Net Zero E-Z Stretch Code
Info Session for Municipal Stakeholders

Codes for Climate

Metropolitan Area Planning Council (MAPC)

November 4, 2020

MAPC
METROPOLITAN AREA PLANNING COUNCIL

NOTIFICATION OF RECORDING

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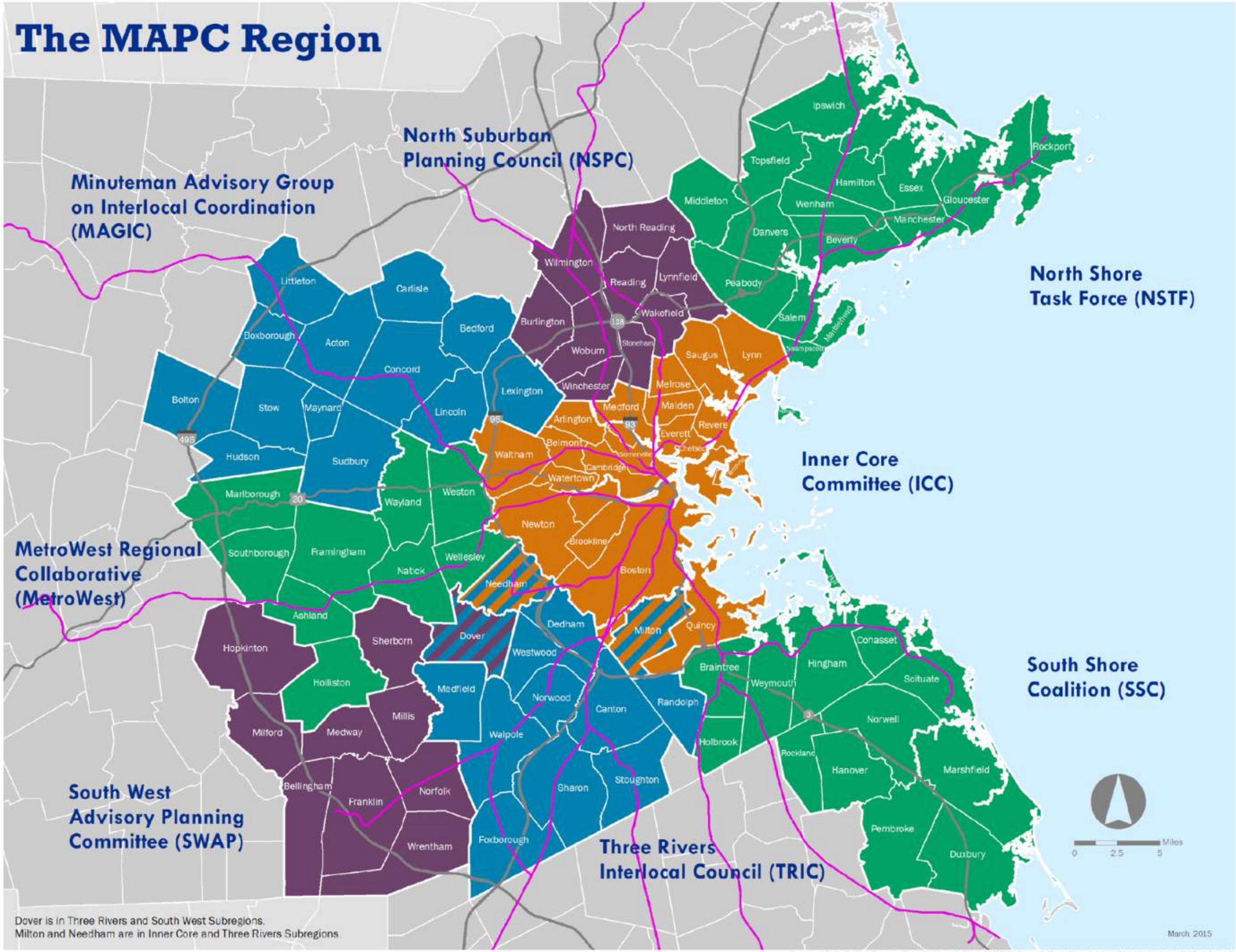


MAPC
METROPOLITAN AREA PLANNING COUNCIL

101 municipalities

1,440 square miles

Nearly 3.2 million residents

1.8 million jobs (2010 Census)

MAPC: Clean Energy

Regional Clean Energy Projects

- LED Streetlight Retrofit Program
- ESCO Procurement
- Regional Solar Initiative
- Green Municipal Aggregation
- Green Mobility Program
- Energy Resiliency

Climate and Clean Energy Planning

- Clean energy and climate baselining, planning, and strategizing
- Connecting municipalities with incentives + plug-and-play programs
- Outreach programming and education

Clean Energy Technical Assistance

- Grant Writing
- Green Communities Support
- Methane Leaks
- Solar Permitting and Zoning
- State and Local Policy
- Net Zero Guidance & Education

Net Zero as a Framework for Holistic Climate Planning

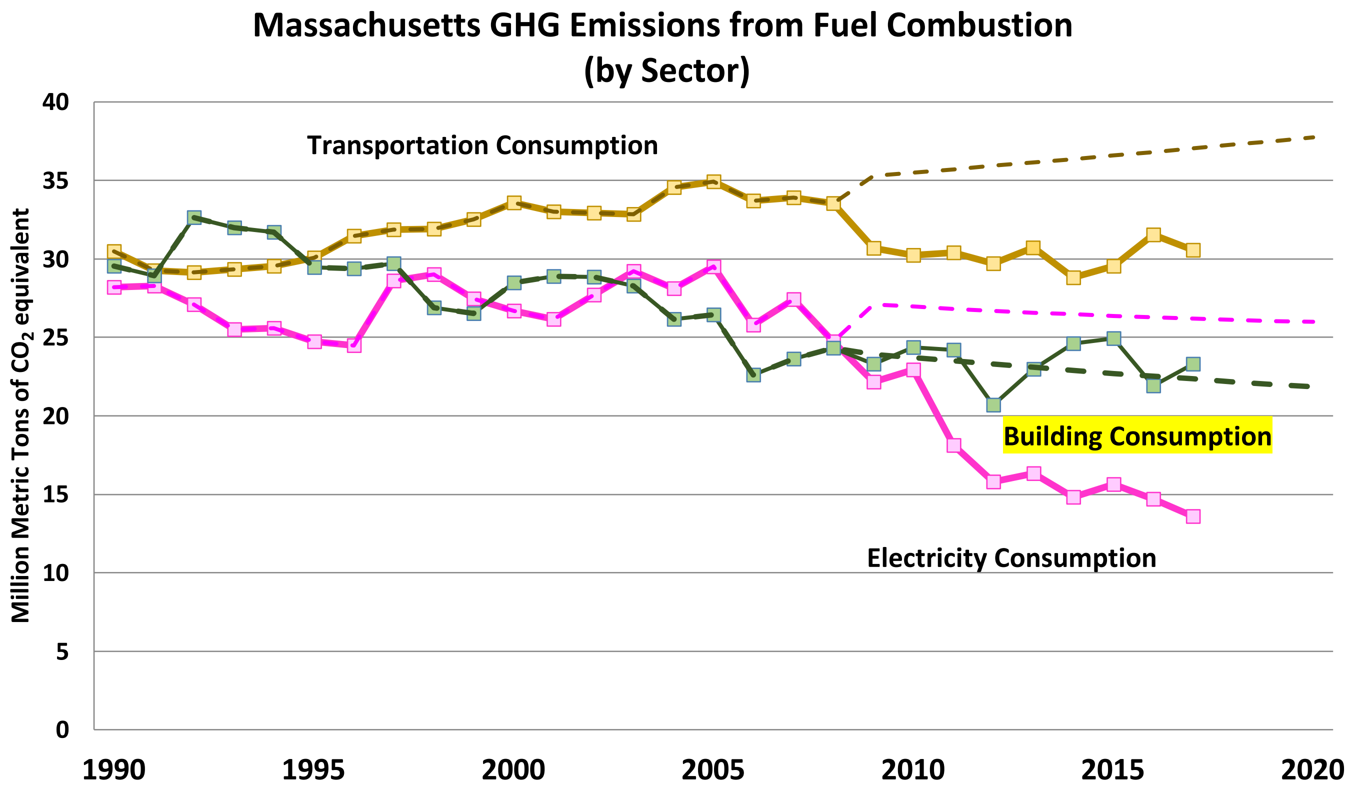
Multi-Benefit Outcomes

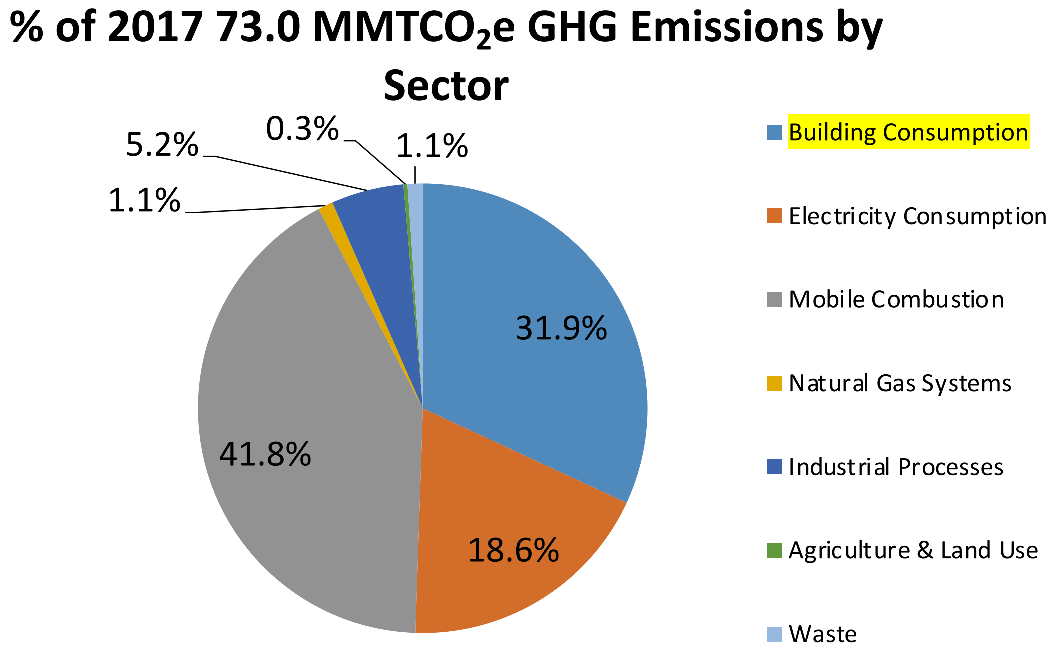
- Energy
- Economic
- Environmental
- Public Health
- Equity
- Livability

ZERO to 101

Bringing Net Zero to 101 Cities and Towns and Beyond

MA GHG Emissions from Buildings





Source: Appendix C: Massachusetts Annual Greenhouse Gas Emissions Inventory: 1990-2017, with Partial 2018 & 2019 Data. Summary of Massachusetts GHG Emissions - October 2020. https://www.mass.gov/lists/massdep-emissions-inventories#greenhouse-gas-baseline,-inventory-&-projection-

How Can We Improve Buildings?

There are four main ways that Massachusetts municipalities can impact building regulations:

VOTE

International Energy Conservation Code (IECC)

COMMENT

Base Code (MA Building Code CMR 780)

Stretch Energy Code (780 CMR Ch. 15 AA)

ADOPT

Zoning and other local ordinances

Stretch Energy Code (780 CMR Ch. 15 AA)

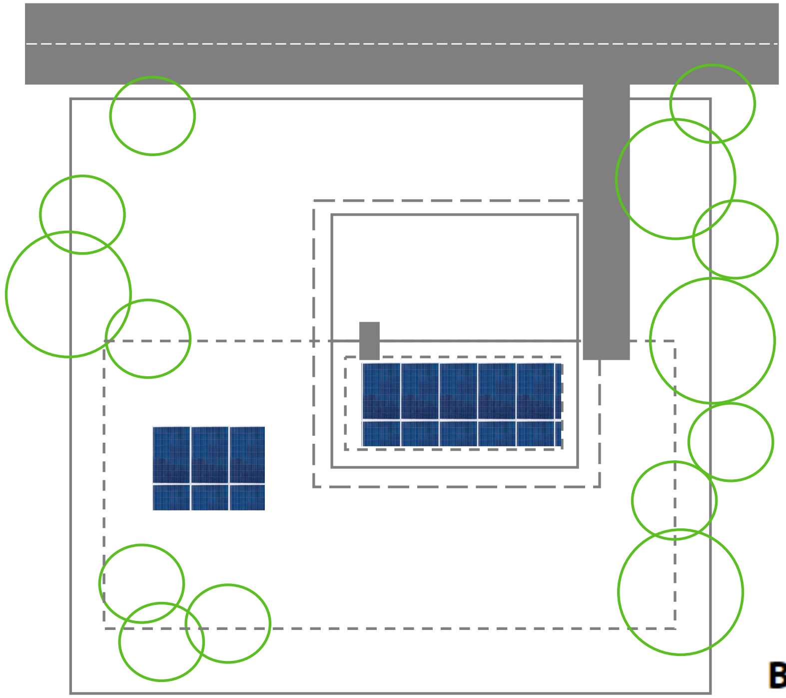
ENFORCE

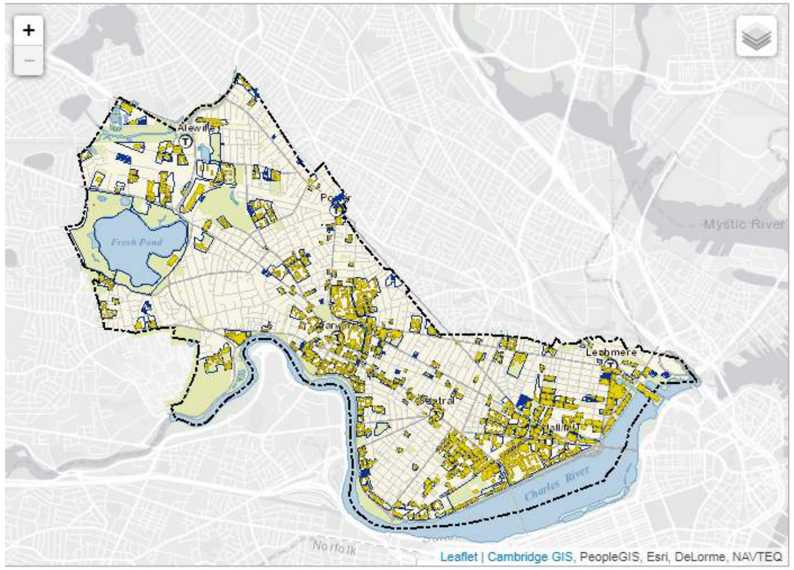
Zoning and other local ordinances

Base Code (MA Building Code CMR 780)

Stretch Energy Code (780 CMR Ch. 15 AA)

Local Levers





Building Energy Use Disclosure Compliance Map

Art. 29: Zero Energy Town Buildings

Amherst Select Board & Mothers Out Front

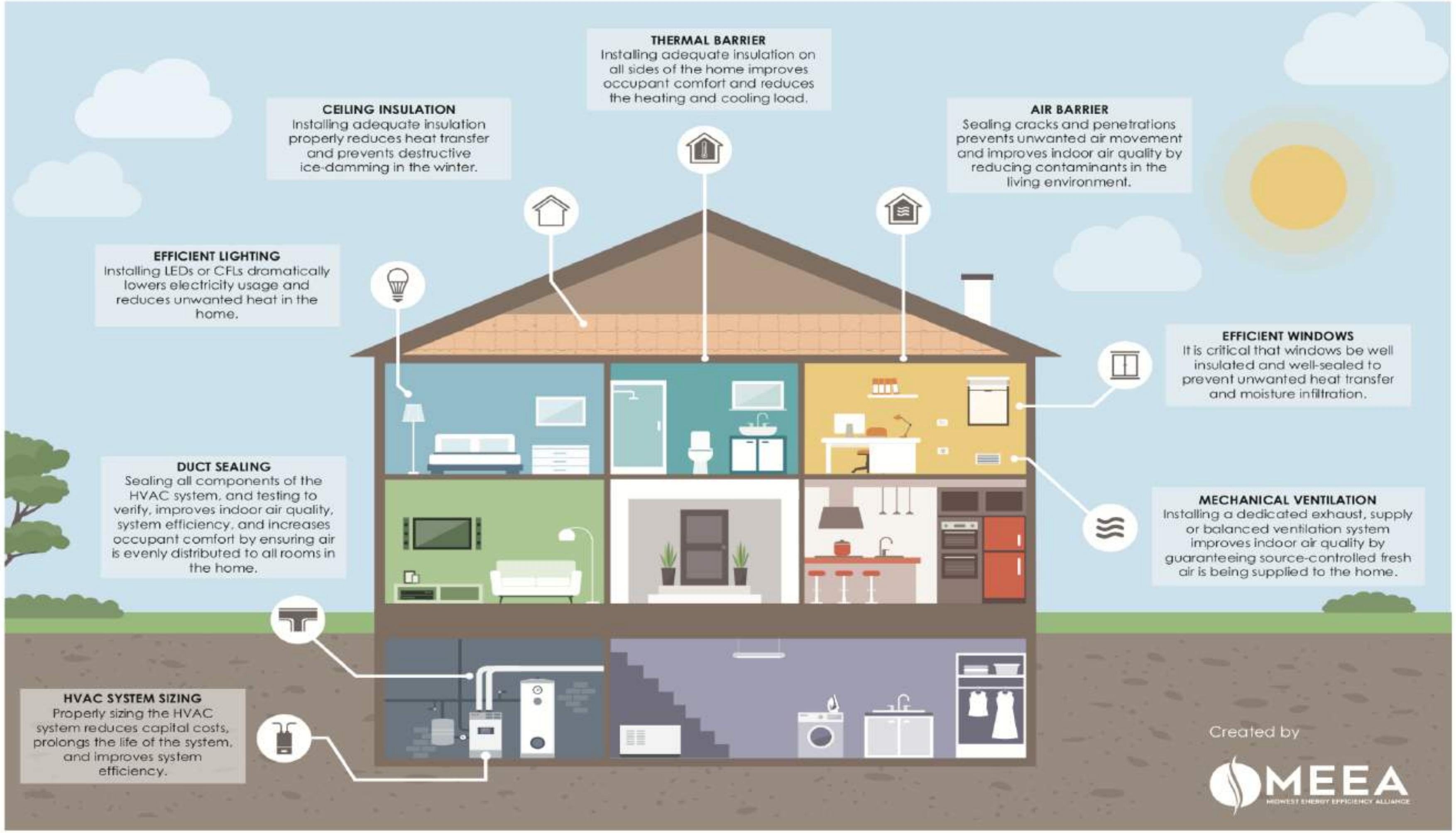
April 11, 2018

The work was done in a spirit of collaboration with a goal of preserving the original purpose of the Zero Energy Bylaw, while avoiding possible obstacles to implementation identified by Town officials. The following chart summarizes the major changes from the original bylaw that would be made by the proposed replacement Zero Energy Town Buildings Bylaw:

Current Zero Energy Bylaw	Proposed Zero Energy Town Buildings Bylaw
1. Compliance is based on the energy performance of the Project during 12 months of operation of the completed Project. The building administrator was to continue working towards zero energy compliance each year until achieved. [See current bylaw § 2.e.i]	1. Compliance is based on the modeled performance of the Project at the completion of the construction design documents, with zero energy capability certified by the Project's architect. The design will also be peer reviewed for zero energy capability. [See proposed bylaw § 3]
2. More challenging to determine at funding and contracting whether the Project is bylaw-compliant (since compliance is based on future operation).	2. Easier to determine at funding and contracting whether the Project is bylaw-compliant (since compliance is based on design, not future operation).
3. Required energy efficiency of the building or addition is implicit, but not explicit in bylaw. [See § 2.c]	3. Required energy efficiency of the building or addition is explicit in proposed bylaw. [§§ 1.a, 3.a, and Definition of "Zero Energy Capable"]

Building Energy Code

How the Energy Code Improves a Home

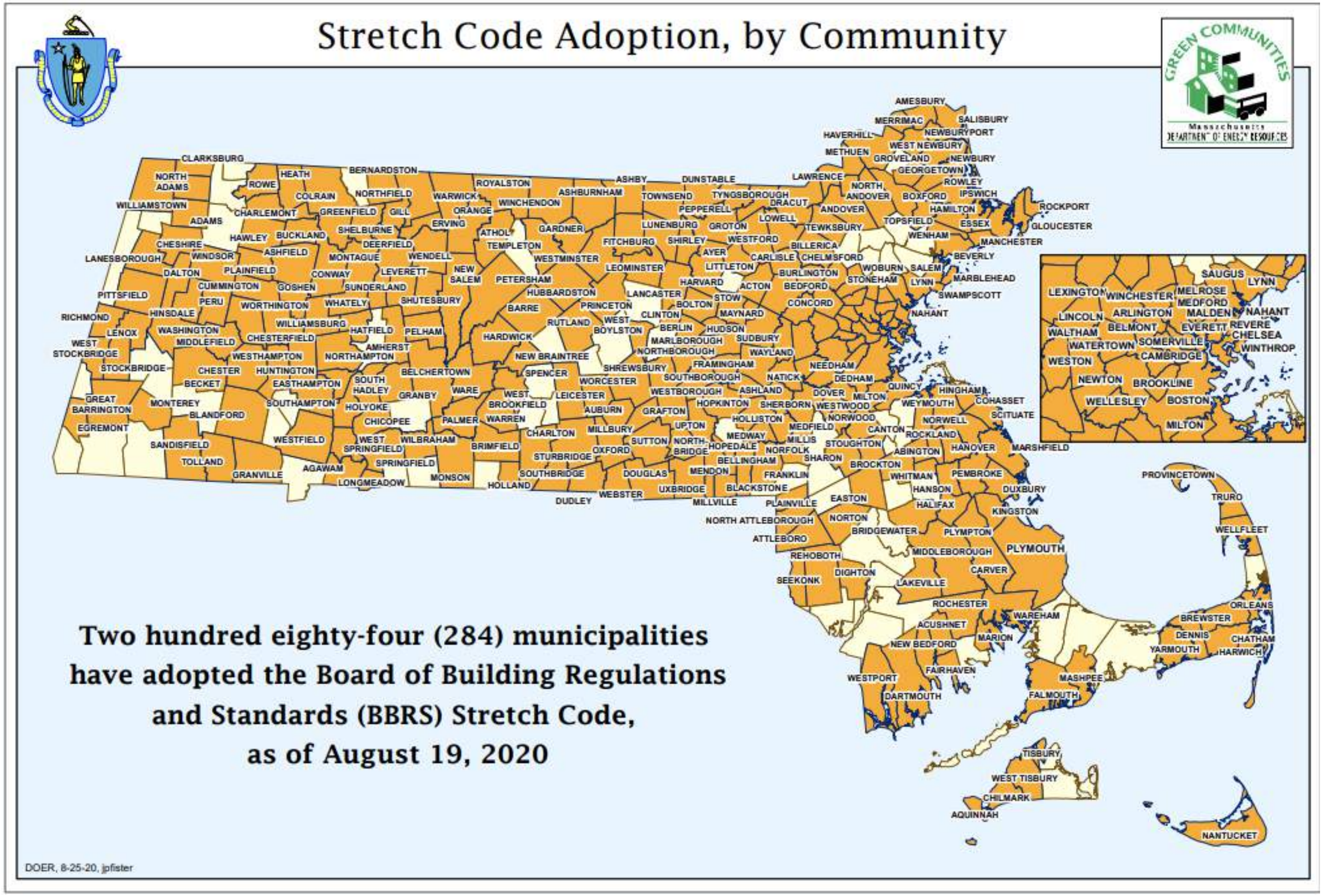


State Base Building Code

Mass General Law (MGL), Chapter 143, Section 94

"To adopt and fully integrate the latest International Energy Conservation Code as part of the state building code, together with any more stringent energy-efficiency provisions that the board, in consultation with the Department of Energy Resources, concludes are warranted."

Stretch Energy Code



Net Zero Stretch Code

Background and Rationale:
The MA E-Z Code offers an alternative compliance path for building energy efficiency and an update to the existing stretch code. The alternative compliance path is a prescriptive path, which may be selected for new buildings, instead of the performance (energy model) path. The prescriptive path has been named the "Energy Zero (E-Z)" path because it enhances building energy efficiency, is simpler to apply, and supports a more streamlined regulatory review for compliance.

In addition to offering a prescriptive compliance path, the MA E-Z Code addresses the electrification of buildings, a critical strategy for the Commonwealth to reach carbon neutrality. The MA E-Z Code modifies the IECC 2021 Zero Code Renewable Energy Appendix (ZCREA) to limit renewable energy sources to those that meet 'additionality,' ensuring that the renewable energy will have a net positive effect on Massachusetts greenhouse gas (GHG) emissions. The MA E-Z Code additionally addresses demand response, resilience, and several other topics that minimize a new building's life cycle impact on GHG emissions.

E-Z Code Presenters

MEREDITH ELBAUM

Executive Director, Built Environment Plus

JACOB KNOWLES

Director of Sustainable Design, BR+A

MA E-Z
STRETCH CODE

SUPPORT LETTER - THANK YOU! (roughly 100 firm endorsements and 1,500 professional signatures)

BR+A

PAYETTE

Thornton Tomasetti

Gensler

Bergmeyer

AKF

BEHNISCH ARCHITEKTEN

DEVENS ENTERPRISE COMMISSION

USGBC MASSACHUSETTS

ZED ZeroEnergy DESIGN

enviENERGY

Stantec

SAGE BUILDERS LLC

COLUMBIA We're with you

ARUP

cbt

SASAKI

south mountain company

ARROWSTREET

WILSON HGA

utile

LINNEAN Solutions

HED

EYP/ ARCHITECTURE & ENGINEERING

MDS ARCHITECTS

The Green Engineer Sustainable Design Consulting

Ai3 architects

GOODY CLANCY

ELLENZWEIG

CANNONDESIGN

RDH BUILDING SCIENCE

ers energy & resource solutions

FUSED STUDIOS

ELEVATED DESIGN INC

EJA EPSTEIN JOSLIN Architects

Soden Sustainability Consulting

ZeroEnergy Design

LEERS WEINZAPFEL ASSOCIATES

SHEPLEY BULFINCH

thoughtforms build to endure

studio g ARCHITECTS

BSA BOSTON SOCIETY OF ARCHITECTS/AIA

Sustainable IQ, Inc.

CA Design Studio LLC

Höweler+Yoon Architecture

PERKINS EASTMAN

STRUCTURETONE

PLACETAILOR

VANDERWEIL

ARCHITERRA

CambridgeSeven

PAUL LUKEZ ARCHITECTURE

Gorman Richardson Lewis Architects

Big Bend Studio Architects

C JAMES R ARCHITECT

BUROHAPPOLD ENGINEERING

D/R/E/A/M COLLABORATIVE

AVA WS | Architects & Consultants

HMFH ARCHITECTS

Trotti & Associates, Inc.

RSE ASSOCIATES Inc.

RMF Engineering Reliability. Efficiency. Integrity.

Steven Winter Associates, Inc.

NV5

Bruner/Cott ARCHITECTS

WORKING GROUP

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Jim Stanislaski, Architect, Gensler
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Rebecca Winterich-Knox, Massachusetts Climate Action Network (MCAN)
Review by the Cities of Boston, Somerville and Cambridge

The development management of this code was organized by Northeast Energy Efficiency Partnerships (NEEP), www.neep.org

PARTNERS

BUILT ENVIRONMENT PLUS

neep

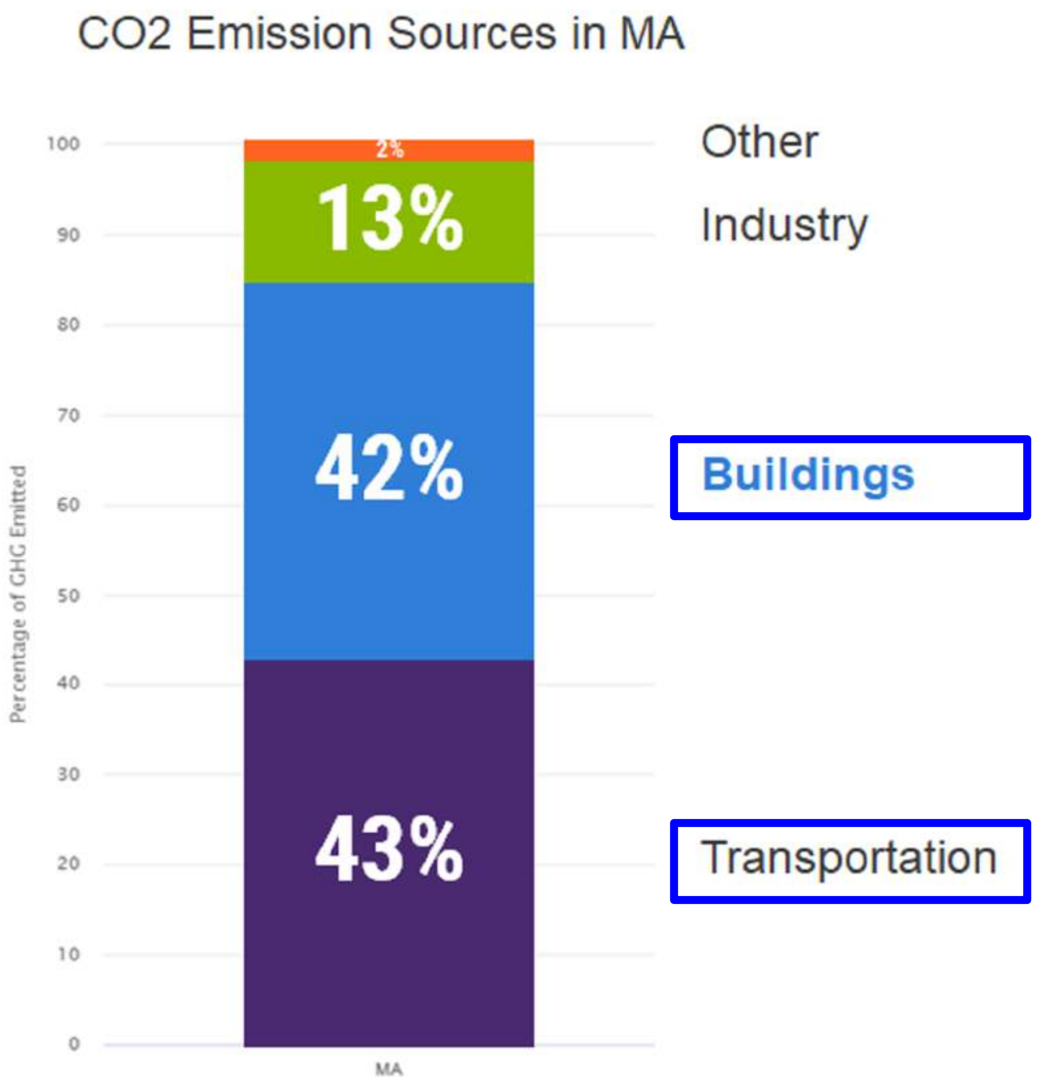
MCAN
Mass Climate Action Network

MAPC

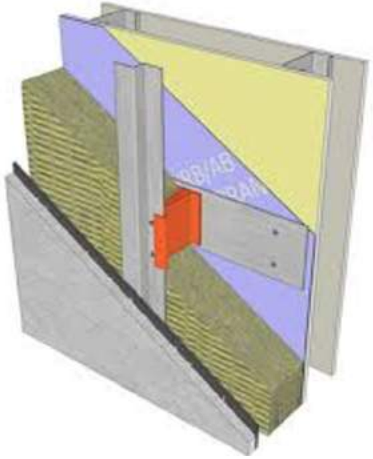
MASSACHUSETTS SIERRA CLUB

CONTEXT

Massachusetts: Emission Drivers



Net Zero



+

+

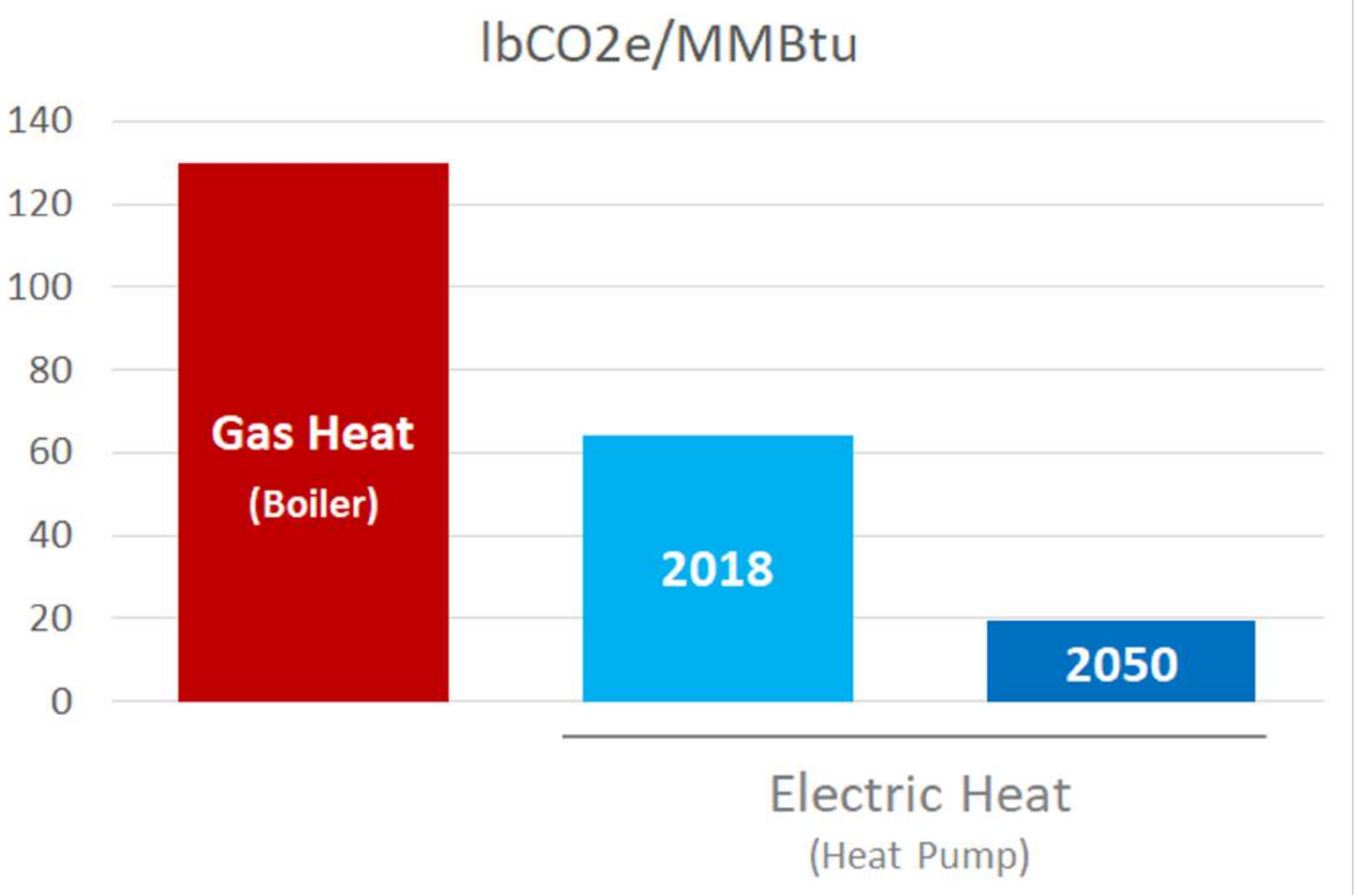
= **Net Zero**

Energy Efficiency

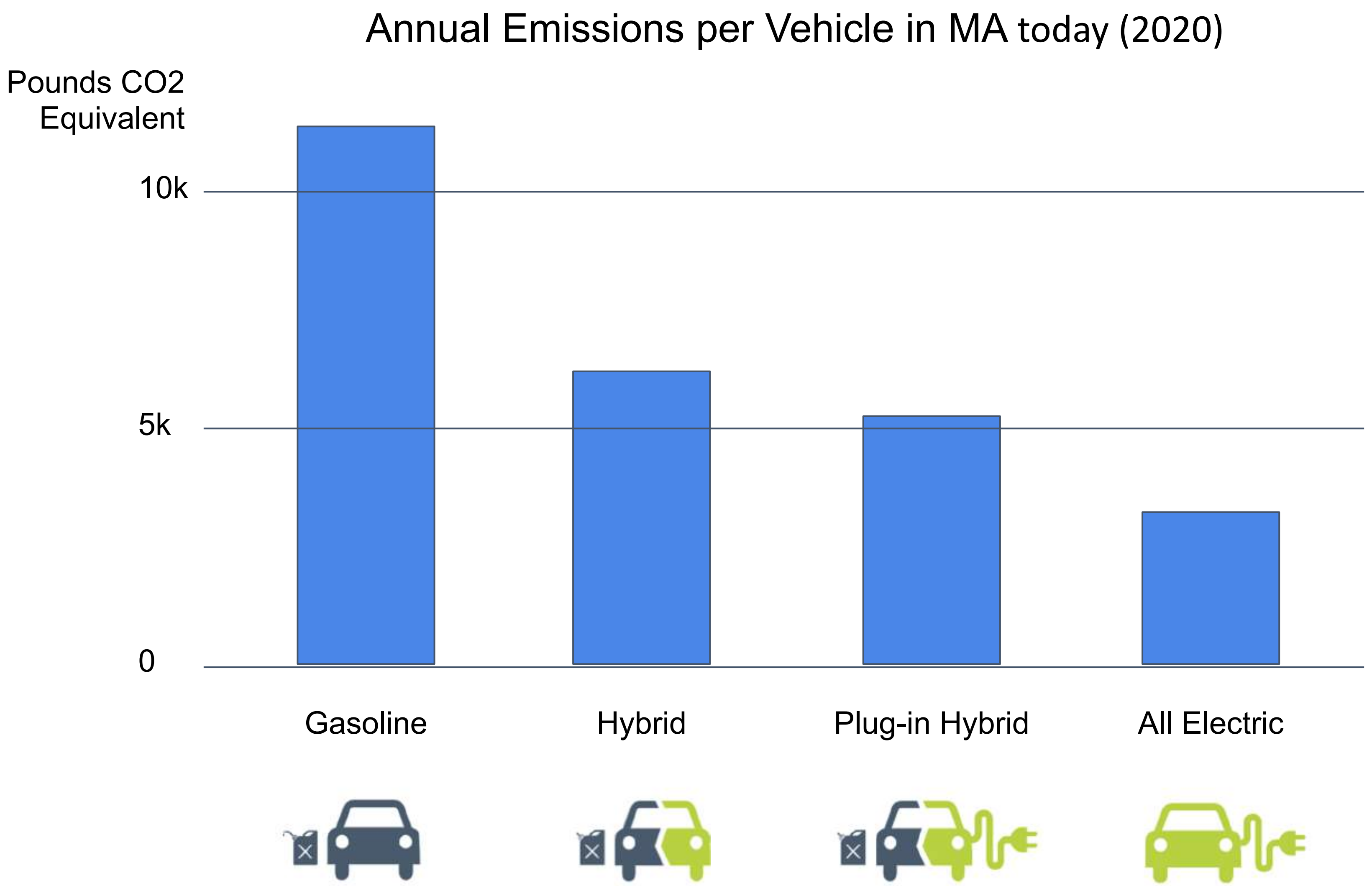
Electrification (Heat + Hot Water)

Renewable Energy

GAS VS. ELECTRIC HEATING: CO2 EMISSIONS

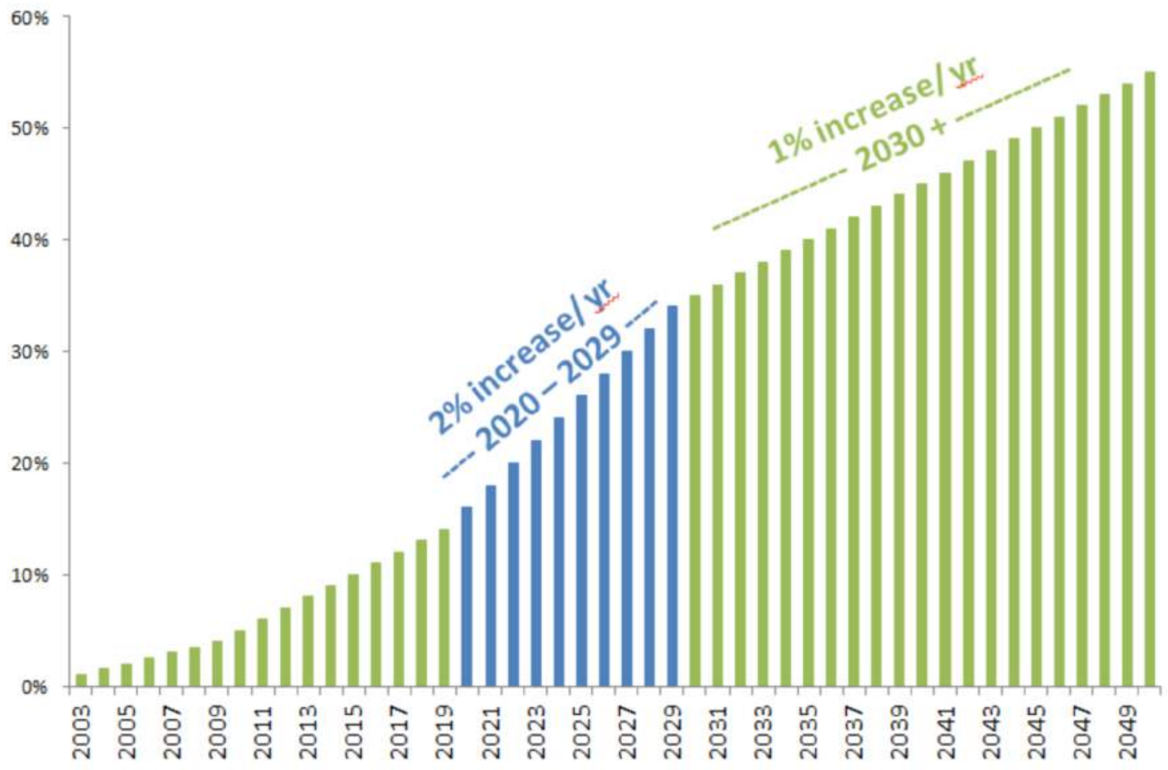


ELECTRIFICATION of TRANSPORTATION (in MA, already ~75% cleaner & getting cleaner)

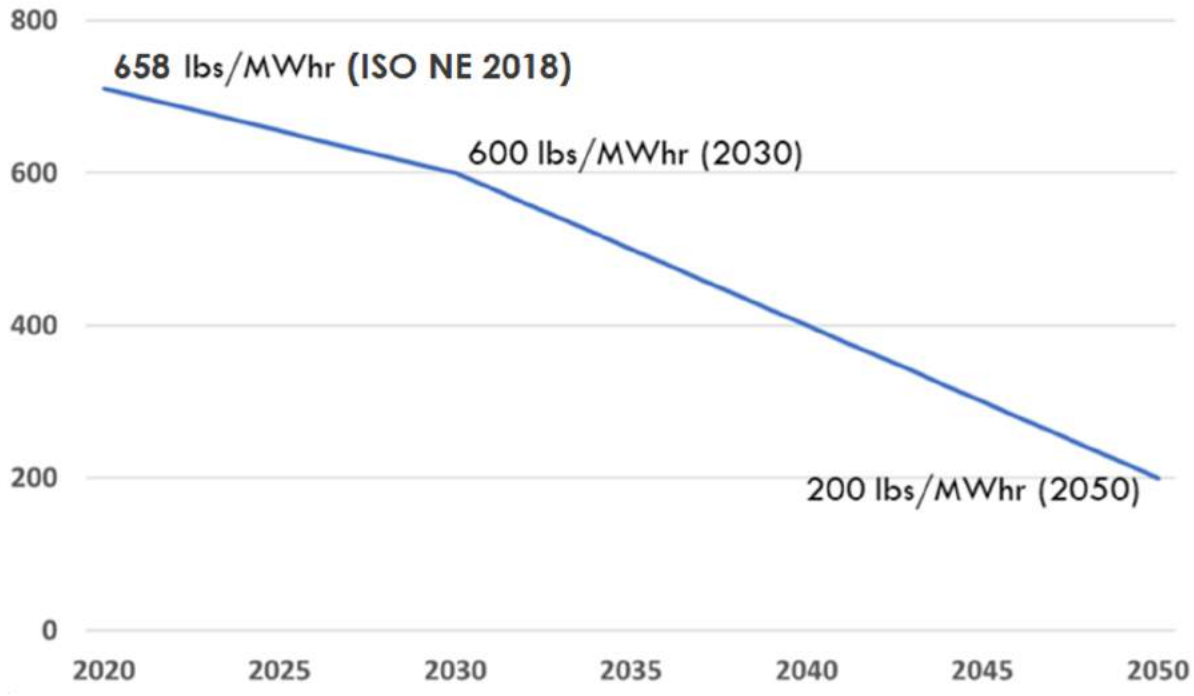


ELECTRIFICATION - Grid Emissions Over Time

Renewable Portfolio Standard (required by law)



Resulting Grid Emissions (lbs/MWh)



PRECEDENTS

Portland,
Seattle,
Vancouver,
and other
cities

NATIONAL
IECC 2021
ZNE Appendix
IECC 2030 / ASHRAE 90.1-2031 = Approaching ZNE

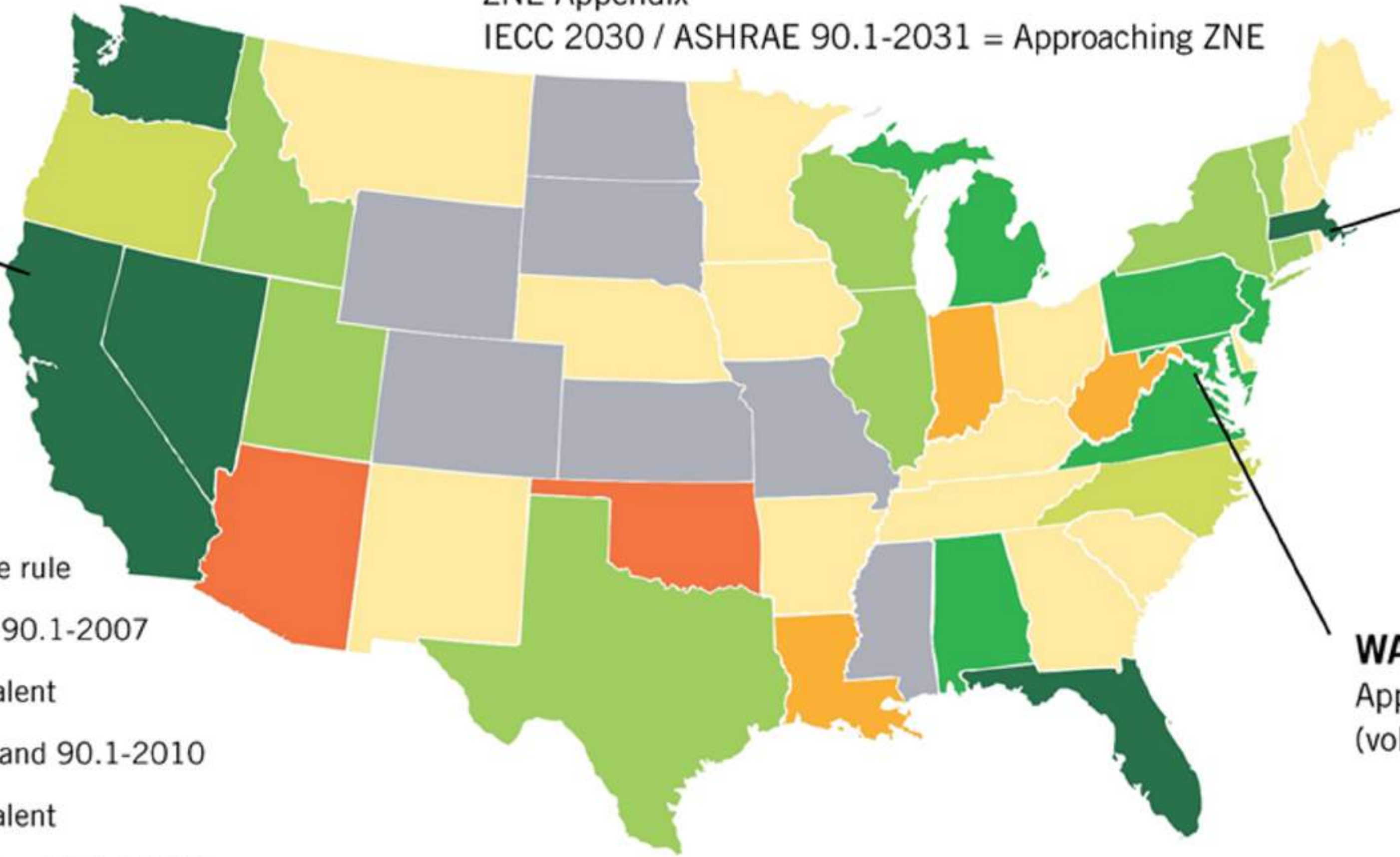
PROTOTYPES
Zero Code

CALIFORNIA
Title 24-2019
(near residential ZNE)
Zero Code
(commercial proposed)

MASSACHUSETTS
Net Zero Carbon Stretch Code **?**

Boston + Cambridge + Somerville
ZNE zoning regulations
being developed

WASHINGTON DC
Appendix Z
(voluntary compliance path)



Timeline

CURRENT

9th Edition 780 CMR

2015 ICC Codes

STRETCH CODE:
ASHRAE 90.1-2013
+ Amendments

Nov 7, 2020

9th Edition 780 CMR – Revised

2015 ICC Codes + 2018 IECC

STRETCH CODE:
ASHRAE 90.1-2013
+ Amendments

January 1 2022

Next code cycle adoption?

2021 ICC Codes?

STRETCH CODE:
E-Z Code?

E-Z CODE SUMMARY

Category	Requirement
Energy Efficiency	Prescriptive Path -OR- Performance Path WITH Prescriptive Backstop
Electrification	No Combustion, with exceptions Electric Vehicle requirements Demand Response requirements
Renewable Energy	Achieve Net Zero Only Renewable Energy demonstrating Additionality allowed No Weighting Factors On-site Solar requirements

E-Z Code Application

- Stretch Code Towns
- New commercial buildings >5,000 SF   (Green Communities statute says “all commercial buildings”)
- NOT including: detached one and two-family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2, R-3, and R-4 buildings three stories or less in height above grade plane.

E-Z Code – Builds Upon the AIA Zero Code, with a few key enhancements:

IECC 2021 ZCREA AIA Zero Code	MA E-Z Code
• Code minimum building • Combustion Allowed • Renewable energy does not have to be additional, different renewable energy types have different weighting factors	• Better energy performance than base code • Combustion-free building (with exceptions) • Renewable energy must be additional, no weighting of different renewable energy sources

ENERGY EFFICIENCY - PRESCRIPTIVE PATH

Objective:

1. Provide a straightforward approach to compliance and regulatory review, that does not require energy modeling.
2. Focus on the fewest amendments that ensure low energy, grid-friendly, cost effective buildings.

Proposal:

1. Envelope Heating Load Limit
2. Fenestration U-value Requirements
3. Air Leakage - Thermal Envelope
4. Energy Recovery Ventilation Systems - Efficiency
5. Heat Pump Capacity
6. Service Water Heating Performance Efficiency

ENERGY EFFICIENCY - PRESCRIPTIVE PATH

Category	**E-Z Prescriptive Path**	**IECC 2021 Base Code (for reference)**
Envelope Heating Load Limit	UA x ΔT / sf ≤ 5 Btu/h-sf	There is a U-value x Area limit, but it is based on total envelope area, not floor area, so how the base code compares to the E-Z code will vary based on the building geometry.
Fenestration U-value	Fixed fenestration 0.28 Operable fenestration 0.35	Fixed fenestration 0.38 Operable fenestration 0.45
Air Leakage: Envelope	0.10 cfm/sf @ 75pa	0.40 cfm/sf @ 75pa
Energy Recovery Efficiency	80% 50% (class 4) 0% (exceptions)	50% no recovery required if 50% airflow turn-down 0% (exceptions)
Heat Pump Capacity	5 Btu/h-sf	not required
Service Water-Heating	Weighted avg. COP >1.0, with exceptions	Typically 80% efficient (COP 0.8)

ENERGY EFFICIENCY - PRESCRIPTIVE PATH

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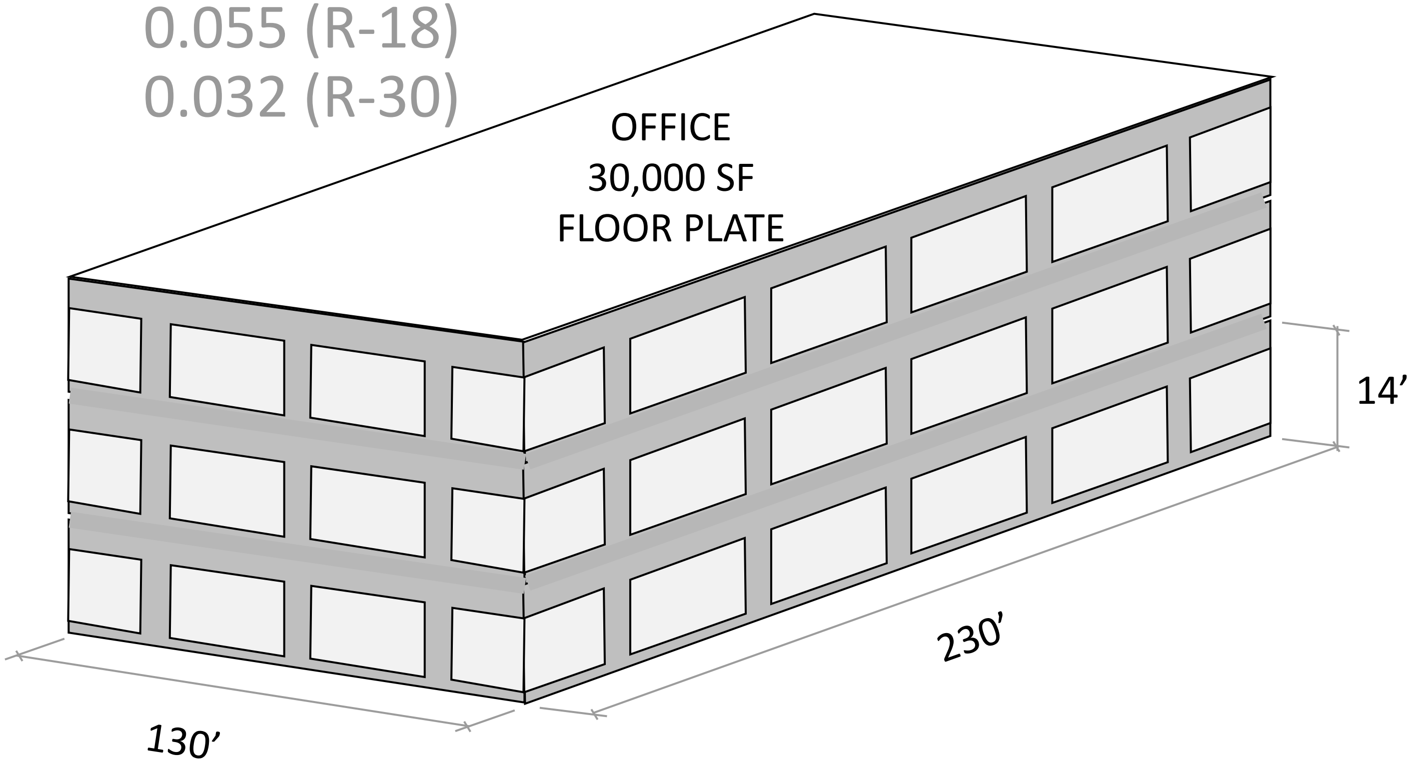
ENVELOPE

Example compliance:	IECC 2021
Window:Wall	40%
Window U-value	0.38
Wall U-value	0.055 (R-18)
Roof U-value	0.032 (R-30)

Varies by building type.
Assembly values, accounting for frame / thermal bridging.

Floor Area 90,000 GSF



30,000 SF VERTICAL ENVELOPE AREA
12,000 SF WINDOW AREA
(not to scale)

ENVELOPE

Example compliance:	**E-Z Code**	IECC 2021
Window:Wall	40%	40%
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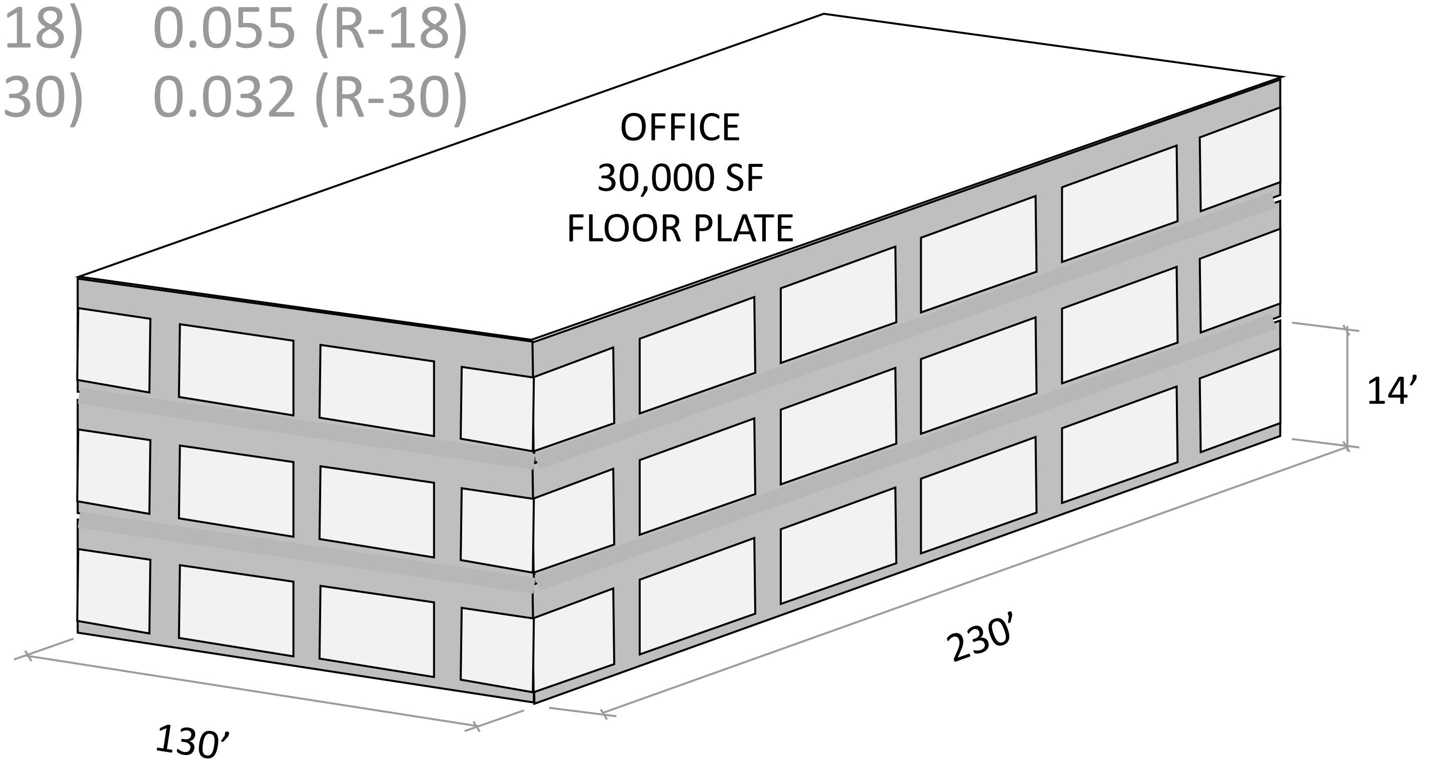
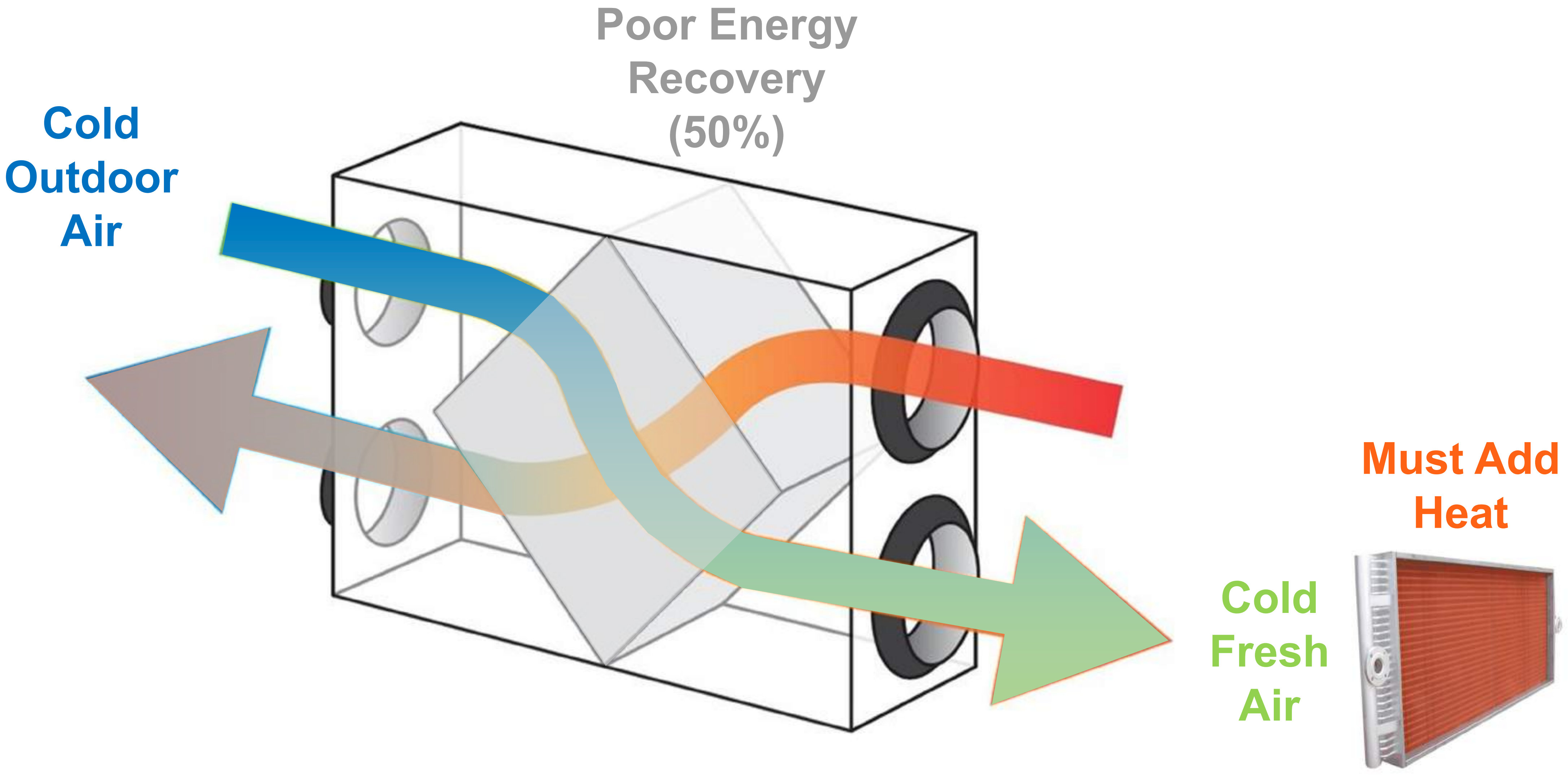
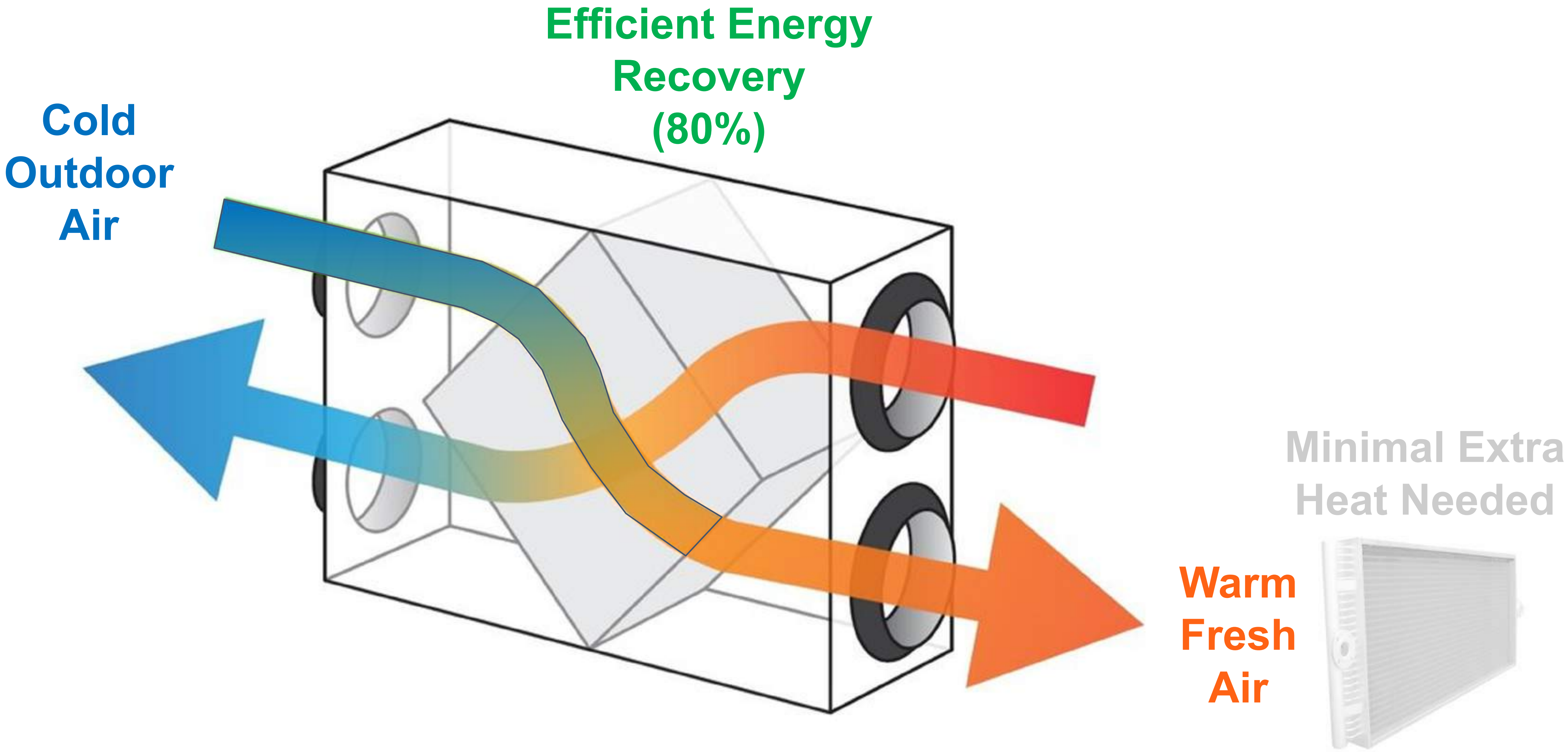


30,000 SF VERTICAL ENVELOPE AREA
12,000 SF WINDOW AREA
(not to scale)

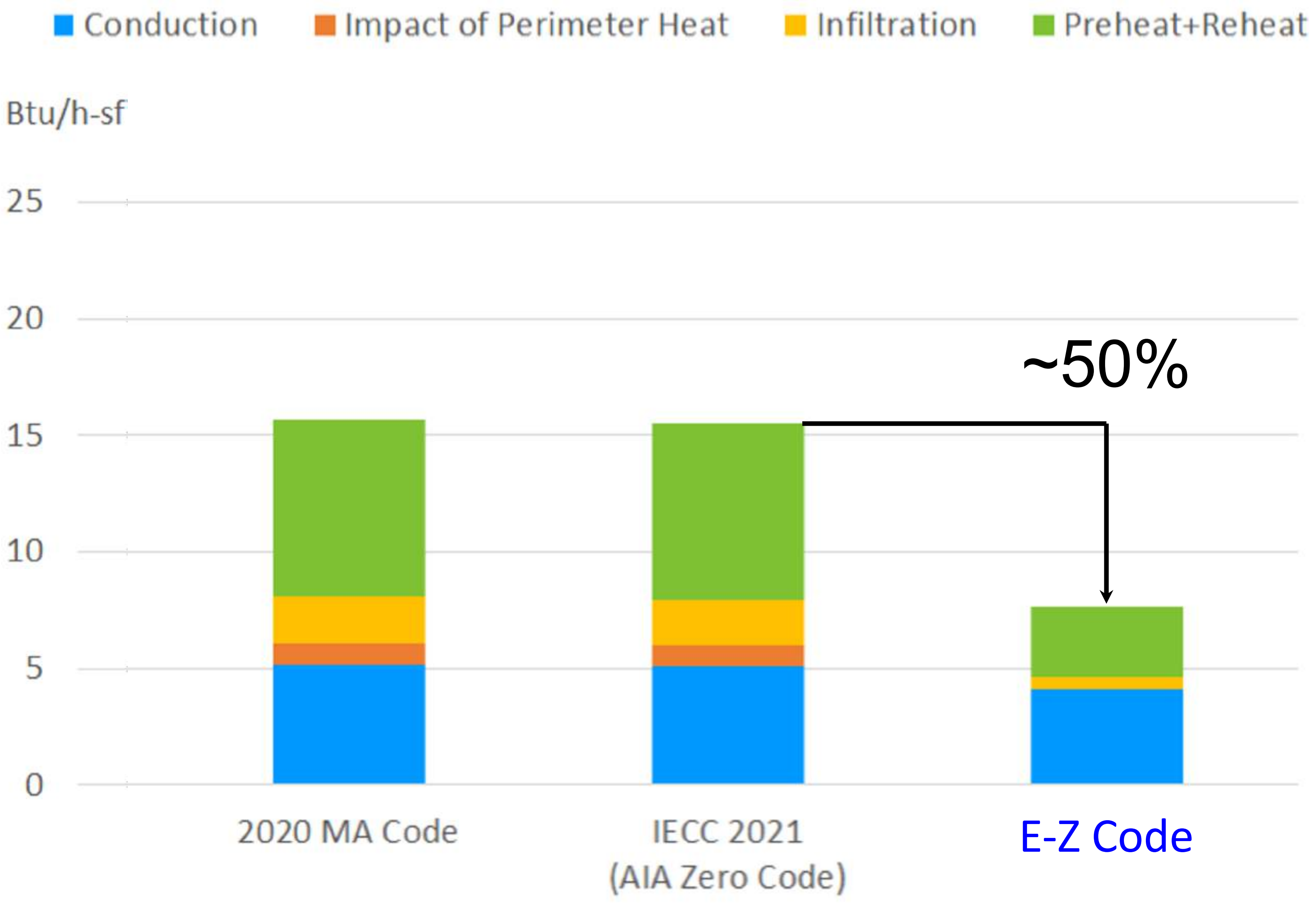
HEAT RECOVERY: BASE CODE



HEAT RECOVERY: E-Z CODE



TOTAL HEATING LOAD



*Varies by building type and size. Values based on 90,000 GSF, 3-story building.

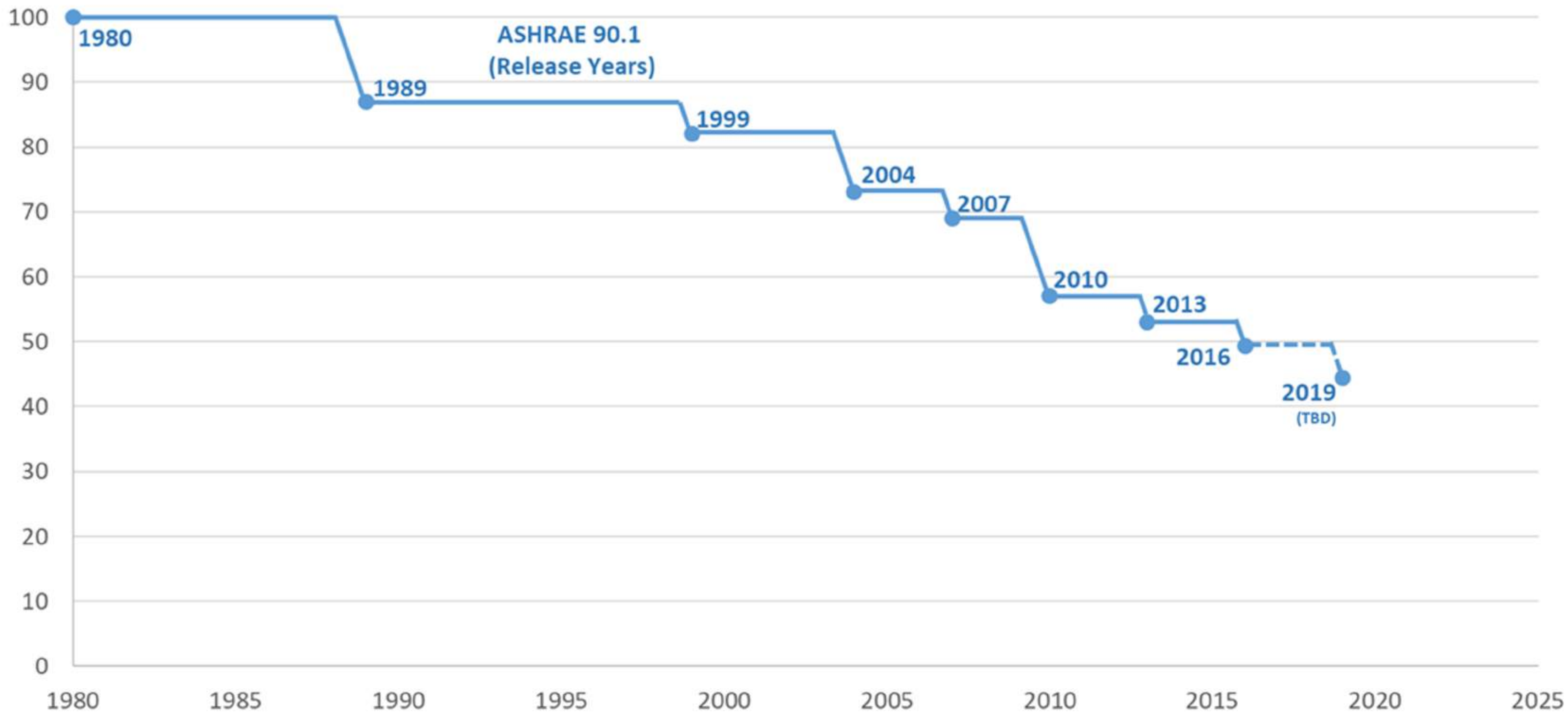
ENERGY EFFICIENCY - PERFORMANCE PATH

Objective: Align with national standards, with key enhancements to ensure low energy, grid-friendly, cost effective buildings.

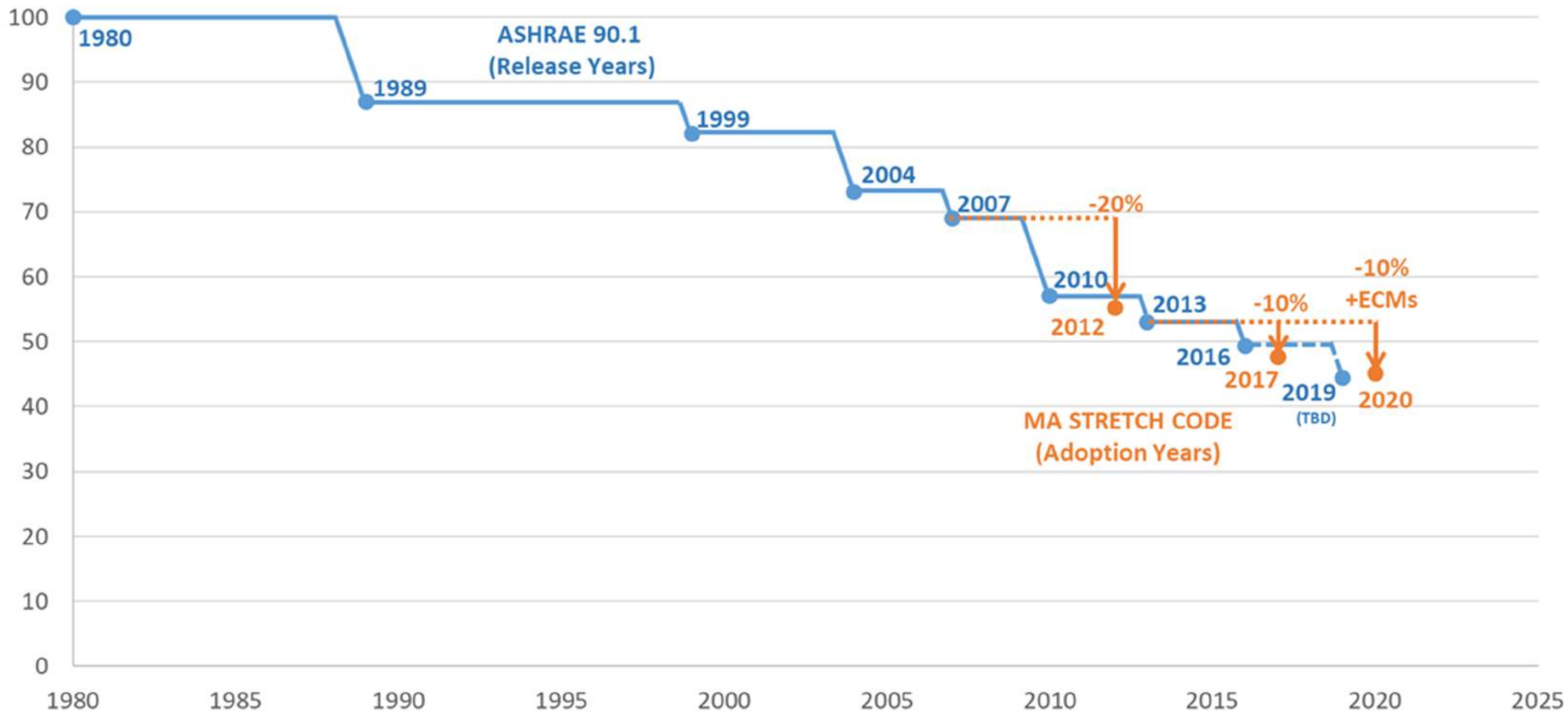
Proposal:

1. Same as Base Code + AIA Zero Code
2. Add a prescriptive backstop

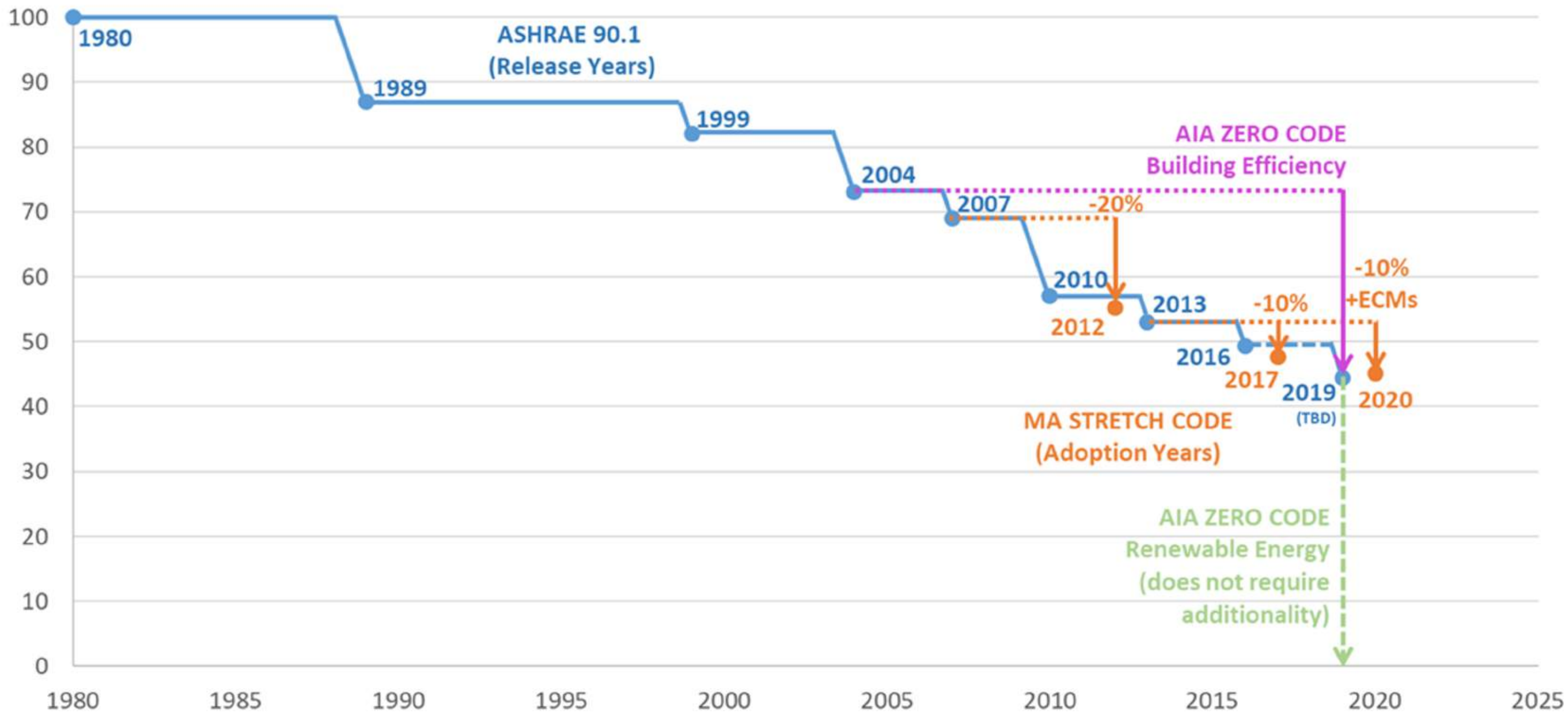
PERFORMANCE PATH - ASHRAE 90.1 HISTORY



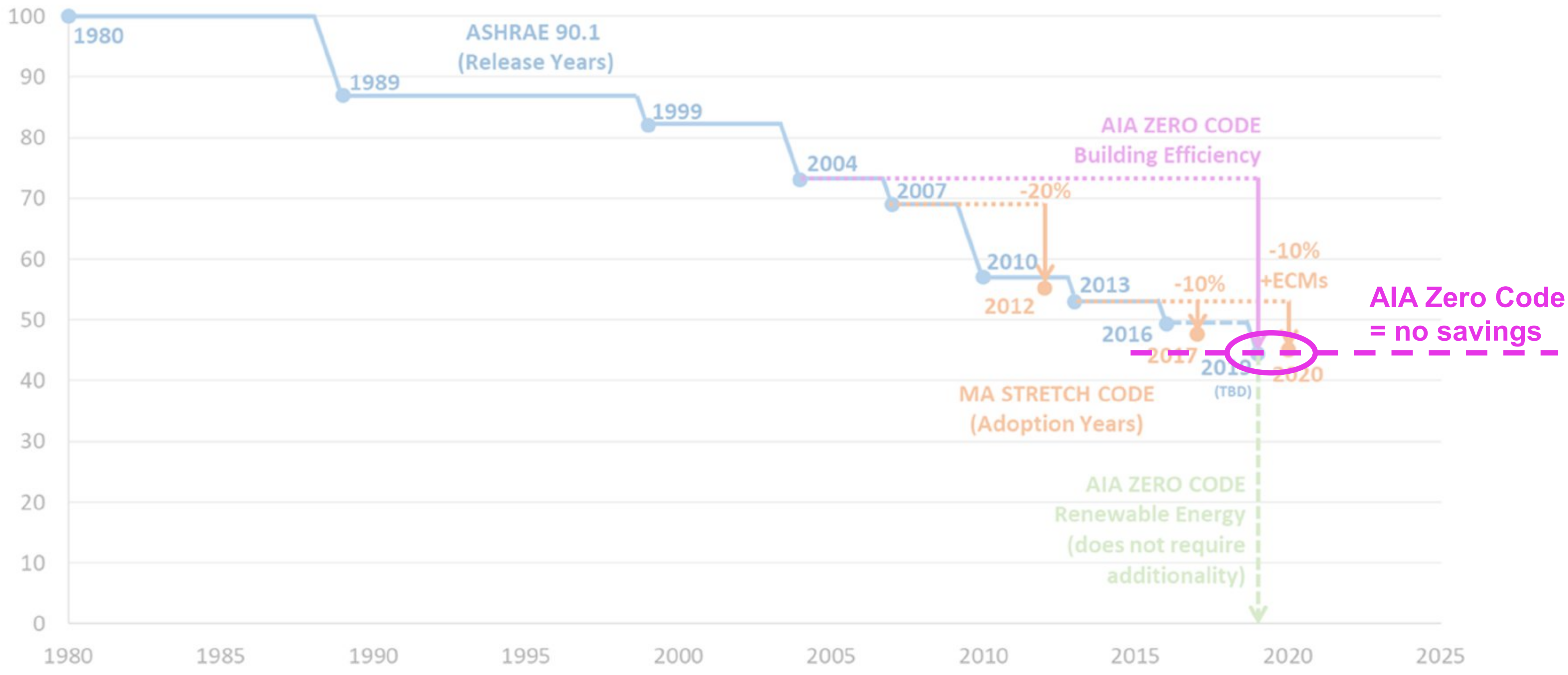
PERFORMANCE PATH - STRETCH CODE HISTORY



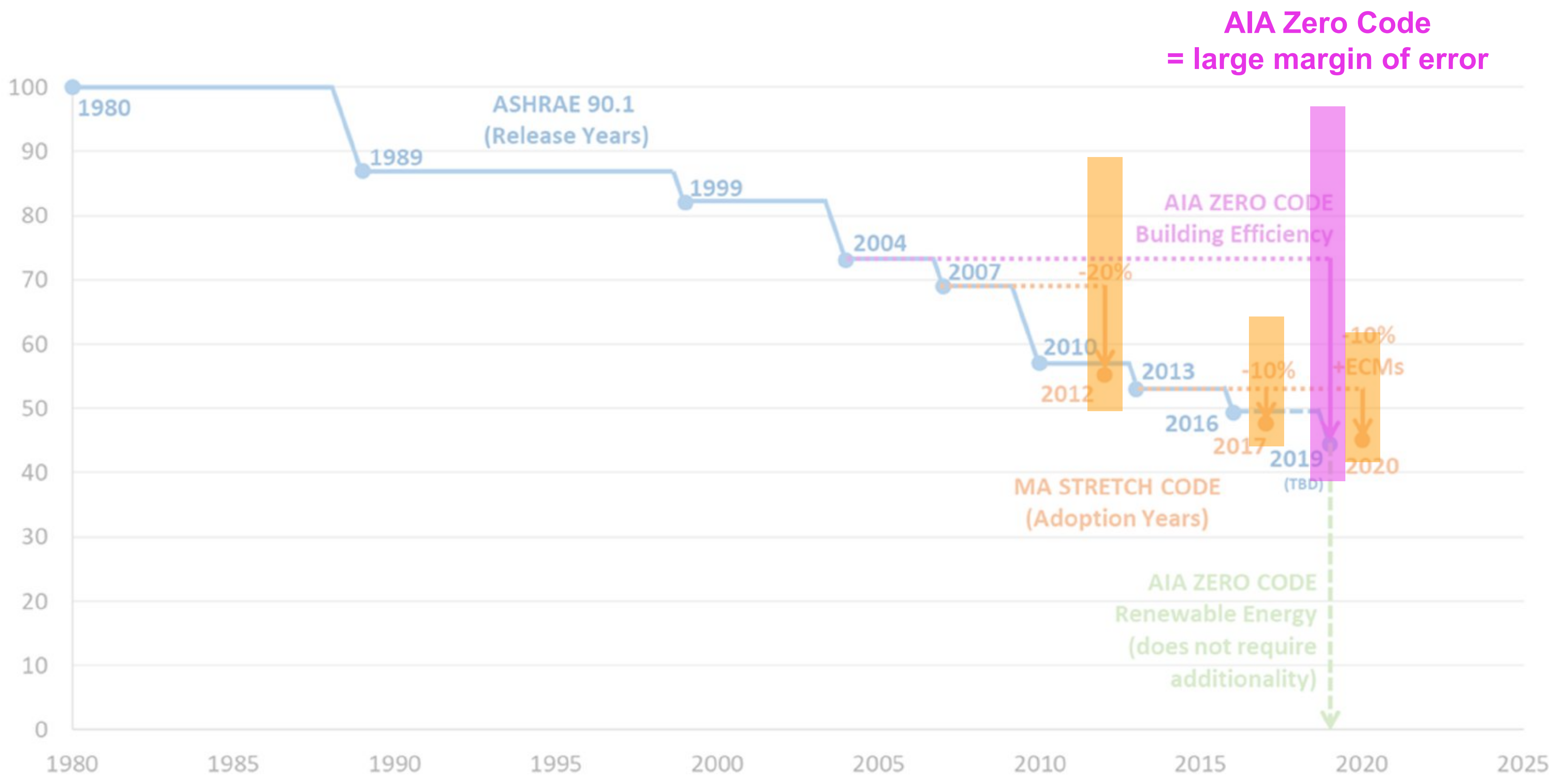
PERFORMANCE PATH - AIA ZERO CODE



PERFORMANCE PATH - AIA ZERO CODE



PERFORMANCE PATH - AIA ZERO CODE



PERFORMANCE PATH - Solution = Prescriptive Backstop

Category	E-Z Prescriptive Path	Performance Path Backstop	IECC 2021 Base Code (for reference)
Envelope Heating Load Limit	UA x ΔT / sf ≤ 5 Btu/h-sf	8 Btu/h-sf	There is a U-value x Area limit, but it is based on total envelope area, not floor area.
Fenestration U-value	Fixed fenestration 0.28 Operable fenestration 0.35	0.33 0.40	Fixed fenestration 0.38 Operable fenestration 0.45
Air Leakage: Envelope	0.10 cfm/sf @ 75pa	0.12 cfm/sf @ 75pa	0.40 cfm/sf @ 75pa
Energy Recovery Efficiency	80% 50% (class 4) 0% (exceptions)	75% 50% (class 4) 0% (exceptions)	50% no recovery if 50% airflow turn-down 0% (exceptions)
Heat Pump Capacity	5 Btu/h-sf	(same as prescriptive)	not required
Service Water-Heating	Weighted avg. COP >1.0 with exceptions	(same as prescriptive)	Typically 80% efficient (COP 0.8)

ELECTRIFICATION

Objective: Rely on electricity (in lieu of on-site combustion) to unlock the potential for net zero emissions buildings.

Proposal:

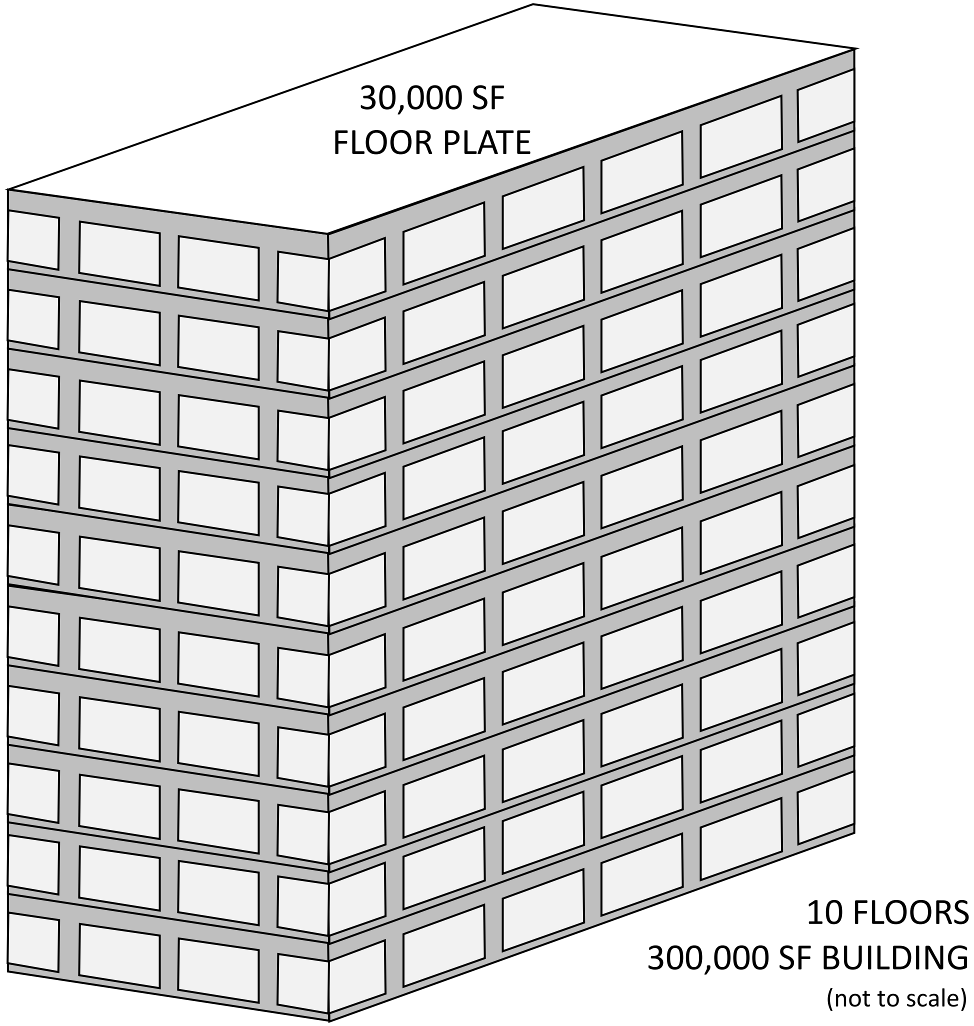
1. Limitation of cases where on-site combustion is allowed
2. Electric vehicle charging infrastructure
3. Demand response capable

CASES WHERE ON-SITE COMBUSTION IS ALLOWED

1. **Labs**
2. **Healthcare**
3. **Central domestic hot water systems in buildings >10,000 GSF**
4. **Commercial kitchens + commercial cooking appliances**
5. **Public health and safety buildings**
6. **Industrial, agricultural processes, etc.**
7. **Standby generators**
8. **Back-up domestic hot water systems**

ELECTRIFICATION + LOAD REDUCTION

Capacity Required for Heating



Heating Load: 2020 MA Code and IECC 2021 (AIA Zero Code)
15 btu/h-sf

*135MBH each

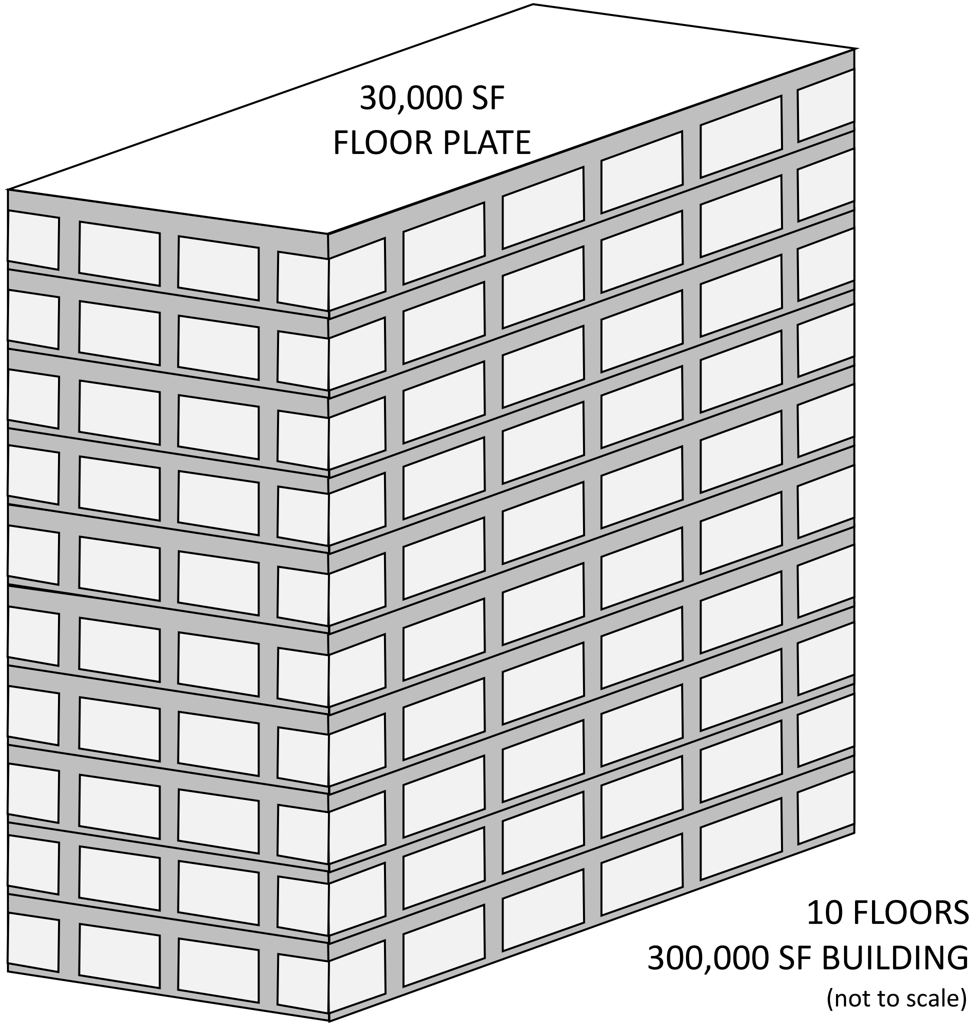
ELECTRIFICATION + LOAD REDUCTION

Capacity Required for Heating

Heating Load:

2020 MA Code and IECC 2021 (AIA Zero Code)
15 btu/h-sf

MA E-Z Code
8 btu/sf



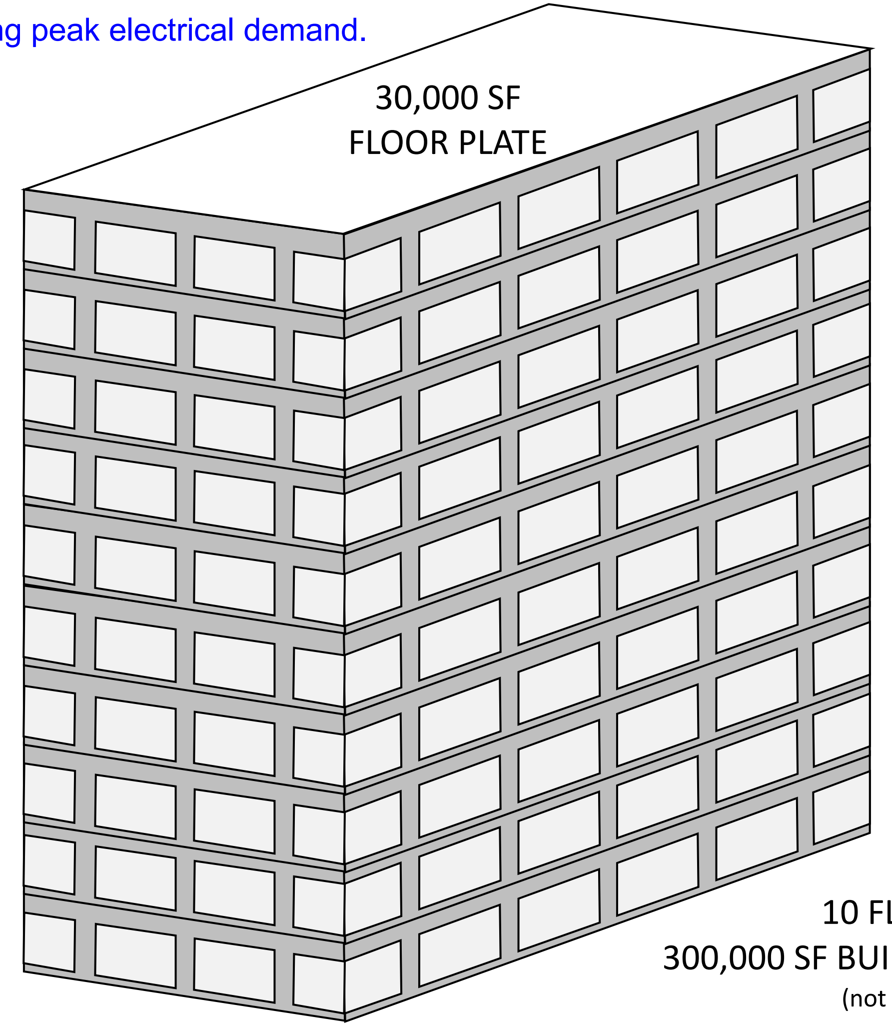
*135MBH each

ELECTRIFICATION + LOAD REDUCTION

Electrification of heating does not drive building peak electrical demand.

Heating = Peak | Cooling = Peak

Capacity Required for Heating



Heating Load:

2020 MA Code and IECC 2021 (AIA Zero Code)
15 btu/h-sf

MA E-Z Code
8 btu/sf

*135MBH each

ELECTRIFICATION of TRANSPORTATION

Governor Baker:
“We anticipate 600,000 electric vehicles in Massachusetts by 2025.”
(MA Future Transportation Task Force)

E-Z Code Requirement:
Electric Vehicle Supply Equipment (EVSE) Parking Spaces

- 10% of parking spaces are required to have EV charging stations installed

- 60% capable parking spaces are required to have 40-Amp circuit and raceways to space installed

RENEWABLE ENERGY

Objective: Require renewable energy systems of adequate capacity to achieve net zero energy.

Proposal:

1. Require on-site + off-site renewable = net zero
2. On-site solar requirements
3. Off-site renewable energy must be “Additional” (no weighting factors)

ON-SITE AND OFF-SITE RENEWABLES ARE ALLOWED

ON-SITE RENEWABLES
Prioritized as primary

+

OFF-SITE RENEWABLES
Supplement as necessary

=

<u>100%</u> of the building's annual energy consumption

ON-SITE RENEWABLES

Solar Energy Systems

1. Solar array = **50 percent of the roof area of buildings** (excluding skylights)
2. Additionally solar array = **90 percent of** accessory structures within 250 feet of the buildings or installed with the building project.
3. Ground-mounted solar and other types of renewable energy can be used instead

Exceptions:

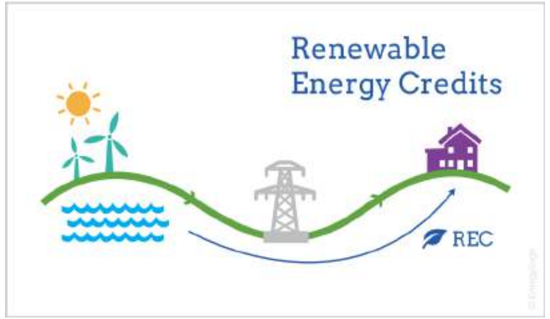
1. No solar-ready zone (mechanical equipment, etc.)
2. Shaded roof area

OFF-SITE RENEWABLES

Additionality: Sourcing renewable energy that creates a new tangible net reduction in GHG emissions that otherwise would not have occurred.

Qualifying Options:

1. **In Region**
2. **MA Class I RECs**
3. **Anywhere in Continental US with equal or higher grid emissions (Power Purchase Agreement)**



SUMMARY

Category	Requirement
Energy Efficiency	Prescriptive Path -OR- Performance Path WITH Prescriptive Backstop
Electrification	No Combustion, with exceptions Electric Vehicle requirements Demand Response requirements
Renewable Energy	Achieve Net Zero Only Renewable Energy demonstrating Additionality allowed No Weighting Factors On-site Solar requirements

JURISDICTIONAL REQUIREMENTS

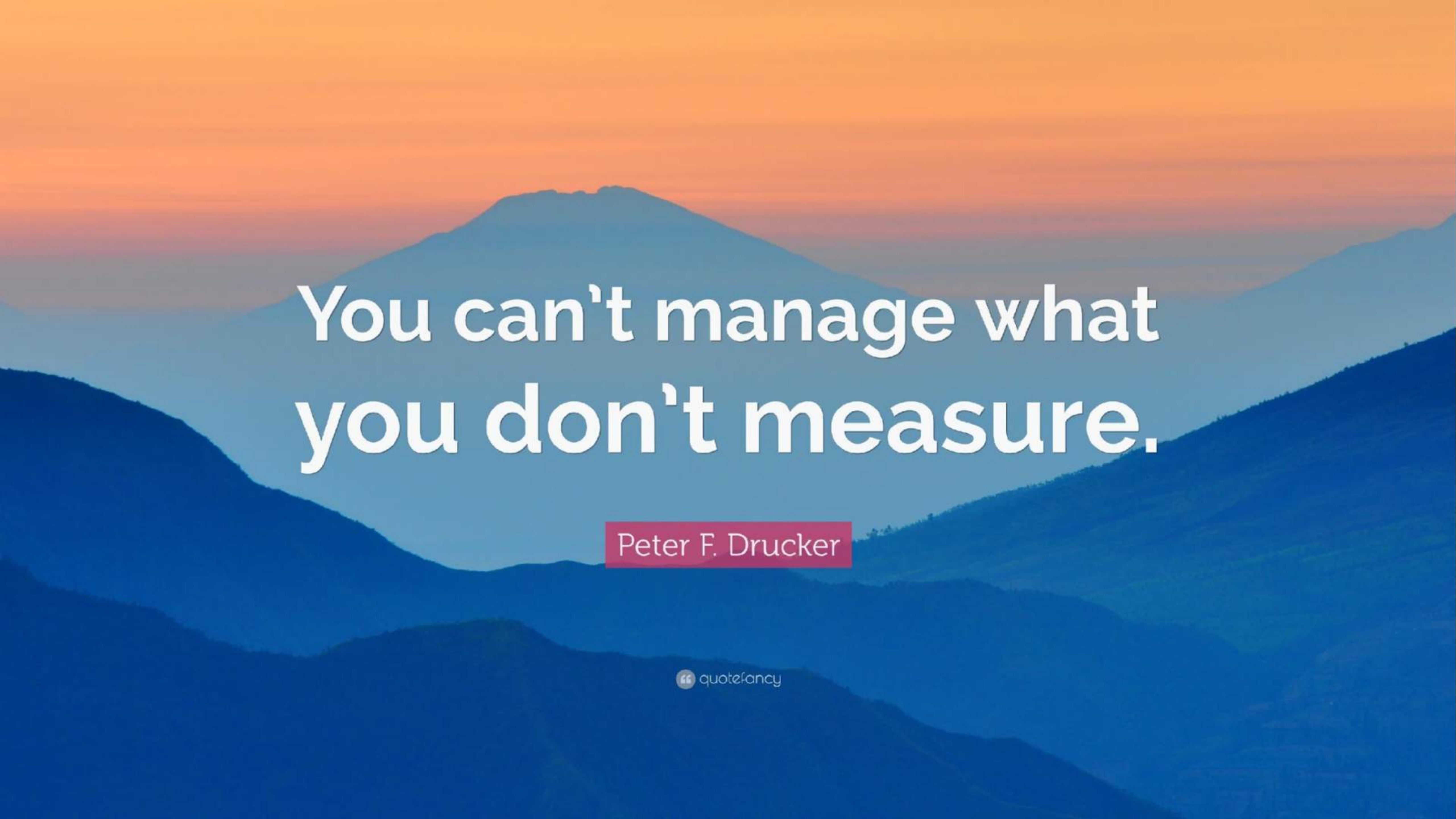
Objective: Provide template language that can be adopted to support additional performance factors.

Proposal:

1. Calculate embodied carbon
   (reduction not required)
2. Calculate GWP + ODP of refrigerants
   (reduction not required)
3. Commission all systems that pertain to energy
   (some systems missing in base code requirement)
4. Post occupancy evaluation to validate NZE
5. Energy audit, benchmark and disclose data
6. Re-commission periodically

Jurisdictional Requirements

Type of Documentation	Documentation Timeline
Life Cycle Assessment (reduction not required)	Certificate of Occupancy
Global Warming Potential Refrigerants (reduction not required)	Certificate of Occupancy
MA E-Z Code Building Commissioning	Certificate of Occupancy
Post Occupancy Evaluation (POE)	18 Months from Certificate of Occupancy
Benchmarking And Disclosure	24 Months from Certificate of Occupancy; On-going annually
Recommissioning	36 Months from Certificate of Occupancy and thereafter every five years.


You can't manage what you don't measure.
Peter F. Drucker
quotefancy

Board of Building Regulations and Standards (BBRS)

The Board of Building Regulations and Standards (BBRS) monitors Massachusetts building codes and construction supervisor licensing. The Board also licenses concrete testing labs and technicians, approves manufactured buildings and related inspection procedures, approves native lumber producers, and certifies municipal building inspectors.

Source: https://www.mass.gov/orgs/board-of-building-regulation-and-standards

How to Participate

MAPC
METROPOLITAN AREA PLANNING COUNCIL

Biannual BBRS Public Hearing

Next Tuesday November 10, 2020
10am - 1pm
Find the notice, meeting link, and agenda online

The participation of municipal staff and local elected officials from across the Commonwealth enables municipal perspectives to inform the discussion. A robust net zero code can support and accelerate progress toward climate and energy goals and multiple co-benefits, including cost savings, resilience, and public health.

ACTION ITEMS: We encourage municipal stakeholders to:

- Attend the Public Hearing
- Submit written comments following the Hearing
- Attend future BBRS meetings and stay engaged

Q & A

https://www.mapc.org/resource-library/building-codes-climate

CLEAN ENERGY

Building Codes for Climate

Take Action Today to Help Set Higher Efficiency Minimums!

BACKGROUND

Massachusetts municipalities can help support their residents' health and safety through the adoption and enforcement of state building codes. These codes also set forth essential energy policies, setting minimum efficiency requirements for a variety of building practices and technologies used in our cities and towns. With the Green Communities act of 2008, Massachusetts created to option for municipalities to adopt a stretch energy code.

QUESTIONS? NEED HELP?

For more information or for help walking through the process, contact **Nicole Sanches** at nsanches@mapc.org or 617-933-0760.

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