BUILDINGENERGY BOSTON

Massachusetts Stretch and Specialized Codes

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Northeast Sustainable Energy Association (NESEA) | March 20, 2024

MASSACHUSETTS STRETCH AND SPECIALIZED CODES

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PAUL ORMOND

BACKGROUND

BACKGROUND

The new MA code is a thermal code

Grid-friendly electric heating swap

Comfort

Simplified, reduced HVAC

Resilience

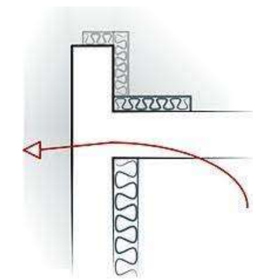
Thermal Code: Gives high priority to heating and cooling demand reduction to deliver above four benefits

BACKGROUND

Envelope
U-value

Low Air
infiltration

Ventilation
energy recovery



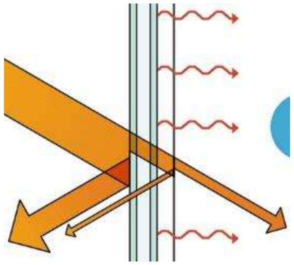
Thermal bridge
mitigation

Key strategies for reducing building heating demand.
These are the four pillars.

BACKGROUND

External shading

Recessed windows



Low solar heat gain coefficient

Thoughtful aperture

Key strategies for managing building cooling demand.

BACKGROUND

Thermal code: Grid-friendliness

Grid-friendly electric heating swap

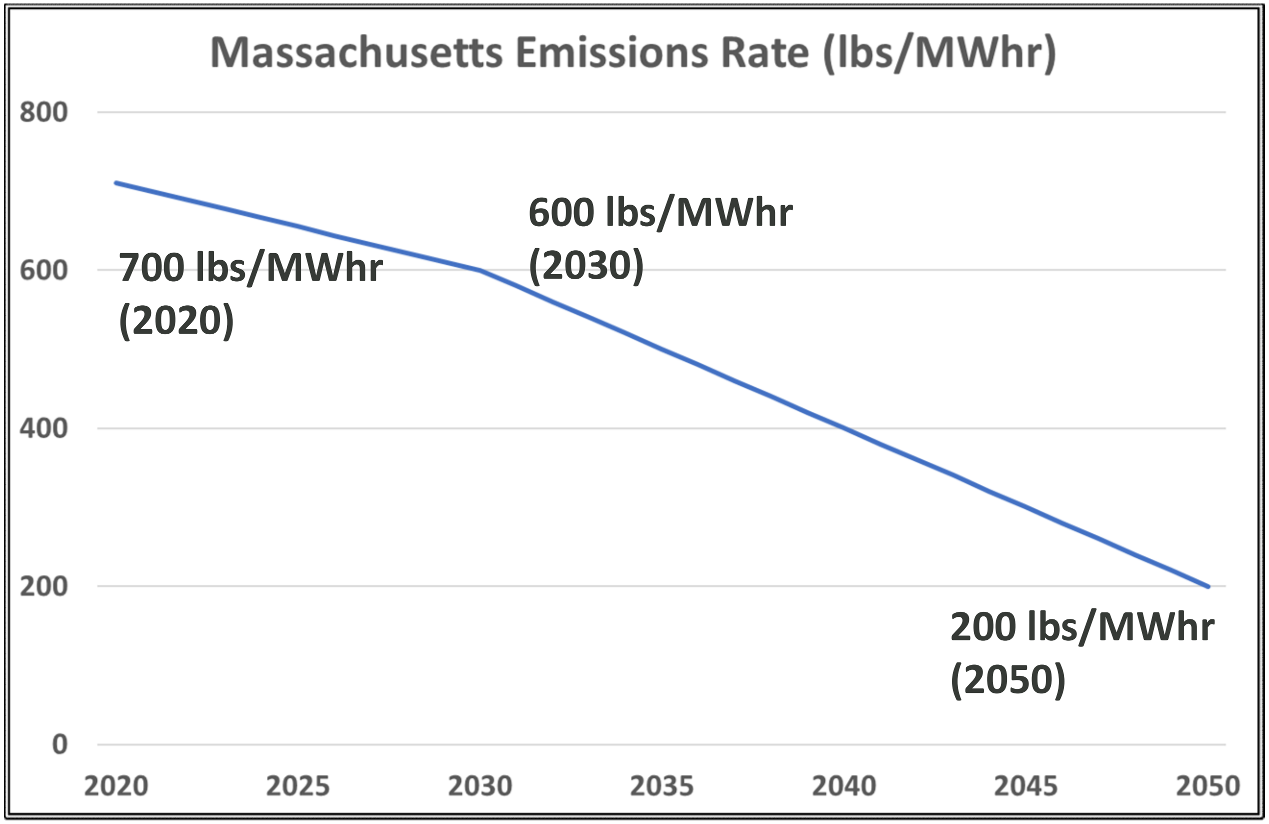
Comfort

Simplified, reduced HVAC

Resilience

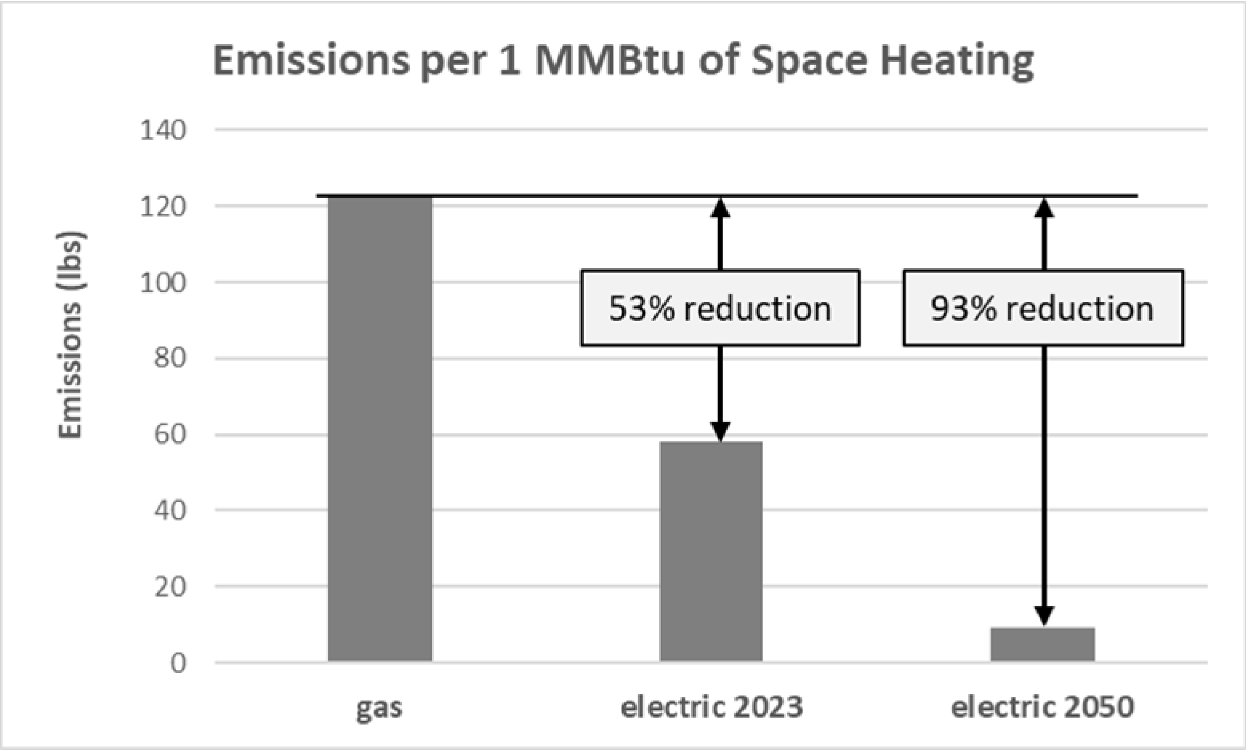
Thermal Code: Gives high priority to heating and cooling demand reduction to deliver above four benefits

BACKGROUND



Electric grid emissions in Massachusetts (and in many other states) are declining due to replacing fossil fuel with renewable inputs.

BACKGROUND

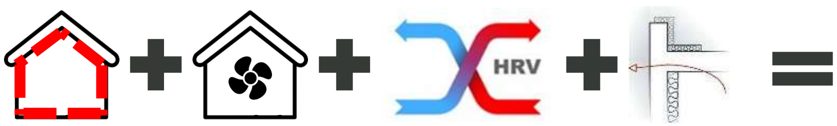


Due to increasing renewable inputs to the grid,
swapping from gas to electric results in profoundly lower building emissions.

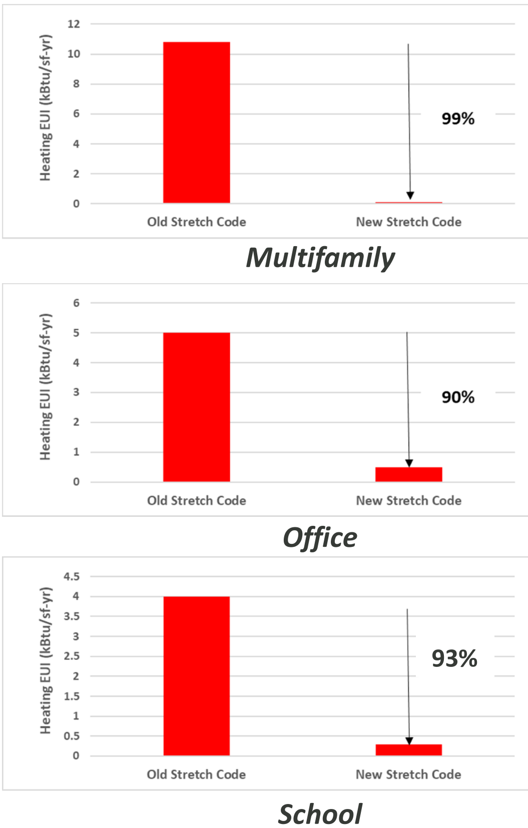
BACKGROUND

Decisions that we make today have major implications on current and future carbon footprint of our built space.

BACKGROUND



New stretch code
(thermal code)



Easy to electrify
Grid friendly

The new stretch "thermal code" means 90%+ less space heating than the old stretch code – easy to electrify and grid friendly

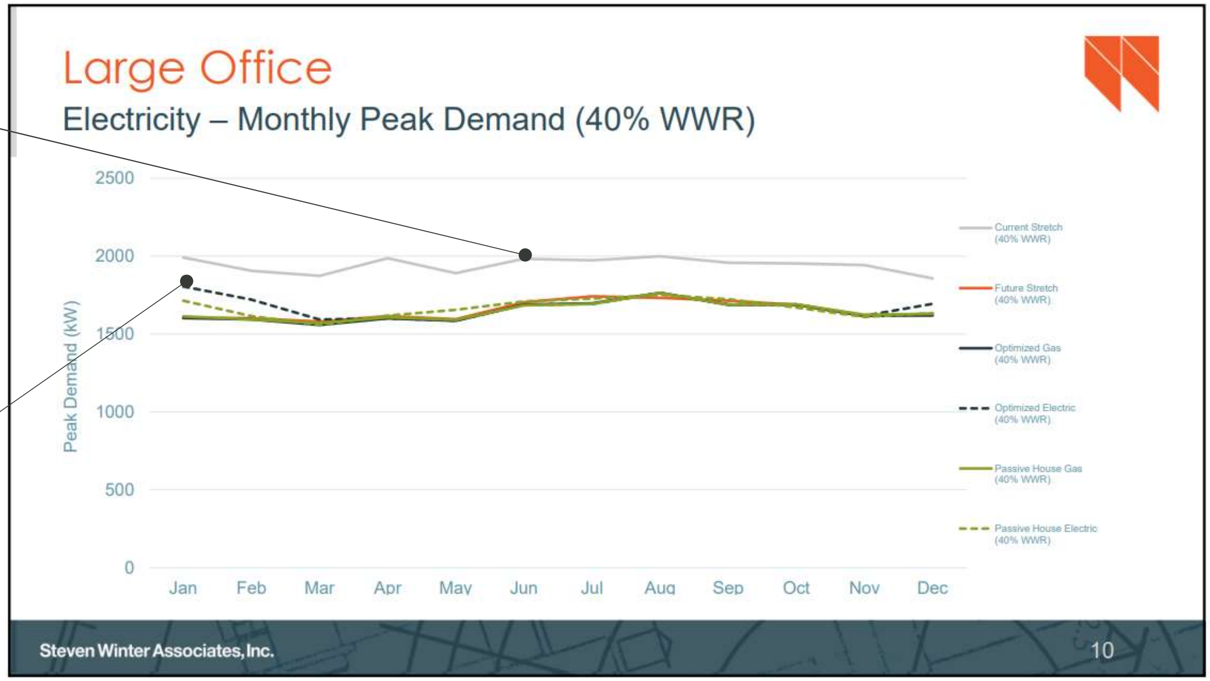
BACKGROUND

Old stretch code
gas space heating

Peak electric demand:
2000 kW

New "thermal" stretch code
electric heating

Peak electric demand:
1,800 kW

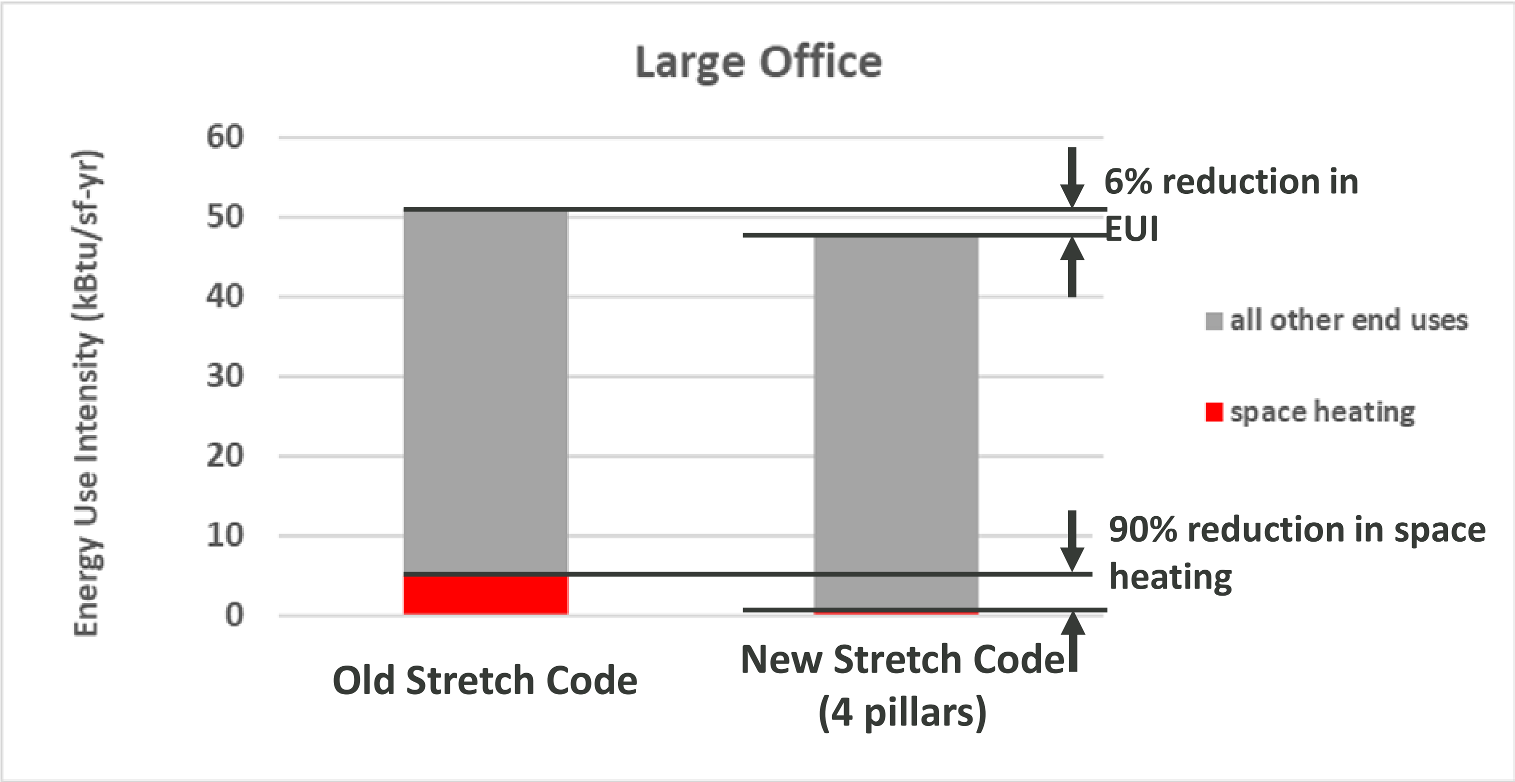


Grid friendly: no increase in electric load on grid due to swap from gas to electric space heating for many building types. (In fact, a decrease.)

BACKGROUND

New Buildings Institute: swapping from gas to electric increases peak winter electric load by 5% across the Commonwealth using the thermal code approach compared to old stretch code.

BACKGROUND



Modest reduction in EUI does not make the benefits crushing space heating (grid friendly, resilient, comfort, simple HVAC) any less true.

Thermal Code: Comfort and Simplified HVAC

Grid-friendly electric heating swap

Comfort

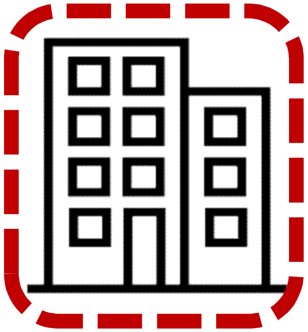
Simplified, reduced HVAC

Resilience

BACKGROUND

This 1,500-sf condo has no perimeter heating.
All space heating/cooling is a single indoor HP unit.

BACKGROUND



Premium envelope and energy recovery

−

Savings from simplified HVAC

=

Net first costs

Thermal codes: usually more envelope and energy recovery costs but can be netted against smaller/simpler other HVAC.

BACKGROUND

	Net First Cost	Life Cycle Cost
Small office	+4.5%	-0.2%
Large office	-4.0%	-8.3%
Primary school	+2.7%	-1.9%
Secondary school	+0.8%	-2.5%
Midrise multifamily	+3.2%	-1.9%
Highrise multifamily	+4.2%	-1.1%

Improved (with elec heat) compared to code (with gas heat)

Does not include MassSave and other incentives

Net first costs are modest and sometimes negative.

Life cycle cost improvement is always lower.

Thermal Code: Resilience

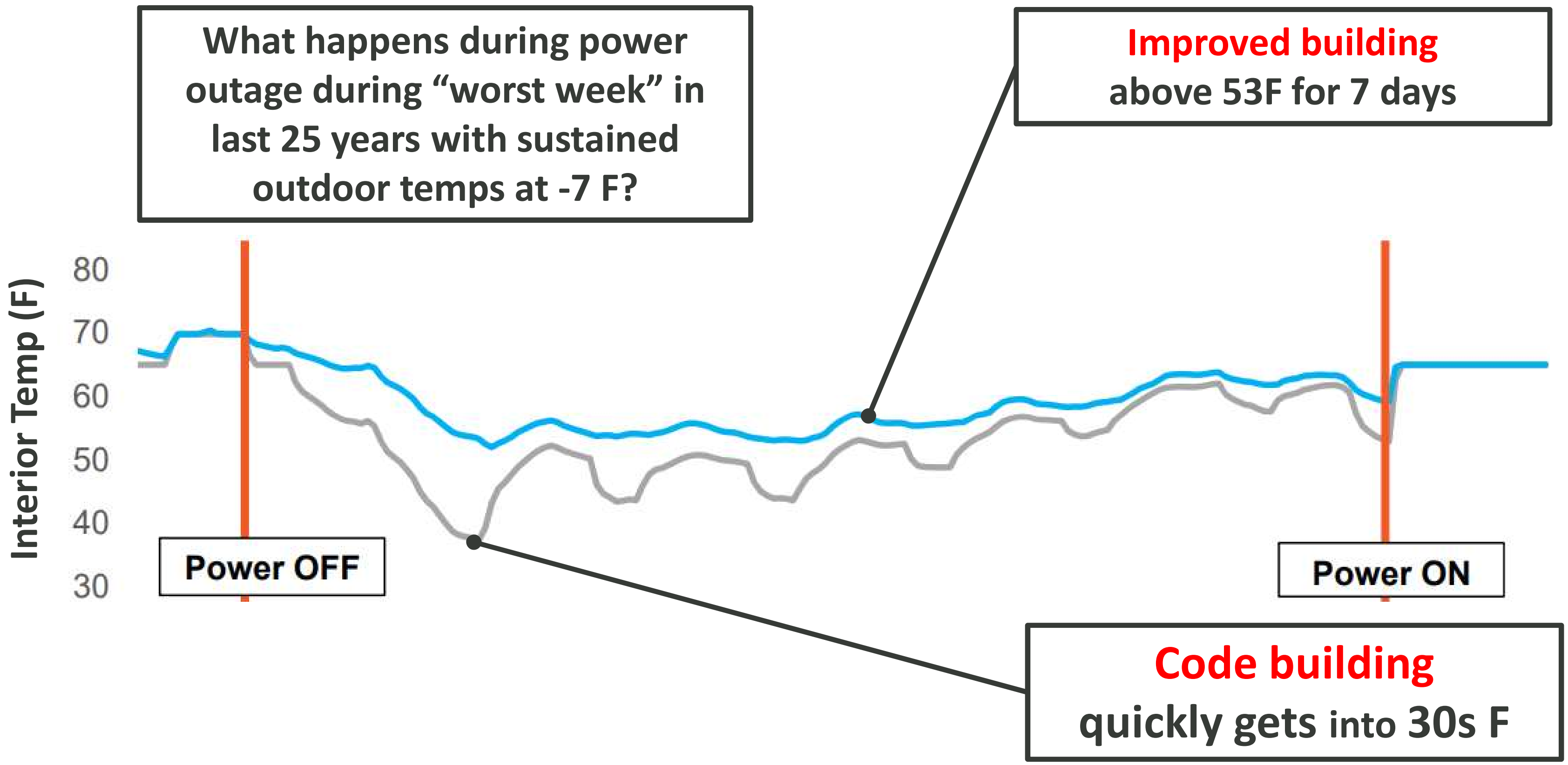
Grid-friendly electric heating swap

Comfort

Simplified, reduced HVAC

Resilience

BACKGROUND



Buildings built with the new "thermal" stretch code will not freeze on the inside if there is a loss of power and no heating.

BACKGROUND

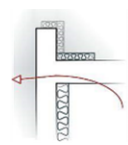
IECC 2021

\+

Envelope
U-value

Ventilation
energy recovery

Low Air
infiltration



Thermal bridge
mitigation

\+

Limits on thermal energy demand intensity (TEDI) for some building types

Massachusetts Stretch Code

BACKGROUND

IECC 2021

+

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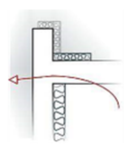


Thermal bridge
mitigation

+

Limits on thermal energy demand intensity (TEDI) for some building types

Massachusetts Stretch Code

+

All electric space, water, drying, and cooking

<u>or</u>

Electric-readiness where fossil equipment used + installed PV

+

Passive House:
Residential >12,000-sf

Massachusetts Specialized Code

JOANNE BISSETTA

CODE ADOPTION

POLICY, IMPLEMENTATION, & IMPACT OF STRETCH CODES

Green Communities Act

Climate Act of 2021

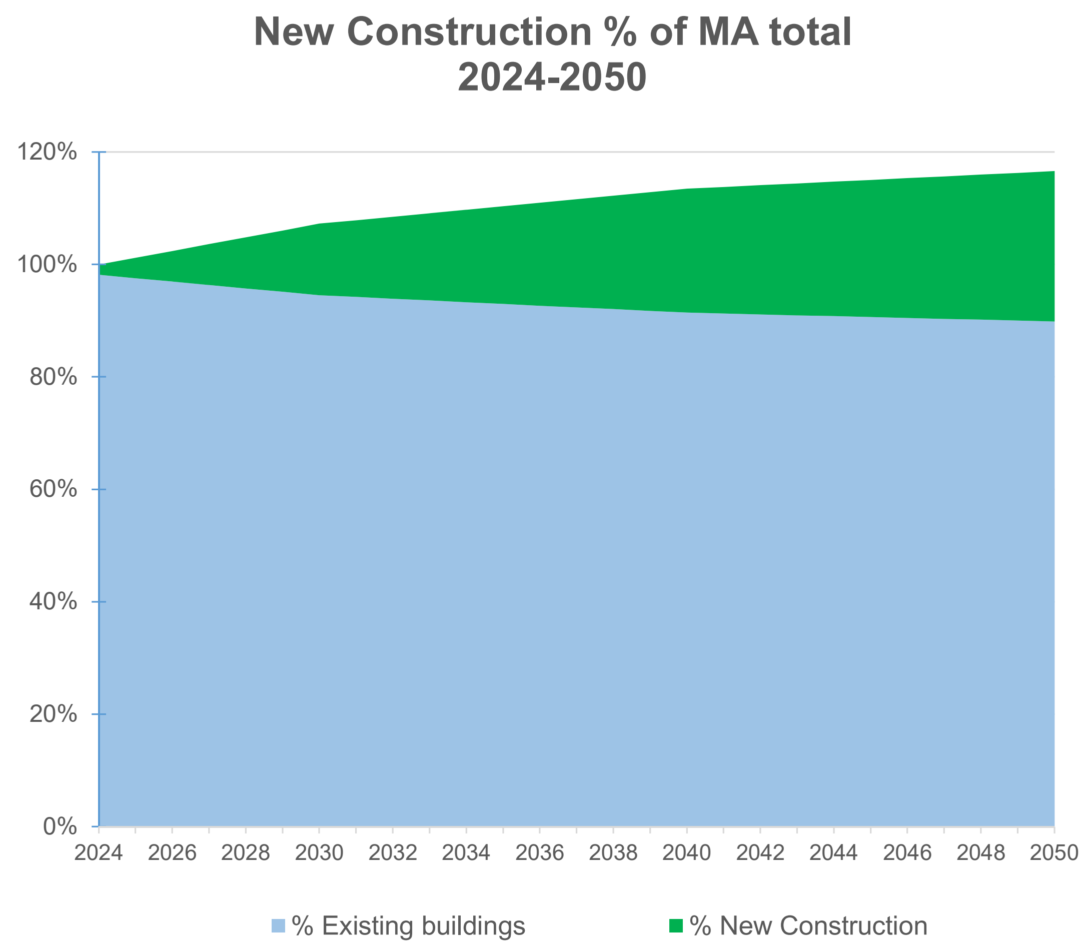
Fossil Fuel Free Demonstration Pilot

CLIMATE ACT 2021

- Commits Massachusetts to achieve **Net Zero emissions in 2050**, and authorizes the Secretary of Energy and Environmental Affairs (EEA) to establish an emissions limit of no less than **50% for 2030**, and no less than **75% for 2040**
- Moved stretch code regulatory authority from BBRS to DOER

BUILDING ENERGY CODE'S ROLE IN REDUCING EMISSIONS

- Building code is the primary policy impacting new buildings.
- New buildings (built after 2023) **~27% of all building space by 2050**
- New buildings are easiest and cheapest to make 2050-compliant
- New construction market helps drive cost reductions in building retrofits



POLICY GOALS FOR BUILDING ENERGY CODES

Low-cost GHG emissions reductions

Start with Energy Efficiency

- All cost-effective required by 2008 Green Communities Act for Stretch code

Incentivize Electrification of remaining heating load

Mitigate peak electric loads to minimize grid infrastructure costs

Plan for future infrastructure needs

EV ready and Solar ready across all energy codes

All-Electric ready pre-wiring in the Specialized code

Allow Cities and Towns to adopt on their timeline

Base, Stretch and Specialized codes – 3 options for municipalities

Separate 10 community fossil-fuel free demonstration program

GREEN COMMUNITIES
DESIGNATION/GRANT PROGRAM

Established by the Green Communities Act of 2008

Designation Criteria

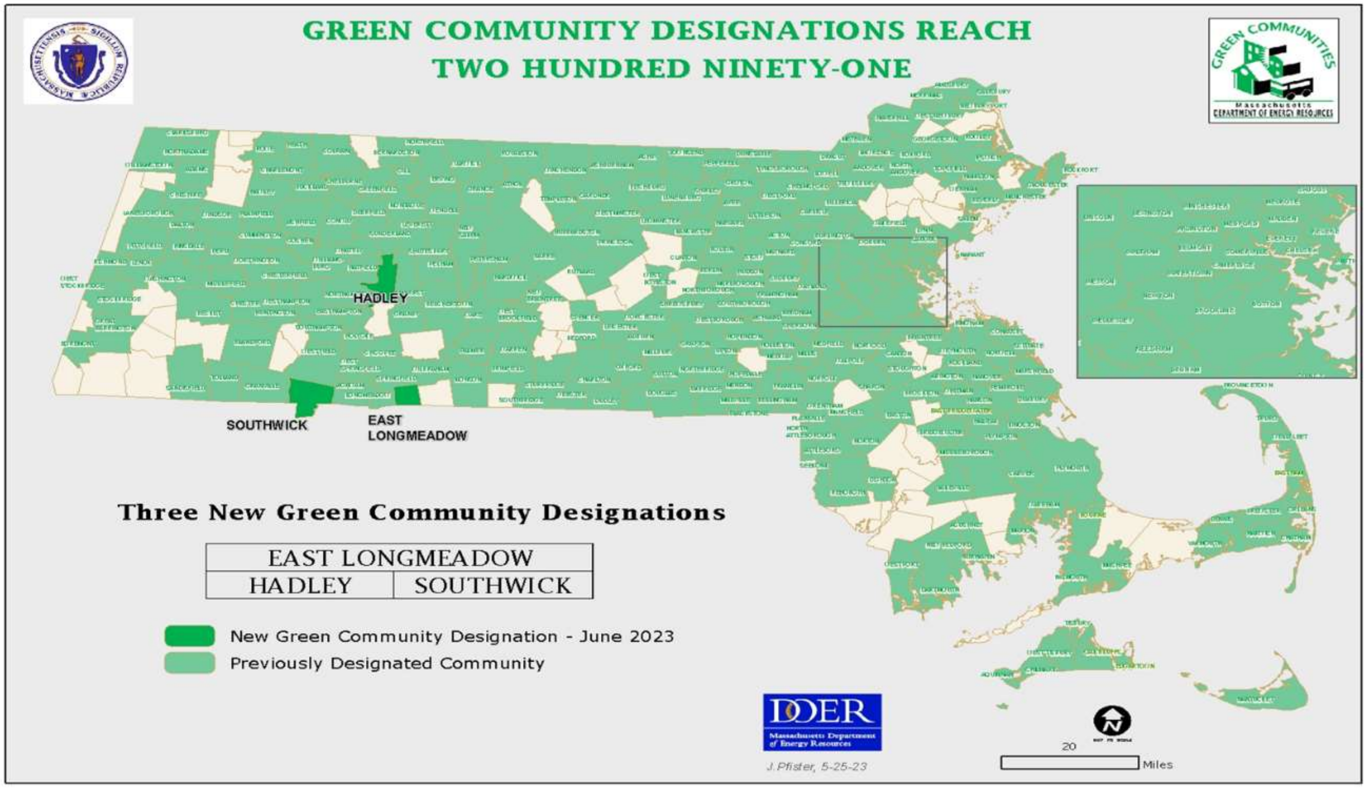
1. Adopt as-of-right siting for renewable/alternative energy generation, research and development, or manufacturing
2. Adopt expedited permitting process
3. Create an energy use baseline and a plan to reduce municipal energy use by 20% in 5 years
4. Purchase only fuel-efficient vehicles
5. **Reduce life-cycle costs of new construction by adopting the stretch energy code**

Eligible for Grants on Municipal Property

- Energy efficiency projects
- Renewable energy projects

GREEN COMMUNITIES PROGRESS

- **291 of 351** Cities/Towns are Green Communities
- **89%** of the population lives in a Green Community
- **$177M+** grants awarded since 2010
- **$41M** Leveraged in MassSave Incentives
- **$28M** Annual Energy Cost Savings
- **72K** tons GHG reduced

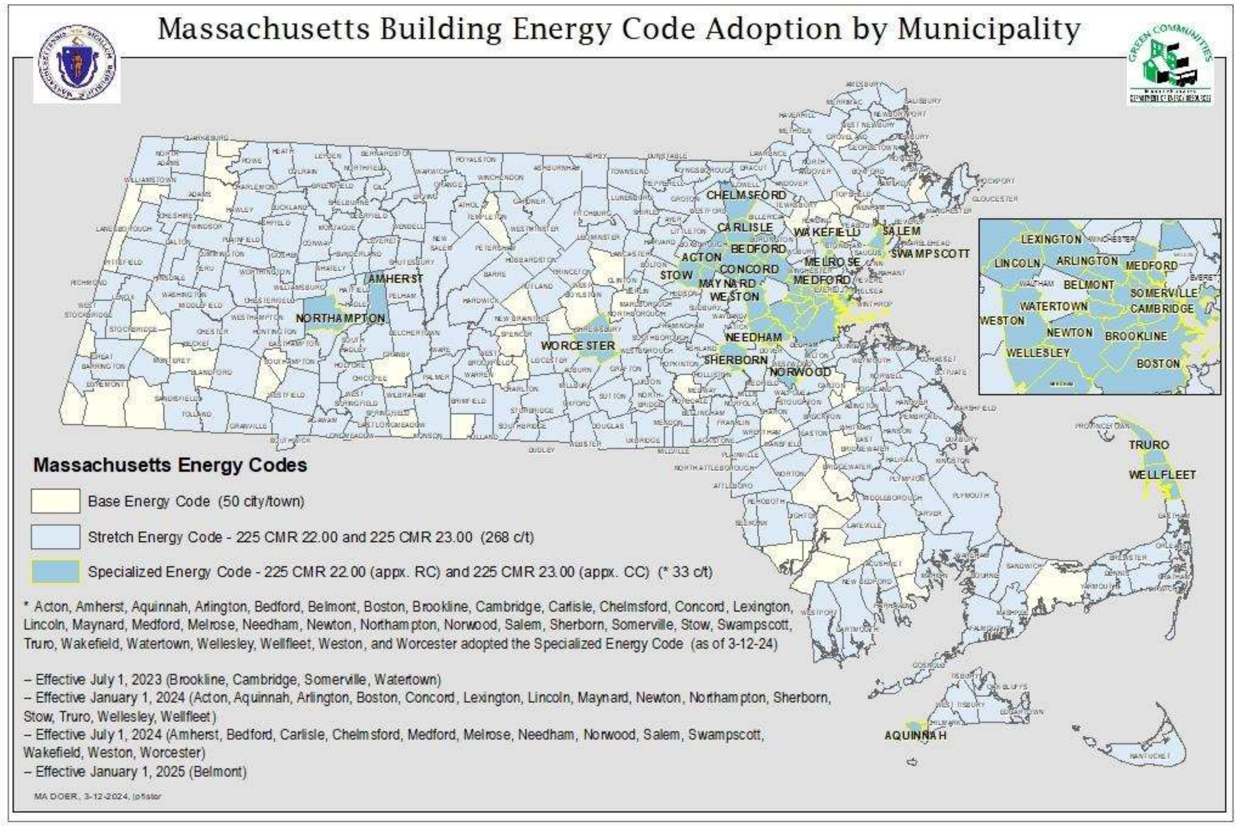


PROGRAM EVOLUTION
FROM GREEN COMMUNITY-TO-CLIMATE LEADER

Green Communities Criteria	Climate Leaders Criteria
Adopt as-of-right siting for RE/AE generation, R&D, or manufacturing	Establish/maintain local committee to advise, coordinate, and/or lead clean energy and climate activities
Adopt expedited permitting process	Municipal decarbonization commitment
Create an Energy Reduction Plan to reduce energy use by 20% in 5 years	Create Municipal Decarbonization Roadmap with 2030 & 2050 goals
Purchase only fuel-efficient vehicles	ZEV-First vehicle policy
Minimize life cycle cost in new construction – a.k.a adopt the **Stretch Code**	**Specialized Stretch Code Adoption**

CURRENT ADOPTION

- 68% population in stretch code cities/towns
- 26% population in specialized code cities/towns
- 9% population under “base” IECC code
- Estimated Impact to reduce CO_2 emissions by 48% annually



ONE MORE LAYER OF BUILDING ENERGY CODE

Fossil Fuel Free Demonstration Project

- Up to 10 communities can ban new connections to fossil fuel systems in new construction, large additions, and major renovations
- Study the impact on construction costs, housing production, emissions, energy use and cost

GREEN COMMUNITY CONTACTS

Regional coordinators act as direct liaisons with cities and towns

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Joanne Bissetta, Director - Joanne.Bissetta@mass.gov
Mark Rabinsky, Deputy Director – Mark.Rabinsky@mass.gov

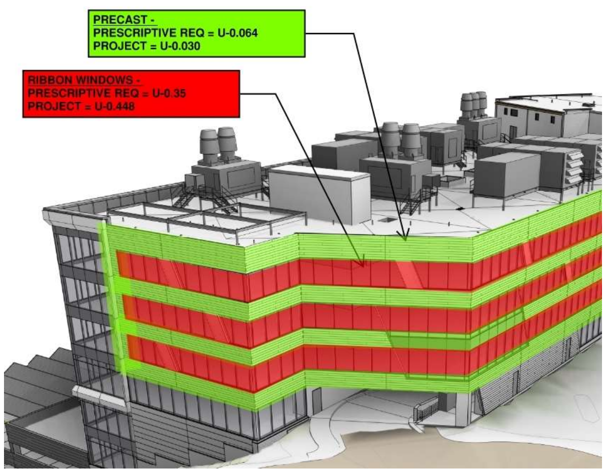
CHRISTOPHER GREY

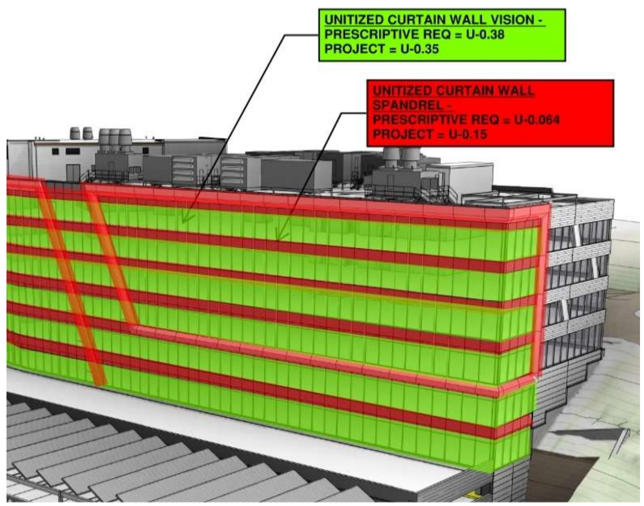
ENCLOSURE IMPACTS

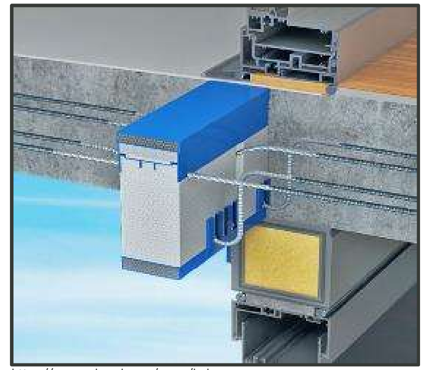
ENERGY CODE EVOLUTION

PRE 2020: LIMITED ATTENTION TO ENCLOSURE PERFORMANCE

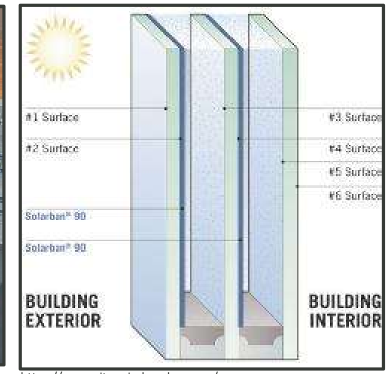
- Most projects opt for performance path
  - Whole building energy analysis
  - "Trade-offs" - Offsets lower performing envelope systems with mechanical and lighting systems
  - Can result in envelope performing worse than prescriptive code



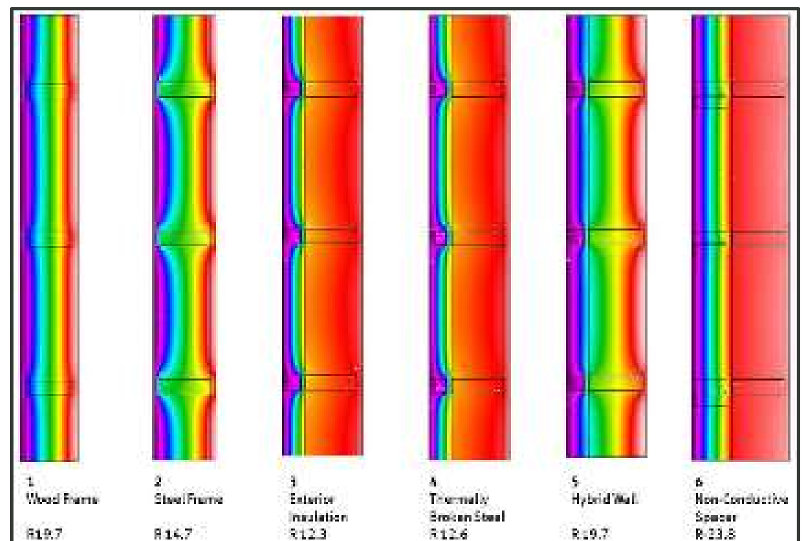




https://www.schoeck.com/en-us/balcony



https://www.vitrowindowglass.com/



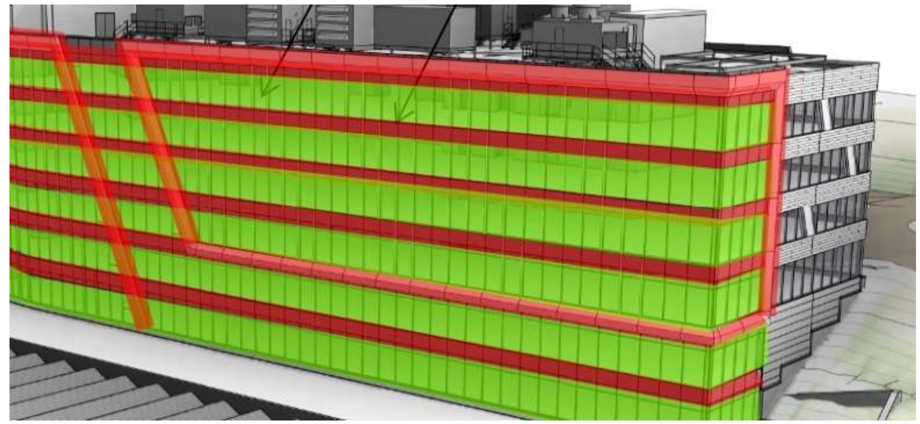
https://www.henneberyeddy.com

ENERGY CODE EVOLUTION

PRE 2020: LIMITED ATTENTION TO ENCLOSURE PERFORMANCE

2020-2023: SOME ATTENTION TO ENCLOSURE PERFORMANCE

- **Addition of (3) Energy Packages per Project**
  - Whole Building Air Leakage Testing
  - 15% Improvement over Prescriptive Code
- **“Backstop Calculation” Required with Performance Pathway for Certain Project Types**
  - Compare proposed versus prescriptive building envelope thermal values and fenestration areas with Equation 4-2.
    - **Penalty for increased WWR beyond 30% or 40%**
  - This limits trade offs (i.e. heating/cooling systems, better lighting, etc.) for a lesser performing building envelope.
    - **Still allowed trade offs with horizontal and below-grade assemblies.**



Calculation

	Example building: 2-story building with 10,000 SF each floor, 10,000 exterior wall area, 5,000 SF floor over parking, no basement walls, and 40% vertical glazing (instead of code max 30%). In this case, the extra glazing area is accommodated in the design by use of a triple-glazed curtain wall with a very low *U*-value.							
	Formula: (A + B + C + D + E ≤ Zero)							
		Area	Proposed *U*-value	Proposed UA (U x Area)	Table *U*-factor	Table UA (U x Area)	UA Dif (Proposed UA - Table UA)	Totals
	roof - insul above deck	10,000	0.03	300	0.034	340	-40	
	wall 1 - mass wall	6,000	0.09	540	0.078	468	72	
	wall 2 - steel stud	4,000	0.055	220	0.055	220	0	
	floor - framed	5,000	0.029	145	0.029	145	0	
	skylight	100	0.5	50	0.5	50	0	
	VG 1 - alum curtain wall	3,000	0.22	660	0.38	1140	-480	
	VG 2 - wood framed	1,000	0.3	300	0.3	300	0	
A	**Sum of the (UA Dif) values for envelope assemblies**						-448	**-448**
		Length of slab edge	Proposed *F*-value	Proposed F x Length	Table *F*-factor	Table F x Length	FL Dif	
	slab edge - perimeter	200	0.54	108	0.528	105.6	2.4	
	slab edge - at garage	100	0.62	62	0.528	52.8	9.2	
B	**Sum of the (FL Dif) values for both slab-on-grade perimeter conditions**						11.6	**11.6**
C	**(no basement walls in this design)**							**0**
	Uwall	0.076	= Area-weighted avg *U*-value of above-grade wall assemblies					
	UAV	960	= Sum of the (UA Proposed) values for each vertical glazing assembly					
	UV	0.24	= UAV / total vertical glazing area					
	DA	1,000	= (Proposed VG Area) – (VG Area allowed by Section C402.3.1)					
	VGA	4,000	= Proposed Vertical Glazing Area					
	Allow VG Area	3,000	= 30% max from Section C402.3.1					
	Wall Area	10,000	= Gross wall area					
	UA Wall	760	= Uwall x Wall Area)					
D	**Excess vert glazing area**	164	(DA x UVG) – (DA x UWall) - Zero if ≤ zero					**164**
E	**Excess skylight area**	(Proposed skylight area is less than allowable area, so value is zero)						**0**
Component Performance: (A + B + C + D + E) - OK since less than zero.								**-272**

Commentary Figure C402.1.5
COMPONENT PERFORMANCE EXAMPLE

A = Thermal Enclosure: Sum of the values of each distinct assembly type of the building thermal envelope, not including slab on grade or below grade walls. Includes walls, glazing, roof, floor.

B = Slab on Grade: Sum of the values of each distinct slab on grade perimeter condition of the building thermal envelope.

C = Below-Grade Walls: Sum of the values of each distinct below grade wall assembly type of the building thermal envelope.

D = Glazing Window to Wall Ratio: Sum of the values of each distinct glazing type of the building thermal envelope if the proposed glazing area is more than that allowed by C402.4.1 (excess glazing area > zero).

E = Skylight to Roof Ratio: Sum of the values of each distinct skylight type of the building roof area if the proposed skylight area is more than that allowed by C402.4.1 (excess glazing area > zero)

ENERGY CODE EVOLUTION

PRE 2020: LIMITED ATTENTION TO ENCLOSURE PERFORMANCE

2020-2023: SOME ATTENTION TO ENCLOSURE PERFORMANCE

2023+: HYPERFOCUSED ON ENCLOSURE PERFORMANCE

- Increased Energy Efficiency
  - Air Leakage
  - Thermal Bridging Derating
  - Back Stop Limits
  - Additional Efficiency Packages
  - Solar Readiness
- Increased Electrification
- Existing Buildings

PASSIVE HOUSE DESIGN PRINCIPLES

PH practitioners focus on the following to inform design:

- **Compactness:** use a low ratio of envelope surface area to interior volume.
- **Solar control:** use orientation, space planning, and enclosure design to minimize solar gains.
- **Insulation:** provide as much insulation as possible to reduce thermal transmission.
- **Windows:** use windows with very low U-factors to minimize energy loss through what is typically the weakest point of the thermal enclosure.
- **Airtightness:** limit conditioned air leakage and reduce potential for condensation and drafts.
- **Thermal bridges:** avoid heat loss through thermal bridges, which can be exacerbated in highly insulated buildings.
- **Ventilation:** use systems with heat and energy recovery and verify that they will meet PH energy targets.

CODE COMPLIANCE

Specialized Opt-In

Specialized Opt-In Compliance
COMMERCIAL

COMPLIANCE PATHS

- **Zero Energy Buildings**
    - On Site Renewable Energy to get to Zero
    - HERS Zero or PHIUS Zero
- **Mixed Fuel Buildings**
    - High Ventilation Buildings (i.e. Labs), the building needs to be pre-wired for full electrification.
    - Generators excluded.
    - Onsite renewable requirements.
    - Additional HVAC efficiency requirements
- **All Electric Buildings**
    - All Electric Heating and Hot Water
    - Passive House (Core or Zero)

CODE COMPLIANCE

Specialized Opt-In

Specialized Opt-In Compliance
MIXED-USED

- Passive House Required for Multi-Families Greater than 12,000 s.f.

NET ZERO CERTIFICATION

PHIUS

HERS CERTIFIED
ENERGY EFFICIENT BUILDING ENERGY INC.

TABLE CC101.2 MULTI-FAMILY AND R-USE COMPLIANCE

R-Use buildings over 12,000 sf, or R-Use portions over 12,000 sf in mixed-use buildings	Compliance Path options by permit submittal date		
	C407.3 Passive House	C407.1 Targeted Performance	C407.4 HERS Index
Up to 5 stories	Required from Jan 1, 2023		
6 stories and higher	Required from Jan 1, 2024	Optional until Jan 1, 2024	Optional until Jan 1, 2024

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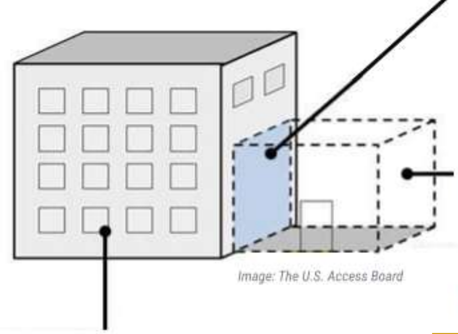
HOW DO WE SATISFY THE NEW CODE REQUIREMENTS

- **Existing Buildings:** Stretch Code now applies to existing construction. Can be difficult depending on building construction.
- **Enclosure Systems**: Need to be more purposeful with enclosure design.
  - **Air Barriers:** Additional design documentation is required to incorporate detailing, coordination, inspection, and testing protocols.
  - **Backstop Calcs:** Modified from previous version.
    - Can no longer count on non-vertical wall systems to offset vertical wall performance.
    - Thermal bridge derating needs to be accounted for.
  - **System Design/Selection:**
    - Opaque systems will include increased insulation to offset bridging and glazed systems.
    - Glazing systems need to evolve:
      - Triple glazing with multiple e-coatings.
      - Alternate system materials and designs.
      - Less spandrel, more rainscreen wall cladding systems.
      - More interior insulation at glazed wall system spandrels.

Stretch Code Applicability:
(Changes in blue)



Alterations:
Follow the stretch code. Envelope requirements are 10% less stringent than new construction envelope.

Additions:
< 20,000 ft²: Base energy code + MA Amendments
≥ 20,000 ft²: Stretch energy code

New buildings:
< 20,000 ft²: Base energy code
≥ 20,000 ft²: Stretch energy code

Change of Use/Occupancy:
If increasing energy demand, must upgrade systems to meet Stretch code mandatory requirements
(with additional exceptions/modifications per this section)

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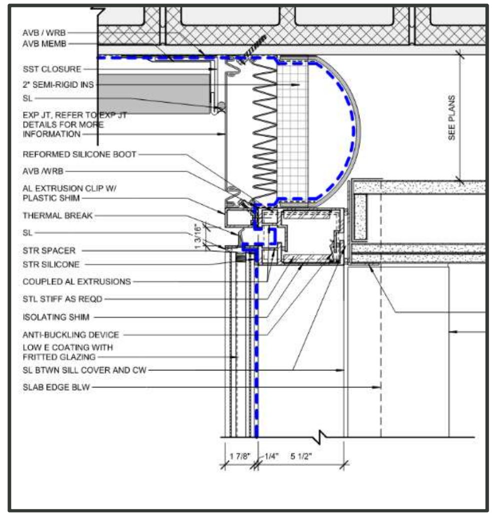

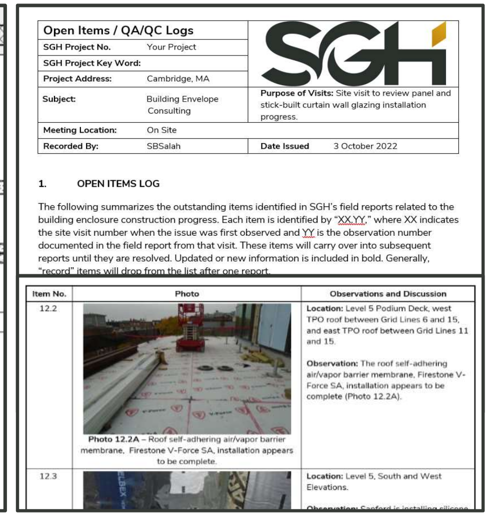

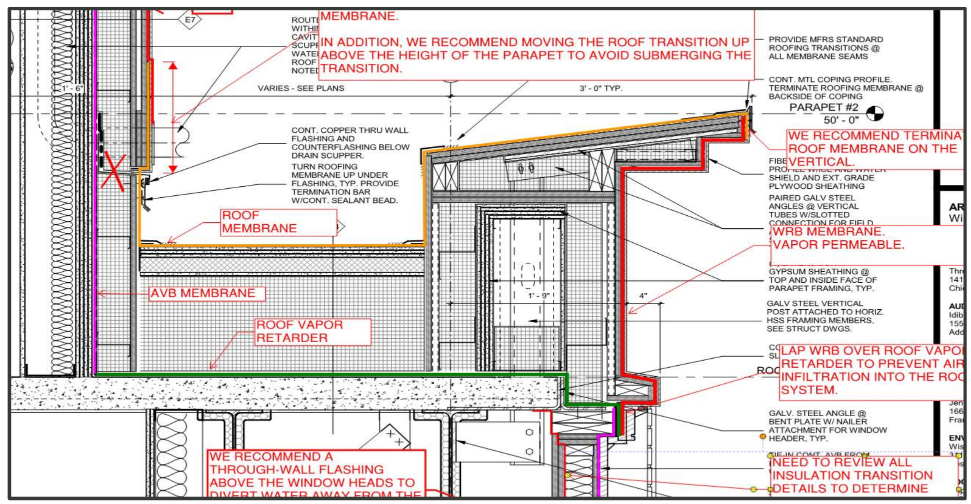

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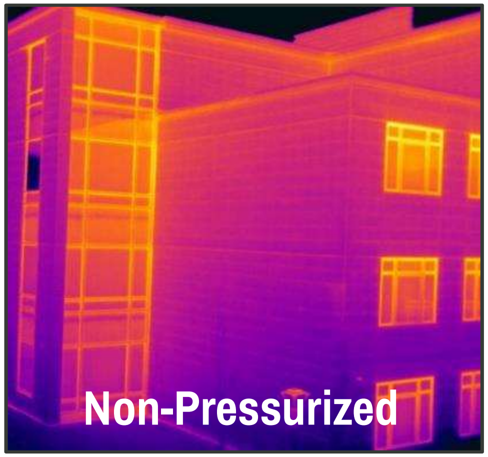
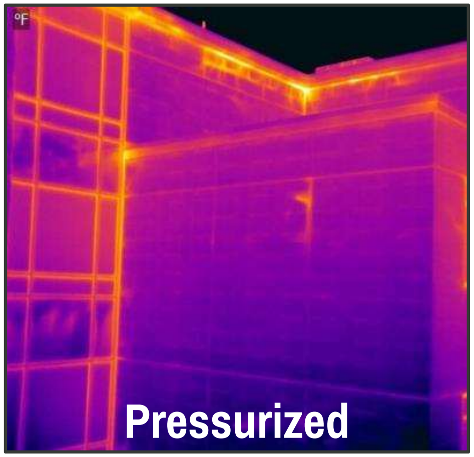




Whole Building Air Leakage Limits:

- Residential - <0.30 cfm/s.f.
- Non-Residential: <0.40 cfm/s.f
- Stretch Code: <0.35 cfm/s.f.
- Energy Efficiency Package: <0.20 cfm/s.f.
- PHIUS: <0.05-0.11 cfm/s.f. (depending on building type)
  - Curtain Wall: <0.06 cfm/s.f.
  - Membrane Air Barrier: <0.003 cfm/s.f.
  - Spray Foam: <0.004 cfm/s.f.

HOW DO WE SATISFY THE NEW CODE REQUIREMENTS

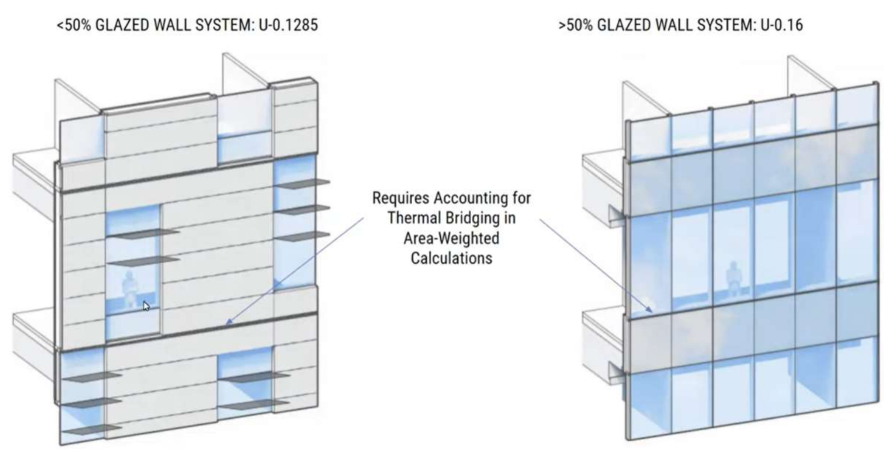
- **Existing Buildings:** Stretch Code now applies to existing construction
- **Enclosure Systems**: Need to be more purposeful with enclosure design.
  - **Air Barriers:** Additional design documentation is required to incorporate detailing, coordination, inspection, and testing protocols.
  - **Backstop Calcs:** Modified from previous version.
    - Can no longer count on non-vertical wall systems to offset vertical wall performance.
    - Thermal bridge derating needs to be accounted for.
  - **System Design/Selection:**
    - Opaque systems will include increased insulation to offset bridging and glazed systems.
    - Glazing systems need to evolve:
      - Triple glazing with multiple e-coatings.
      - Alternate system materials and designs.
      - Less spandrel, more rainscreen wall cladding systems.
      - More interior insulation at glazed wall system spandrels.

Modified Backstop Calc from Previous Version:
Vertical Above-Grade Walls Only

Vertical Above-Grade Wall Area Weighted Average U Factor

- Low Glazed Wall (< 50%) = U-0.1285 / R-7.8
- High Glazed Wall (> 50%) = U-0.1600 / R-6.3
  - *All building types except for high ventilation lab buildings need to be fully electric.*

Maximum Vision U Factor: Assembly – U-0.25 MAX



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Thermal Bridge Derating: Account for thermal bridging by one of the following options:

- **Prescriptive Derating**
  (Code Equations And Derating Values).
- **Reference Derating**
  (Building Envelope Thermal Bridging Guide V. 1.6 or higher, published by BC Hydro Power Smart).
- **Model Derating**
  (2D or 3D Finite Element Analysis Heat Transfer Model)

Types of Thermal Bridges

- Cladding Supports
- Balcony to exterior vertical walls
- Intermediate floor to exterior vertical wall intersection
- Fenestration to exterior vertical wall intersection
- Parapet (vertical wall to roof intersection)
- Brick Shelf Angles
- Vertical wall to Grade Intersection
- Vertical wall plane transition (corners, changes in vertical plane)
- …and more

HOW DO WE SATISFY THE NEW CODE REQUIREMENTS

- **Existing Buildings:** Stretch Code now applies to existing construction
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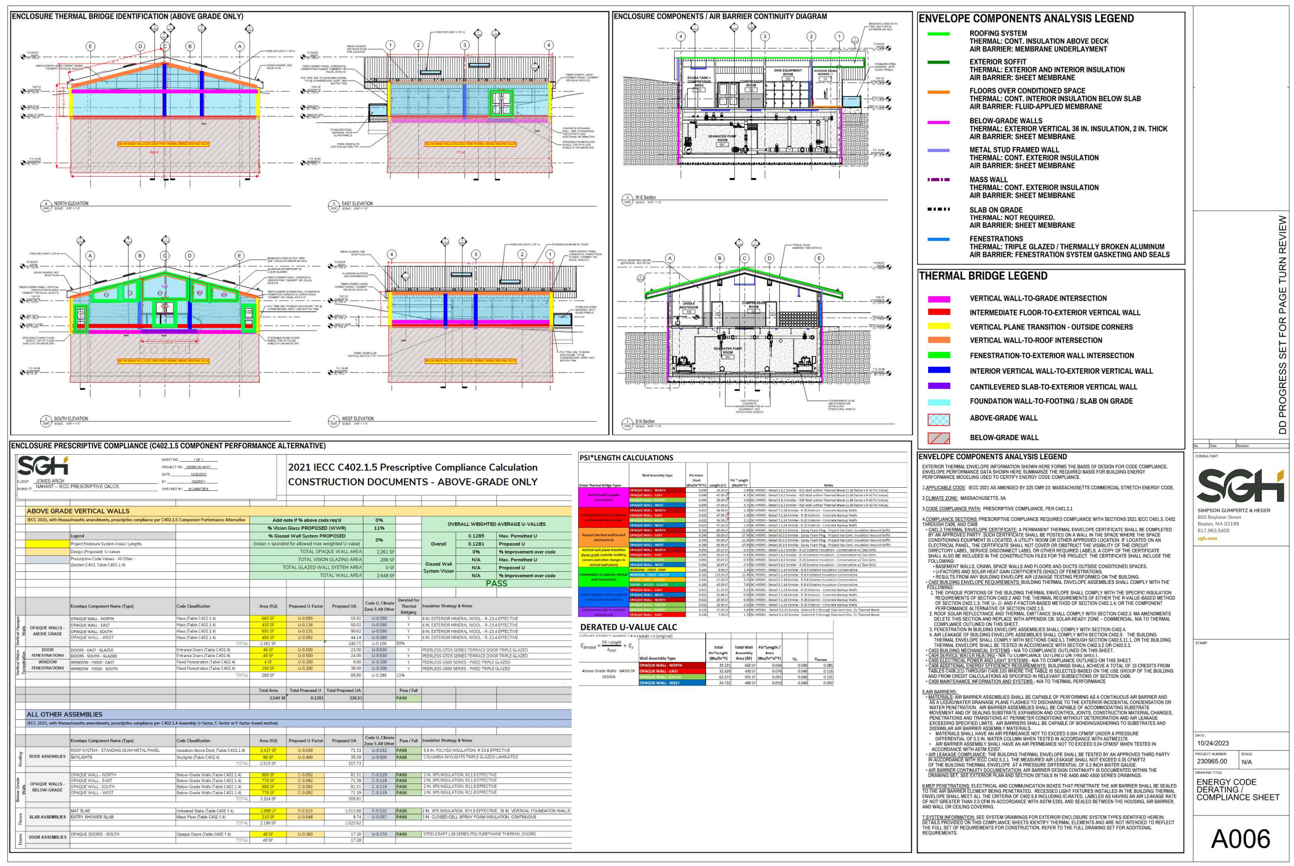
GLAZING %	GLAZING U FACTOR	OPAQUE WALL %	REQD OPAQUE WALL U	WEIGHTED TOTAL REQUIRED
10%	0.25	90%	0.1150	0.1285
20%	0.25	80%	0.0981	0.1285
30%	0.25	70%	0.0764	0.1285
40%	0.25	60%	0.0475	0.1285
50%	0.25	50%	0.0700	0.16
60%	0.25	40%	0.0250	0.16
70%	0.25	30%	-	0.16
80%	0.25	20%	-	0.16
90%	0.25	10%	-	0.16
100%	0.25	0%	-	0.16

		Winter U-value ½" Gap	
	Low-e surface	Argon	Air
Double pane	#2	0.24	0.29
	#2, **#4**	0.20	0.23
Triple pane	#2	0.18	0.21
	#2, #4	0.12	0.16
	#2, **#6**	0.15	0.18
	#2, #4, **#6**	0.11	0.13

Room-side Low-e Coatings: As Good as It Sounds?, NESEA Building Energy Boston 2016, Payette

HOW DO WE SATISFY THE NEW CODE REQUIREMENTS

- **Engagement**: Engage enclosure consultant, manufacturers, subcontractors, etc. early SD to confirm compliance paths and set project performance requirements.
- **Design Documentation**: Additional design documentation required to incorporate detailing, coordination, calculations, analysis, inspection, and testing protocols.
- **Construction Oversight:** Whole building air leakage testing will require more construction oversight to comply.
- **Passive House:** Passive House principles are the backbone of the new code.



OLIVIA BRADY

TARGETED PERFORMANCE PATH

TEDI OVERVIEW

- New compliance path
- Targets building envelope performance due to long useful life and reduced peak loads for electrification
- Projects must meet all prescriptive requirements
- Requires a single whole building energy simulation
- Must follow modeling requirements in the Targeted Performance Simulation Guidelines
- Designs must demonstrate heating and cooling Thermal Energy Demand Intensities (TEDIs) no greater than the individual limits in Table C407.1.1.5 for the appropriate building type and size

Table C407.1.1.5 Thermal Energy Demand Intensity (TEDI Limits)

Use Type	Heating TEDI ($kBtu/ft^2$-yr)	Cooling TEDI ($kBtu/ft^2$-yr)
Office, fire station, library, police station, post office, town hall ≥ 125,000 ft^2	1.5	23
Office, fire station, library, police station, post office, town hall between 75,000 and 125,000 ft^2	4 – 0.00002 * Area (ft^2)	18 + 0.00004 * Area (ft^2)
Office, fire station, library, police station, post office, town hall ≤ 75,000 ft^2	2.5	21
K-12 School ≥ 125,000 ft^2	2.2	12
K-12 School between 75,000 and 125,000 ft^2	2.7 – 0.000004 * Area (ft^2)	32 – 0.00016 * Area (ft^2)
K-12 School ≤ 75,000 ft^2	2.4	20
Residential multifamily and dormitory ≥ 125,000 ft^2	2.8	22
Residential multifamily and dormitory between 75,000 and 125,000 ft^2	3.8 – 0.000008 * Area (ft^2)	4.5 + 0.00014 * Area (ft^2)
Residential multifamily and dormitory ≤ 75,000 ft^2	3.2	15
All other ≥ 125,000 ft^2	1.5	23
All other between 75,000 and 125,000 ft^2	4 – 0.00002 * Area (ft^2)	18 + 0.00004 * Area (ft^2)
All other ≤ 75,000 ft^2	2.5	21

TEDI CALCULATIONS: GENERAL APPROACH

The heating TEDI is the annual heating energy delivered to the spaces and ventilation within the building to maintain heating thermostat setpoints normalized by the floor area.

$$\textit{Heating TEDI}\left[\frac{kBtu}{ft^2}\right] = \frac{\Sigma \textit{ Space and Ventilation Heating Output } [kBtu]}{\textit{Modeled Floor Area } [ft^2]}$$

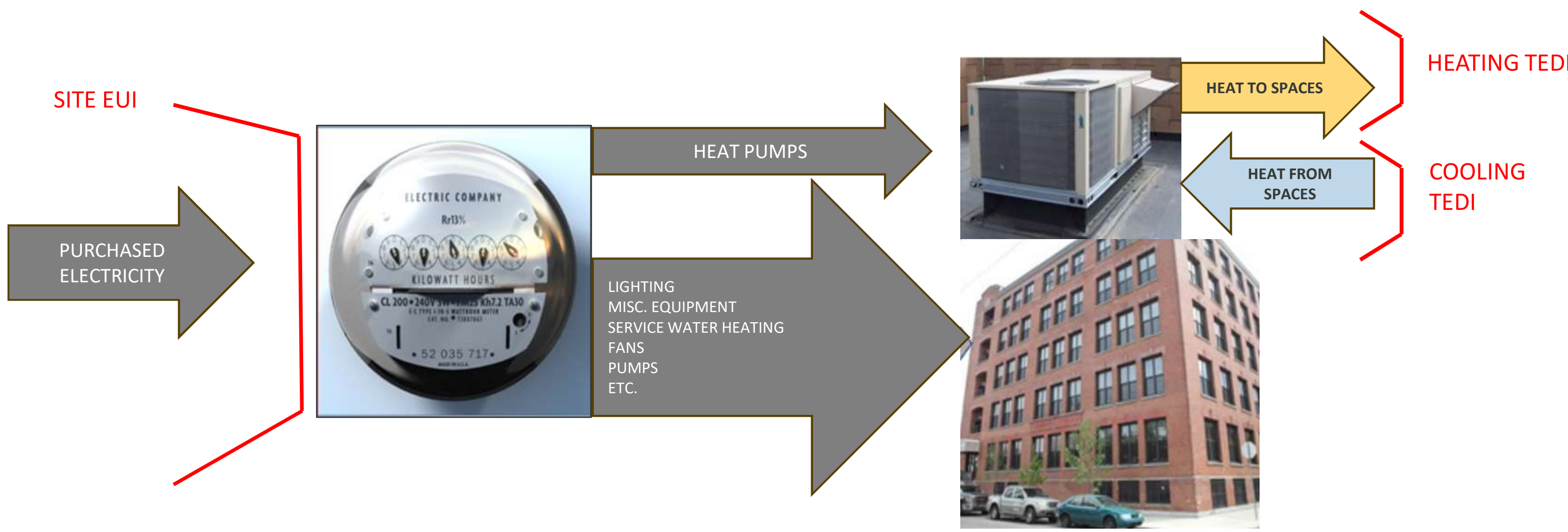
The cooling TEDI is the annual energy extracted from the spaces and ventilation to maintain cooling thermostat setpoints normalized by the floor area.

$$\textit{Cooling TEDI}\left[\frac{kBtu}{ft^2}\right] = \frac{\Sigma \textit{ Space and Ventilation Cooling Output } [kBtu]}{\textit{Modeled Floor Area } [ft^2]}$$

TEDI CALCULATIONS:
HEATING AND COOLING OUTPUT

Σ Space and Ventilation Heating Output = the annual heating output of all systems in the building that maintain space temperature setpoints and heat ventilation air including the heating coils of the central air systems (e.g., make-up air units and air handling units) and terminal equipment (e.g., fan coils, terminal heat pumps, and unit heaters).

Σ Space and Ventilation Cooling Output = the annual cooling output of all HVAC systems that maintain space temperature setpoints and cool ventilation air, including but not limited to the cooling coils of the central air systems (e.g., make-up air units and air handling units) and terminal equipment (e.g., fan coils, heat pumps).



HOW IS TEDI DIFFERENT FROM ENERGY USE INTENSITY (EUI)?

Although TEDI and EUI have the same units ($kBtu/ft^2$-yr), they are not the same.

- TEDI represents the annual heating (or cooling) load on the HVAC systems (e.g., it represents the heating (or cooling) “need”).
- EUI represents the annual amount of energy used to operate equipment that heats (or cools) the spaces and ventilation air.

Example

- If a heat pump delivers 4.8 $kBtu/ft^2$ heating energy to spaces annually and has annual average COP = 3.2, the site heating EUI is 1.5 $kBtu/ft^2$ while the Heating TEDI is 4.8 $kBtu/ft^2$.
- Improved heat pump efficiency reduces site heating EUI but does not impact heating TEDI.

WHAT IMPACTS TEDI AND HOW TO MEET TEDI LIMITS?

Lighting, occupancy, and miscellaneous equipment modeling inputs are prescribed (fixed) and are independent of design. These impact internal heat gains, which affect heating and cooling TEDI. However, these cannot be adjusted as a strategy to meet TEDI requirements.

Solar gains can be addressed with attention to fenestration area and location, solar heat gain coefficient, and external shading.

Over-ventilation should be avoided when possible. If the building is over-ventilated, a penalty may need to be modeled.

Building Component	Adjustable and Impacts TEDI?
Envelope Insulation	Yes
Thermal bridging	Yes
Window U-factor and SHGC	Yes
External shading	Yes
Ventilation air energy recovery	Yes
Lighting	No
Plug loads	No
Heating system efficiency	No
Cooling system efficiency	No

RESOURCES

Final Guideline

In September of 2023, DOER released a series of final Technical Guidance documents designed to inform and assist users in implementing the new Stretch and Specialized energy codes. Guidance documents include:

- Final Stretch and Specialized Code Guidelines, including: Attachment A (Envelope Performance and Thermal Bridge Derating), Attachment B (ASHRAE Appendix G Relative Performance Simulation Guidelines), Attachment C (Targeted Performance Simulation Guidelines), Schedule and Loads Supplement, and weather file.
- Stretch Energy Code Study Support
- Models conforming to TEDI Requirements

CONTACT

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stretchcode@mass.gov

Address

100 Cambridge Street, 9th Floor, Boston, MA 02116
Directions

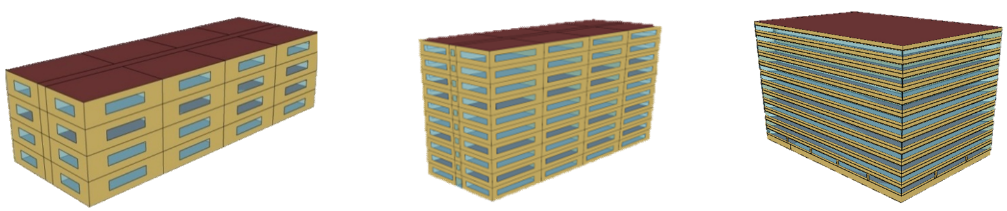
https://www.mass.gov/info-details/stretch-energy-code-development-2022

RELEVANT TRAININGS

Title	Target Audience	Topics covered
MA Stretch Energy Code 2023 for Commercial Buildings: Targeted Performance (TEDI) and Relative Performance (90.1 Appendix G) Compliance Paths (4 hours)	Code Officials & Modelers	• Applicability • Overview of the modeling requirements • Special rules for additions, core-and-shell and retrofits • Requirements other than energy modeling
Modeling for MA Stretch TEDI and Appendix G (8 hours)	Modelers	• Detailed modeling requirements
Compliance documentation for MA Stretch TEDI and Appendix G (2 hours)	Code Officials & Modelers	• Reporting templates • Other materials that must be submitted

TEDI PEER REVIEW

The DOER will be providing a peer review service for TEDI modeling, funded by the US DOE



MASSACHUSETTS STRETCH AND SPECIALIZED CODES

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QUESTIONS?

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Green Communities Massachusetts Department of Energy Resources
KARPMAN CONSULTING
SGH