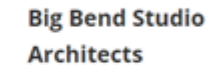
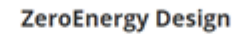
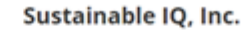
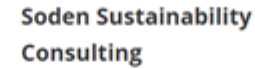


**MA E-Z**  
STRETCH CODE

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



# WORKING GROUP

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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](http://www.neep.org)*

PARTNERS



# CONTEXT

# Massachusetts: GHG Emissions Reduction Policy

## 2008

The Global Warming Solutions Act (GWSA) of 2008 initially required at least an 80% reduction in greenhouse gas (GHG) emissions from all sectors of the economy below the 1990 baseline emission level by 2050.

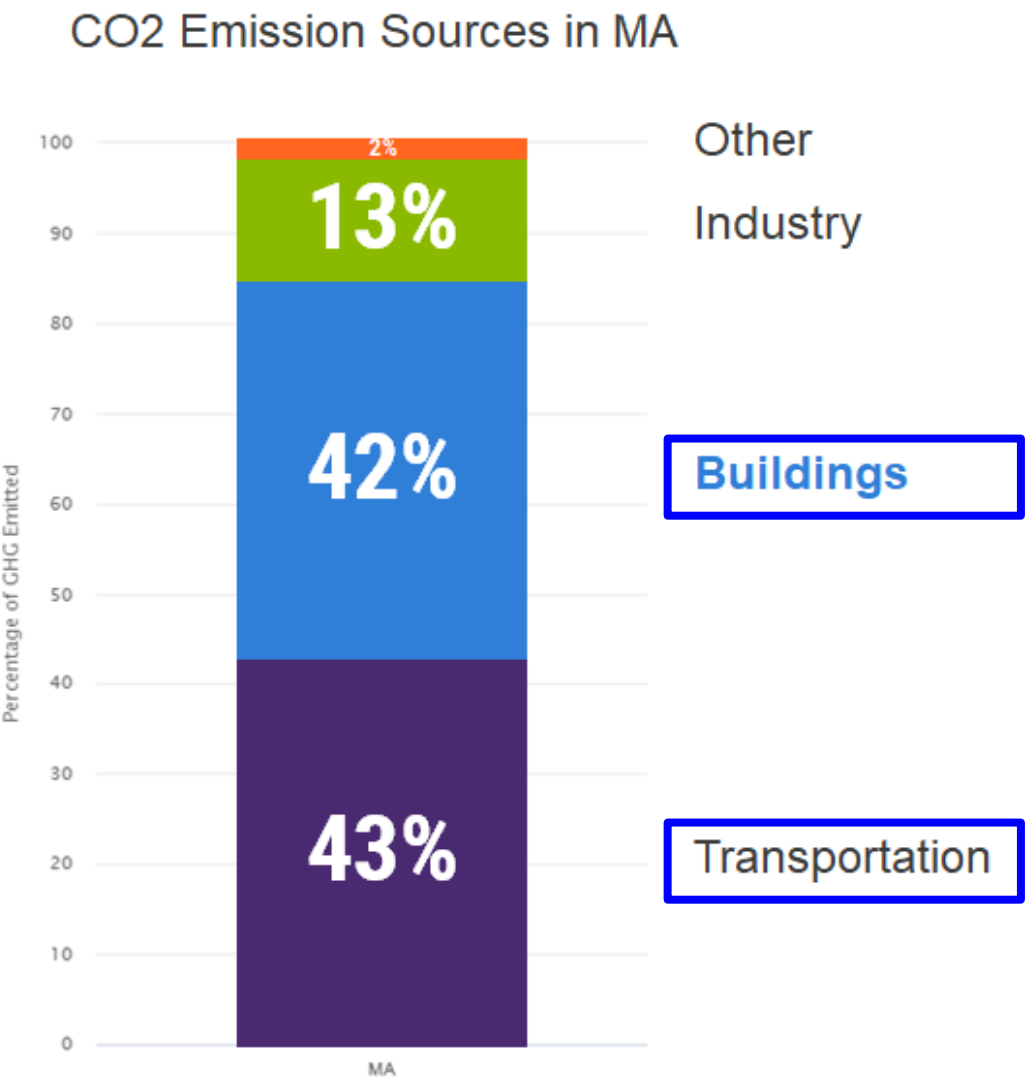


## 2020

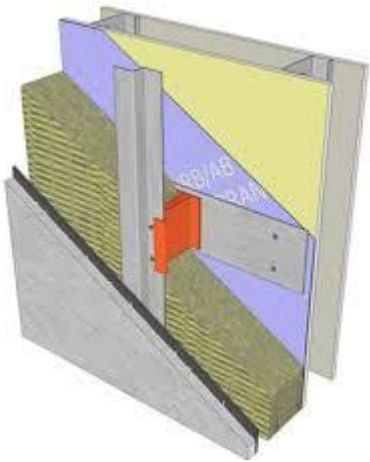
Governor Baker:  
“...I hereby determine that **net zero emissions by 2050**... is a reasonable and appropriate 2050 statewide emissions limit... [and] in no event shall the level of emissions be greater than a level that is 85 percent below the 1990 level.”

[DETERMINATION OF STATEWIDE EMISSIONS LIMIT FOR 2050](#)  
[April 22 2020](#)

# Massachusetts: Emission Drivers



# Net Zero



Energy  
Efficiency

+



Electrification  
(Heat + Hot Water)

+



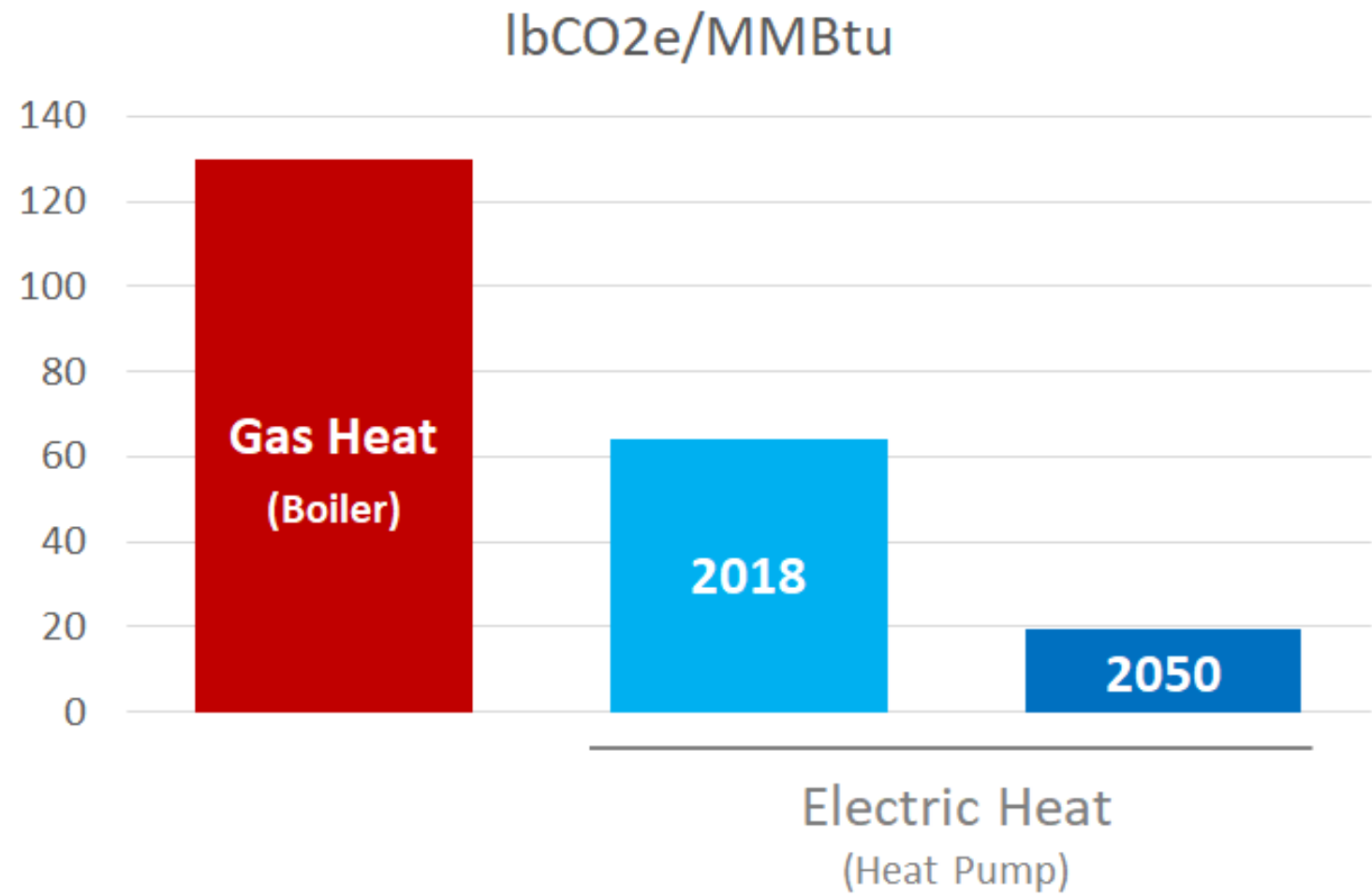
Renewable  
Energy

=

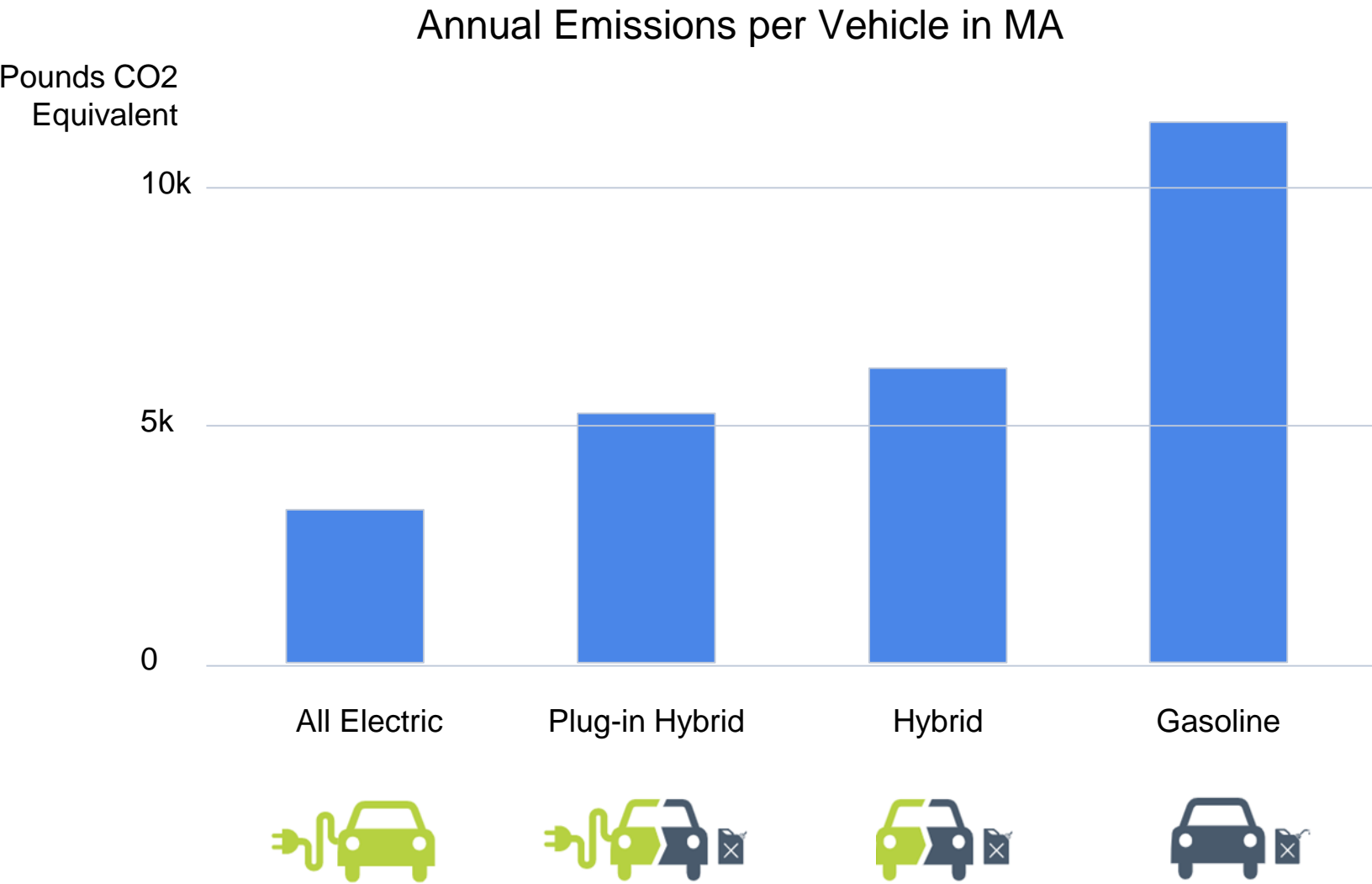
**Net  
Zero**



# GAS VS. ELECTRIC HEATING: CO2 EMISSIONS

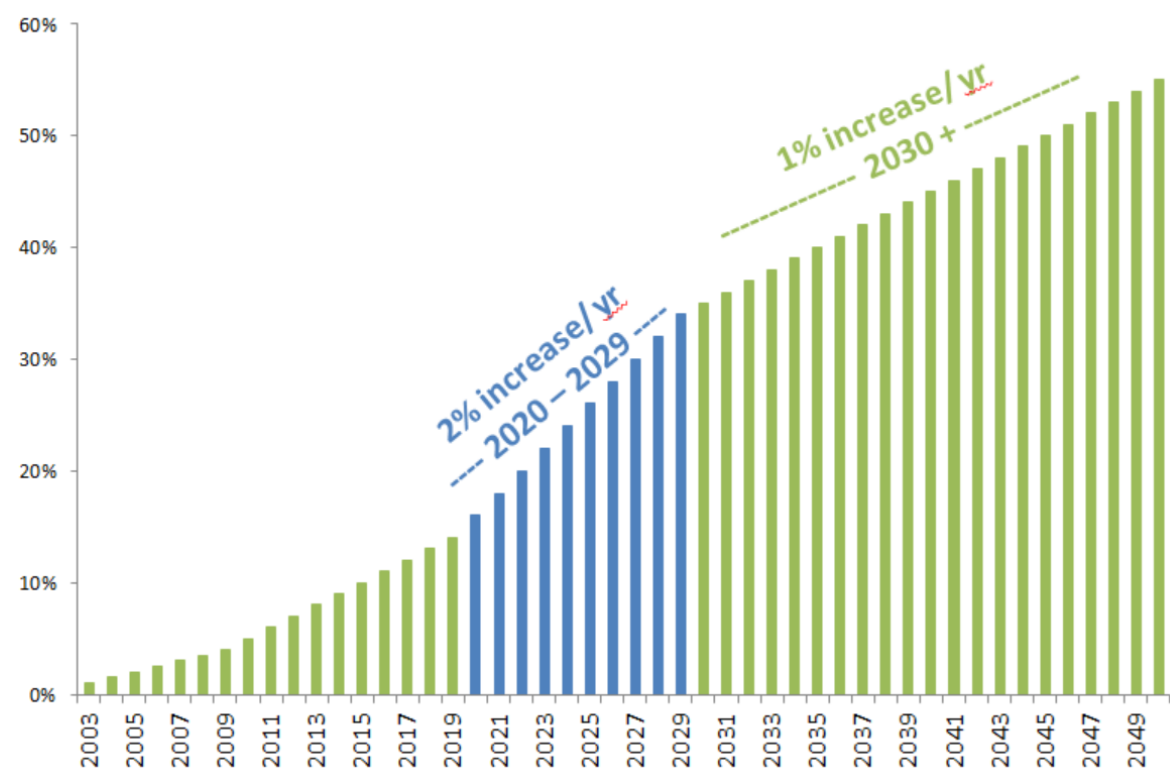


# ELECTRIFICATION of TRANSPORTATION (in MA, already ~75% cleaner & getting cleaner)

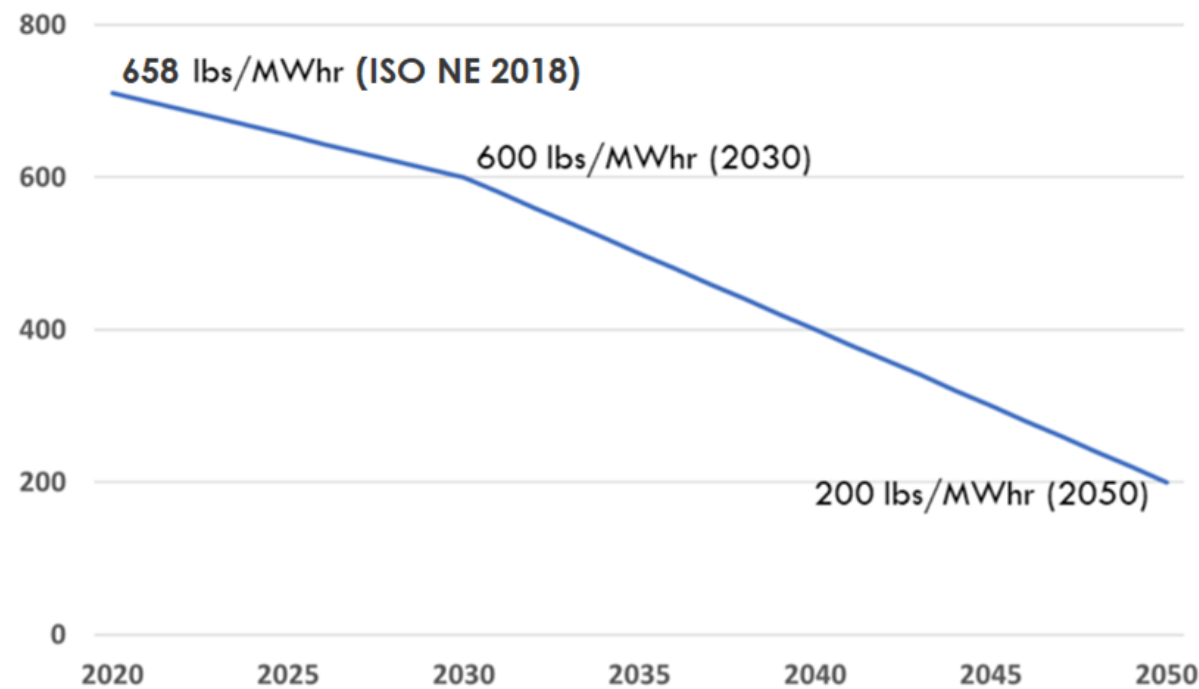


# ELECTRIFICATION - Grid Emissions Over Time

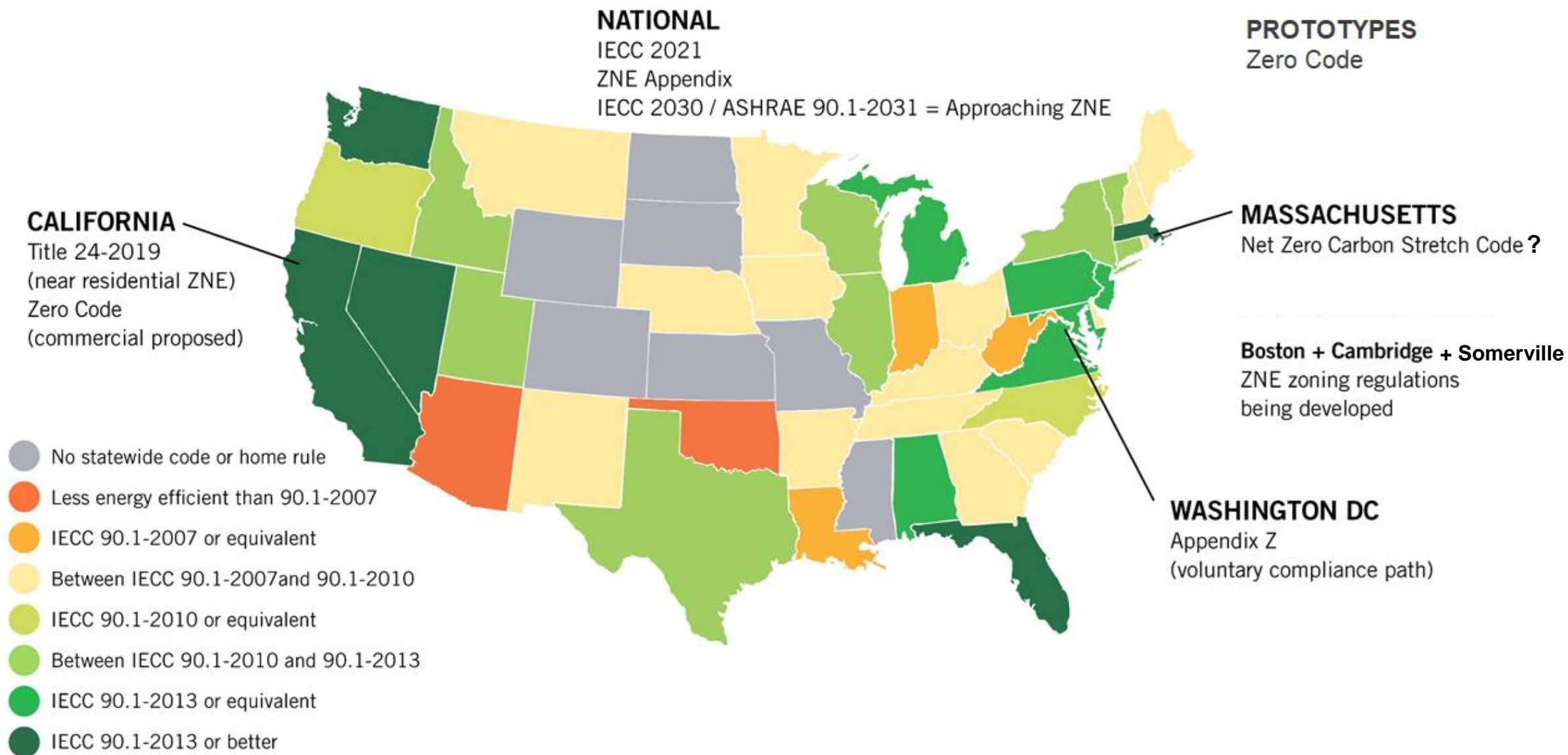
Renewable Portfolio Standard (required by law)



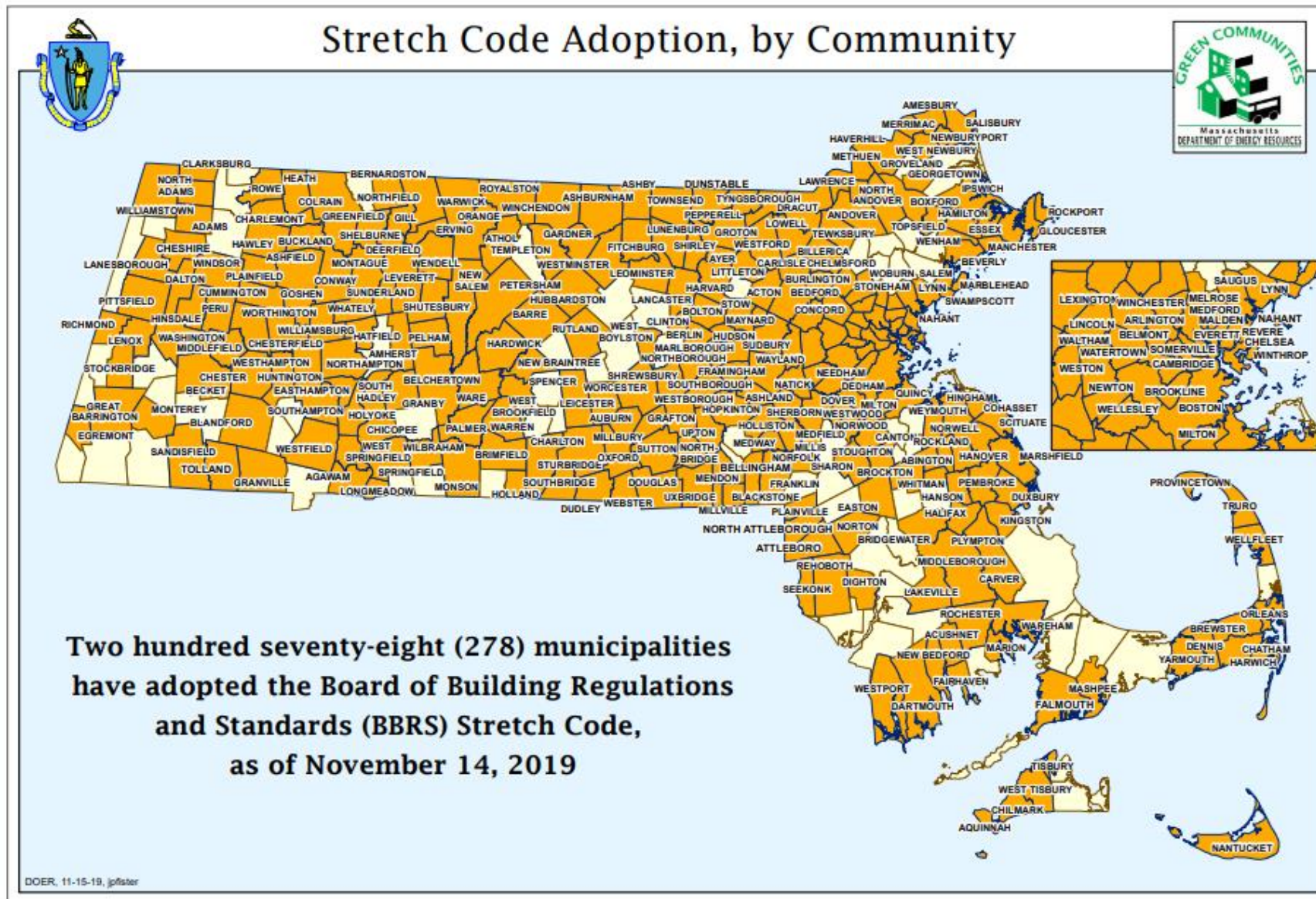
Resulting Grid Emissions (lbs/MWh)



## PRECEDENTS

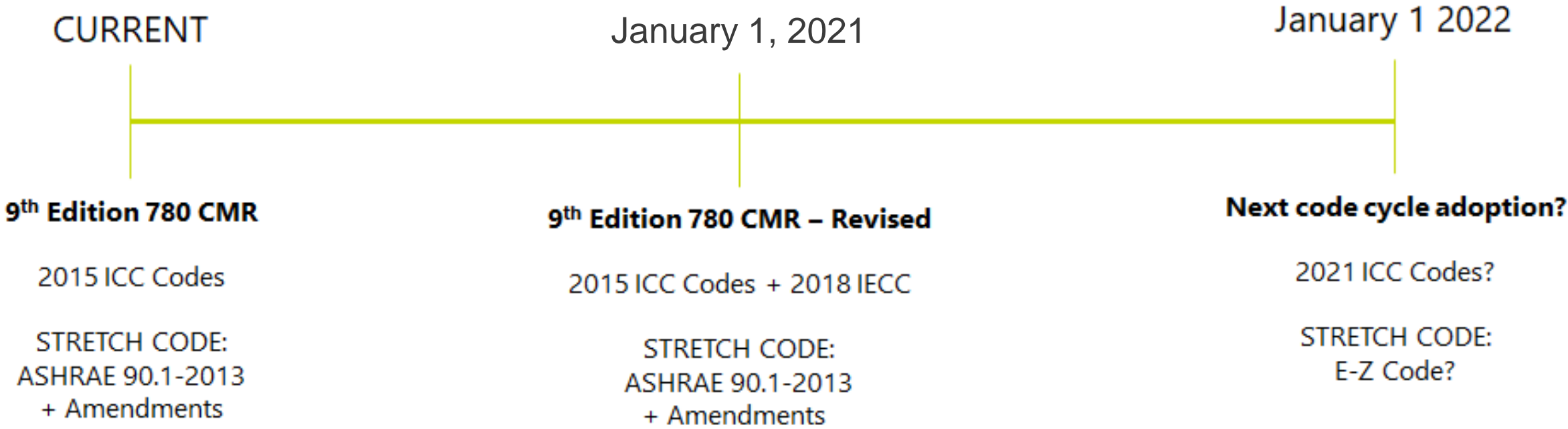


# Massachusetts: Stretch Code Adoption





# Timeline



# 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.



# AIA Zero Code

Things that the AIA Zero Code does not address:

1. Energy Efficiency beyond base code (not a Stretch Code)  
(does not define a prescriptive path to enhance energy efficiency)
2. Does not address eliminating fossil fuels
3. Sets a starting point for renewable energy weighting, but local modification is expected

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

### **IECC 2021 ZCREA AIA Zero Code**

- Code minimum building
- Combustion Allowed
- Renewable energy does not have to be additional, different renewable energy types have different weighting factors

### **MA E-Z Code**

- 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:

### Feasible

### Cost

- |   |   |                                       |
|---|---|---------------------------------------|
| 1. Envelope Heating Load Limit                      | ✓ | minimal                               |
| 2. Fenestration U-value Requirements                | ✓ | minimal if not high window:wall ratio |
| 3. Air Leakage - Thermal Envelope                   | ✓ | minimal                               |
| 4. Energy Recovery Ventilation Systems - Efficiency | ✓ | minimal                               |
| 5. Fan Power Limit                                  | ✓ | minimal                               |
| 6. Heat Pump Capacity                               | ✓ | minimal                               |
| 7. Service Water Heating Performance Efficiency     | ✓ | minimal                               |

# ENERGY EFFICIENCY - PRESCRIPTIVE PATH

Category	E-Z Prescriptive Path	IECC 2021 Base Code (for reference)
Envelope Heating Load Limit	$UA \times \Delta T / \text{sf} \leq 5 \text{ Btu/h-sf}$	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)
Allowable Fan Horsepower	90% of IECC 2021 allowable	100% of IECC 2021 allowable
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

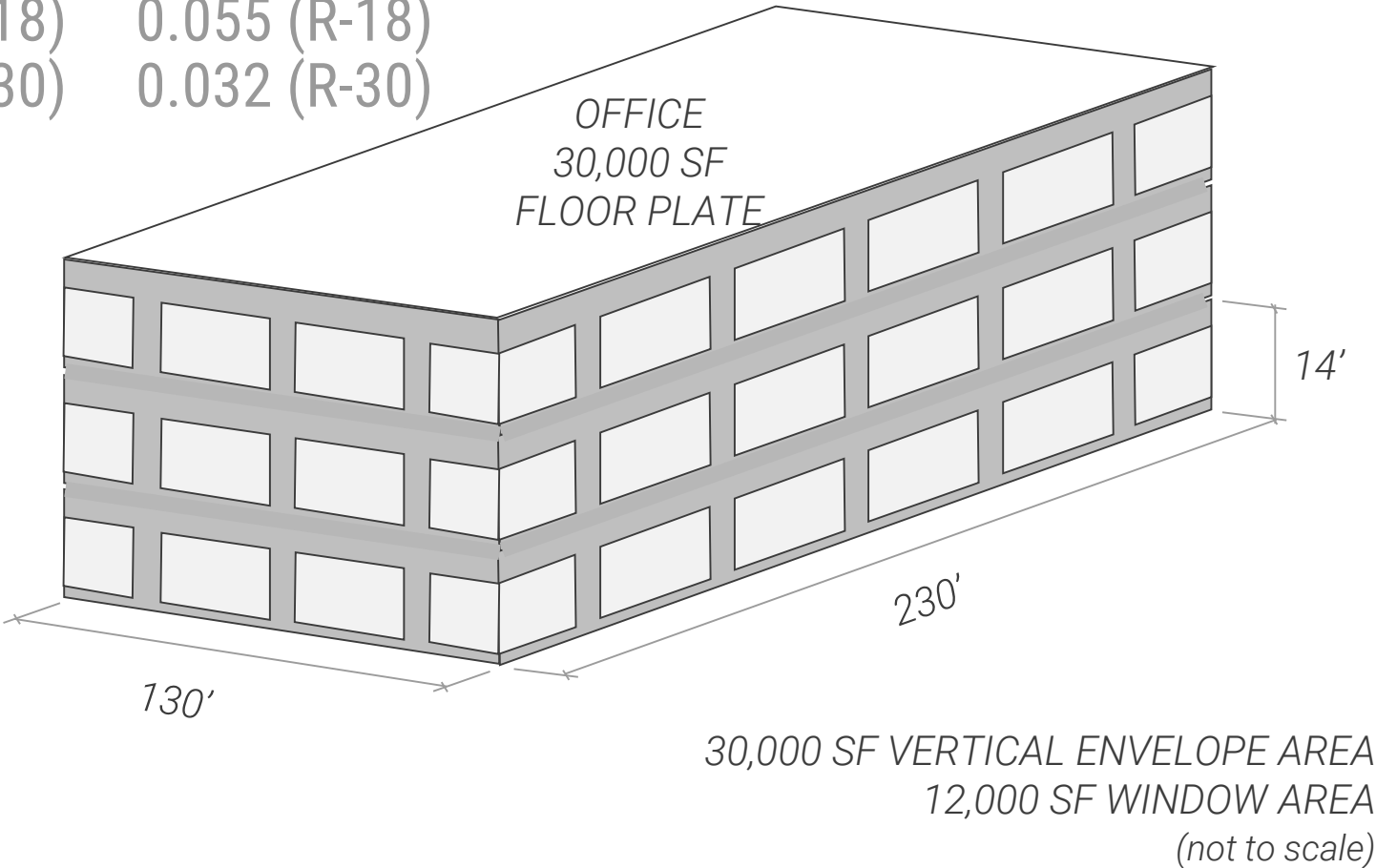
Category	E-Z Prescriptive Path	IECC 2021 Base Code (for reference)
Envelope Heating Load Limit	$UA \times \Delta T / \text{sf} \leq 5 \text{ Btu/h-sf}$	There is a U-value x Area limit, but it is based on total envelope area, not floor area, so how the base code compares to the E-Z code will vary based on the building geometry.
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Allowable Fan Horsepower	90% of IECC 2021 allowable	100% of IECC 2021 allowable
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)

# ENVELOPE

Example compliance:	E-Z Code	IECC 2021
Window:Wall	40%	40%
Window U-value	0.28	0.38
Wall U-value	0.055 (R-18)	0.055 (R-18)
Roof U-value	0.032 (R-30)	0.032 (R-30)

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

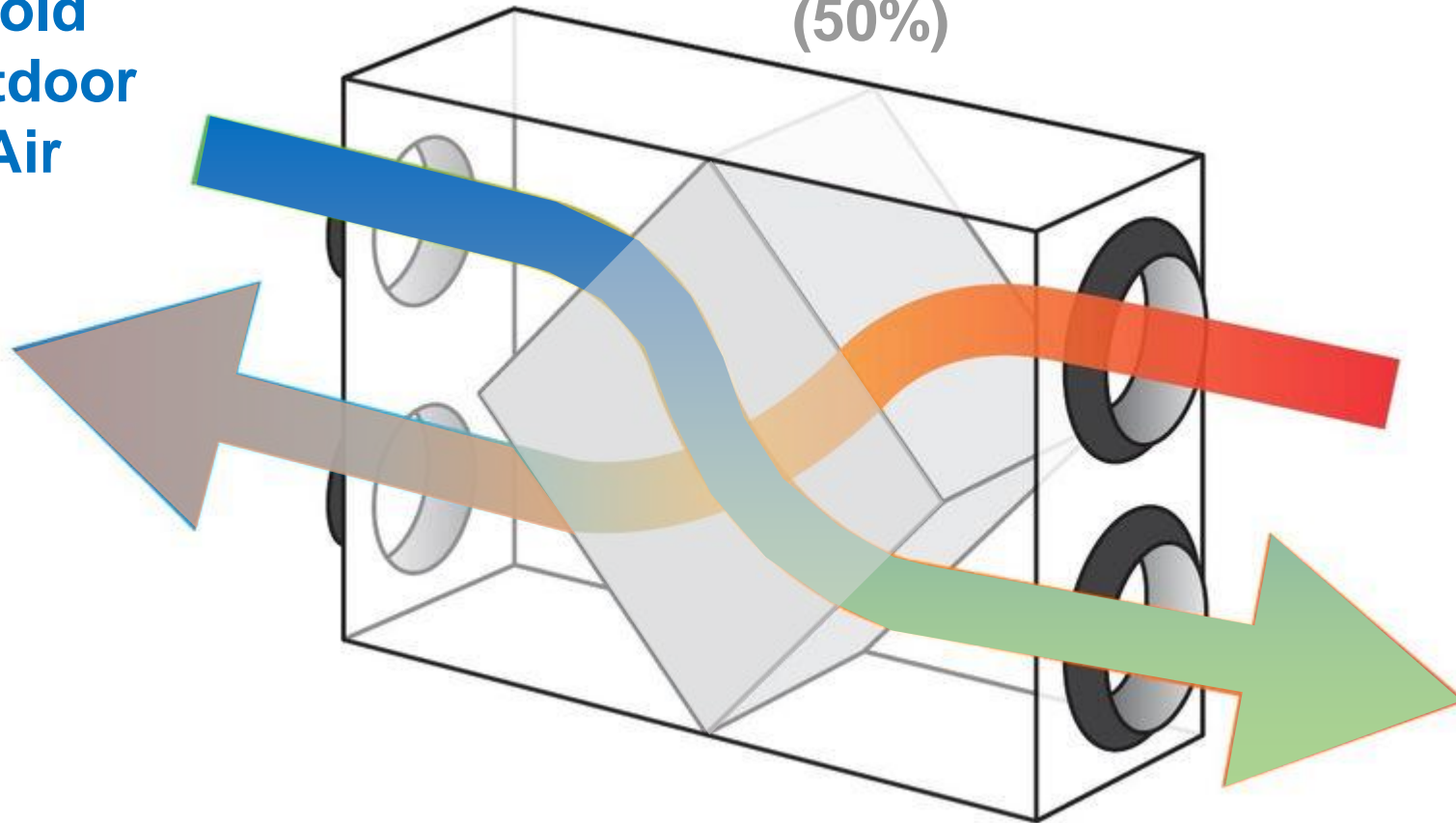
Floor Area      90,000 GSF



# HEAT RECOVERY: BASE CODE

Poor Energy  
Recovery  
(50%)

Cold  
Outdoor  
Air



Must Add  
Heat

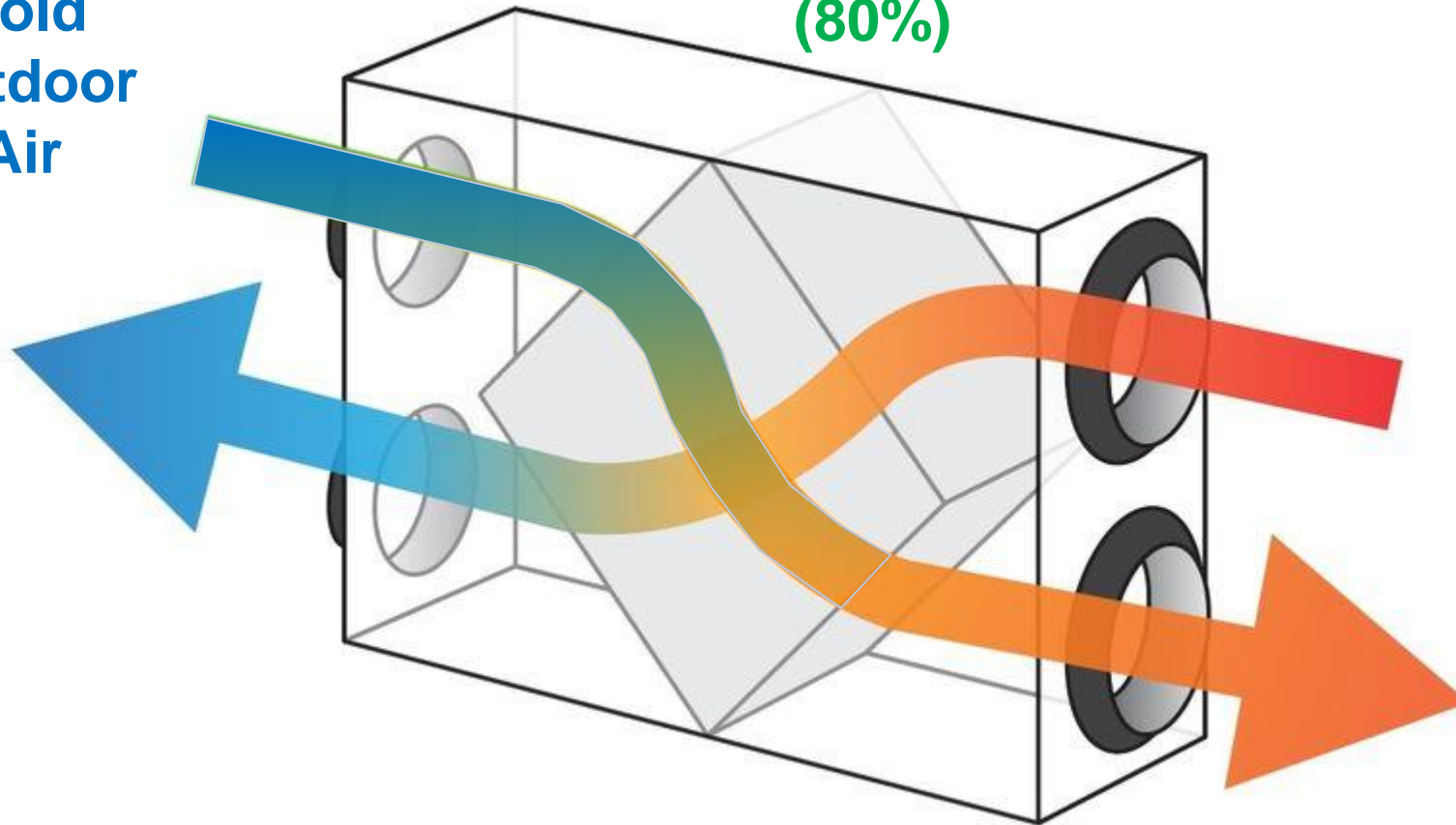
Cold  
Fresh  
Air



## HEAT RECOVERY: E-Z CODE

Efficient Energy  
Recovery  
(80%)

Cold  
Outdoor  
Air



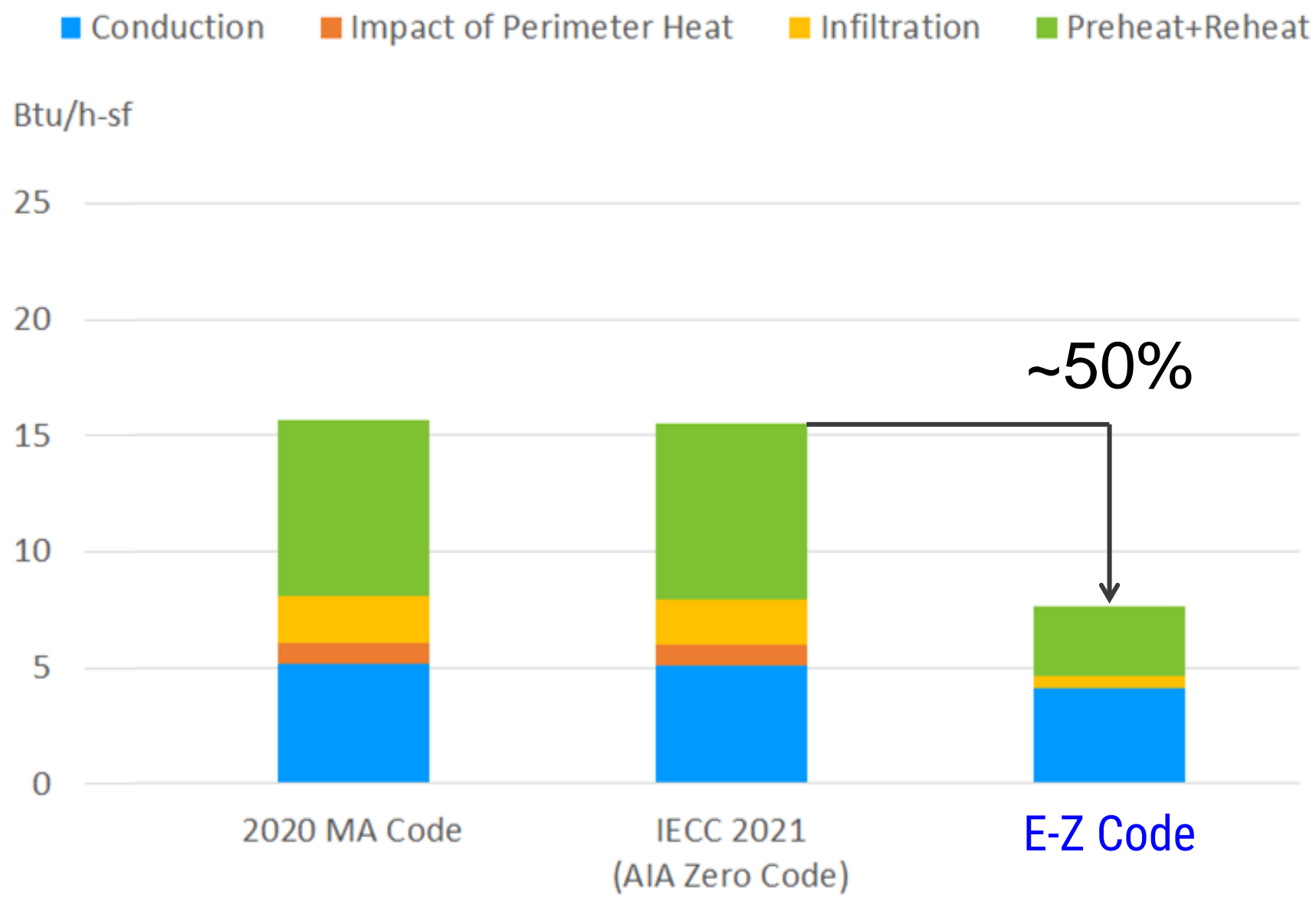
Minimal Extra  
Heat Needed

Warm  
Fresh  
Air





# TOTAL HEATING LOAD



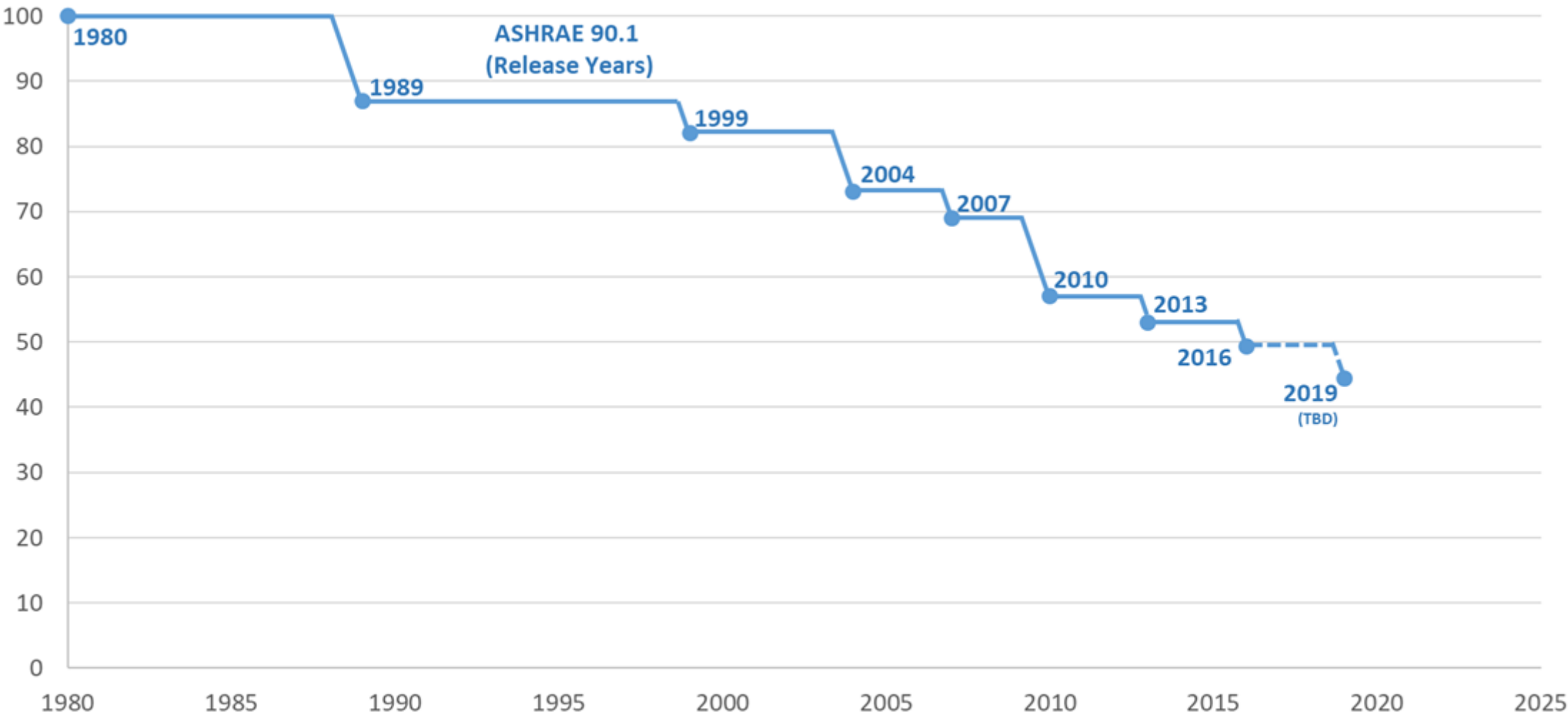
\*Varies by building type and size. Values based on 90,000 GSF, 3-story building.

# ENERGY EFFICIENCY - PERFORMANCE PATH

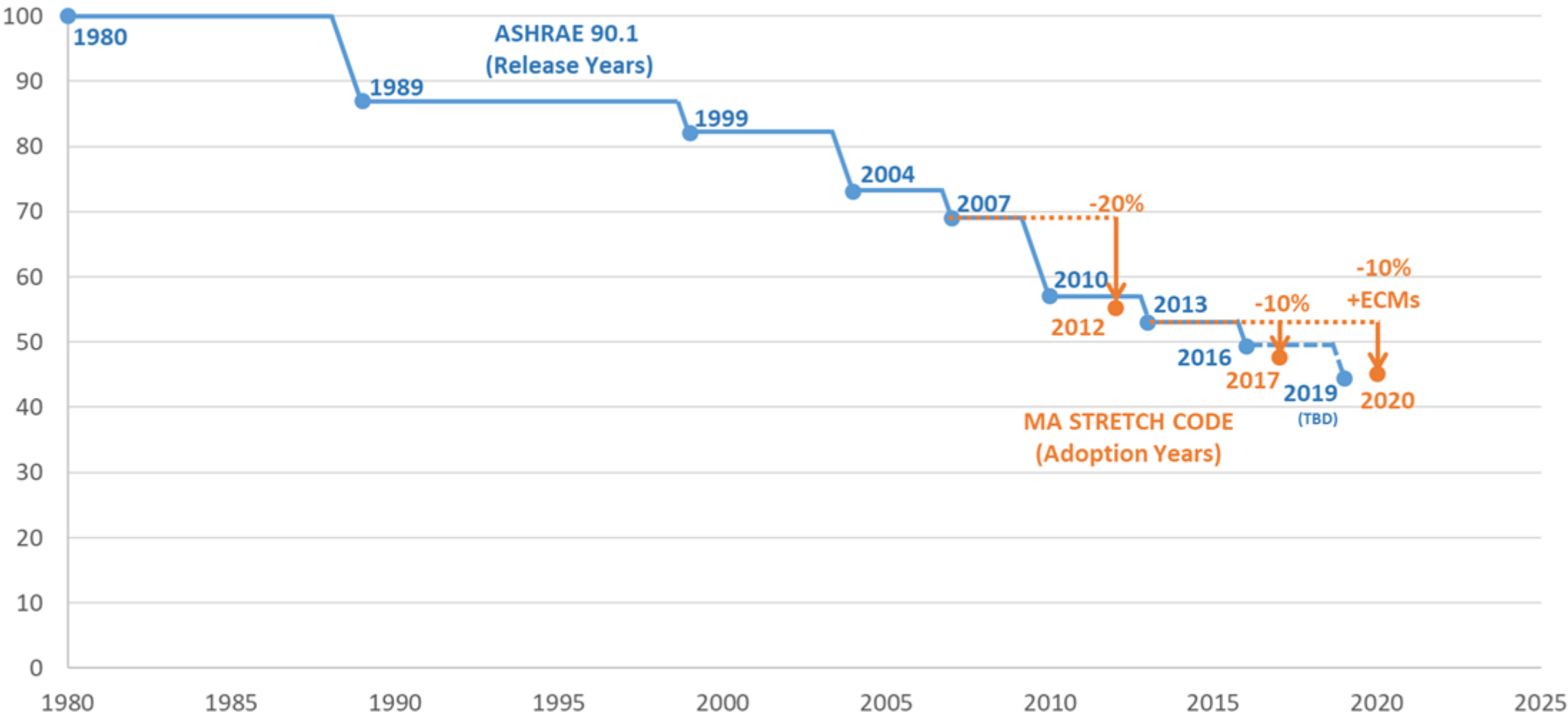
**Objective:** Align with national standards, with key enhancements to ensure low energy, grid-friendly, cost effective buildings.

Proposal:	Feasible	Cost
1. Same as Base Code + AIA Zero Code	√	none (same as base code)
2. Add a prescriptive backstop	√	lower than prescriptive path (less strict)

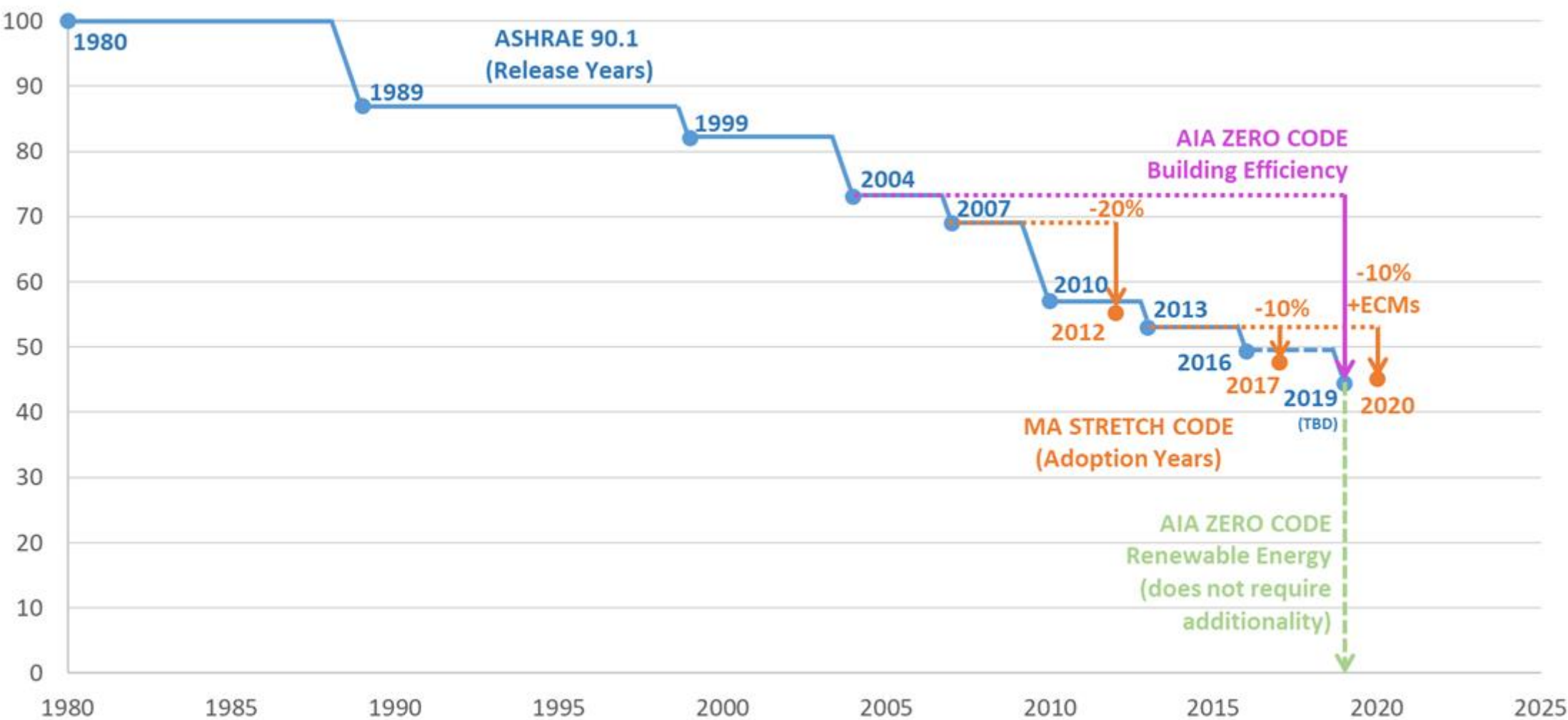
# PERFORMANCE PATH - ASHRAE 90.1 HISTORY



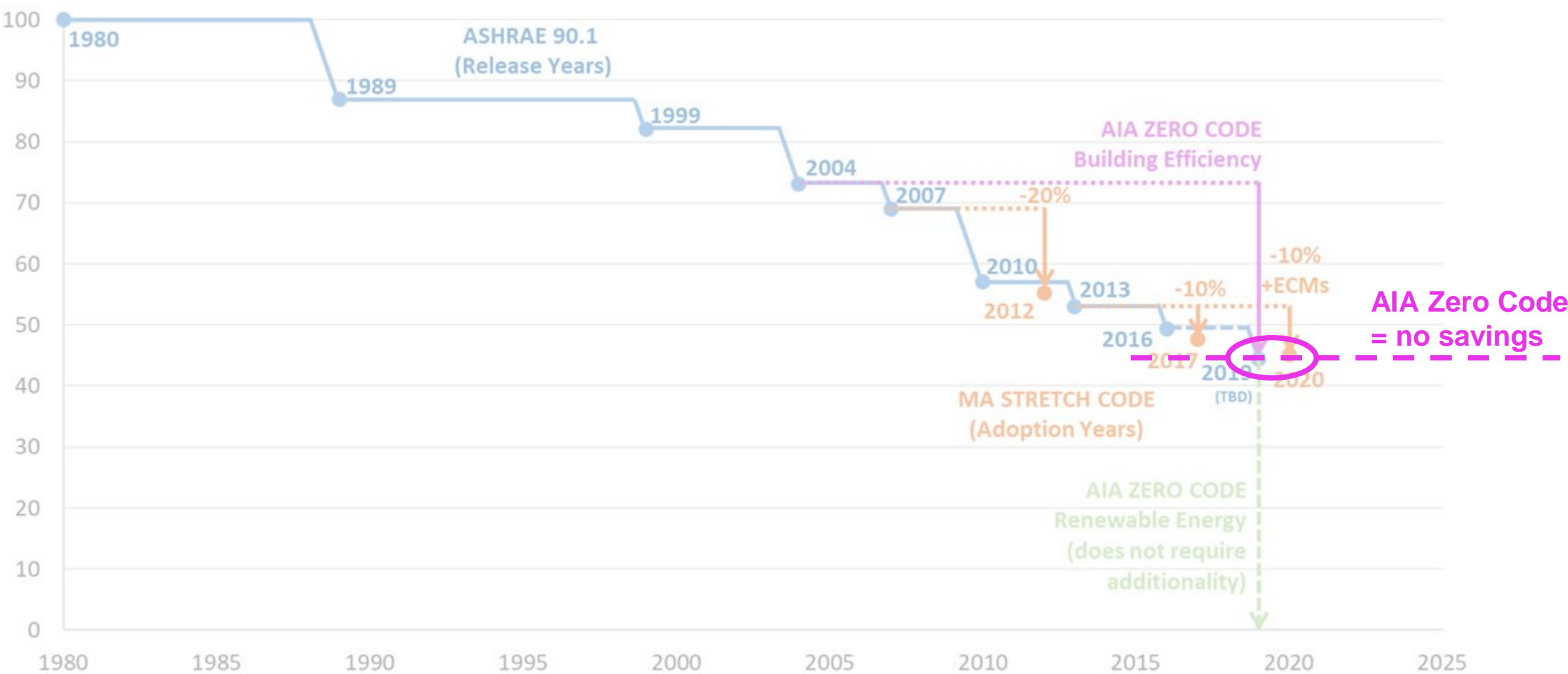
# PERFORMANCE PATH - STRETCH CODE HISTORY



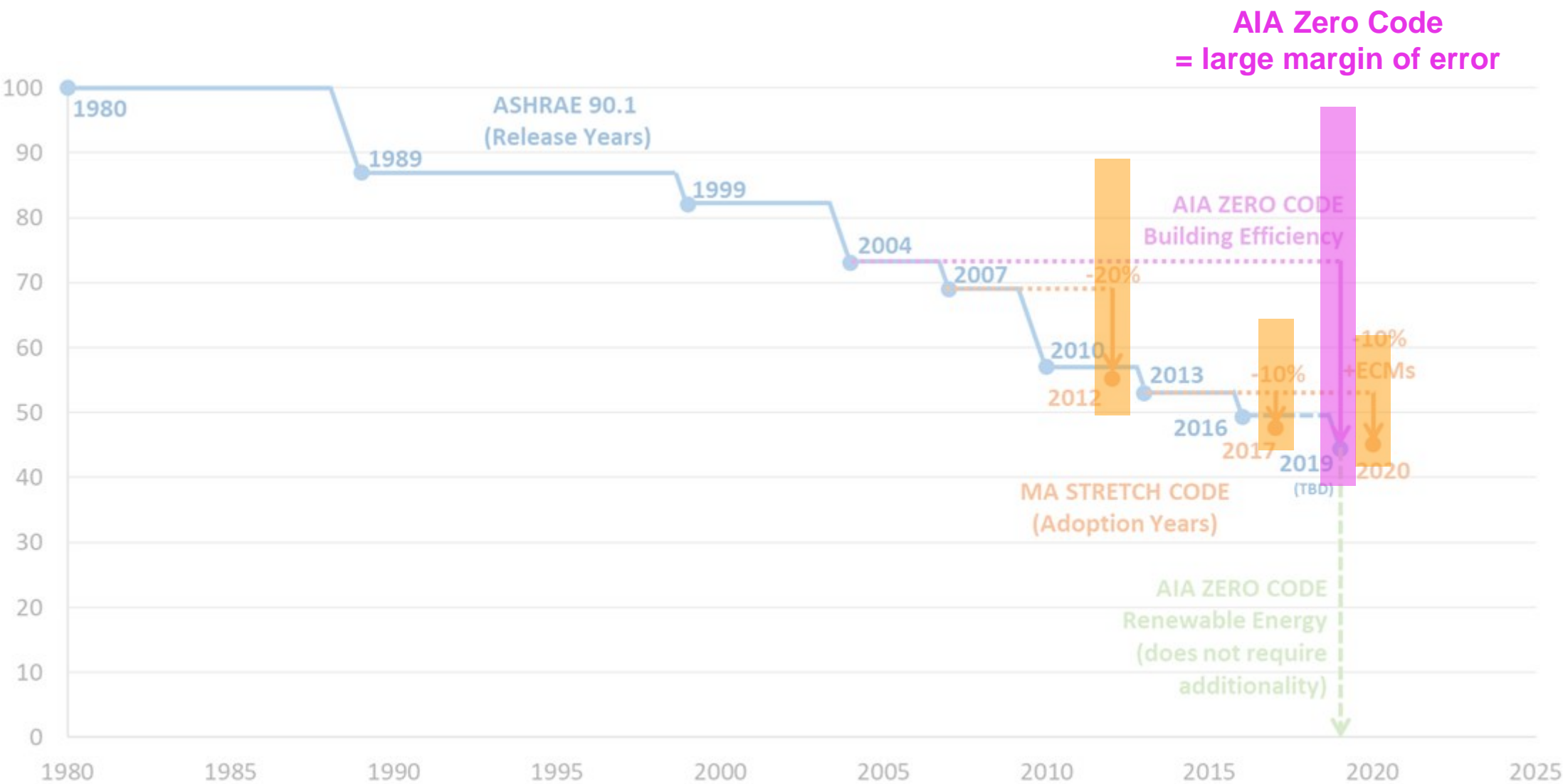
# PERFORMANCE PATH - AIA ZERO CODE



# 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	$UA \times \Delta T / sf \leq 5 \text{ Btu/h-sf}$	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)
Allowable Fan Horsepower	90% of IECC 2021 allowable	110% of IECC 2021 allowable	100% of IECC 2021 allowable
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:	Feasible	Cost
1. Limitation of cases where on-site combustion is allowed	√	minimal (due to efficiency requirements)
2. Electric vehicle charging infrastructure	√	minimal
3. Demand response capable	√	minimal

# 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

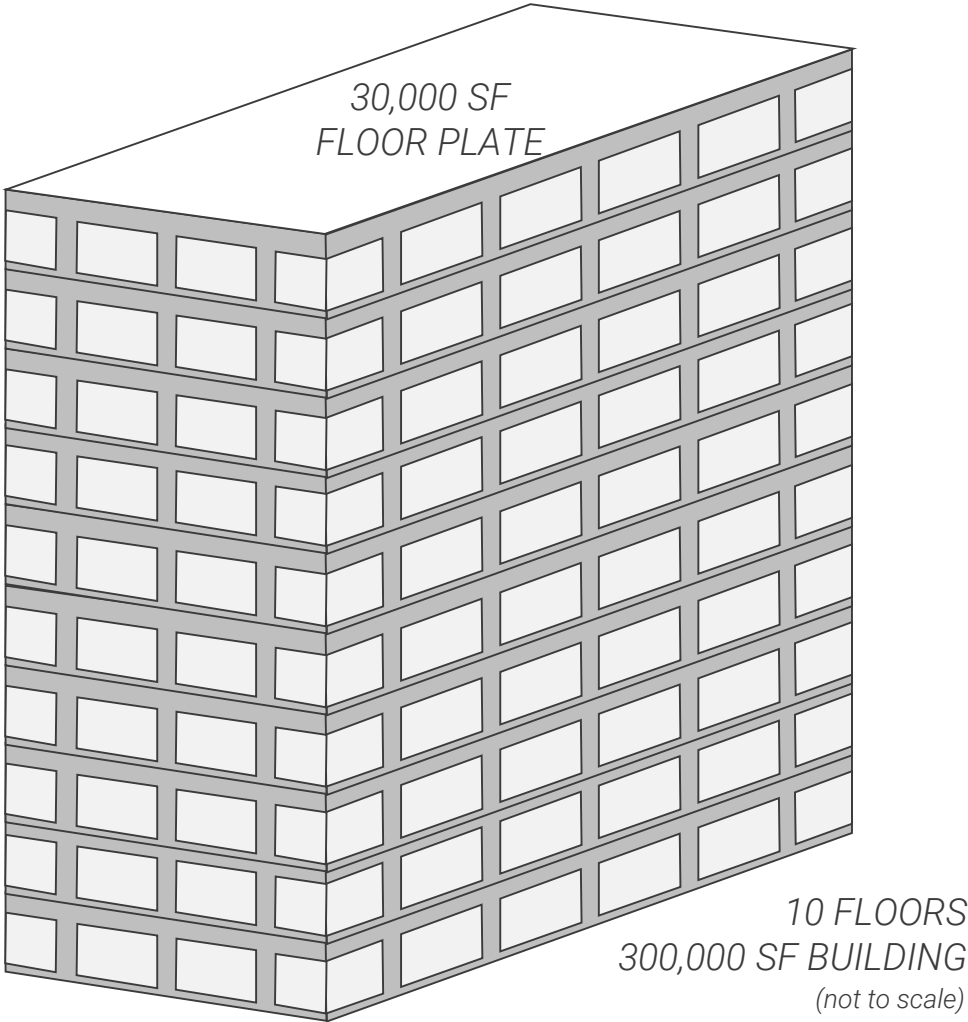
# ELECTRIFICATION + LOAD REDUCTION

Capacity  
Required for  
Heating



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

\*135MBH each



# ELECTRIFICATION + LOAD REDUCTION

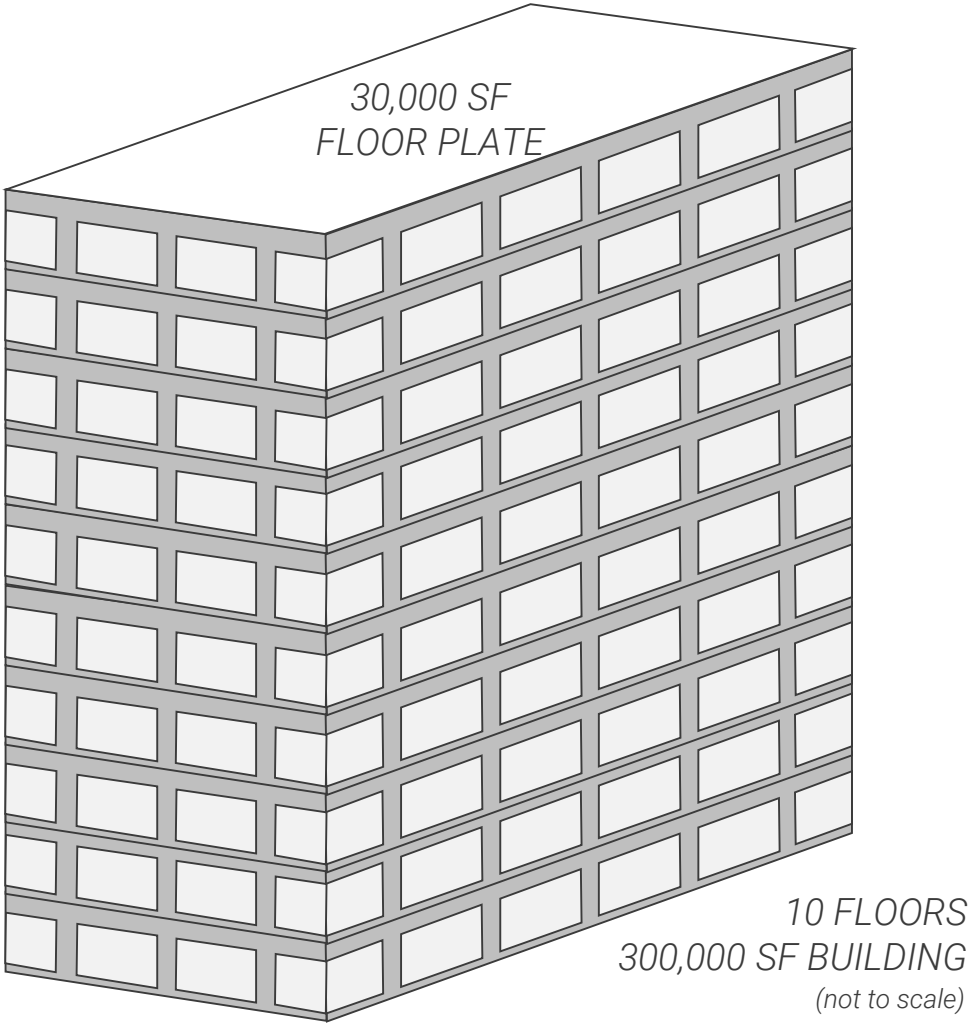
Capacity  
Required for  
Heating



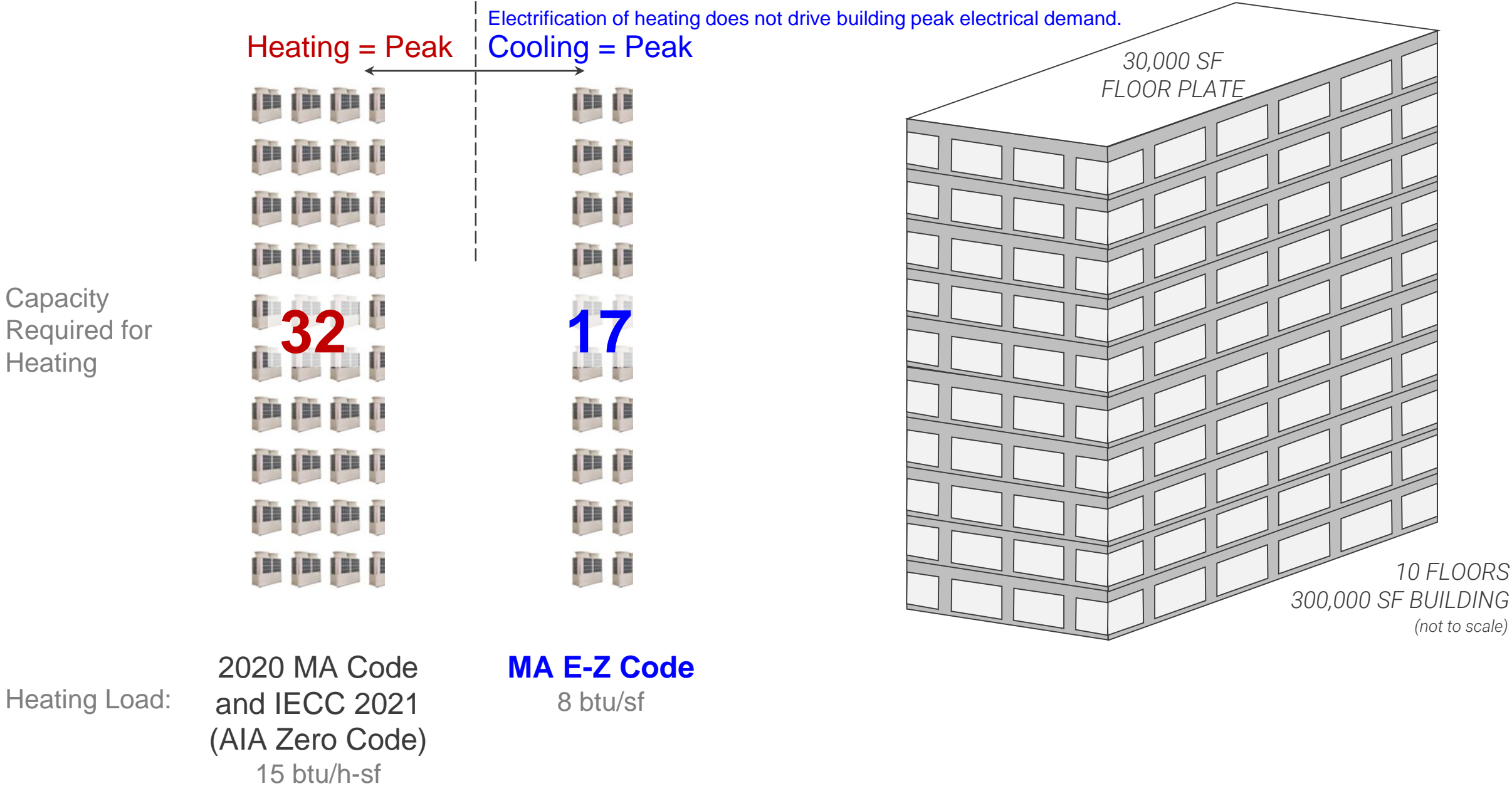
Heating Load:  
2020 MA Code  
and IECC 2021  
(AIA Zero Code)  
15 btu/h-sf

**MA E-Z Code**  
8 btu/sf

\*135MBH each



# ELECTRIFICATION + LOAD REDUCTION



\*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:**

Feasible

Cost

- |   |   |  |
|---|---|--|
| 1. Require on-site + off-site renewable = net zero                          | √ | often zero cost, highly cost effective   |
| 2. On-site solar requirements   | √ | often zero cost, highly cost effective   |
| 3. Off-site renewable energy must be “Additional”<br>(no weighting factors) | √ | increased cost of RECs meeting<br>‘Additionality’ can be mitigated by using<br>alternative procurement options |



# ON-SITE AND OFF-SITE RENEWABLES ARE ALLOWED



**ON-SITE RENEWABLES**  
Prioritized as primary



**OFF-SITE RENEWABLES**  
Supplement as necessary



***100% of the  
building's  
annual energy  
consumption***



# ON-SITE RENEWABLES

## Rooftop Solar

1. Solar array = **50 percent of the roof area of buildings** (excluding skylights)
2. Additionally solar array = **90 percent of** overhangs, covered parking areas, trellises, and similar accessory structures within 250 feet of the buildings or installed with the building project.

## Exceptions:

1. No solar-ready zone (mechanical equipment, etc.)
2. Shaded roof area
3. Ground-mounted solar and other types of renewable energy can be used instead

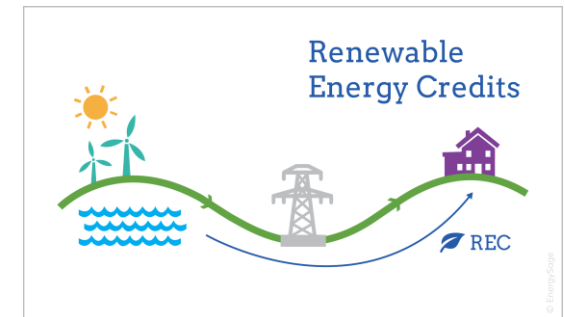


# OFF-SITE RENEWABLES

**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 (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

# E-Z Code - Comparison to IECC 2021 ZCREA / AIA Zero Code

## **IECC 2021 ZCREA AIA Zero Code**

- **Code minimum building**
- **Combustion Allowed**
- **Renewable energy does not have to be additional, different renewable energy types have different weighting factors**

## **MA E-Z Code**

- **Better energy performance than base code**
- **Combustion-free building (with exceptions)**
- **Renewable energy must be additional, no weighting of different renewable energy sources**

# APPENDIX

# E-Z Code - Comparison to IECC 2021 ZCREA / AIA Zero Code

	IECC 2021 ZCREA AIA Zero Code	MA E-Z Code
Energy Efficiency	<p><b>CODE MINIMUM</b></p> <p><u>Prescriptive Path</u> ASHRAE 90.1-2019 Prescriptive</p> <p>-OR-</p> <p><u>Performance Path</u> ASHRAE 90.1-2019 Appendix G (building performance factors, using site energy)</p>	<p><b>BEYOND CODE MINIMUM</b></p> <p><u>Prescriptive Path</u> IECC 2021 + MA Amendments (reduces energy consumption compared to base code)</p> <p>-OR-</p> <p><u>Performance Path</u> ASHRAE 90.1-2019 Appendix G (matches IECC Zero Energy Appendix / AIA Zero Code) <i>with</i> Prescriptive Backstop</p>
Electrification	n/a	<p>No Combustion (with exceptions such as: labs, healthcare, commercial kitchens, domestic hot water)</p> <p>Electric Vehicle requirements</p> <p>Demand Response requirements</p>
Renewable Energy	Many Renewable Energy Options Not Required to Meet Additionality Standards <i>with</i> Weighting Factors	<p>On-Site and/or Off-Site Renewable Energy Meeting Additionality Requirements (no weighting factors)</p> <p>On-site Solar requirements</p>
Jurisdictional Compliance Requirements	n/a	Allows municipalities to choose to adopt a number of additional topics, including embodied carbon, refrigerants, commissioning, and energy use disclosure.

# PERFORMANCE PATH - Use 90.1-2019 Building Performance Factors

Baseline is similar to ASHRAE 90.1-2004  
Proposed must beat performance factor:  
(same as AIA Zero Code)

Building Area Type	Building Performance Factor (Proposed / Baseline)
Multifamily	0.70
Healthcare/hospital	0.57
Hotel/motel	0.50
Office	0.51
Restaurant	0.63
Retail	0.50
School	0.36
Warehouse	0.49
All Others	0.51

# PERFORMANCE PATH - Modifications to ASHRAE 90.1-2019

In lieu of energy cost:  
use site energy (same as AIA Zero Code) OR source fossil fuel energy

Load Type	Source Fossil Fuel Factor
Electricity (Grid Purchase)	1.50 <sup>a</sup>

[other factors listed in E-Z Code, but not shown here]

<sup>a</sup> The default electricity (grid purchase) meter conversion factor is based on the projected average annual grid combustion fuel input per unit of delivered site electricity of the ISO New England grid in 2030.



# JURISDICTIONAL REQUIREMENTS

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

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



You can't manage what  
you don't measure.

Peter F. Drucker

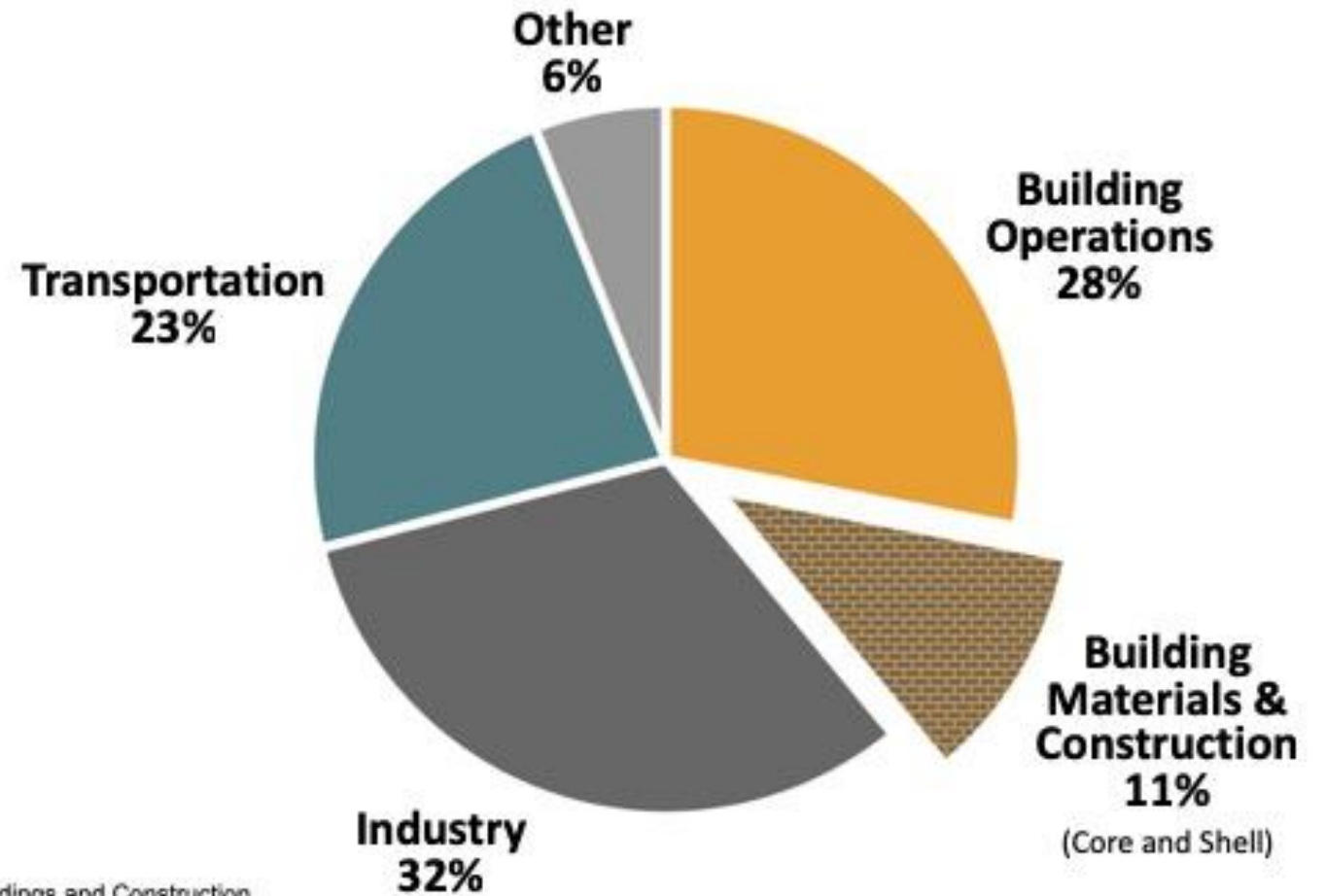
# Jurisdictional Requirements

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

# Carbon in Buildings

Note: E-Z Code does NOT mandate reduction in embodied emissions, but requires an LCA be performed to calculate embodied emissions.

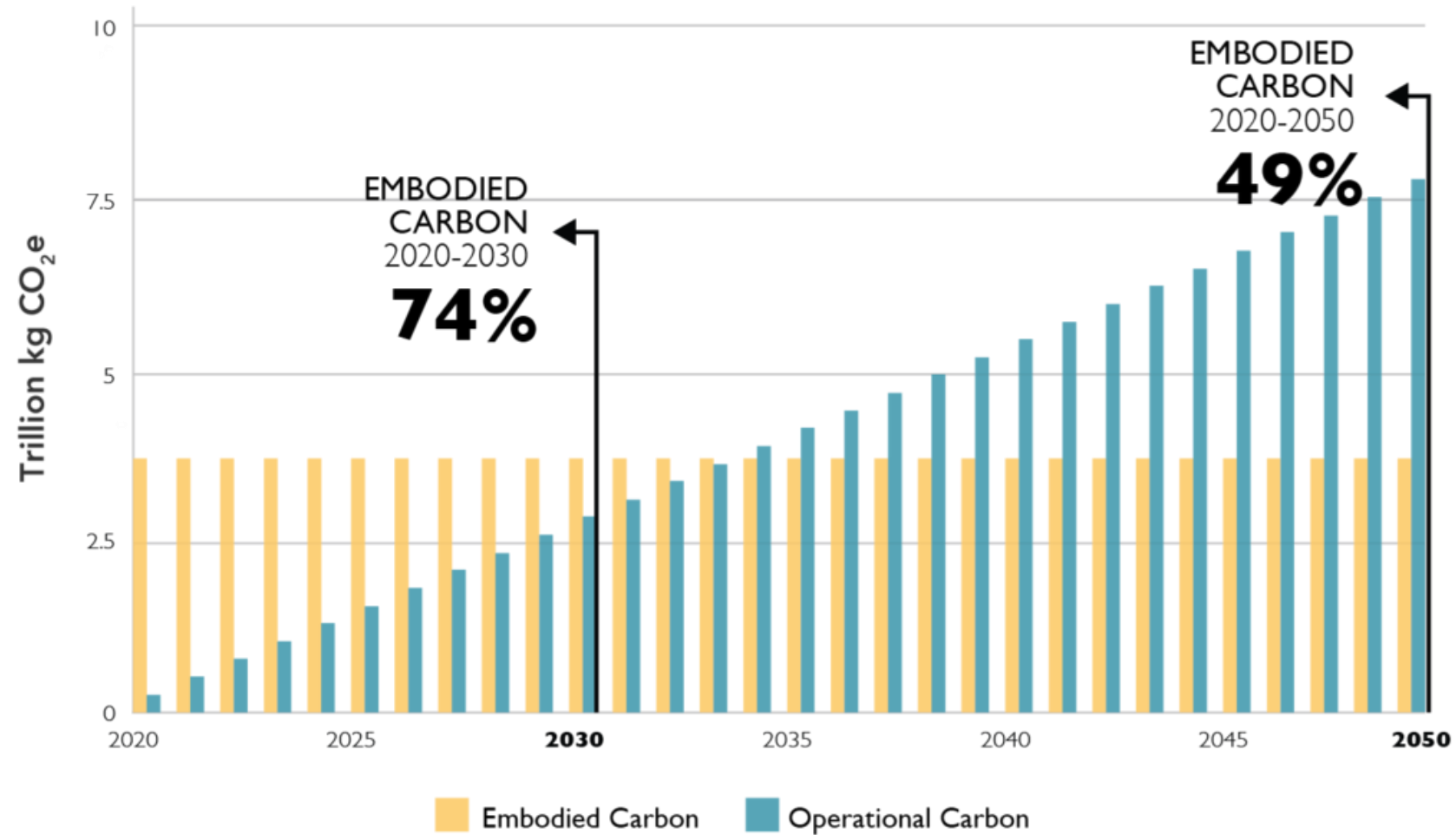
## Global CO<sub>2</sub> Emissions by Sector



Source:  
Global Alliance for Buildings and Construction.  
2018 GLOBAL STATUS REPORT.

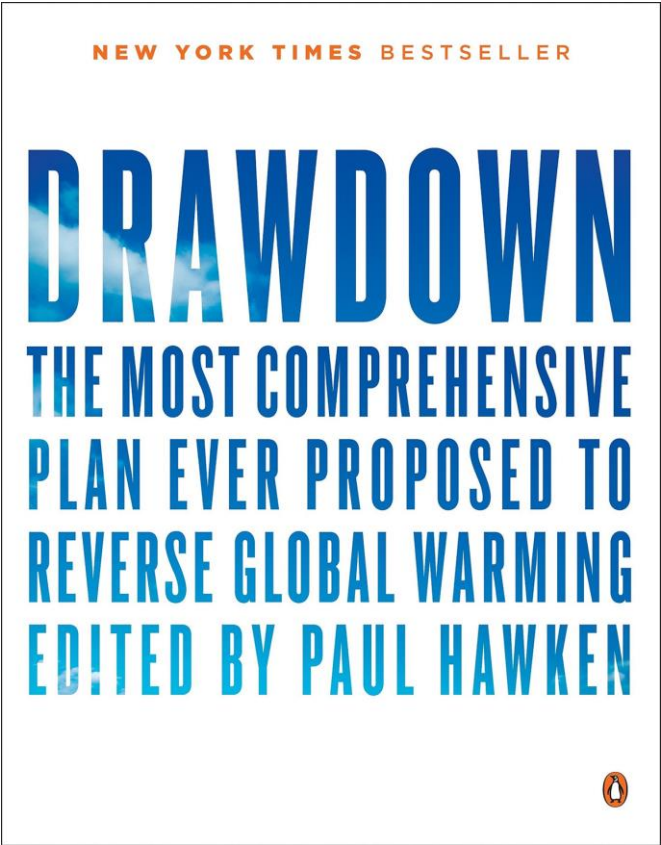
# Embodied Carbon

Total Carbon Emissions of Global New Construction  
from 2020-2050  
Business as Usual Projection

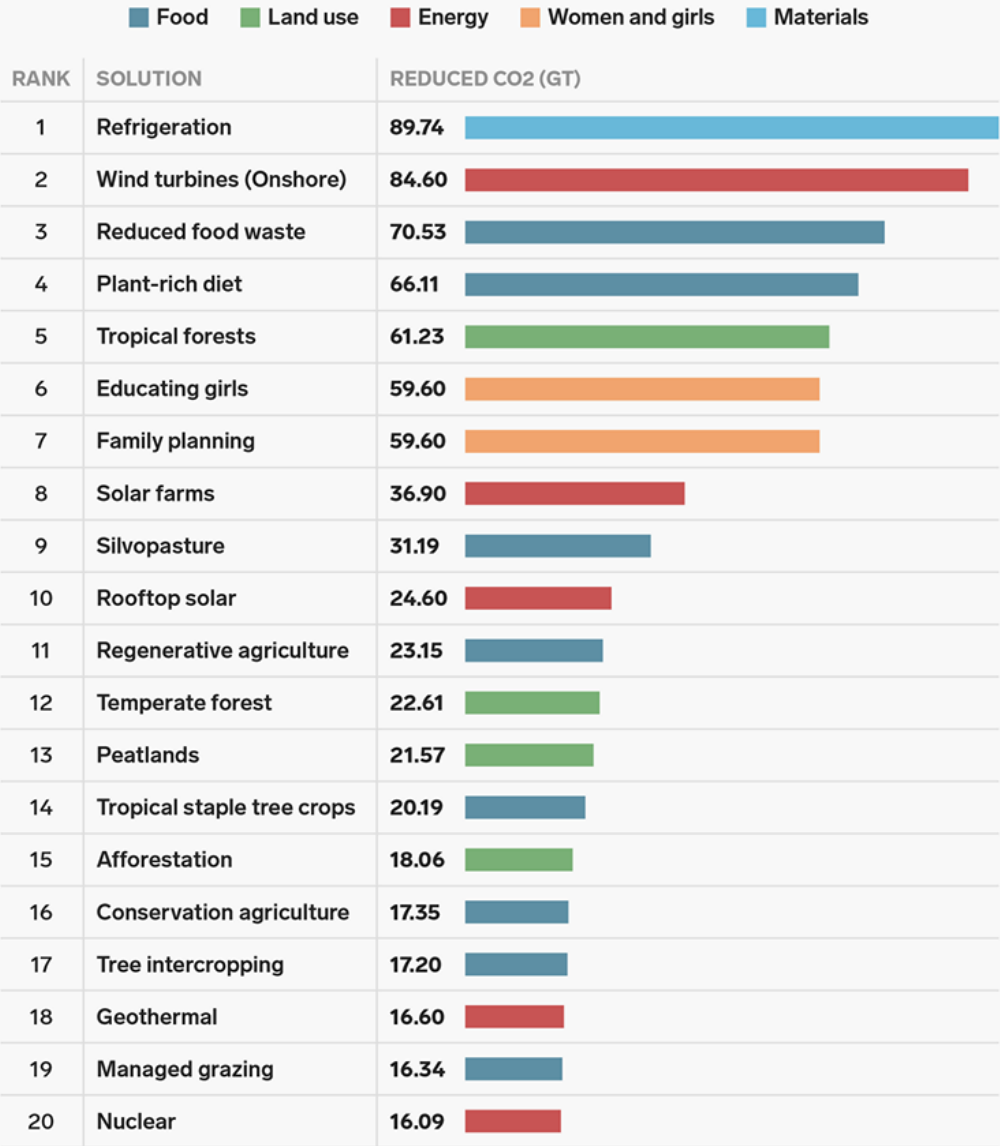


# Refrigerants

Note: E-Z Code does NOT mandate reduction in refrigerant impact, but requires calculations be performed to determine GWP and ODP.



## The top 20 things we can do to cool down the planet



Source: Chad Frischmann/Drawdown

Insider Inc.