2023 Building Stretch Code Updates Town of Maynard

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About Me

- Civil & Environmental Engineer
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  - Master Planning
  - Wastewater, sewer design
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  - Economic Development Committee
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In this Presentation

- Overview
- Understanding the bigger picture: Legislation in Massachusetts
- Building Code Process + History in Massachusetts
- Basics on Stretch code update 2023
- Application + Opportunities for Maynard

What is driving the code updates

MASSACHUSETTS LEGISLATION + DECARBONIZATION PLANNING

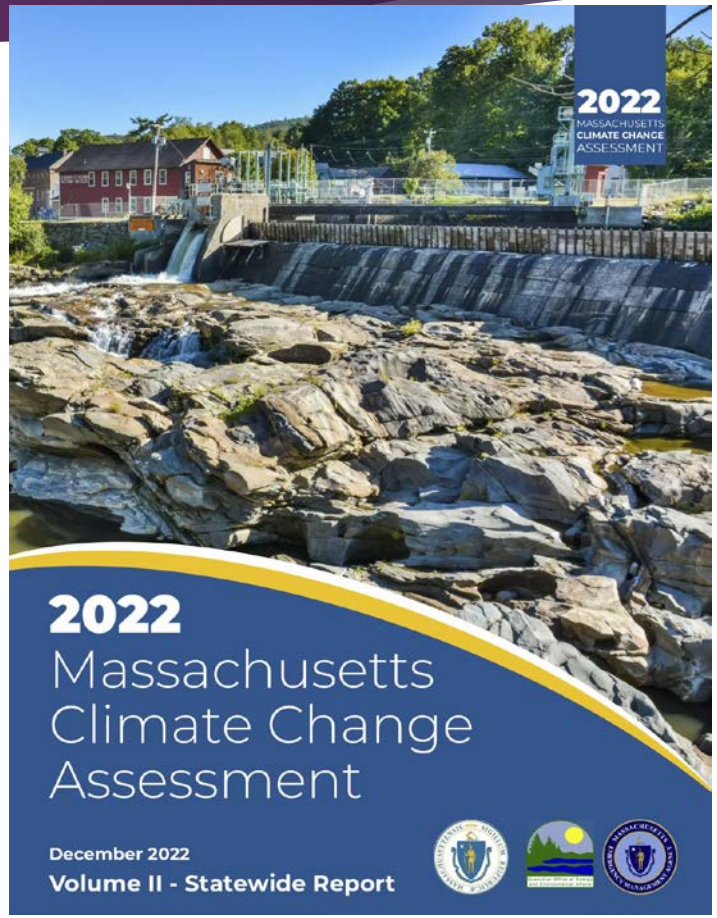
Massachusetts Decarbonization Plan

- **Climate Bill Signed in March 2021 by Gov. Baker**
- **By 2050, Massachusetts will be fossil-fuel free**
  - 2030: 50% GHG emission reduction, compared to 1990 levels
  - 2040: 75% GHG emission reduction, compared to 1990 levels
- What emits GHG's?
  1. Transportation: cars, heavy duty vehicles, buses, public transit
  2. Buildings: commercial, homes, municipal stock
  3. Energy production (20%)

More info: GHG Emissions and Mitigation Policies (Mass.gov)

Climate Change in Massachusetts

- Massachusetts Climate Change Assessment
  - December 2022
  - Informs State Hazard Mitigation and Climate Adaptation Plan (SHMCAP)
- What it considers
  - Climate stressors: temperature, precipitation, sea level
  - Climate hazards: extreme heat, flooding, droughts
  - Impacts to population, infrastructure, natural environment, governance, economy
- MA Climate Predictions: 2030 (NY), 2050 (MD), 2070 (NC), 2090 (GA)
  - Energy use intensity shifts to summer: May – October
  - HVAC efficiency + tight building envelope
  - Mild winter = less heating demand



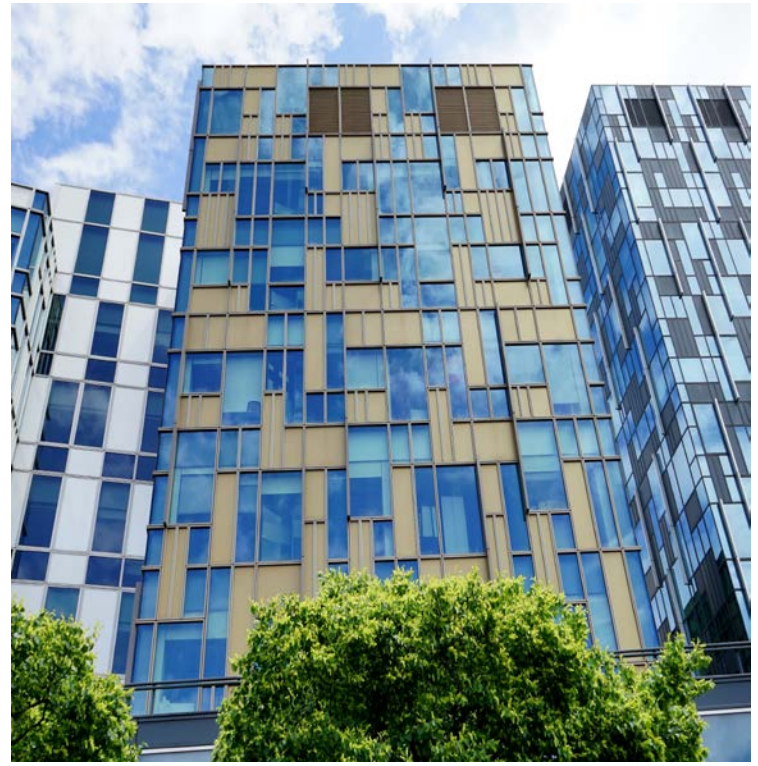
What DOER is doing in this update

- **To meet MA GHG Reductions**, Massachusetts is:
  - Developing **all-electric incentives** for cars, EV charging, EV infrastructure
  - Increasing **clean energy (electricity supply) production**: off-shore wind, community solar, battery storage, geothermal
  - Increasing funding mechanisms for energy efficiency and electrification: heat pumps, building envelope improvements, energy modeling
  - Providing technical assistance programs for municipalities, homeowners, industry
- Carrots + Sticks
  - Carrots: MassSave, IRA/IIJA funding through Green Communities/state agencies, push for solarization/geothermal, *incentives, incentives, incentives.* Strong push for electrification.
  - Sticks: increasingly stringent building codes, including renovations, eliminating new gas connections (possible), limiting decommissioning of buildings (embodied carbon), and high efficiency standards for building envelope; All-electric vehicles by 2035.

mass save

What does this mean for municipalities?

- Design/construction of buildings is increasingly complex
  - Many designers are trailing and have not kept up
  - Lots of training, proactive education needed
  - Need to know who you're working with and their experience level with efficient design
- **Responsibility falls to non-technical building owners and building code enforcement** (i.e. municipalities, zoning, and local code) to oversee and enforce standards
  - Requires looking at building stock differently
  - Asset management, vulnerability assessment
  - Thinking differently about maintenance and upkeep
- **Without proactive, structural change**, many underfunded communities will be hit the hardest
  - It is critical that towns like Maynard do this well
  - Future cost/ conversion can be beyond available means



MA Building Codes

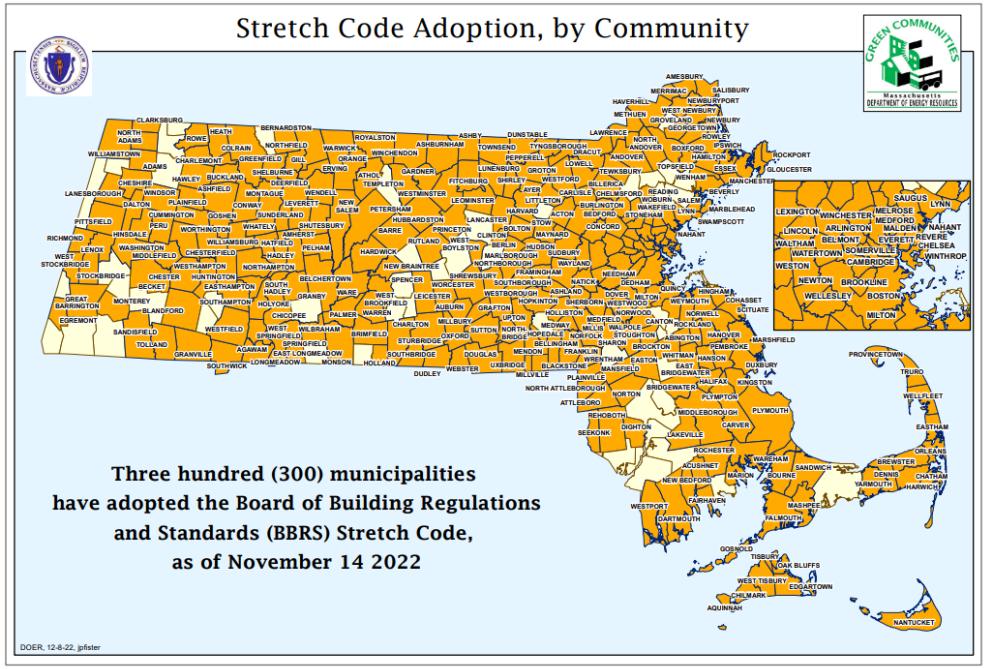
BACKGROUND

Overview of Energy Codes

- Code is based on IECC
  - IECC: International Energy Conservation Code
  - ICC: International Code Council
- Establishes minimum design and construction requirements for building energy efficiency
- Model code is adopted by many state / municipal governments in US
- Updated on a 3-year cycle
  - 2015, 2018, 2021, 2024…
- Building Codes are updated following IECC cycle with Massachusetts Amendments for additional criteria

Building Codes in Massachusetts

- Massachusetts has 351 communities: 312 towns, 39 cities
  - 51 Base Code / Tier 1
  - 300 Green Communities / Tier 2 +
- There are 4 Levels of Building Energy Code in Massachusetts
  A. Tier 1: MA Building Energy Code (IECC 2021)
  B. Tier 2: Stretch Code (IECC 2021 + Amendments)
  C. Tier 3: Expanded Stretch Code (Municipal Opt-in)
  D. Tier 4: Fossil-Fuel Free Demonstration Communities (Opt-in w/ DOER Approval)
- **Tiers designed to show leading edge/ future base code**



2023 Update Summary

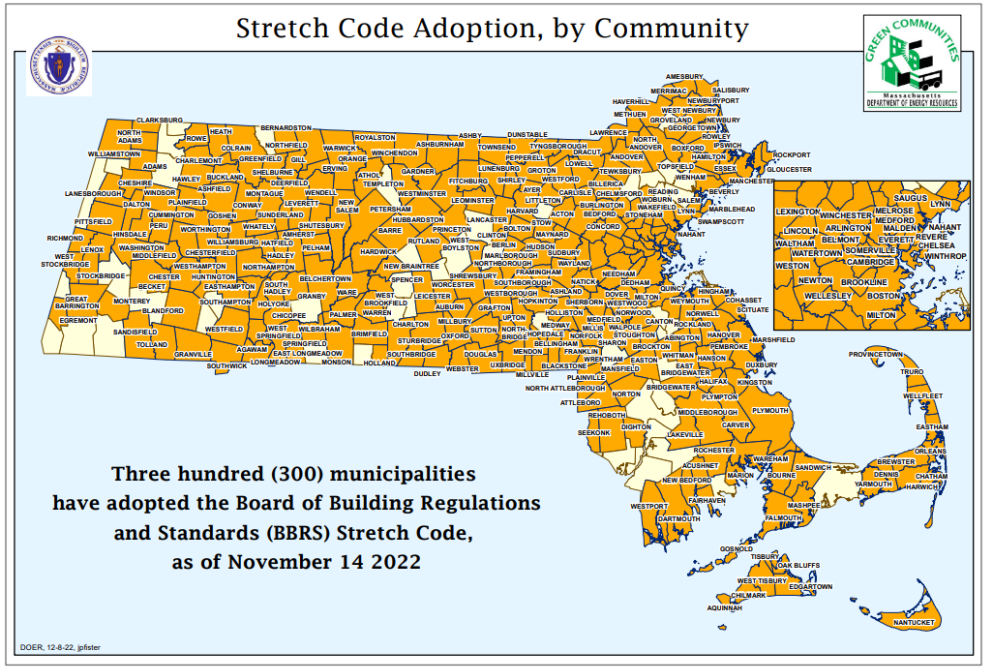
- With these updates, **DOER is providing a paradigm shift in the building process**
  - Energy codes are no longer separate
  - MA Moving away from HERS ratings as the standard
    - HERS: building design + energy efficiency measures
    - Passive House: building designed for efficiency (like cars)
  - Including renovations to capture as many existing buildings as possible under new code
  - Electric future: phasing out gas infrastructure; encouraging on-site energy generation
  - Efficiency first: promoting energy conservation as the primary driver of building design
- **Energy efficiency is no longer niche: it is how new infrastructure in Massachusetts will be built from now on**
  - In the next decade, we can expect to see a continued push for efficiency and, with it, rising costs in gas prices vs. electric
  - On-site energy production is the only way to hedge the increased costs, provides certainty in budgeting

2023 (Tier 2) Stretch Code Details

UPDATES ON EXISTING CODE + EXPANDED CODE DETAILS

Tier 2: Stretch Code (Green Communities)

- Residential Code updates that are new this year:
  - Phase 1 Update: January 1, 2023 – June 30, 2024
  - Phase 2 Update: July 1, 2024
  - NEW Renovations/additions now included
  - More pathways for modeling to meet code
- Commercial Code updates new this year:
  - All new buildings, renovations, additions permitted after effective date
  - NEW Phased approach for implementation
  - Phase 1 Update: July 1, 2023 – June 30, 2024
  - Phase 2 Update: July 1, 2024



Residential code updates

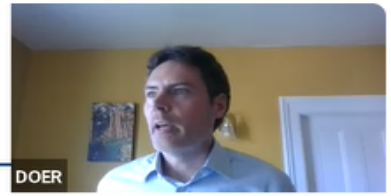
Tier 2 Residential Code Update 2023

- **Residential Low-Rise Construction**
  - Pathway 1: HERS (Home Energy Rating Scores) Index Certification
    - See next slide for details
  - Pathway 2: Passive House – US (Phius) Certification
    - Phius CORE 2021 (efficiency)
    - Phius ZERO 2021 (efficiency + renewables)
- **Categories**:
  - Single family buildings <4,000 ft^2
  - Single family buildings >4,000 ft^2
  - Multi-family <12,000 ft^2
  - Note: Multi-family >12,000 ft^2 under Commercial Code
- New residential stretch code requirements
  - Wiring for Electric Vehicle (EV) Charging: at least 1 space per home

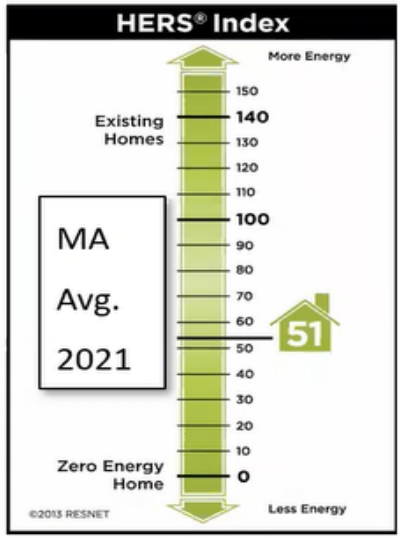
Tier 2 Residential Code Update 2023

DOER Massachusetts Department of Energy Resources

Residential low-rise: New Construction



New Construction			
	Max. HERS index (before solar credit)		
On-site Clean Energy application	2017-2022	Jan 1, 2023	July 1, 2024
Mixed-fuel	HERS 55	HERS 52	HERS 42
Mixed-fuel & Solar	HERS 60	HERS 55	HERS 42
All-Electric	HERS 60	HERS 55	HERS 45
All-Electric & Solar	HERS 65	HERS 58	HERS 45



- Energy Star 3.1 option goes away
- Passive House option updates from Phius2018 to Phius2021 or PHI

Commercial Code Updates

Tier 2 Commercial Code Update 2023

- **Commercial Code applies to all other buildings**: municipal, schools, multi-family above 12,000ft^2, office buildings, high ventilation, and all other commercial
- **Buildings categorized** as follows:
  - Multi-family >12,000 ft^2
  - Small Commercial <20,000 ft^2
  - Commercial >20,000 ft^2 (Municipal buildings and most business construction under this code)
  - High Ventilation: hospitals, labs, etc. (not included in this summary)
- **Additions, alterations, change of use**: follow code prescriptively or treat like new construction, depending on relative size of altered space
- **Schedule**:
  - July 1, 2023 – Phase 1 Commercial
  - July 1, 2024 – Phase 2 Commercial

Tier 2 Commercial Code Update 2023

- **Biggest changes**
  - Shifting from “energy reduction” to heating and cooling demand reduction (TEDI)
  - EV-ready parking for 20% of new businesses and residential spaces; 10% for other uses
  - Prescriptive pathways to meet energy modeling requirements
- **Thermal Energy Demand Intensity (TEDI)**
  - Modeling tool that has been used by commercial building industry for decades can be used to model TEDI; this means less learning required to adapt
  - Heating TEDI + Cooling TEDI modeled
  - TEDI limits vary by building size, type, and use

Thermal Energy Demand Intensity (TEDI)

- Energy Use Intensity (EUI)
- Annual kBtu / building area = kBtu/sqft/yr
- "MPG for Buildings"
- TEDI is essentially the MPG for building heating and cooling

DOER Massachusetts Department of Energy Resources

TEDI Limits – by Building Size and Type

Building type	Heating TEDI limit (kBtu/sf-yr)	Cooling TEDI limit (kBtu/sf-yr)
K-12 school	2.2 - 2.4	12 -20
Office, fire & police station, library, post office, town hall	1.5 - 2.5	21 - 23
Multi-family	2.8 – 3.2	15 - 22

The same models currently used for stretch code compliance also produce TEDI information

IES

EnergyPlus

eQUEST

Maynard: Next Steps

IMPACTS TO COMMERCIAL / MUNICIPAL BUILDINGS

Stretch Code Updates: Impacts to Green Meadow Building Plans

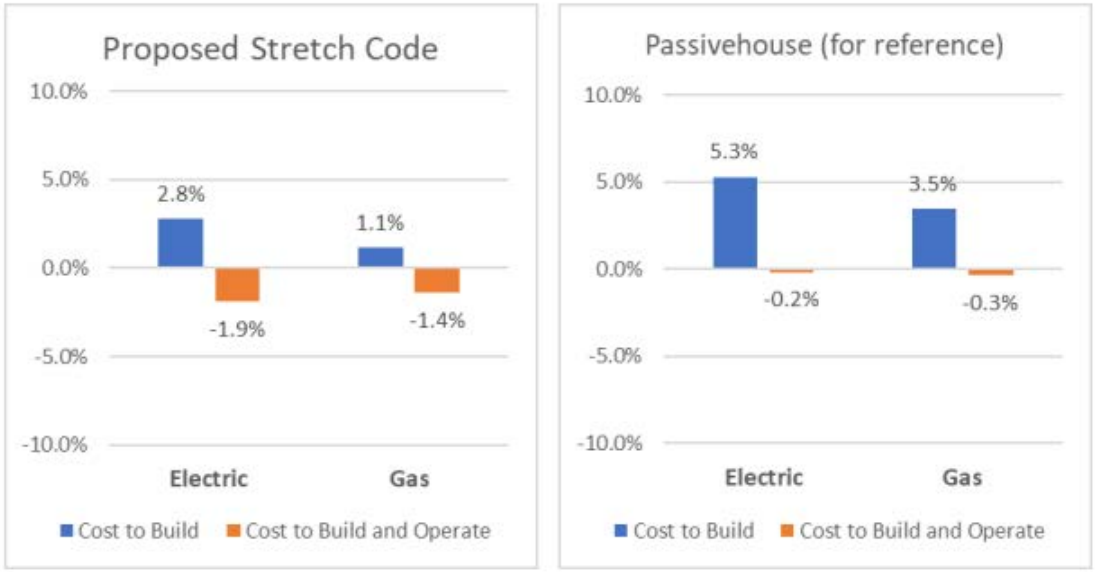
- Tier 2 Impacts (> 20,000 ft^2): Energy modeling will be required
  - TEDI or Passive House modeling
  - The updated Stretch Code mandates full electrification of space heating for buildings not following the ASHRAE pathway
  - 10% of Parking Spaces must be wired for EV Charging
  - Renewable Energy optional
- If Maynard adopts Opt-in Tier 3 Stretch Code
  - Requirement for on-site energy production (PV or Geothermal)
  - Production requirement of at least 1.5W/sf for each square foot of 3 largest floors or 75% of Potential Solar Zone

Impact to Buildings: Cost Analysis

- DOER Stretch Code Cost modeling
  - Completed by Consigli Constriction
  - Reviewed 12 building scenarios: residential + commercial
- Analysis Approach
  1. Identify representative projects for building use/fuel/glazing
  2. Model base code + passive house scenarios to bracket construction/energy cost
  3. Iterate + stress-test the designs with focus on heat load reduction
  4. Detailed pricing for each building type
- Building use case studies available through mass.gov (see next slide)

Cost impact to Green Meadow

- Initial cost to build is 1-3% more
- Total savings (factoring increase initial increase in cost) is 1-2% over 50yrs
- Does not include current incentives from MassSave, MSBA, or IRA/IIJA
- Does not include savings due to on-site energy production (solar/geothermal)



Resource: https://www.mass.gov/doc/summary-of-stretch-code-study-energy-efficiency-analysis-feb-2022/download

Summary

Energy Matters

- What is this code update signaling to building owners/developers?
  - Energy-first building design; refined throughout design process
- Energy modeling drives building design decisions
  - Design process is complex
  - Increased pressure on building owners to be informed during design process
- What other communities are doing
  - Updated building code + opt in code; staff training
  - Net-zero planning for building stock
  - All-electric, efficiency-driven modeling
  - Capitalize on incentives
  - Climate Action Planning, Energy manager at municipal level
  - **Permanent Building Committee**

Next Steps for Maynard

- Municipal Building Energy Assessment
  - HVAC assessment, energy incentives + funding identification
  - Incentives earmarked for EJ communities, schools
- Collaboration among boards to identify potential impacts/ opportunities for building energy analysis review
  - Affordable housing
  - Commercial building permits
  - Planning/ zoning overlay
  - Downtown district
- Permanent Building Committee
  - Expert review of existing building stock, energy demand
  - Informed / knowledgeable of complexity and nuance in building design
  - Informed decision making

Next Steps for Maynard

- Energy Committee?
- Climate Action Planning
  - Impacts to residential, commercial buildings
  - Energy + resource review can be included
  - Resource identification for supporting residents, commercial builders, municipal building
- CAPs open the door to new funding
  - Funding available through IIJA, IRA, MassSave, MVP, DOER/Green Communities, EOEA, MAPC
  - Energy Manager / Sustainability Coordinator

Change is opportunity

Discussion

Additional Slides

Summary of Code Options

Base Code (IECC 2021)

- New construction in towns & cities not a green community
- **52 communities**

Expected from BBRS: **July 2023**

Stretch Code (2023 update)

- New construction in towns & cities that are a green or stretch community
- **299 communities**

Residential: Jan 2023
Commercial: July 2023

Specialized Code ("Net-Zero")

- New Construction in towns & cities that vote to opt-in to this code
- **Effective date:** Typically 6-11 months after Town/City vote

Demonstration Program (All-Electric)

- No mixed fuel option for new construction
- Opt-in program organized through DOER
- Effective date: likely July 1, 2024

2023 Opt-in (Tier 3) Code Details

EXPANDED CODE EXPLAINED

Tier 3: Specialized Code Adoption

- Process for adopting code
- This is an opt-in code, meaning towns have to vote it into the bylaws
  - DOER has written draft bylaw language, including warrant article
  - Sponsoring Committee submits warrant to Town Administrator
  - Warrant article put on Town Meeting Agenda
  - Voted in Town Meeting
- Timeline
  - Opt-in code would be in effect as of January 1, 2024 at the earliest

Tier 3: Specialized Code Summary

- This is an opt-in code, meaning towns have to vote it into the bylaws
- Designed to be an easy-yes for towns to add in, with minimal differences
  - Push for energy efficiency, electrification, and EV pre-wiring
- **For all-electric buildings, there is no change between Tier 2 and Tier 3**, except for multi-family buildings above 12,000 ft^2
  - More efficiency measures required for multi-family homes
  - Protects renters/low-income individuals from future increase cost of gas (see tables for specifics)
- If a single-family home is connected to gas for heating/cooking, Tier 3 code requires pre-wiring for future electric conversion
  - If Passive House pathway is used, no other requirements are needed
  - If HERS pathway, home must have some on-site Solar generation
  - Exception made for highly shaded areas (which encourages low-impact building/less trees cut during build)
- On-site clean energy production required for commercial buildings

Residential - Tier 2 vs. Tier 3

Comparison of updated Stretch and Municipal Opt-in Specialized Energy Codes for New Low-rise Residential Buildings[1]

Building Size	Fuel Type	Minimum Efficiency		Electrific Pre-Wiring		EV Pre-Wiring		Renewable Generation Required	
		Stretch Code	*Specialized Opt-in Code Addition*	*Stretch Code*	*Specialized Opt-in Code Addition*	*Stretch Code*	*Specialized Opt-in Code Addition*	*Stretch Code*	*Specialized Opt-in Code Addition*
Dwelling units <4,000 sf	All-electric	HERS 45[2] or Passive House	--	N/A	--	1 parking space	--	Optional	--
	Single Family Mixed-fuel	HERS 42[2] or Passive House	--	Optional	Pre-wiring required	1 parking space	--	Optional	Not for Passive House; ≥4 kW Solar PV for HERS
	Multi-Family Mixed-fuel	HERS 42[2] or Passive House	--	Optional	Pre-wiring required	1 parking space	--	Optional	Not for Passive House; ≥0.75 W/sf Solar PV for HERS

Definitions

Abbreviations: sf = square feet; HERS = Home Energy Rating System (a lower score indicates a more efficient building)

All-electric buildings: Buildings using either air source or ground source heat pumps for primary space heating, heat pump or solar thermal water heating, and all electric appliances.

Mixed-fuel buildings: Buildings with any fossil fuel combustion equipment or piping for such equipment.

Zero energy building: A building which, through a combination of highly energy efficient design and onsite renewable energy generation, is designed to result in net zero energy consumption over the course of a year as measured in MMBtus or KWheq, on a site energy basis, excluding energy use for charging vehicles.

Sources: Summary at *https://www.mass.gov/doc/summary-document-explaining-stretch-energy-code-and-specialized-opt-in-code-language/download*
Code language at *https://www.mass.gov/doc/residential-low-rise-stretch-energy-code-and-specialized-opt-in-code-language-redline/download*

1 DRAFT pending review by the Department of Energy Resources

2 During the July 1, 2023 to June 30, 2024 phase in period of the updated Stretch Code, maximum HERS scores are 52 for mixed-fuel buildings and 55 for all-electric buildings.

Commercial - Tier 2 vs. Tier 3

Comparison of updated Stretch and Municipal Opt-in Specialized Energy Codes for New Low-rise Residential Buildings[1]

Building Size	Fuel Type	Minimum Efficiency		Electric Pre-Wiring		EV Wiring		Renewable Generation Required	
		Stretch Code	*Specialized Opt-in Code Addition*	*Stretch Code*	*Specialized Opt-in Code Addition*	*Stretch Code*	*Specialized Opt-in Code Addition*	*Stretch Code*	*Specialized Opt-in Code Addition*
Multi-family <12,000 sf	All Electric	TEDI, HERS 45[2], Passive House pathway	Passive House or HERS 0[3]	Full	Full	20% of parking spaces	--	Optional	--
	Mixed-fuel	TEDI, HERS 42[2], Passive House pathways	Passive House or HERS 0[3]	Optional[5]	Pre-wiring required	20% of parking spaces	--	Optional	Optional with Passive House
Small Commercial <20,000 sf, except multi-family	All Electric	Prescriptive pathway plus Stretch Code amendments	--	N/A	--	20% of parking spaces for residential/business, 10% for other uses	--	Optional	--
	Mixed-fuel	Prescriptive pathway plus Stretch Code amendments	--	Optional[5]	Pre-wiring required	20% of parking spaces for residential and business uses, 10% for other uses	--	Optional	On-site solar PV: Minimum 1.5W/sf for each sqft of 3 largest floors or 75% of Potential Solar Zone
All Commercial including Offices, Municipal, and Schools >20,000 sf	All Electric	TEDI or Passive House	--	N/A	--	20% of parking spaces for residential/business, 10% for other uses	--	Optional	--
	Mixed-fuel	TEDI or Passive House	--	Optional[5]	Pre-wiring required	20% of parking spaces for residential and business uses, 10% for other uses	--	Optional	On-site solar PV: Minimum 1.5W/sf for each sqft of 3 largest floors or 75% of Potential Solar Zone

Regional Movement towards Expanded Stretch Code

- At least 30 Municipalities bringing Tier 3 to Town Meeting in Spring/Fall 2023, including:
  - Athol, Belmont, Boxborough, Carlisle, Chelmsford, Devens, Harvard, Ipswich
  - Maynard, Needham, Sherborn, Stow, Wellesley, Weston, Winchester
- With 16 Municipalities bringing Tier 4 to Vote:
  - Towns of Acton, Aquinnah (Martha's Vineyard), Arlington, Concord, Lexington, Lincoln, West Tisbury
  - Cities of Boston, **Brookline**, **Cambridge**, Newton, Northampton, Salem, **Somerville**, **Watertown**, Worcester
- List last updated January 30, 2023

Four Tiers of Code, Explained

DETAILS ON 4 TIERS OF CODE

Tier 1: Baseline Building Energy Code

- State of Massachusetts baseline building code
- Based on IECC schedule
- All towns must meet this code, at a minimum
- Applies to about 50 communities
- Baseline trails the Stretch Code with Massachusetts-based amendments, but keeps up with current IECC code
- New: Base Code now includes HERS or Phius (Passive House US) pathways
- Updates to base code
  - Current: IECC 2018 Code + 780CMR Chapters 13 and IRC Chapter 11
  - Update: IECC 2021 will go into effect when new code books are published.

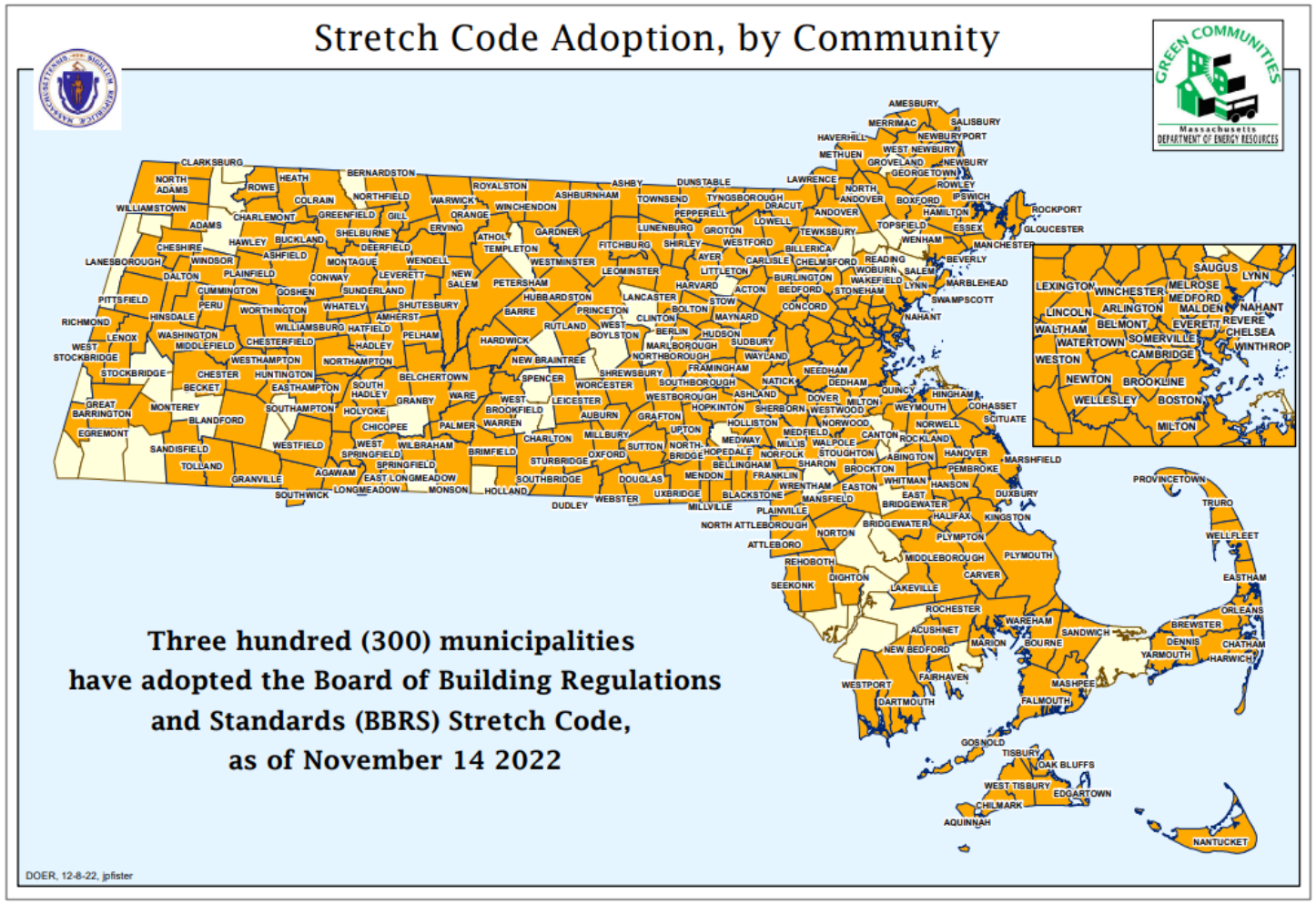
Tier 2: Stretch Code (Green Communities)

- This is required to be a Green Community through DOER
  - Automatically updated
  - No town vote required
  - Staff should check to ensure this is being met/enforced
- New: Up until recently, this has been the only step up from Baseline Code from the state
- New: Rather than a single update, codes are being "phased in" (creating a lot of confusion)
- **Residential Low-Rise Code**
  - IECC 2021 Residential Code + 225 CMR 22
  - January 1, 2023 with additions July 1, 2024
- **Commercial (Multi-unit above 12,000 sf, Municipal, Office, K-12, etc.)**
  - Includes commercial, municipal, k-12, multi-family above 12,000 sf, highly ventilated spaces
  - IECC 2021 + 225 CMR 23

Green Communities in Massachusetts

300 Green Communities in the Commonwealth

All required to meet Tier 2 Stretch Code updates



Tier 3: Expanded / Specialized Code

- New: DOER now offering an Opt-in code for communities looking to get ahead
- This is a step up from Stretch Code, but not most stringent code available
- Leading-edge code, designed to guide development towards future code updates
- Follows Massachusetts Decarbonization Plan 2050
- Towns must vote to opt-in to this code
  - Effective date 6-12 months after town vote
  - Model bylaw language available on DOER Green Communities Webpage
- Requirements allow for mixed-fuel, if criteria are met
- Residential Low-Rise + Commercial
  - IECC 2021 + 225 CMR 22 and 23, including appendix RC and appendix CC
  - Effective date: either January 1 or July 1, 2024

Tier 4: Fossil-Fuel Free Demonstration Program

- New: DOER 10-Community Fossil Fuel Free Pilot Program
- DOER enabled cities and towns to adopt/amend general or zoning ordinances or by-laws to require all new building construction or major renovations to be fossil-fuel free
- Program; towns must pass Tier 3 Expanded/Specialized Code AND vote to join DOER Demonstration Project
- Towns apply for the program, DOER Approves
- **This has already started in many communities**, through individual ordinances or by-laws that have already been instituted
  - DOER/State provide consistency in the housing production market
  - Helps push the leading edge of advancing innovation and expertise with energy efficient design
  - Future-planning: this will be the standard within 10 years
- Legislation filed January 26, 2023 to expand beyond 10 communities