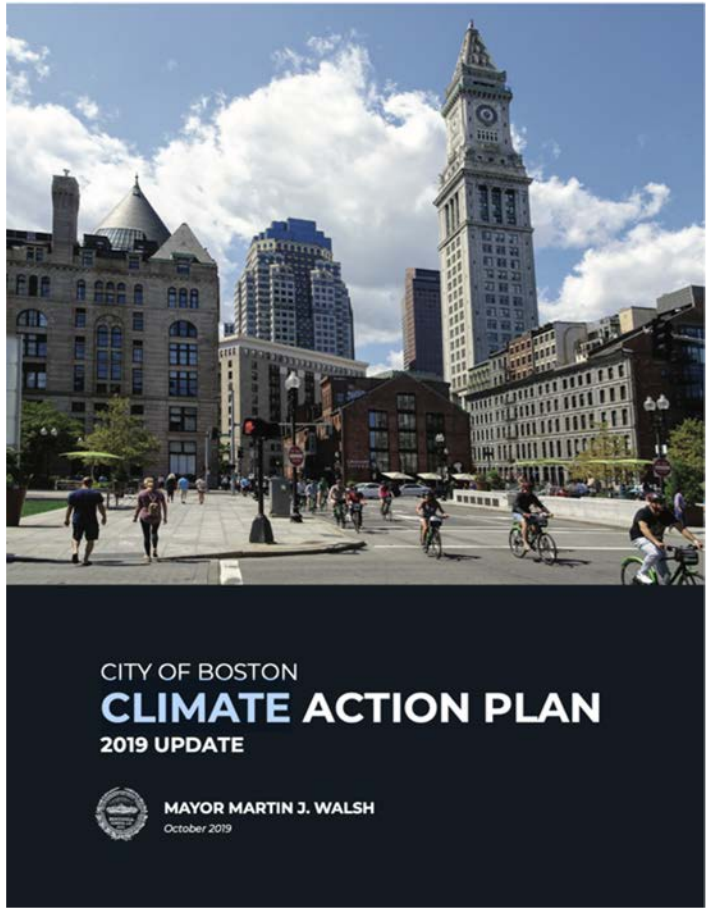
Understanding what it takes to get to carbon neutrality...



... to inform the 2019 Climate Action Plan update



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NEW BUILDINGS & MAJOR RENOVATIONS

1 CONSTRUCT NEW MUNICIPAL BUILDINGS TO A ZERO NET CARBON STANDARD **B**

2 ADOPT A ZERO NET CARBON STANDARD FOR CITY-FUNDED AFFORDABLE HOUSING IN BOSTON **B**

3 STRENGTHEN GREEN BUILDING ZONING REQUIREMENTS TO A ZERO NET CARBON STANDARD

EXISTING BUILDINGS

4 INVEST IN ENERGY EFFICIENCY AND RENEWABLE ENERGY GENERATION IN MUNICIPAL BUILDINGS **B**

5 DEVELOP A CARBON EMISSIONS PERFORMANCE STANDARD TO DECARBONIZE EXISTING LARGE BUILDINGS

ENABLING STRATEGIES

6 EXPAND WORKFORCE DEVELOPMENT PROGRAMS FOR BUILDING DECARBONIZATION

7 ADVOCATE FOR STATE BUILDING POLICIES THAT ALIGN WITH CARBON NEUTRALITY BY 2050

3 | STRENGTHEN GREEN BUILDING ZONING REQUIREMENTS TO A ZERO NET CARBON STANDARD

Art. 37 within Art. 80 review

- LEED-certifiable
- Resiliency checklist
- Carbon Neutral Building Assessment
- Integration with Smart Utilities

Steps to adopt a ZNC standard:

- Engage consultants for technical analysis of standards and phasing
- Launch stakeholder engagement process

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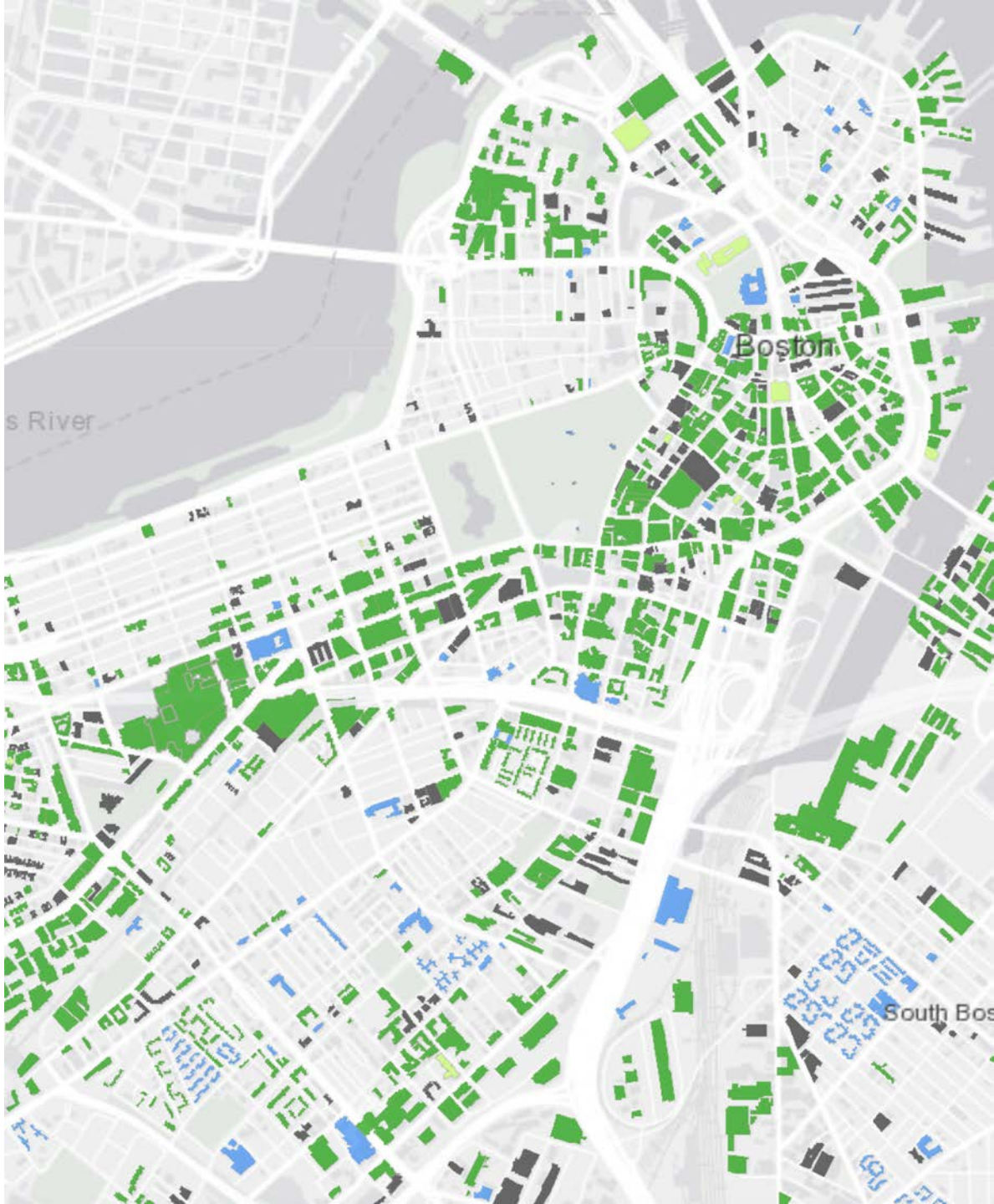
5 DEVELOP A CARBON EMISSIONS PERFORMANCE STANDARD TO DECARBONIZE EXISTING LARGE BUILDINGS

Current policy: Building Energy Reporting and Disclosure Ordinance

Goal: develop a carbon emissions performance standard

- Develop specific targets for different building types
- Evaluate covering more buildings
- Develop new support programs
- Pilot deep energy retrofits



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ZNC Building Zoning

POLICY FRAMEWORK

Low Carbon Building
Establish Emission Targets

On-site Renewable Energy
On-site Energy Generation Standard

Renewable Energy Procurement
Determine Options & Reporting

Bunker Hill Housing – Building F
Proposed design modeled performance (271,844 SF, EUI 19.1, Solar PV 81.9 kW = 104,500 kWh/yr)
Building CO_2e = 1.48 (kg/sf/yr) emission
Solar CO_2e = 0.12 (kg/sf/yr) reduction

Building	445. tons / yr
On-site RE	36. tons / yr (less)
RE Procure	409. tons / yr (less)
ZNCarbon	0.

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ZNC Building Zoning Initiative

PUBLIC PROCESS AND SCHEDULE - 2020 - 2021

- Outreach – August and September
- Public Meeting #1 – September 30th
- Stakeholder and Public Engagement – October and onward
- Technical Advisory Groups – October and onward
- Public Meeting #2 – late winter / early spring
- Public Regulatory Meetings – spring 2021

TEAM

- Thornton Tomasetti
- Cadmus Group / SolSmart
- Architecture 2030
- City / BPDA Staff

LOW CARBON BUILDINGS

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Vice President, Sustainability

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***Colin Schless**, CPHC, LEED AP*

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Jacob Knowles

Director of Sustainable Design

BR+A Consulting Engineers

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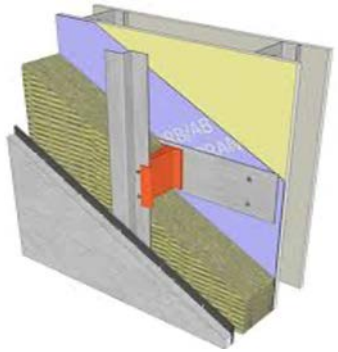
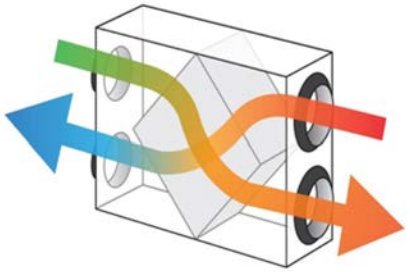
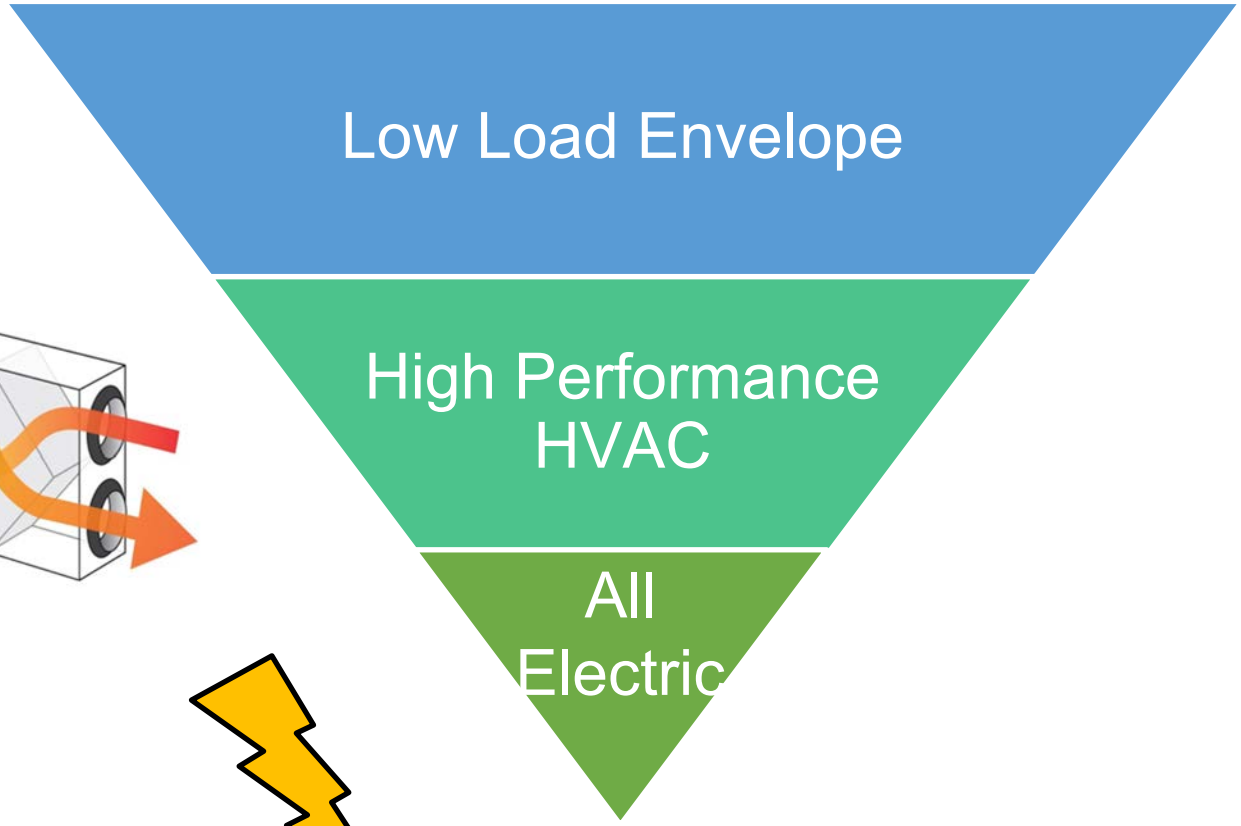
Low Carbon Buildings

- What are they?
- Are they a realistic goal for Boston?
- How to design them cost-effectively?

Path to Low Carbon







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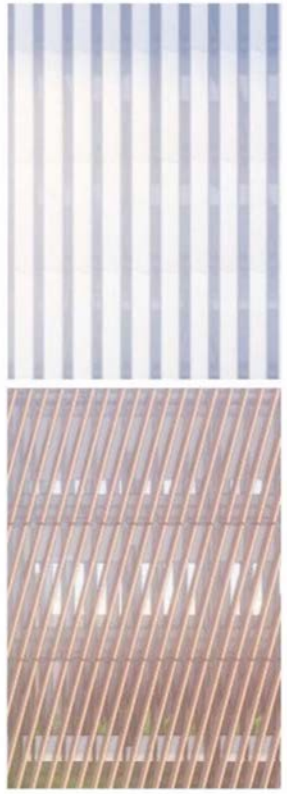
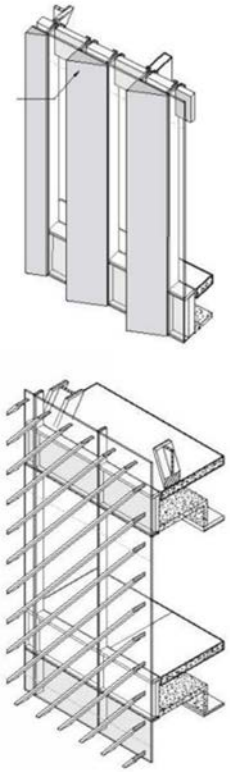
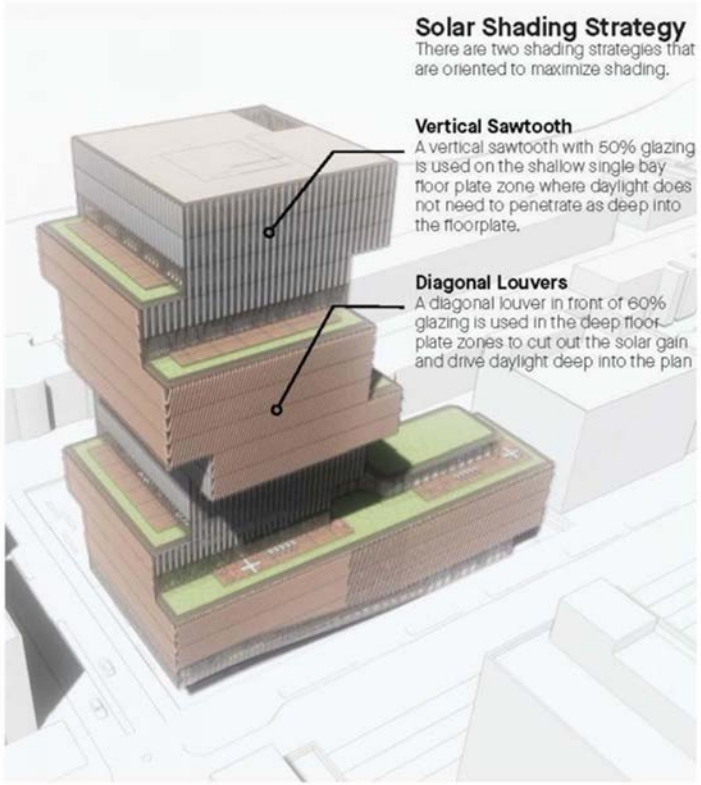
BU Data Sciences Building







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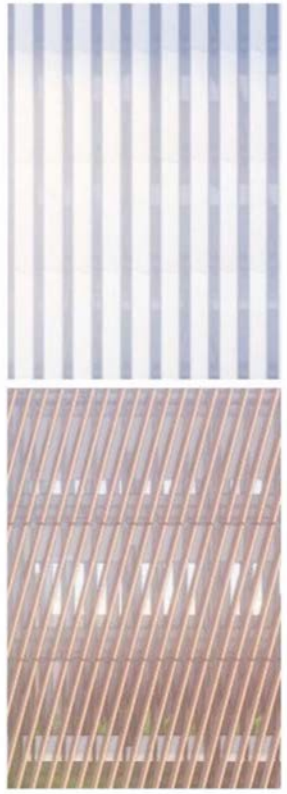
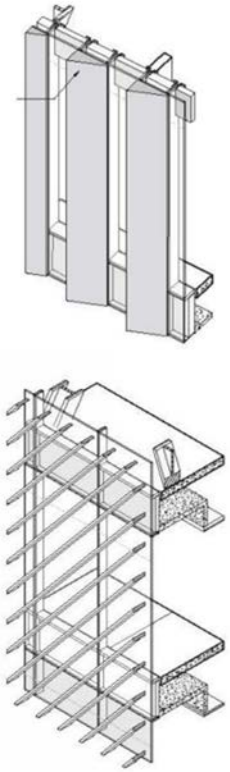
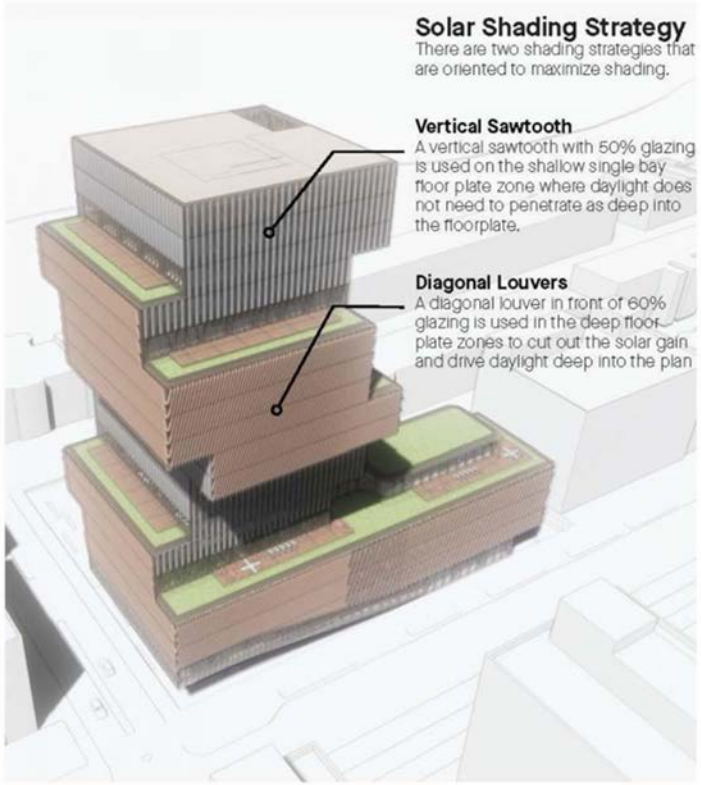
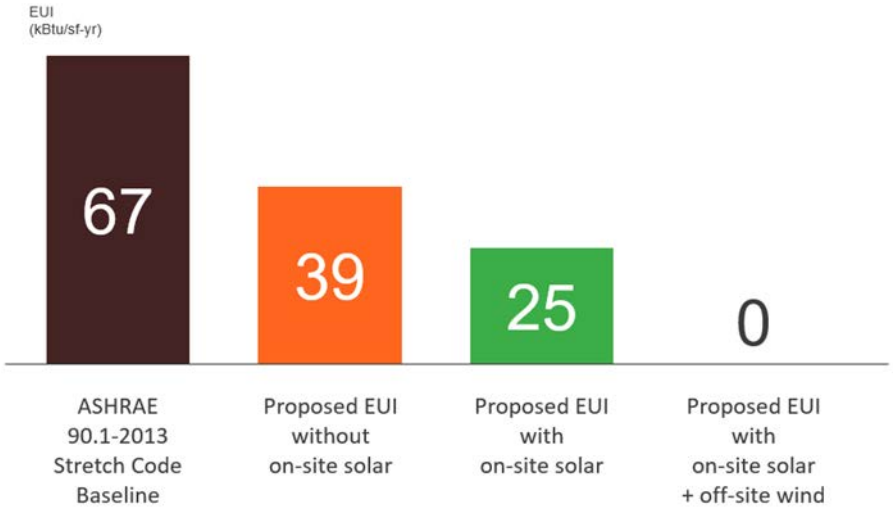
BU Data Sciences Building









Construction Cost Premium
< 1%

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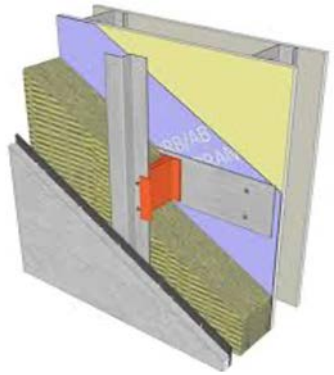
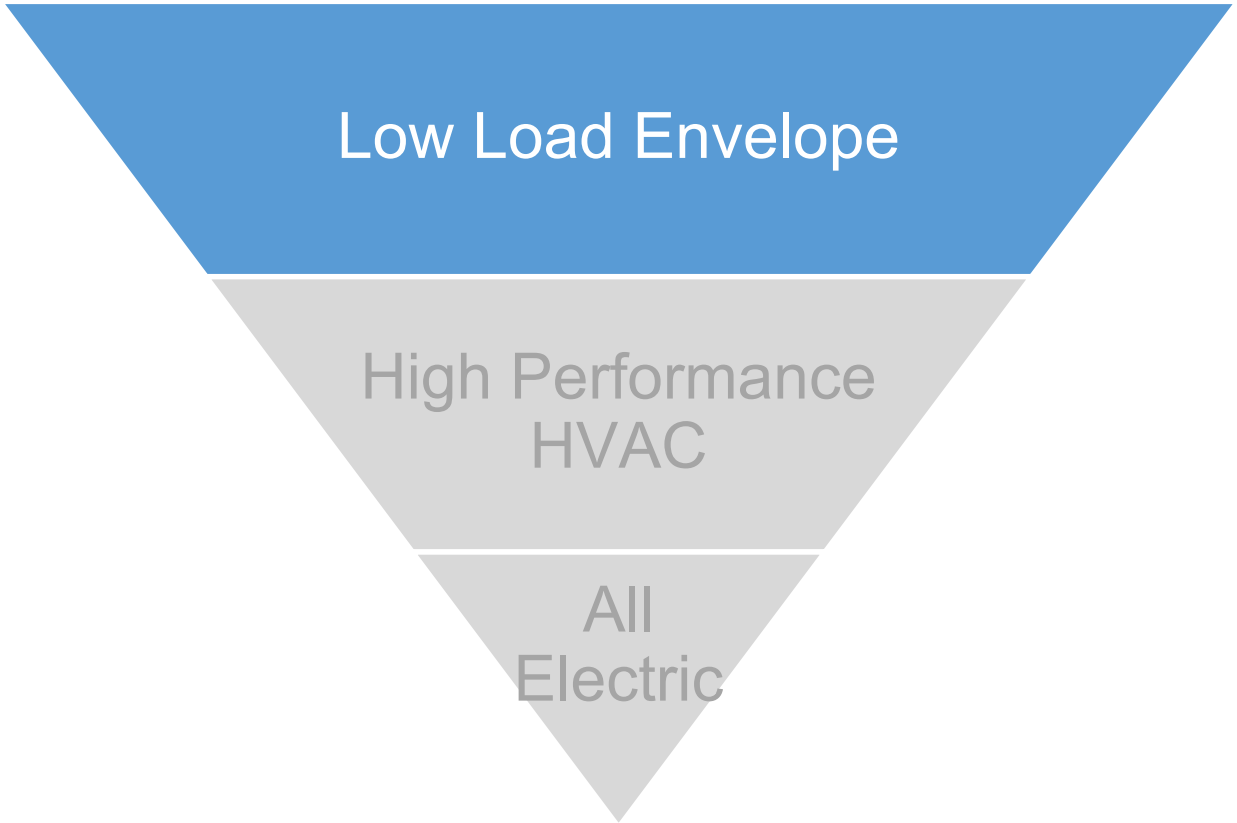
Path to Low Carbon





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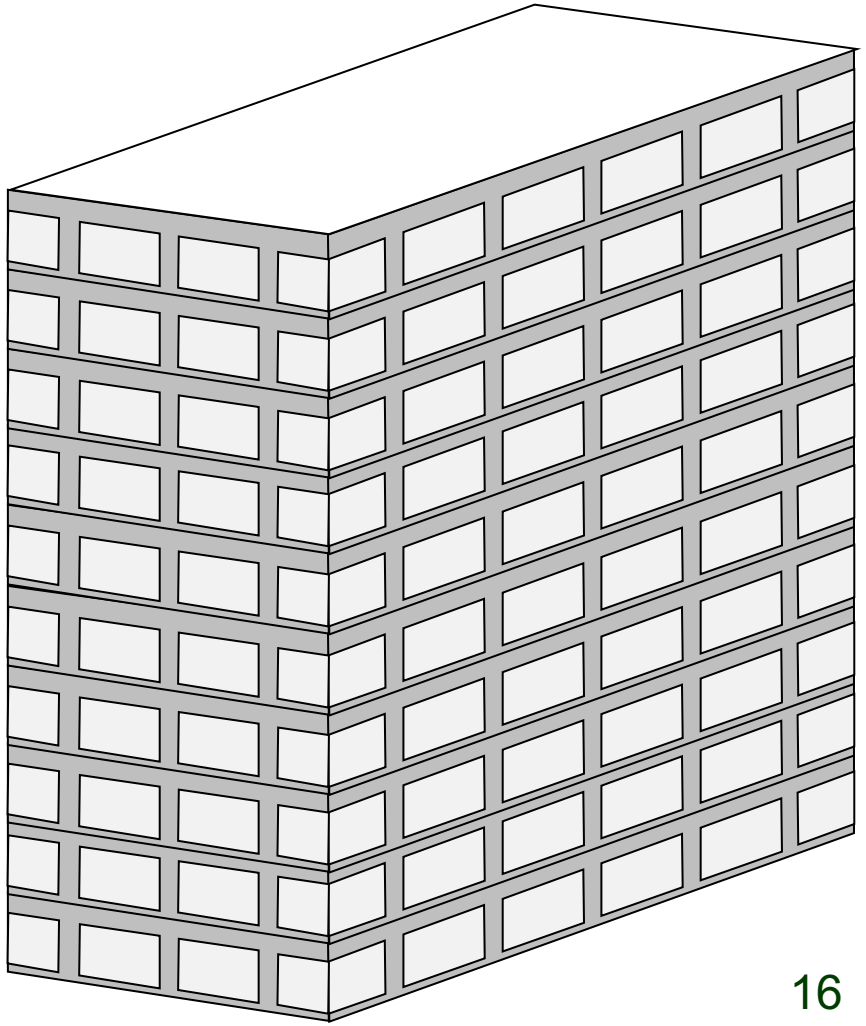
Low Load Envelope

Area Weighted “UA”

$$UA = \frac{U_{window} * A_{window} + U_{roof} * A_{roof} + U_{wall} * A_{wall} + \ldots}{A_{envelop}}$$



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Low Load Envelope

Area Weighted “UA”

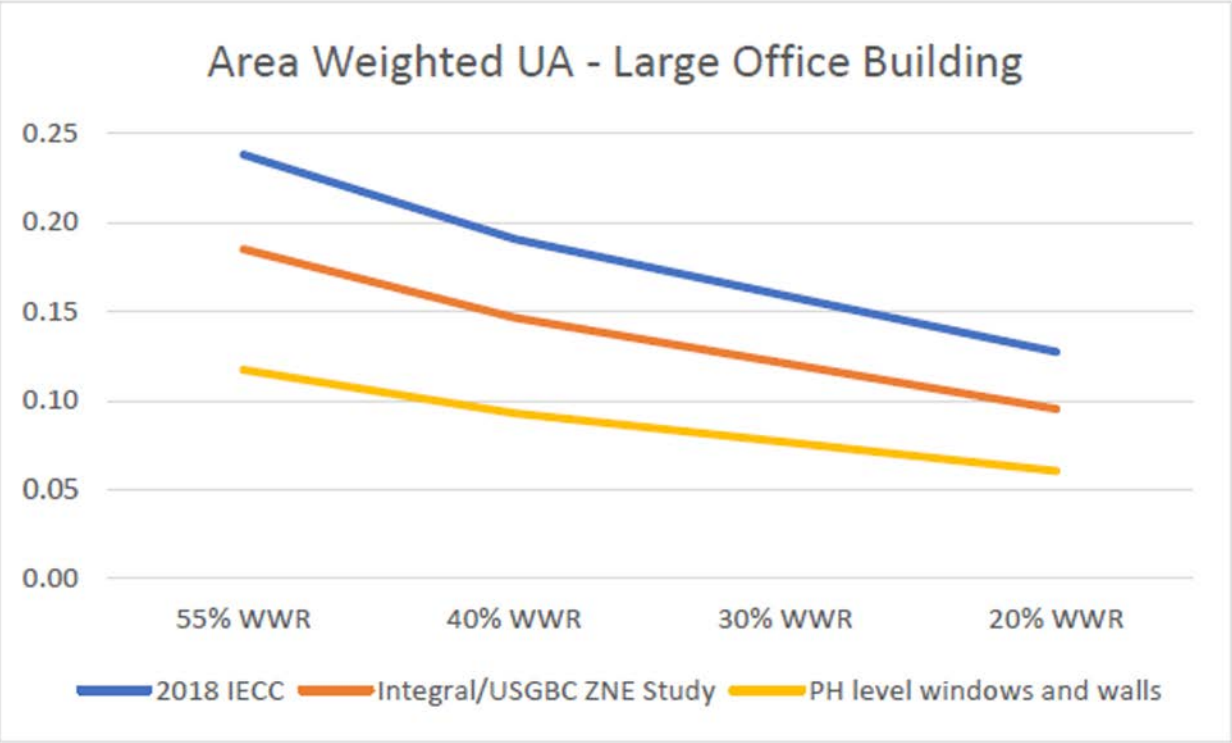

Figure 4: Large Office UA Comparison

New Buildings Institute, *“Building Performance Targets and Building Prototype Profiles for Boston - DRAFT”, Feb 2020*

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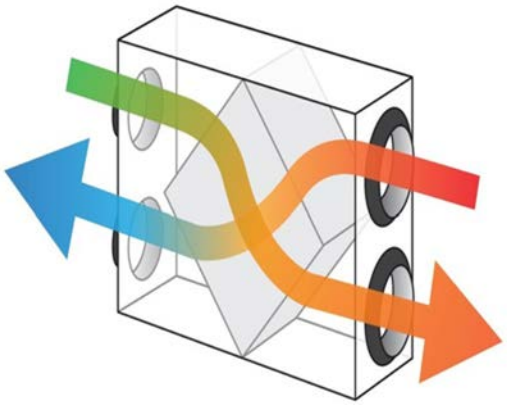
Path to Low Carbon



Low Load Envelope

High Performance HVAC

All Electric

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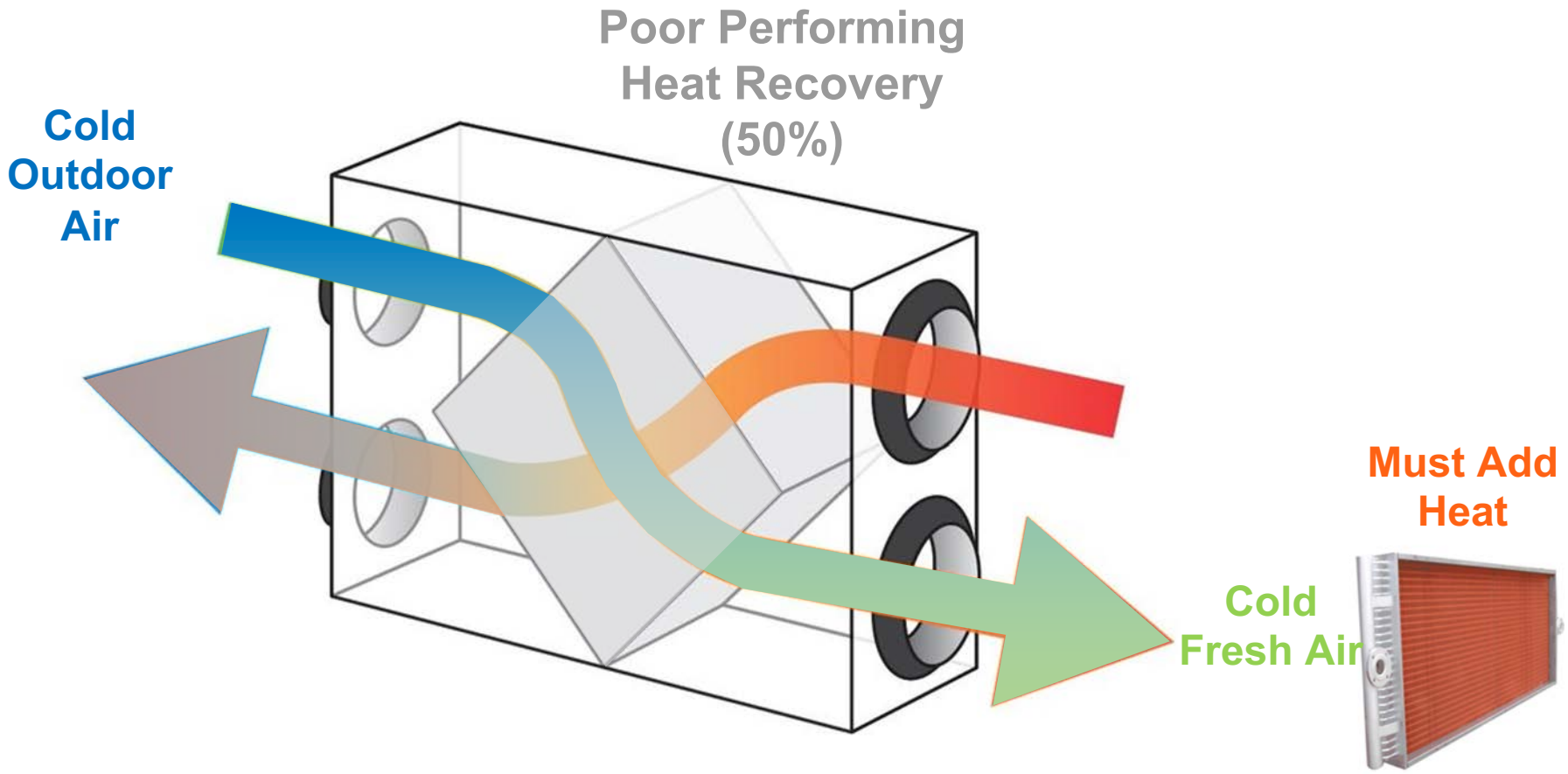
High Performance HVAC

High Efficiency Energy Recovery



New Buildings Institute, *"Building Performance Targets and Building Prototype Profiles for Boston - DRAFT", Feb 2020*

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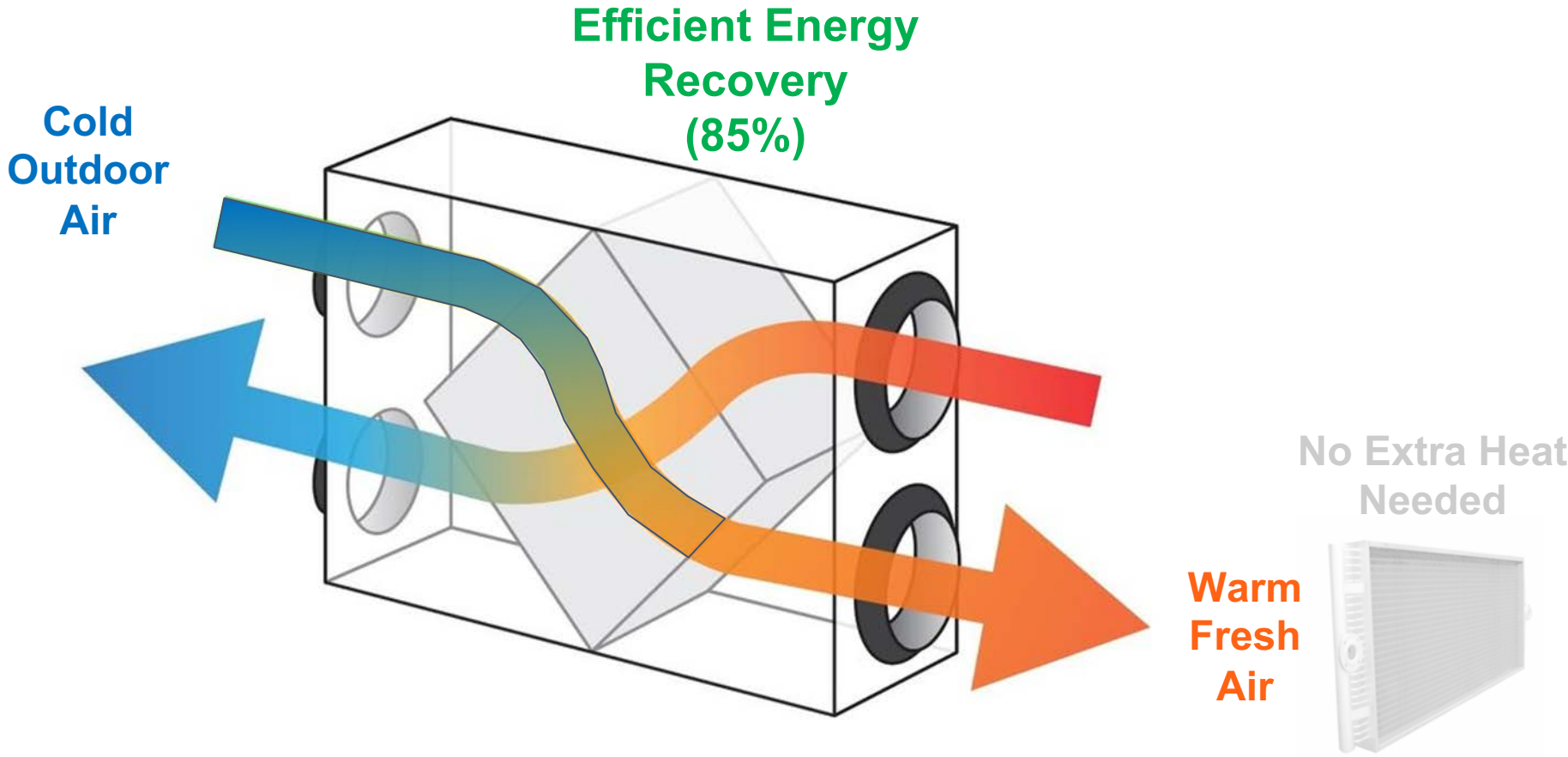
High Performance HVAC

High Efficiency Energy Recovery



New Buildings Institute, *"Building Performance Targets and Building Prototype Profiles for Boston - DRAFT", Feb 2020*

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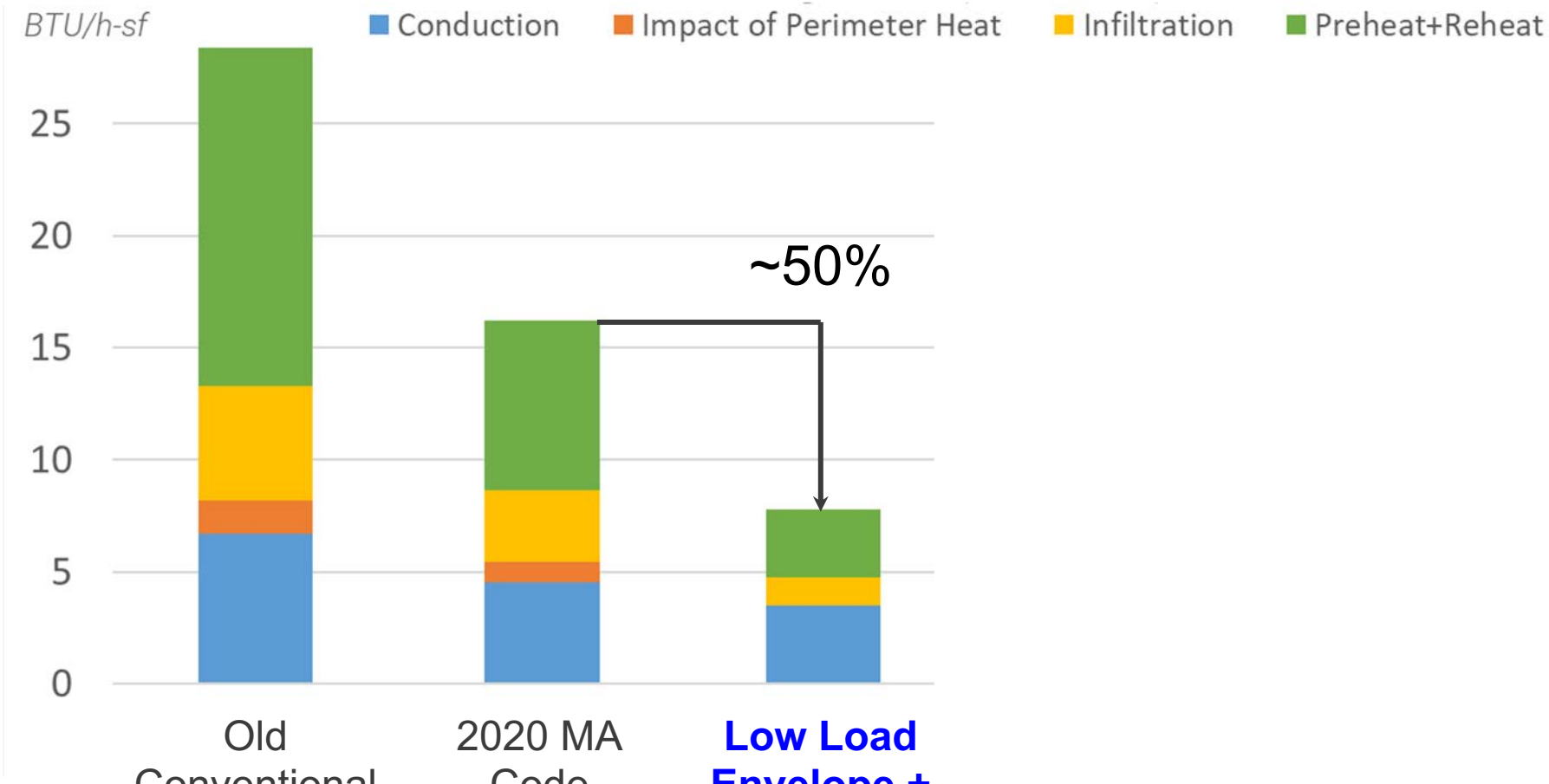
Low Load Buildings



*Varies by building type.

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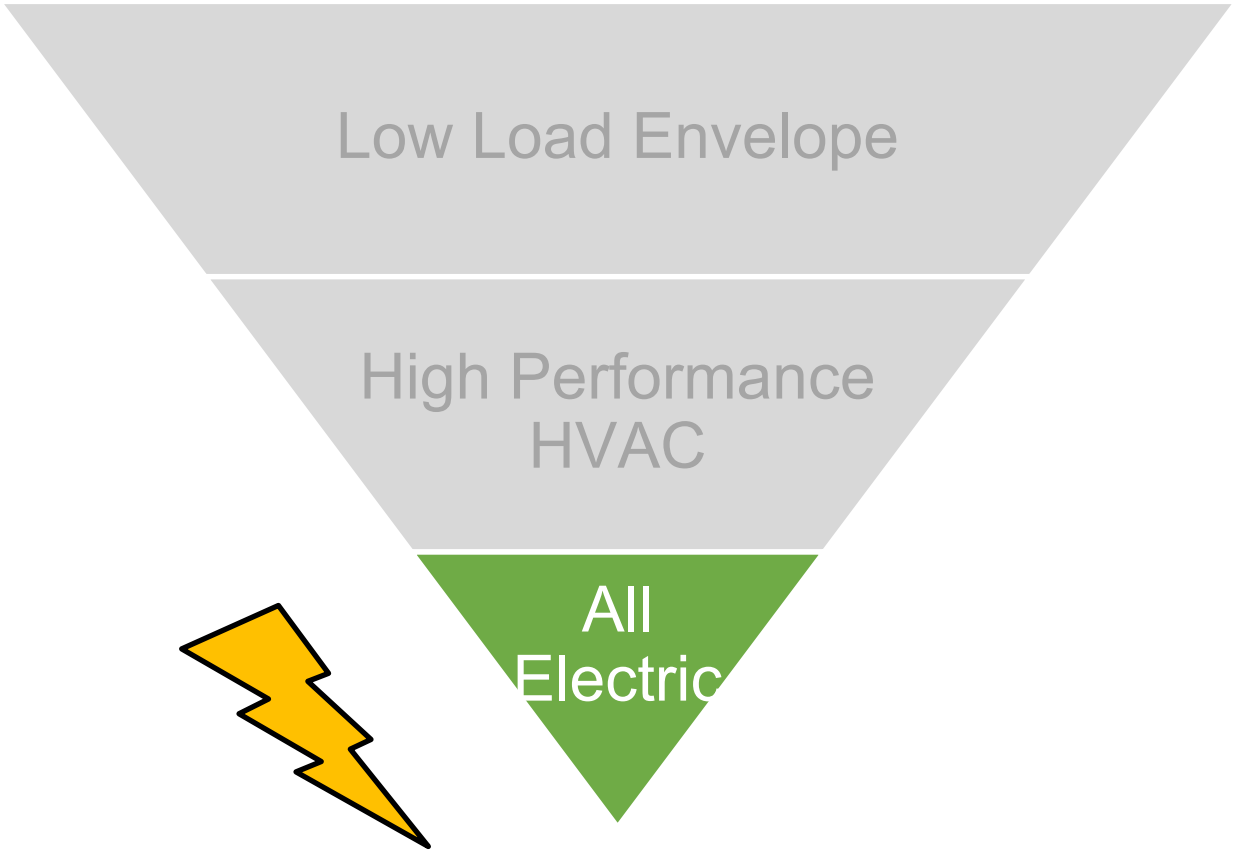
Path to Low Carbon



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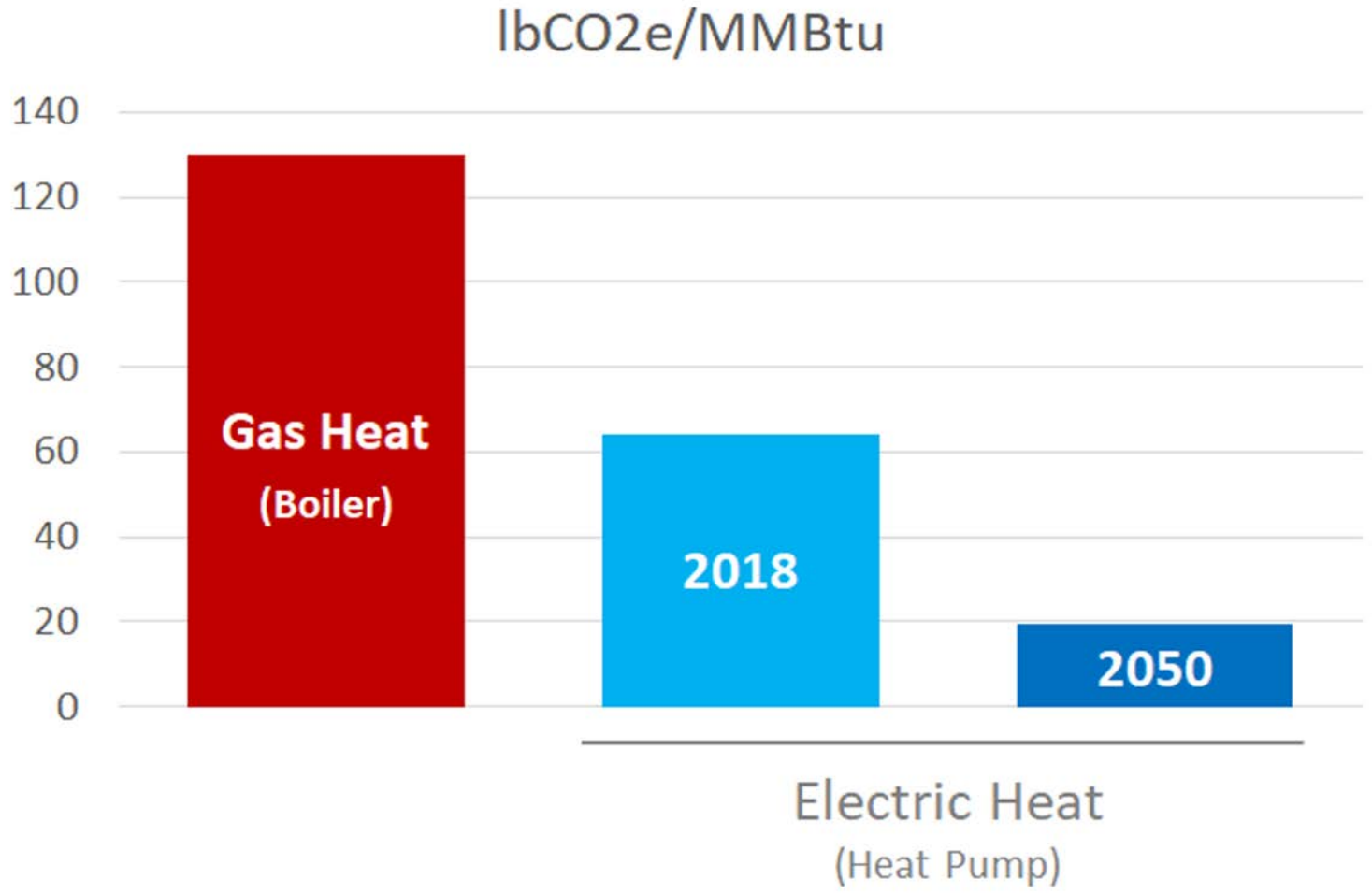
Gas vs. Electric heating: CO2e emissions



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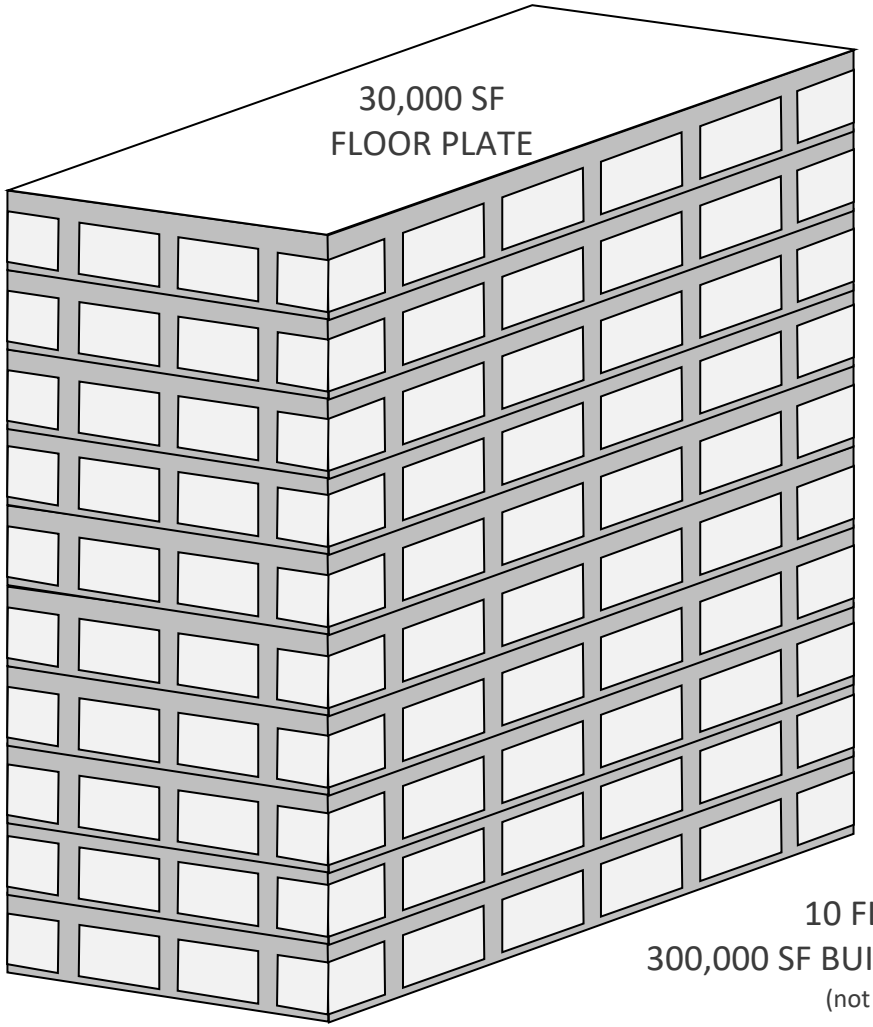
Very Expensive Path to All-Electric

Capacity Required for Heating

Old Conventional

Heating Load: 28 btu/sf



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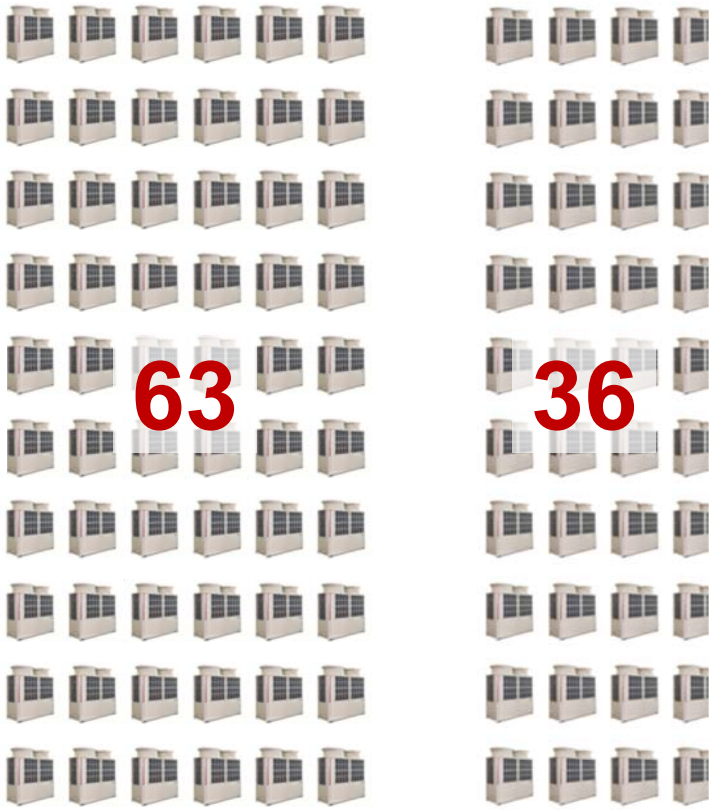
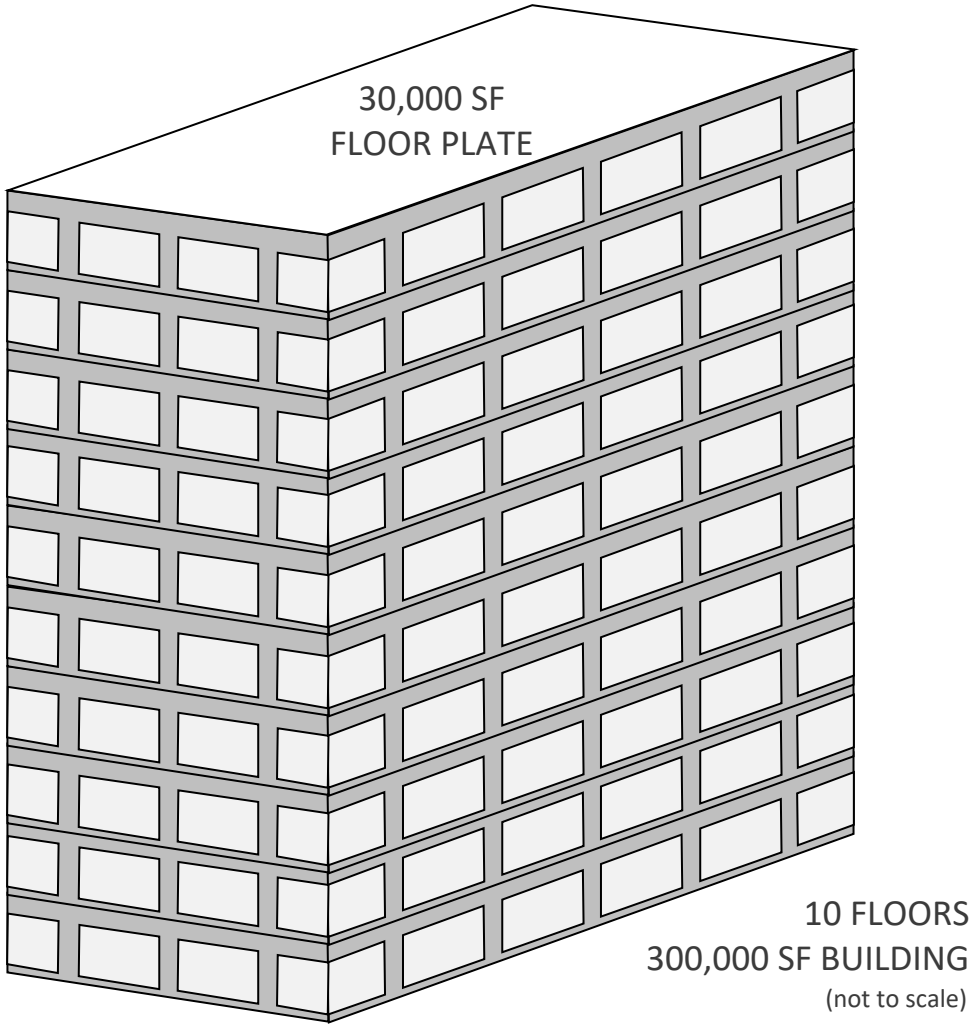
Expensive Path to All-Electric

Capacity Required for Heating



	Old Conventional	2020 MA Code
Heating Load:	28 btu/sf	16 btu/sf



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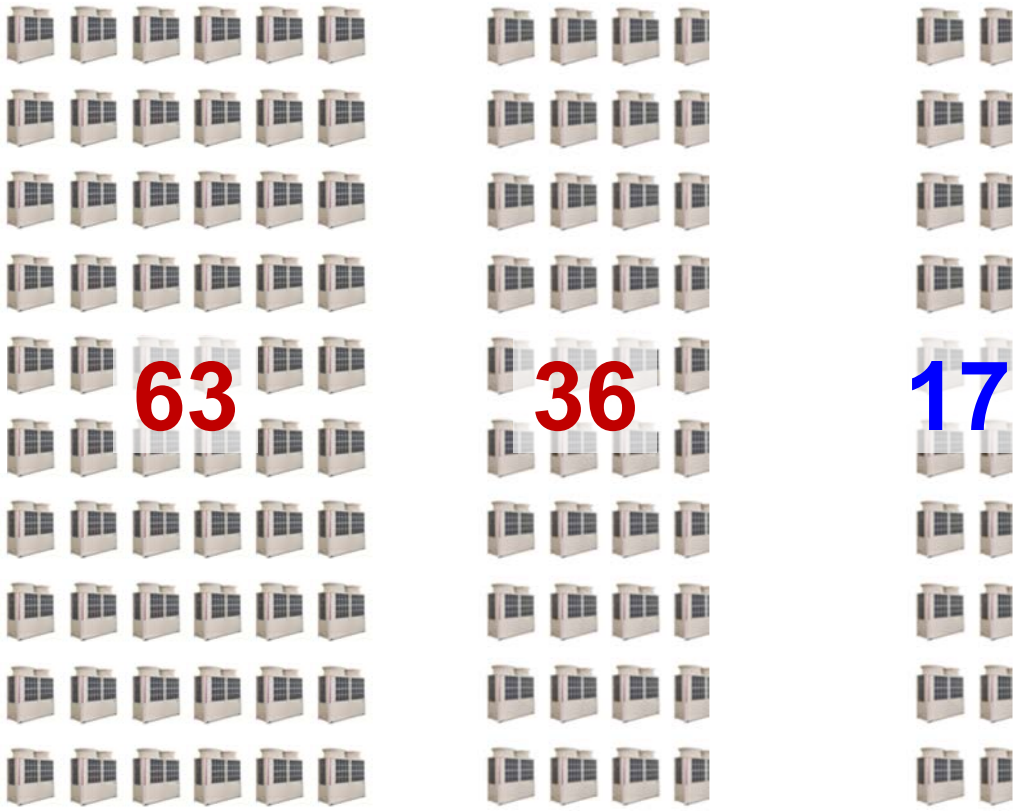
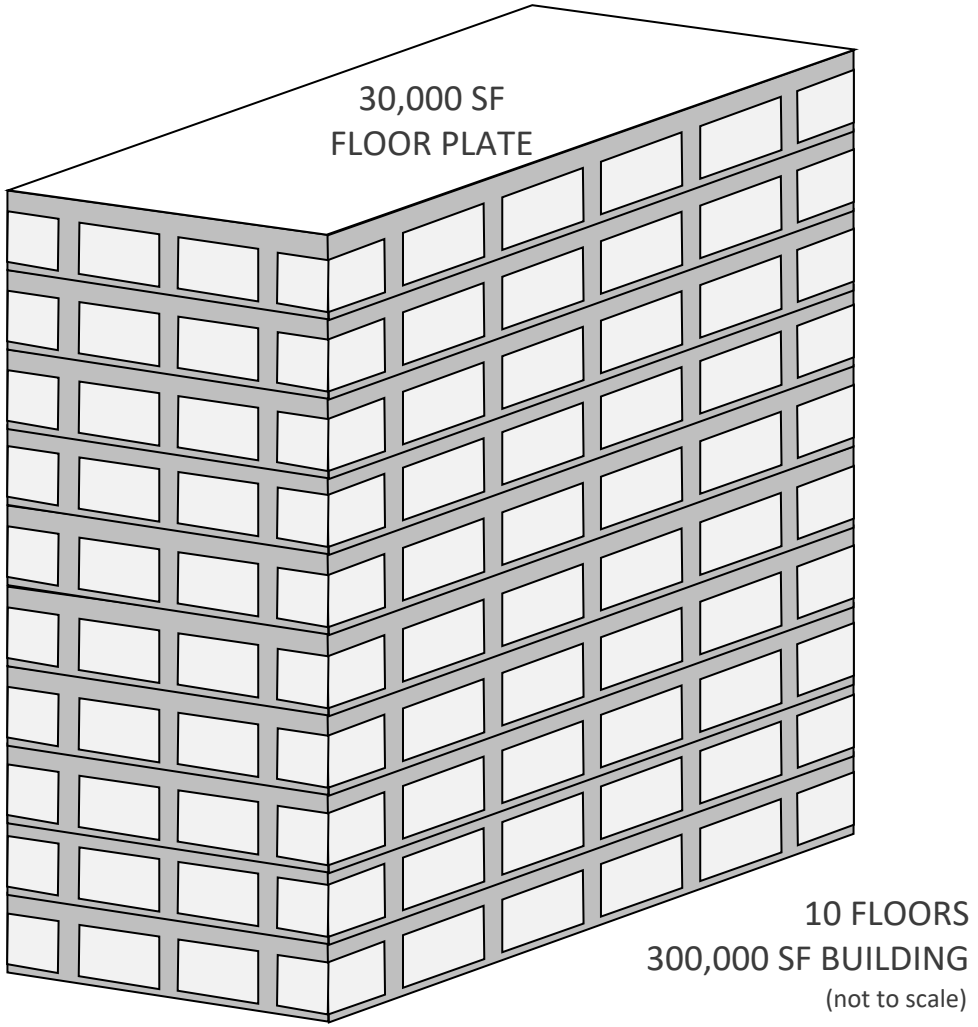
Cost-Effective Path to All-Electric

Capacity Required for Heating



	Old Conventional	2020 MA Code	**Low Load**
Heating Load:	28 btu/sf	16 btu/sf	8 btu/sf



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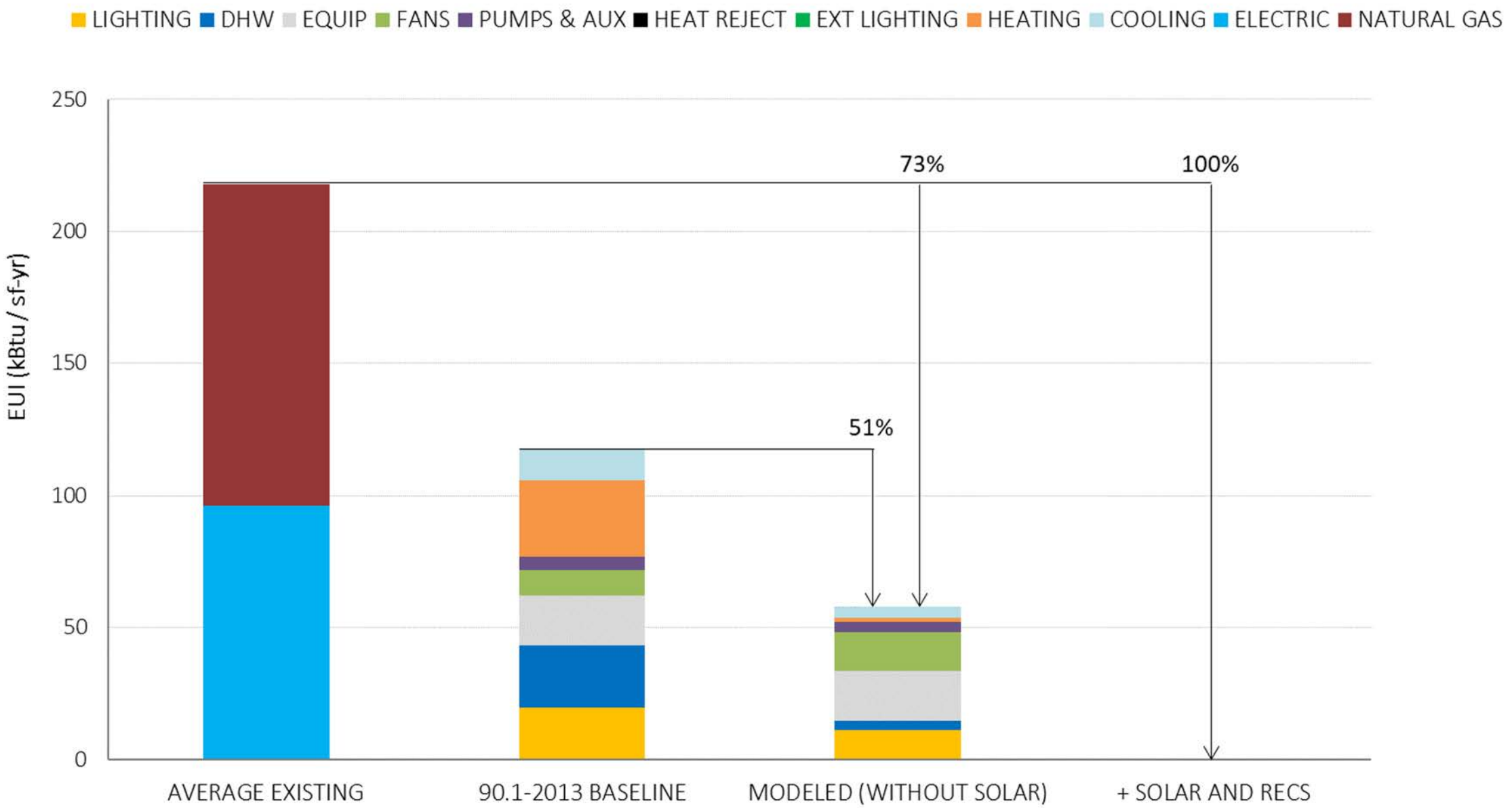
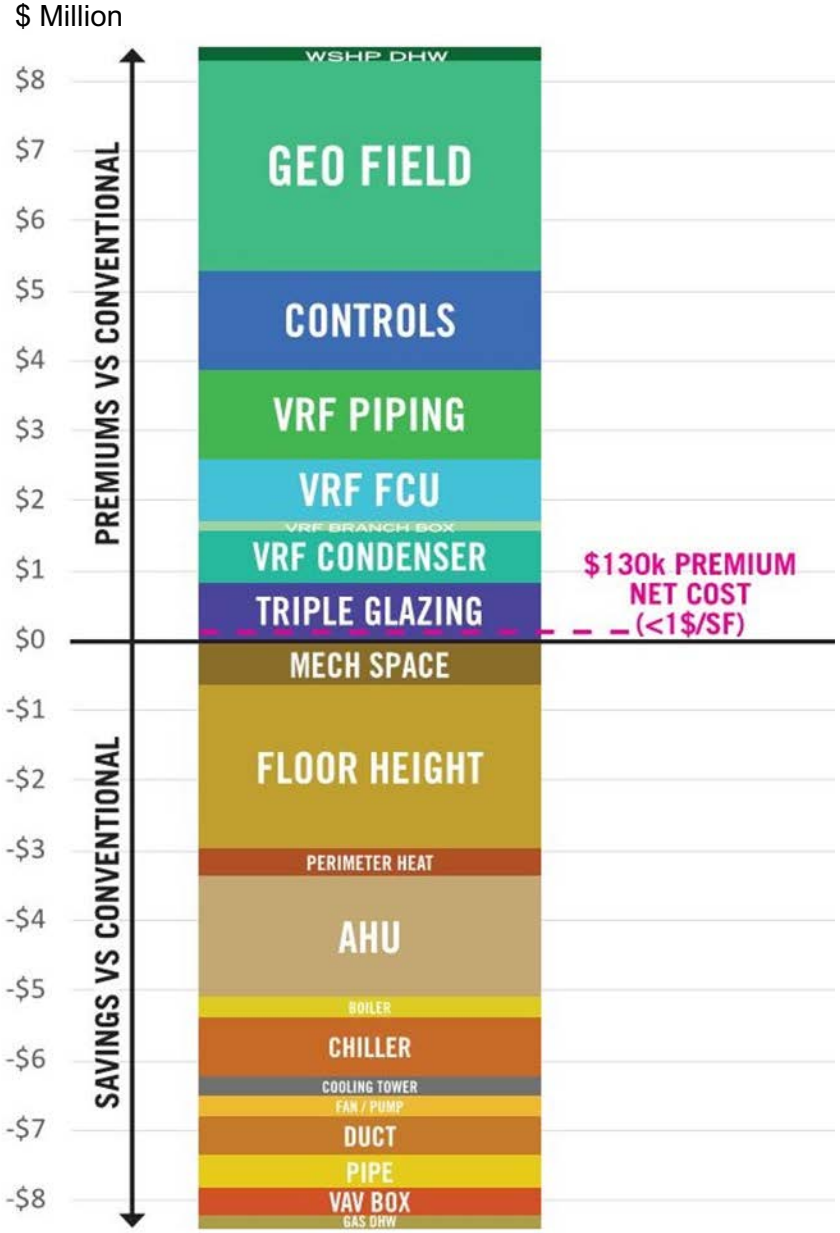
Case Study: Chelsea Soldiers' Home

- 30% Window-to-Wall Ratio
- Triple pane glass
- Highly insulated envelope
- Ground Source Heat Pump + VRF
- Dual heat wheel

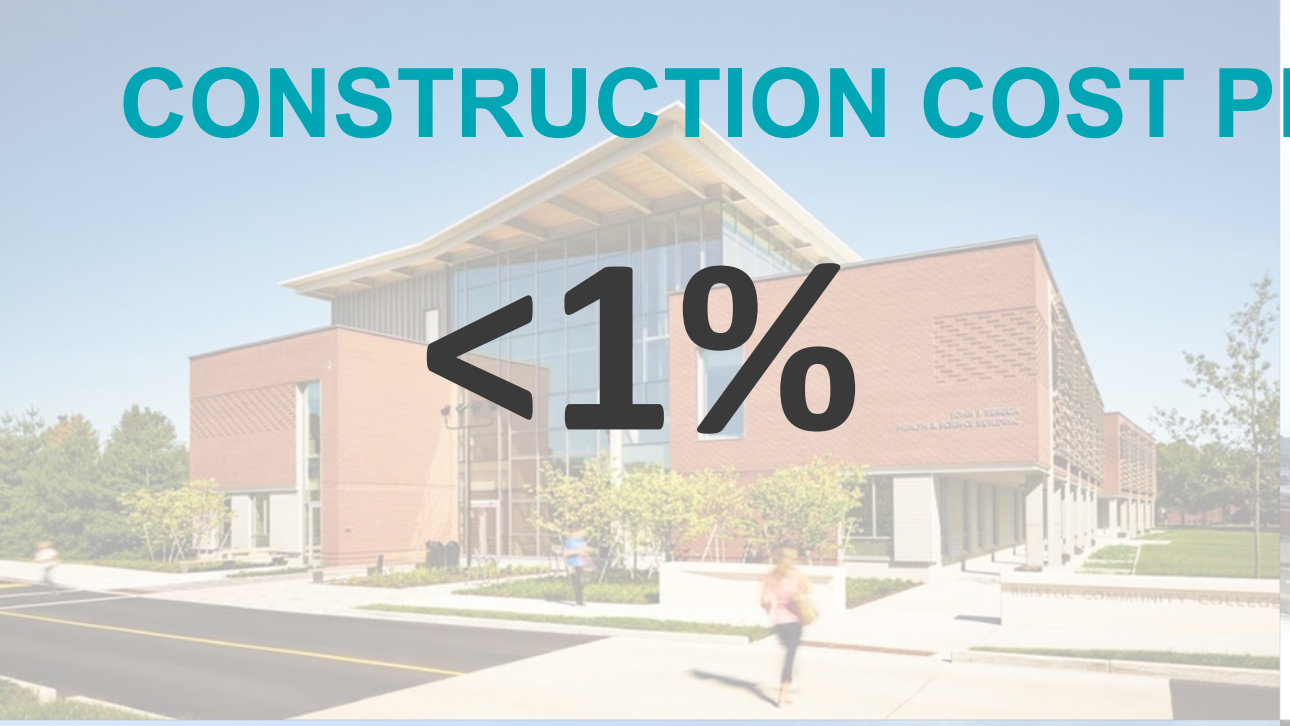
Chelsea Soldiers' Home Energy



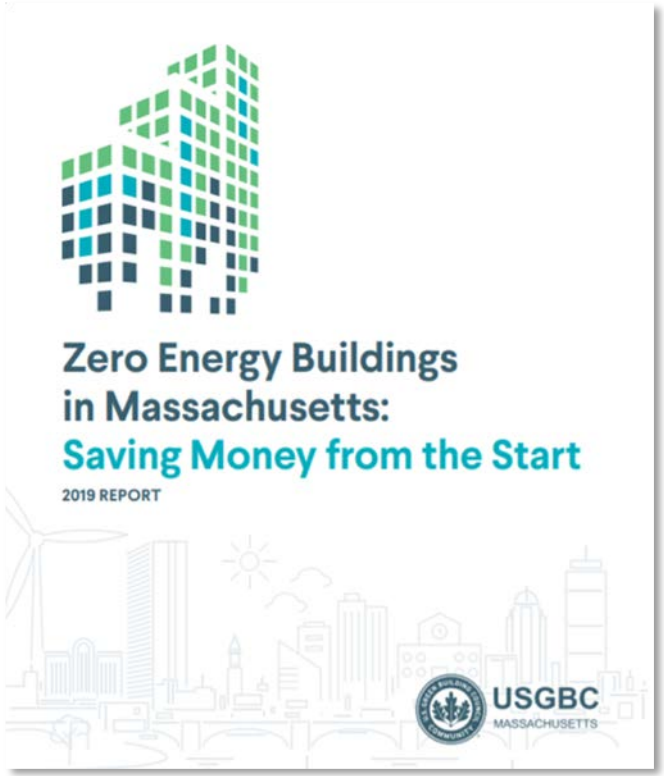
ZNE Net Construction Cost

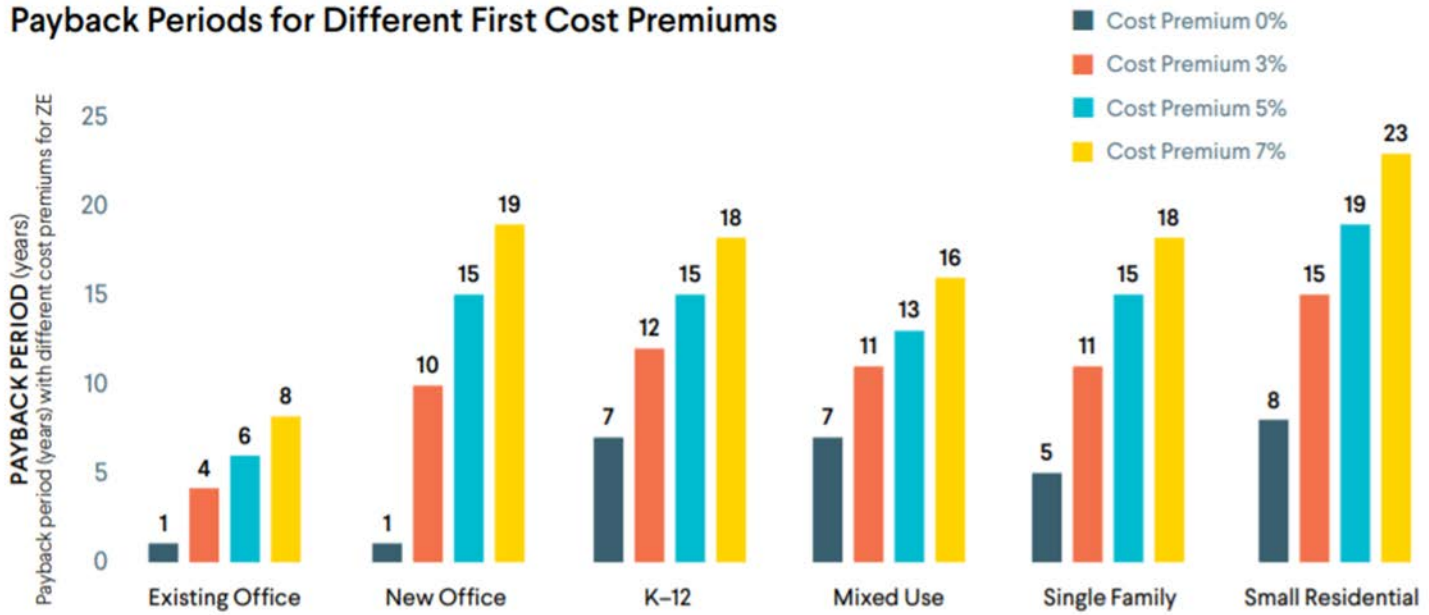


CONSTRUCTION COST PREMIUM



Cost-Effective Net Zero Buildings





https://builtenvironmentplus.org/wp-content/uploads/2019/09/ZeroEnergyBldgMA2019.pdf

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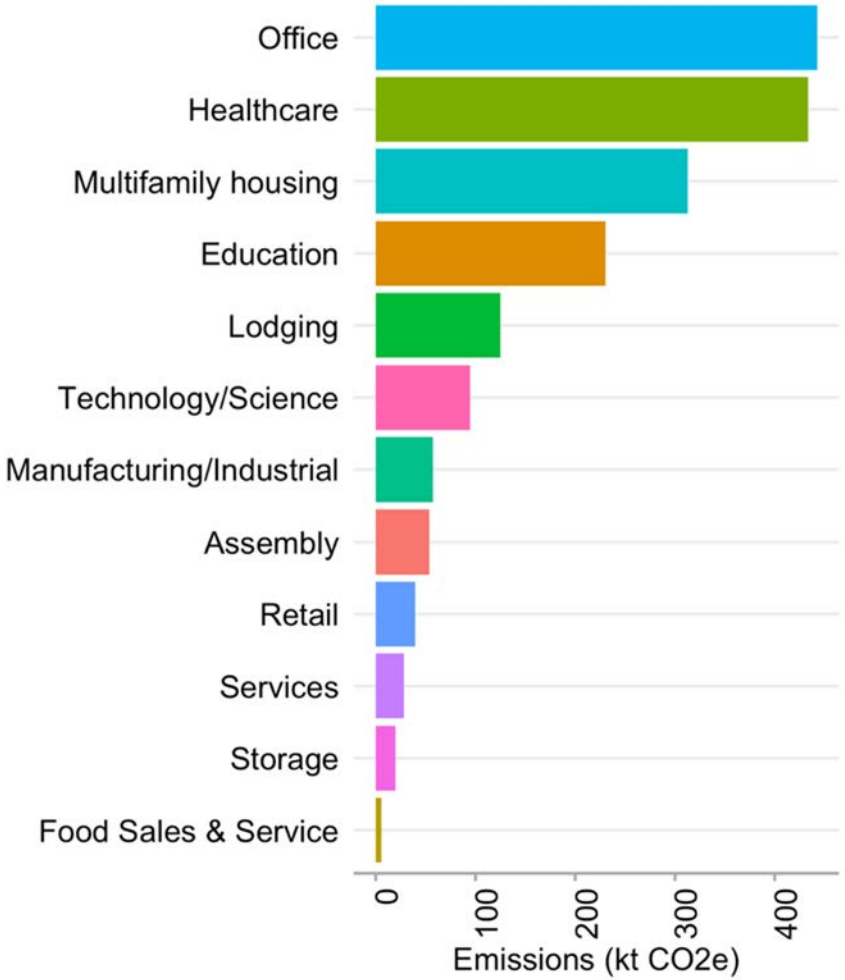
Striving for a ZNC Built Environment in Boston

Carbon Emissions of Boston Buildings <50,000 sf



Goal:
Identify aggressive yet achievable targets for Boston's most common building typologies.

Source: Building Energy Reporting and Disclosure Ordinance (BERDO)

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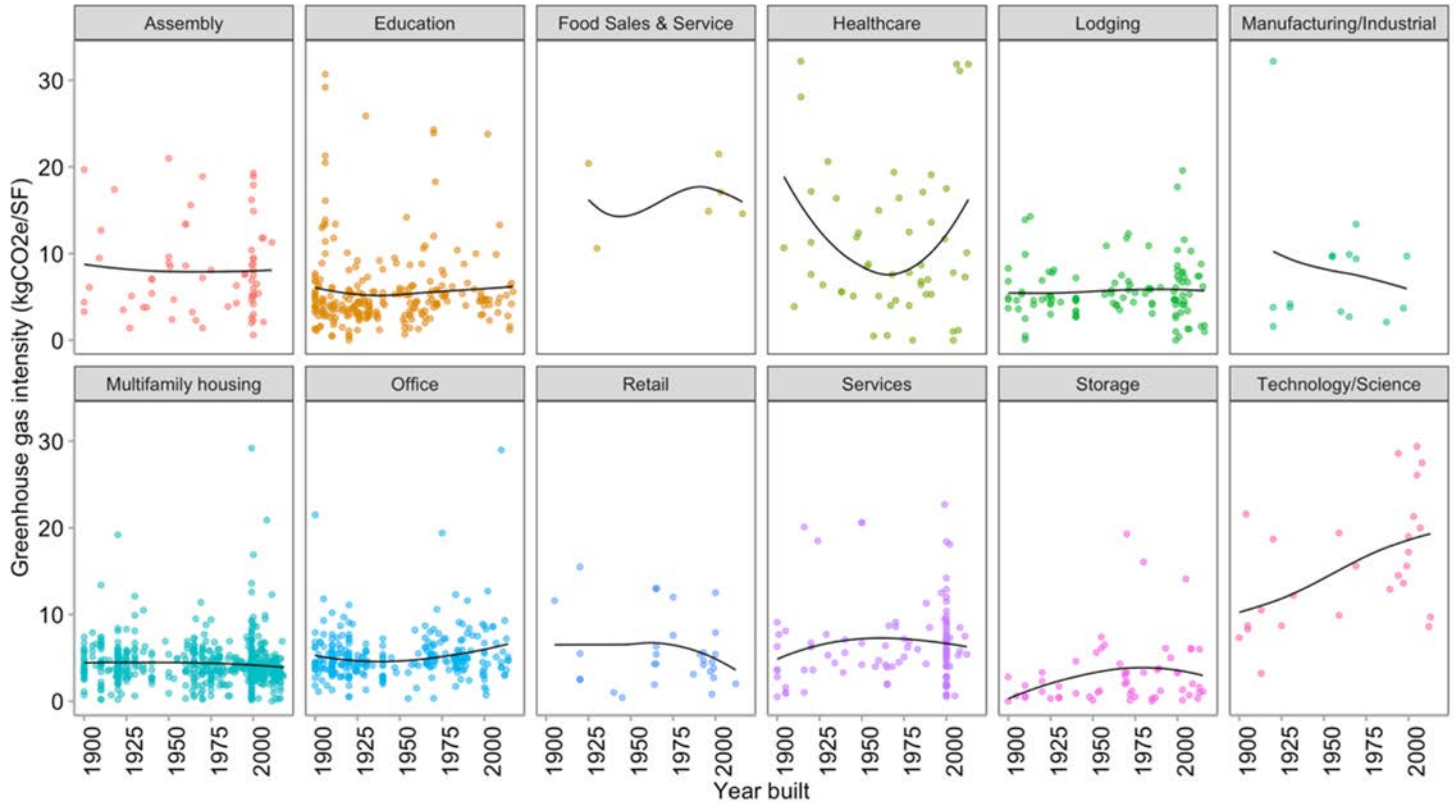
A Data-Driven Process

Carbon Emissions of Boston Buildings <50,000 sf over time



Goal:
Use and understand available data for existing buildings to assess and determine the most achievable targets.

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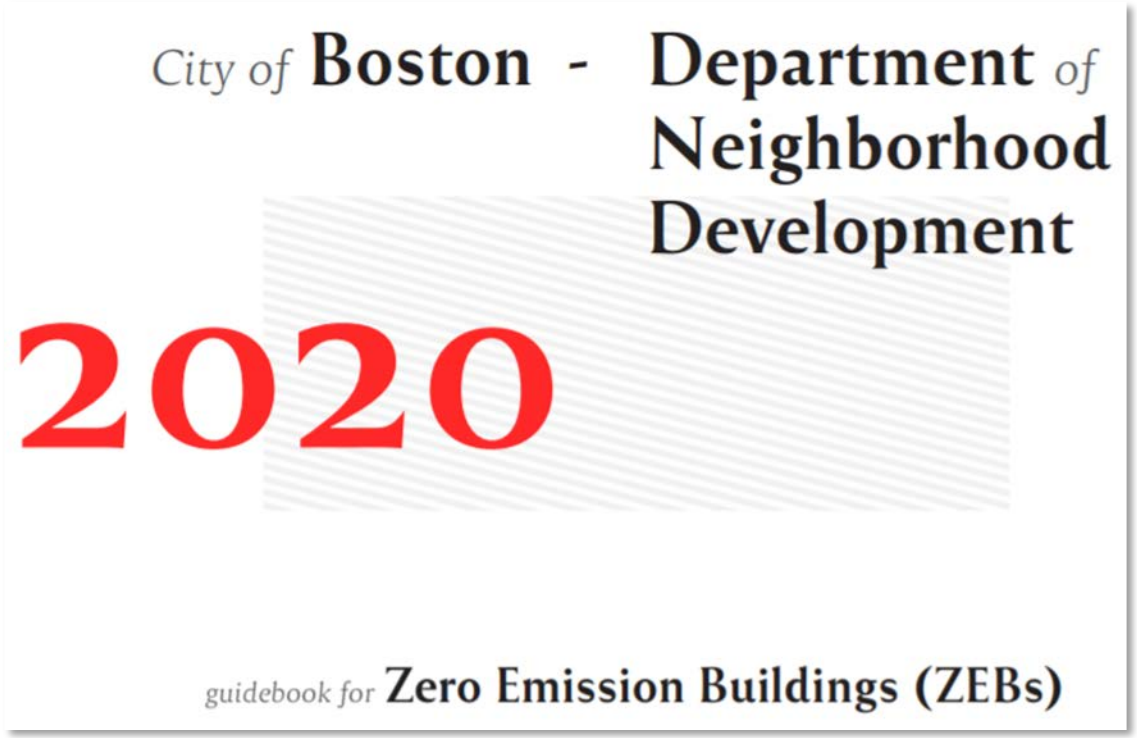
Low Carbon Buildings: Reference Documents



Goal:

Incorporate methods proposed in recently-issued studies and guidelines.

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Low Carbon Buildings Zoning

Process to date:
5 month draft development with regular feedback from Technical Advisory Group.

Framework:

- Applicable to all building typologies
- Aligned with utility incentive and industry practice process, market-friendly
- Simple to review (relying on third party frameworks as much as possible)
- Compatible with upcoming BERDO emissions performance standard
- Performance targets aligned with achievable best-in-class buildings in New England

ON-SITE RENEWABLE ENERGY

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Cadmus Group and SolSmart

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www.CadmusGroup.com

CADMUS

SOLSMART

NATIONALLY DISTINGUISHED. **LOCALLY POWERED.**

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Boston – SolSmart

Through SolSmart designation, Boston is recognized for its efforts to reduce local barriers to solar energy and is eligible for technical assistance to foster the growth of stronger solar market.

Photo by Roman Piaskoski, NREL 07172

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On-Site Renewable Energy

Net Zero buildings integrate **on-site** renewable energy as much as possible and procure off-site renewable energy as necessary.

On-site renewable energy is located on:

- the building,
- the property upon which the building is located,
- a property that shares a boundary with and is under the same ownership or control as the property on which the building is located, or
- a property that is under the same ownership or control as the property on which the building is located and is separated only by a public right-of-way on which the building is located.

Benefits of Local Generation

- Emission reductions
- Public health
- Job creation
- Grid management
- Resilience

E+ 232 Highland, Credit: Studio G Architects

Optimizing On-Site Generation

Integrate on-site generation **early in design** and make choices to **maximize** solar opportunities.

Photo by Atlantis Energy, NREL 13999

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Limitations and Innovation

Through this process, will need to consider:

- Technical limitations of space, access, shading, etc.;
- Incentives and regulations;
- Financial feasibility and market conditions;
- How to encourage and accommodate innovation.

Rendering of initial GE Headquarters, Credit: Gensler

Renewable Energy Procurement

***Vincent Martinez**, Chief Operation Officer*

Architecture 2030

martinez@architecture2030.org

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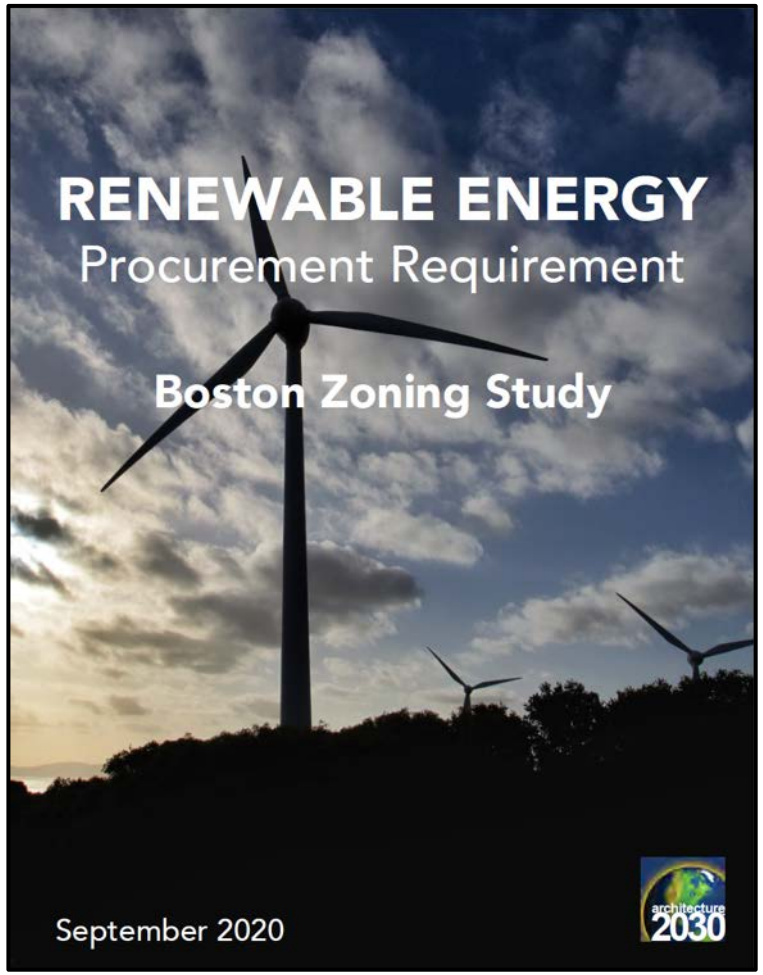
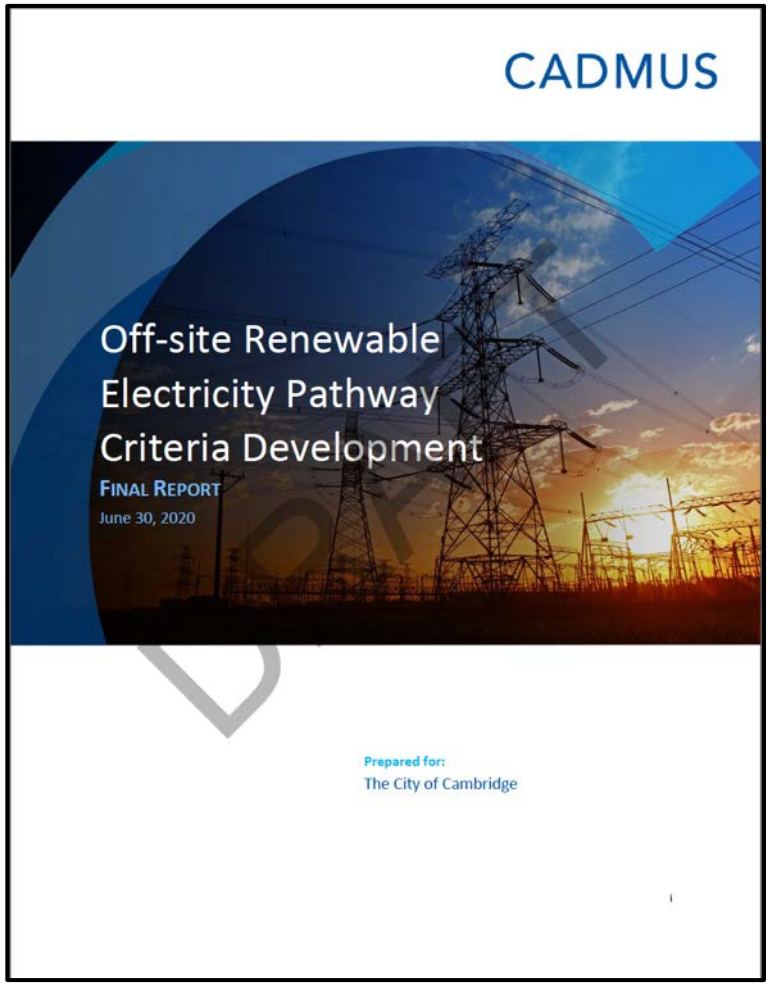
Renewable Energy Procurement

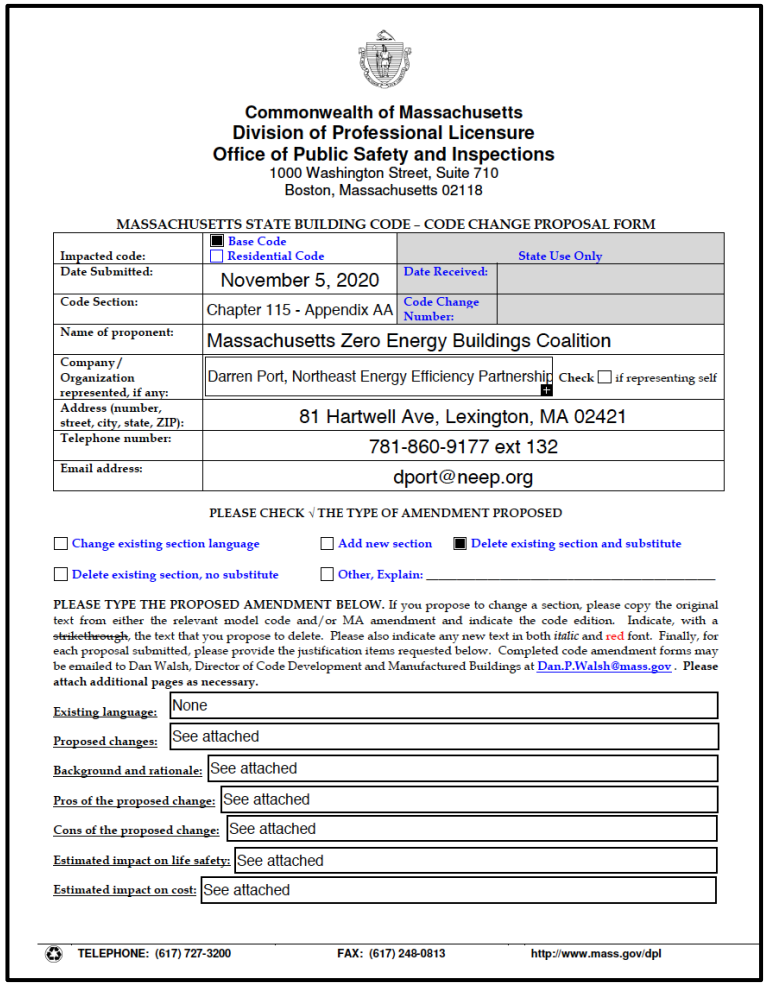
The purchasing of energy and/or its environmental attributes from off-site renewable energy systems.

“Off-site” renewable energy is anything that is not considered “on-site”.

Foundational Documents







Commonwealth of Massachusetts
Division of Professional Licensure
Office of Public Safety and Inspections
1000 Washington Street, Suite 710
Boston, Massachusetts 02118

MASSACHUSETTS STATE BUILDING CODE – CODE CHANGE PROPOSAL FORM

Impacted code:	■ Base Code ☐ Residential Code	State Use Only	
Date Submitted:	November 5, 2020	Date Received:	
Code Section:	Chapter 115 - Appendix AA	Code Change Number:	
Name of proponent:	Massachusetts Zero Energy Buildings Coalition		
Company / Organization represented, if any:	Darren Port, Northeast Energy Efficiency Partnership	Check ☐ if representing self	
Address (number, street, city, state, ZIP):	81 Hartwell Ave, Lexington, MA 02421		
Telephone number:	781-860-9177 ext 132		
Email address:	dport@neep.org		

PLEASE CHECK √ THE TYPE OF AMENDMENT PROPOSED

☐ Change existing section language ☐ Add new section ■ Delete existing section and substitute

☐ Delete existing section, no substitute ☐ Other, Explain: _____

PLEASE TYPE THE PROPOSED AMENDMENT BELOW. If you propose to change a section, please copy the original text from either the relevant model code and/or MA amendment and indicate the code edition. Indicate, with a ~~strikethrough~~, the text that you propose to delete. Please also indicate any new text in both *italic* and red font. Finally, for each proposal submitted, please provide the justification items requested below. Completed code amendment forms may be emailed to Dan Walsh, Director of Code Development and Manufactured Buildings at Dan.P.Walsh@mass.gov. **Please attach additional pages as necessary.**

Existing language:	None
Proposed changes:	See attached
Background and rationale:	See attached
Pros of the proposed change:	See attached
Cons of the proposed change:	See attached
Estimated impact on life safety:	See attached
Estimated impact on cost:	See attached

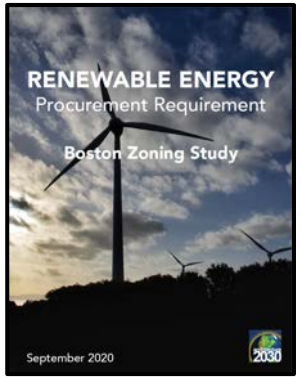
TELEPHONE: (617) 727-3200 FAX: (617) 248-0813 http://www.mass.gov/dpl

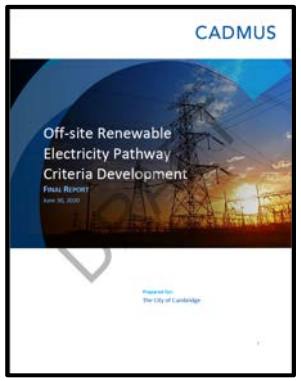
boston planning & development agency

Renewable Energy Procurement

- Direct Ownership / Self-owned, off-site project
- Community Renewables
- Power Purchase Agreements (PPAs)
- Virtual Power Purchase Agreements (VPPAs)
- Utility Renewable Energy Contract / Direct Access to the Wholesale Markets
- Green Retail Tariffs / Green Pricing / Green Municipal Aggregation
- Renewable Energy Investment Fund
- Unbundled Renewable Energy Certificates / Credits (RECs)

Evaluation Criteria / Guiding Principles





- Impact / Additionality
- Durability /Long-Term Commitment
- Locality / Local Impact
- Assignment to Building
- Electricity Credit
- Incremental Acquisition
- Grid Management
- Environmental Impact
- Inspirational/Educational Value
- Permanent Financing
- Renewable Generation Sources
- Equity
- Public Health

Renewable Energy Procurement TAG

- Procurement Options
  - Most Relevant
  - Minimum Requirements
  - Classification Criteria and Risks
- BERDO Interactions
- Other Community Concerns (e.g. Local Markets, Local Investments)

Questions, Comments, and Discussion

Next Steps

Public and Stakeholder Engagement

We would like to participate in your Organization and Association Meetings. *Please contact us!*

Technical Advisory Groups

TAG meetings are ongoing. We would welcome members with focus area specific expertise.

- Low Carbon Buildings
- On-site Renewable Energy
- Renewable Energy Procurement

Open Houses, Office Hours, and Updates

We will be hosting additional engagements and posting updates.

Please be sure to sign up on our contact list!