

COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF ENERGY RESOURCES  
*Patrick Woodcock, Commissioner*

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# **Building Energy Code Straw Proposal: AIA MA Q&A**

**March 2nd 2022**

# Starting in 2023 – 3 Energy Code options:

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This straw proposal includes an update to the stretch code alongside the new specialized stretch option for Municipalities

## Base Code (10th Edition of MA Building Code)

- New Buildings in towns and cities that have not adopted a stretch code
- 52 communities
- BBRS update effective in 2023

## Stretch Code (Update)

- New Buildings in towns and cities that adopted, including all green communities
- 299 communities
- DOER update effective in 2023

## Specialized Opt-in (New Code Option)

- New Buildings in towns and cities that choose to opt-into this code
- Available for adoption Dec 2022

# 4 Topics to cover

(based on AIA member submitted questions)

- **Scope of codes – 5Qs**
- **Net Zero – 3Qs**
- **Residential sector – 2Qs**
- **Commercial sector – 2Qs**
- **Next Steps / Other Qs**

# SCOPE OF STRETCH ENERGY CODES

## **Q. About Green Communities adopting Opt-in specialized code**

Q. Claims are beginning to surface that DOER's proposed straw proposal is circumventing the requirements of the Green Communities Act by not requiring/mandating and incentivizing designated existing Green Communities to adopt the new municipal opt-in stretch code. Could DOER explain where they feel their legal authority begins and ends with regard to mandating the opt-in code and providing financial incentives?

The 2021 Climate Roadmap Act states in Section 98A:

*"A community designated as a green community under subsection (c) of section 10 of said chapter 25A that elects not to adopt the municipal opt-in specialized stretch energy code under said section 6 of said chapter 25A shall not lose its designation as a green community as a result of that election."*

Reference: <https://malegislature.gov/Laws/SessionLaws/Acts/2021/Chapter8>

## **Q. About existing buildings and stretch codes**

**Q.** While the Massachusetts 2050 Decarbonization Roadmap notes the most cost-effective time for an existing building to transition to new mechanical systems is during routine home improvements, it appears the DOER straw proposal does not intend to extend the stretch code or new municipal opt-in code into existing buildings via the commercial codes Chapter 34 or the residential codes Appendix J. Is the reason behind this that DOER does not feel they have the legal authority to do so, but the Board of Building Regulations and Standards does, or is there another reason? If there is another reason, could you please share it?

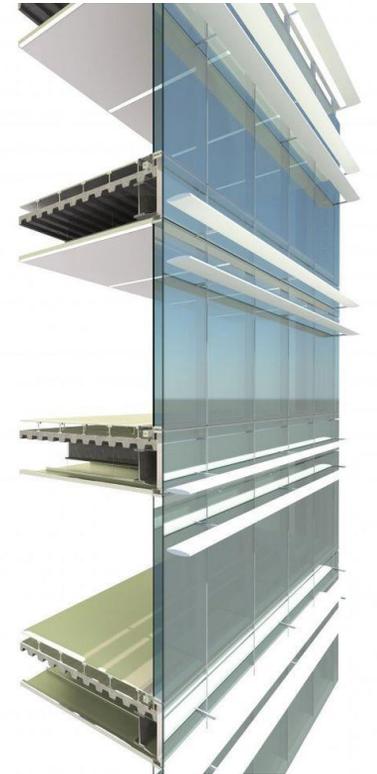
## **Q. About embodied carbon**

**Q.** Could DOER please expand on why embodied carbon calculations/considerations are only being applied to buildings utilizing curtain wall systems and not to other building use groups or construction types?

## Proposed Stretch Code: Accommodation for Curtain wall

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- Envelope performance backstop
  - Will be somewhat strengthened from current code
  - However, for curtain wall construction – will maintain about current level to accommodate builder preference
- Additional requirements if using curtainwall - demonstrate embodied carbon reduction from a choice of options
  - Low carbon concrete
  - Carbon sequestering materials (e.g. wood fibre-board, mass timber)
  - Recycled materials (e.g. Foamglass)
  - Reused materials/building reuse



## **Q. About % improvement in codes**

**Q.** Could DOER please provide the actual percentage increase related to energy efficiency improvements for the following (noted below), and why that particular percentage increase was chosen:

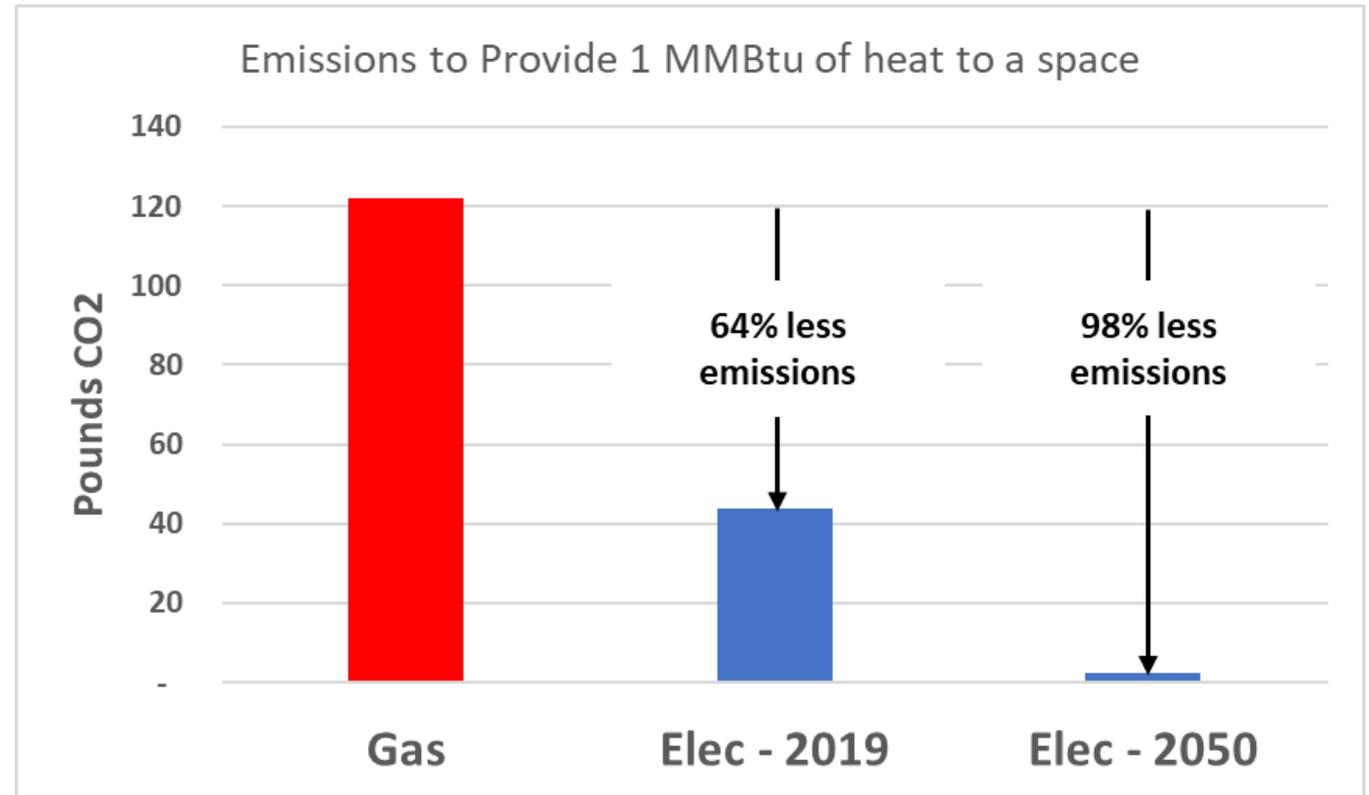
- Between the current stretch code and updated stretch under the straw proposal, i.e. ASHRAE 90.1-2013 vs ASHRAE 90.1-2019;
- Between the 2020 MA new home average HERS 51 and the updated stretch under the straw proposal i.e. HERS 42/45;
- Between the updated stretch and the opt-in specialized stretch

## **Q. About mandating building electrification**

**Q.** Could DOER please expand on their thoughts as to why the straw proposal does not require/mandate building electrification?

## Key Consideration: Electrification in Residential & Commercial

- Electric heating compared to gas heating
  - 64% less emissions current
  - 98% less emissions in 2050
- Critical that buildings migrate toward electrification



# NET ZERO DEFINITION

## Q. About Net Zero definition

Q. Could DOER explain their thought process in not using an industry standard definition specific to Net Zero Energy Buildings, like the one used by the US Department of Energy?

Q. The U.S. Department of Energy & the National Institute of Building Sciences definition of a net zero building is, “A zero energy building (ZEB) produces enough renewable energy to meet its own annual energy consumption requirements” - which appears (*not*) to be in line with DOER’s proposed definition of net zero. Claims are beginning to surface that DOER’s proposed net zero definition is not in line with Chapter 8 of the Acts of 2021 (the Commonwealths recently enacted climate bill). Could DOER explain how/why they feel their definition is in line Chapter 8 of the Acts of 2021 requirements?

## **Q. About Net Zero definition**

**Q.** Could DOER please expand on their thoughts as to why the straw proposal appears to forgo a 100% renewable energy offset for true "net zero" performance?

# Specialized Code: Proposed Net Zero Definition

- Consistent with EEA's 2050 Roadmap
- Compatible, as-built, with the Commonwealth's net zero emissions economy in 2050
- Does not necessitate onsite or offsite renewables, but means a building becomes net zero energy when MA electric grid is net zero
- Includes enhanced energy efficiency and elimination of on-site emissions from space heating, domestic hot water, cooking and other process uses

**Electric Heat:** No additional requirements, compliant as built with net-zero in 2050

**Fossil Fuel Heat:** Require solar on-site to offset emissions and pre-wire for future electric heating and cooking

“Net Zero new construction is defined as being consistent with the electrification and deep efficiency benchmarks described in the All Options pathway, discussed in the *Energy Pathways Report* – that is, that the new construction is compatible, as-built, with the Commonwealth’s net-zero emissions economy in 2050. Its focus is on-site emissions; it does not necessitate onsite or offsite renewables, nor the assumption that a building is net-zero energy.” EEA Buildings Sector Technical Report, p. 39



# Building Energy Code in MA state law

## 2008 Green Communities Act

- **Base Energy Code:**

“To adopt and fully integrate the latest International Energy Conservation Code (IECC) and any more stringent amendments thereto as part of the state building code, in consultation with DOER.”

*MGL CH143, Section 94(o)*

- Created DOER Green Communities Program and **Stretch energy code:**

“minimize, to the extent feasible, the life-cycle cost of the facility by utilizing energy efficiency, water conservation and other renewable or alternative energy technologies.”

*MGL CH25a. Section 10(c)*

## 2021 Climate Act

- 50% emission reduction in 2030 (sub-limits to be established for buildings sector)
  - DOER to **update the Stretch Code** from time to time, in consultation with BBRS
  - DOER to develop: a **municipal opt-in specialized stretch energy code** that includes:
    - net-zero building performance standards
    - a definition of net-zero building
    - designed to achieve MA GHG emission limits and sub-limits.
    - may be phased in by building type
- Session Laws of 2021 Chapter 8: Section 31*

## Statutory Timeline

- **July 2022:** EEA must establish specific 2025 and 2030 emissions reduction targets for the buildings sector
- **December 2022:** DOER must promulgate new specialized opt-in code
- **January 2023:** New Base Energy Code expected to go into effect
- **2030:** Massachusetts must achieve at least 50% reduction in GHG emissions

# Specialized Opt-in Code – Residential low rise

## Proposing 3 Options for ‘net zero’ Code Compliance:

- **HERS 42** for gas/propane heating (each unit)  
+ **Rooftop solar (where unshaded)**  
+ **pre-wired for electrification**

or

- **HERS 45** for electric heating (each unit)

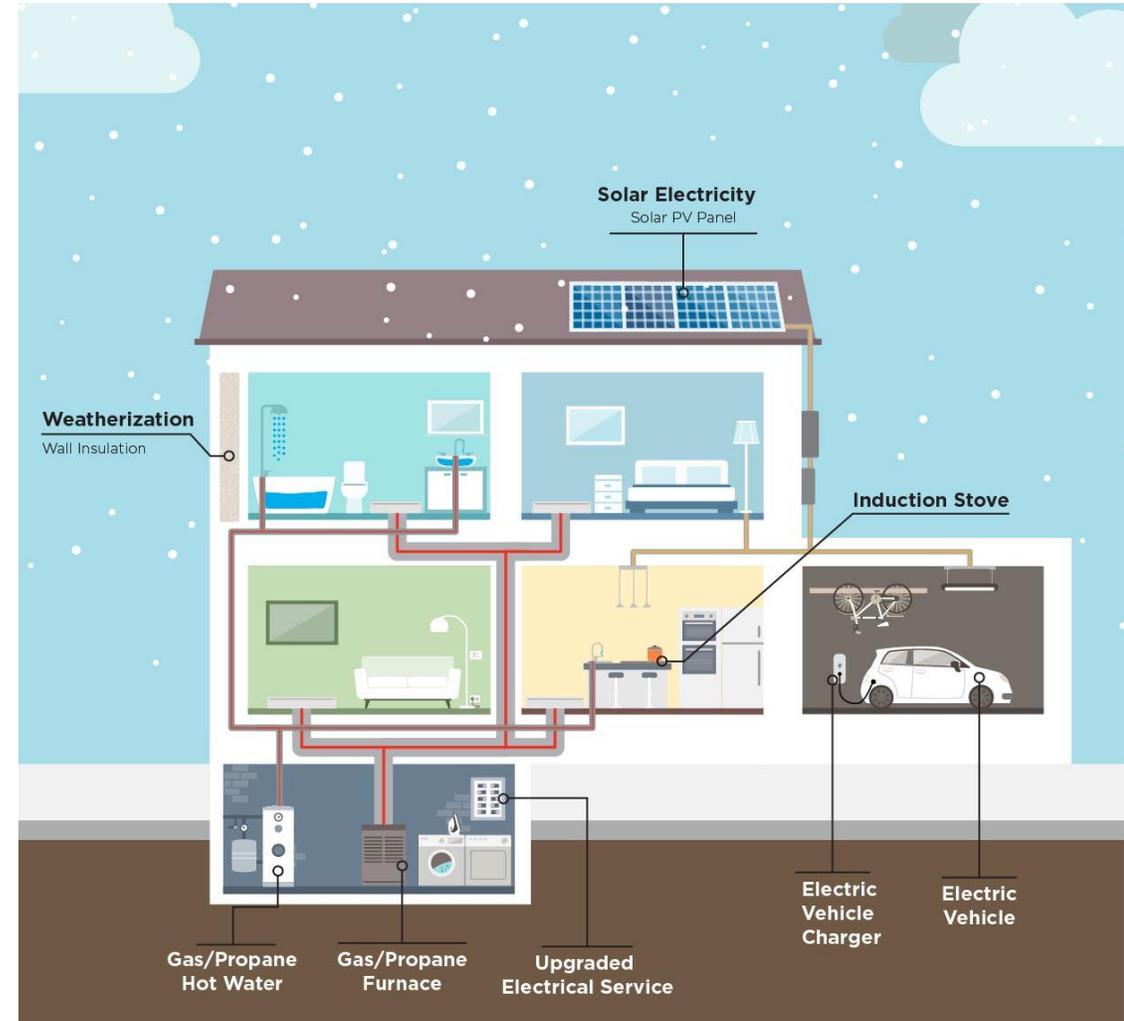
or

- **Passivehouse** (whole building)

+ **wired for electrification**

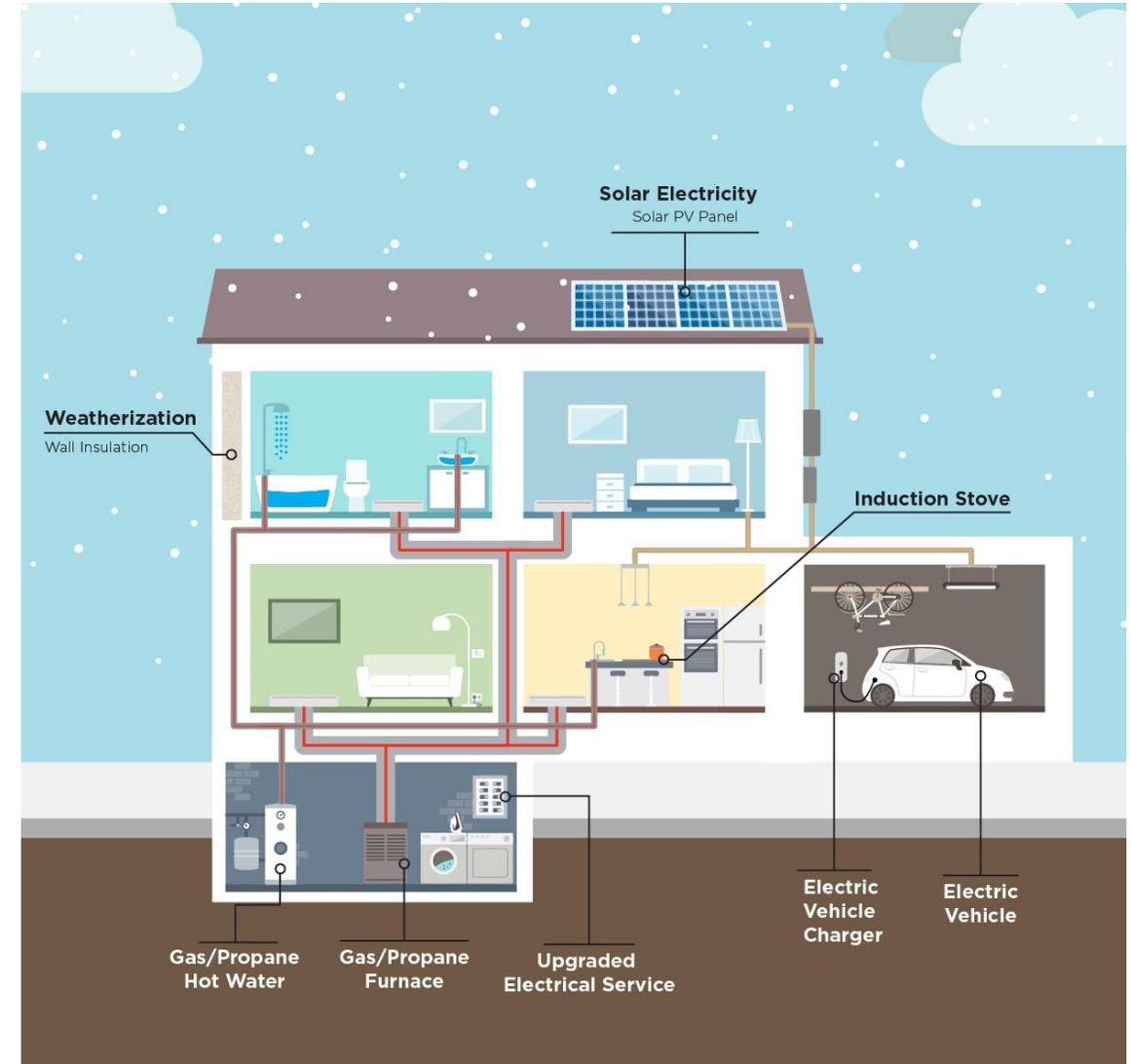
**And in all cases**

**EV ready wire to parking spaces (20% of spaces)**

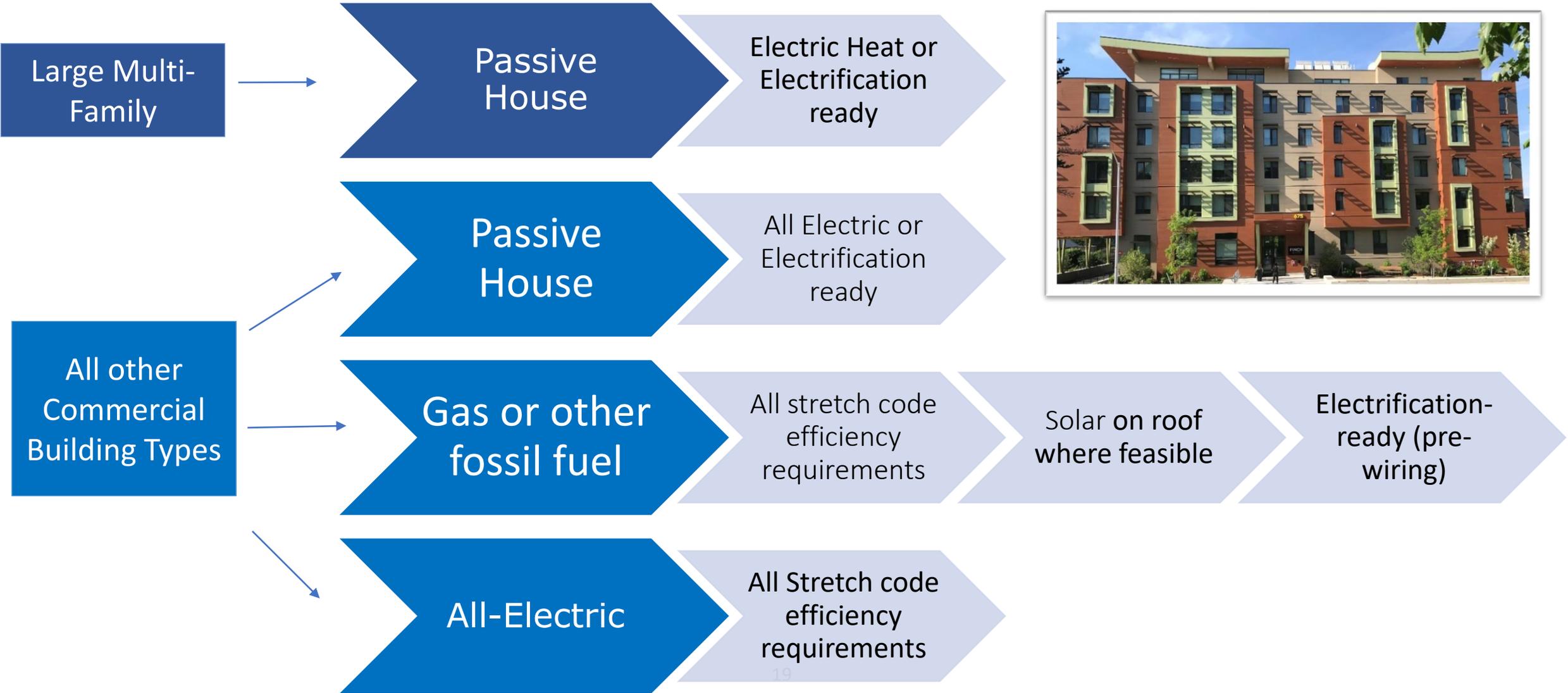


# Net-zero requirements for homes with fossil fuels

- Solar PV requirement
  - Required solar PV installation on all unshaded roof with good solar access
  - Solar PV production may not meet full load
- Pre-wiring for future electrification
  - To be 2050 net-zero ready homes required to size electric panel and prewire to appliances for future electric conversion
  - E.g. install 240volt wire to cooking and dryer appliances, and adjacent to furnace & water heater



# Specialized Opt-in Code (Net Zero) - Commercial



# RESIDENTIAL SECTOR

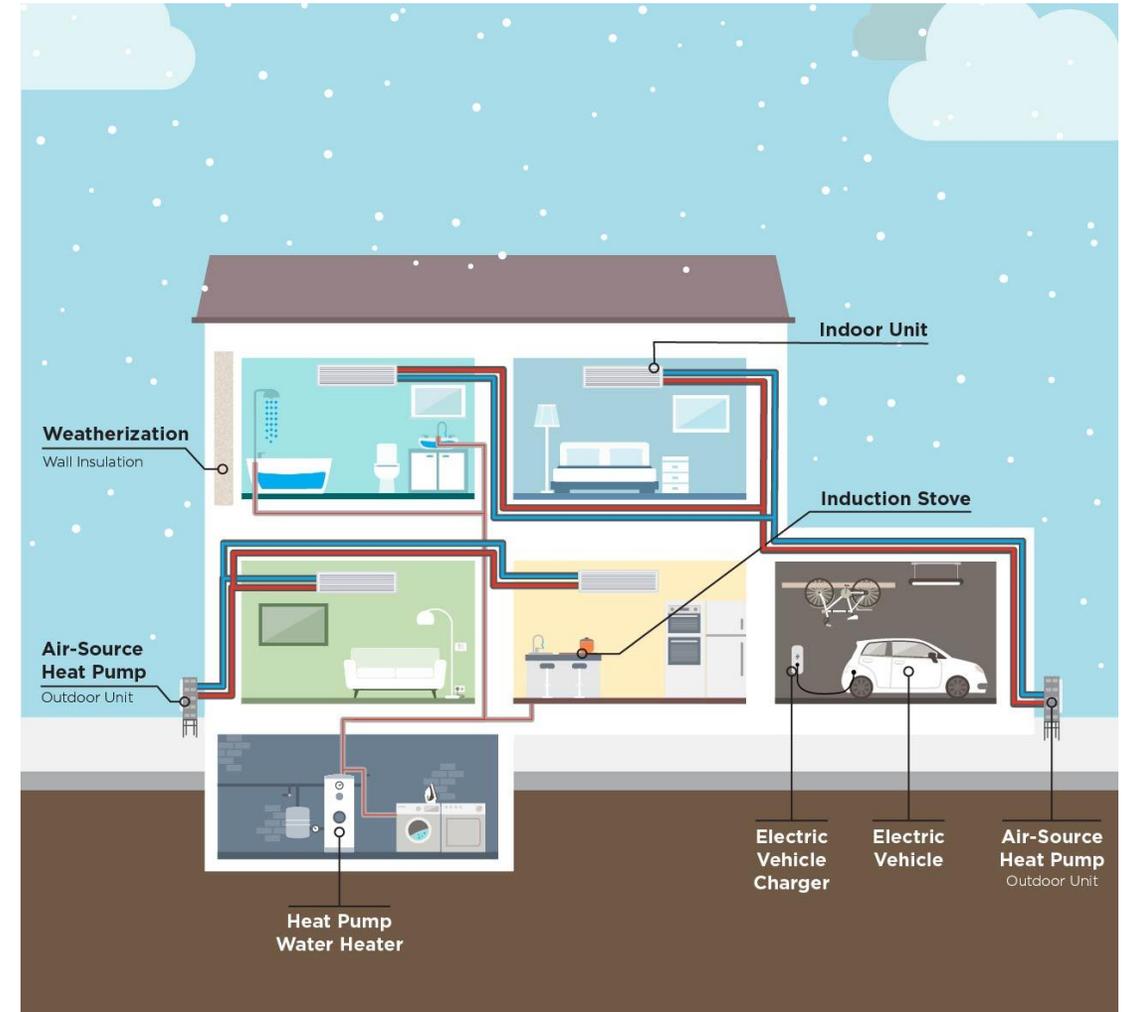
**Q. About HERS rating equivalent to Passivehouse**

**Q.** Could DOER include in their presentation the equivalent of Passive House 3.4 Btu/sf/year translated to HERS rating?

# Stretch Code Update – Residential low rise

## Proposing 3 Options for Code Compliance:

- **HERS 42** for fossil fuel heating (each unit)  
or
  - **HERS 45** for electric heating (each unit)  
or
  - **Passivehouse** (whole building)
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- Jan-Dec 2023 transition year with HERS 52/55
  - Effective December 2023 HERS 42/45

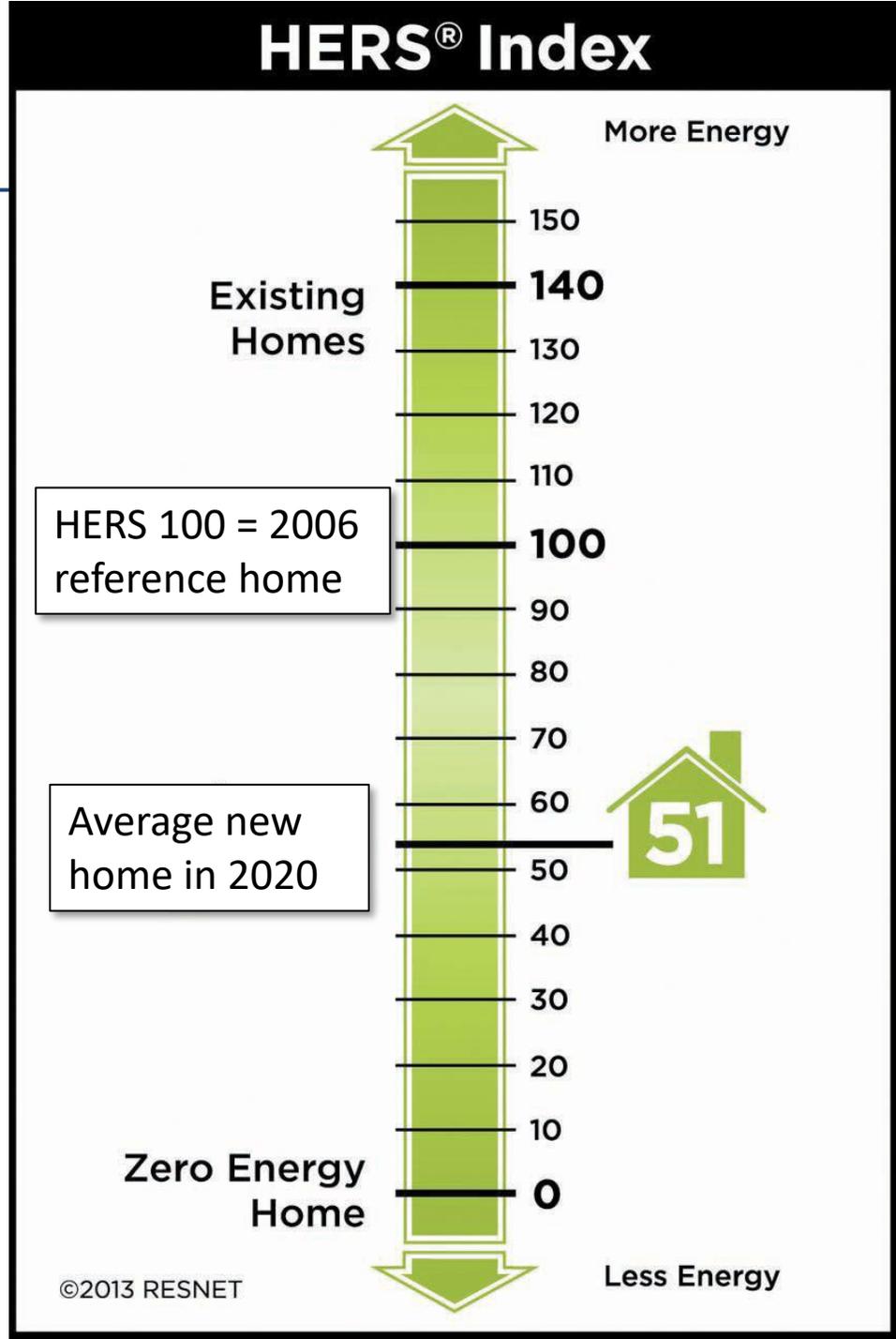
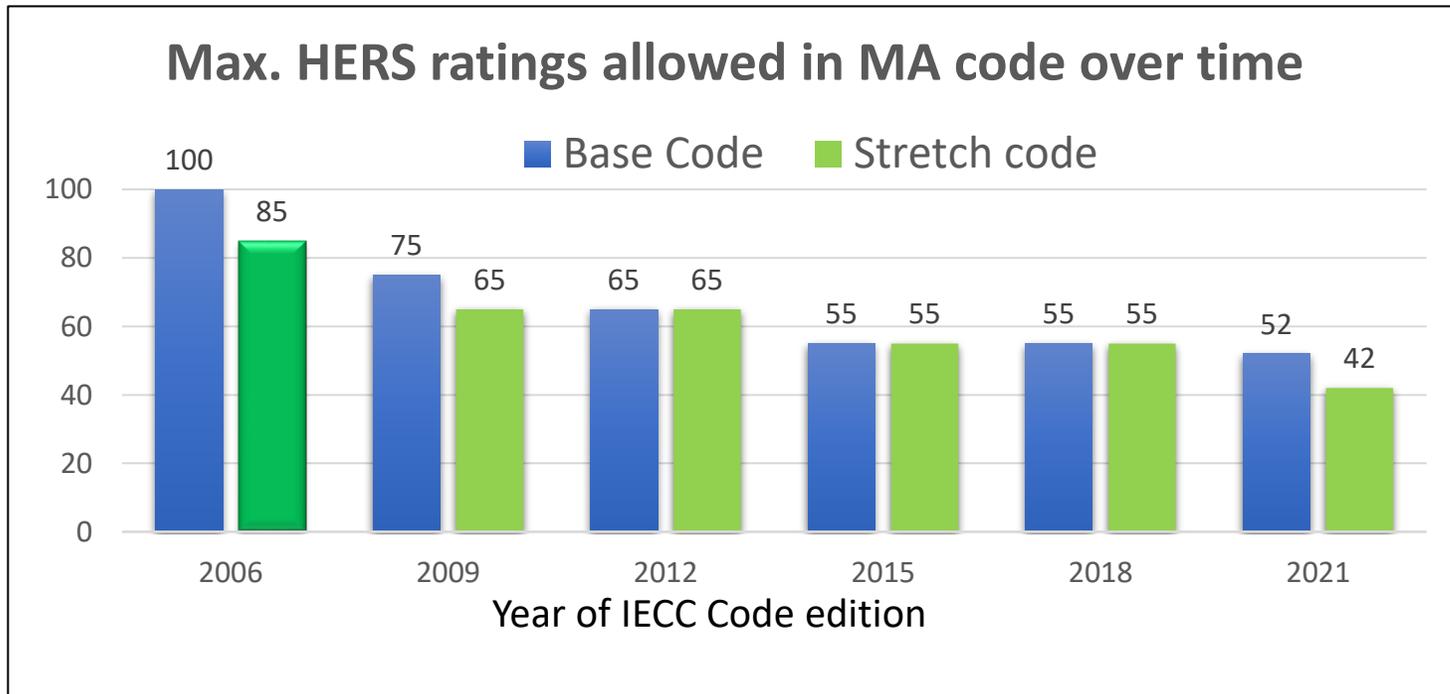


**Q. About selected HERS ratings: HERS 42 / 45**

**Q.** Could DOER please provide a more detailed explanation as to why it is proposing a HERS ratings of HERS 42 when using fossil fuel heating and HERS 45 when using electric heating? What are the reasons for not pressing further e.g. HERS 40 and HERS 43?

# What is HERS?

- HERS (Home Energy Rating System) used in MA energy code since IECC 2006 edition
  - HERS 51 = Average in MA in 2020
  - 87% of new homes used HERS in 2020
  - HERS ratings qualify for Mass Save incentives & Federal tax credits



# Residential Analysis Approach

1

HERS 52 base code  
baseline cost & efficiency

3

Representative homes  
selected for detailed  
analysis

2

Ran 10,000 home  
scenarios to evaluate  
emissions and cost  
impacts

**ekotrope**   
**REM/Rate**<sup>TM</sup>

4

Detailed cost-benefit  
building case studies

 **NREL**  
NATIONAL RENEWABLE ENERGY LABORATORY



Natural Gas Heat



Electric Heat Pump

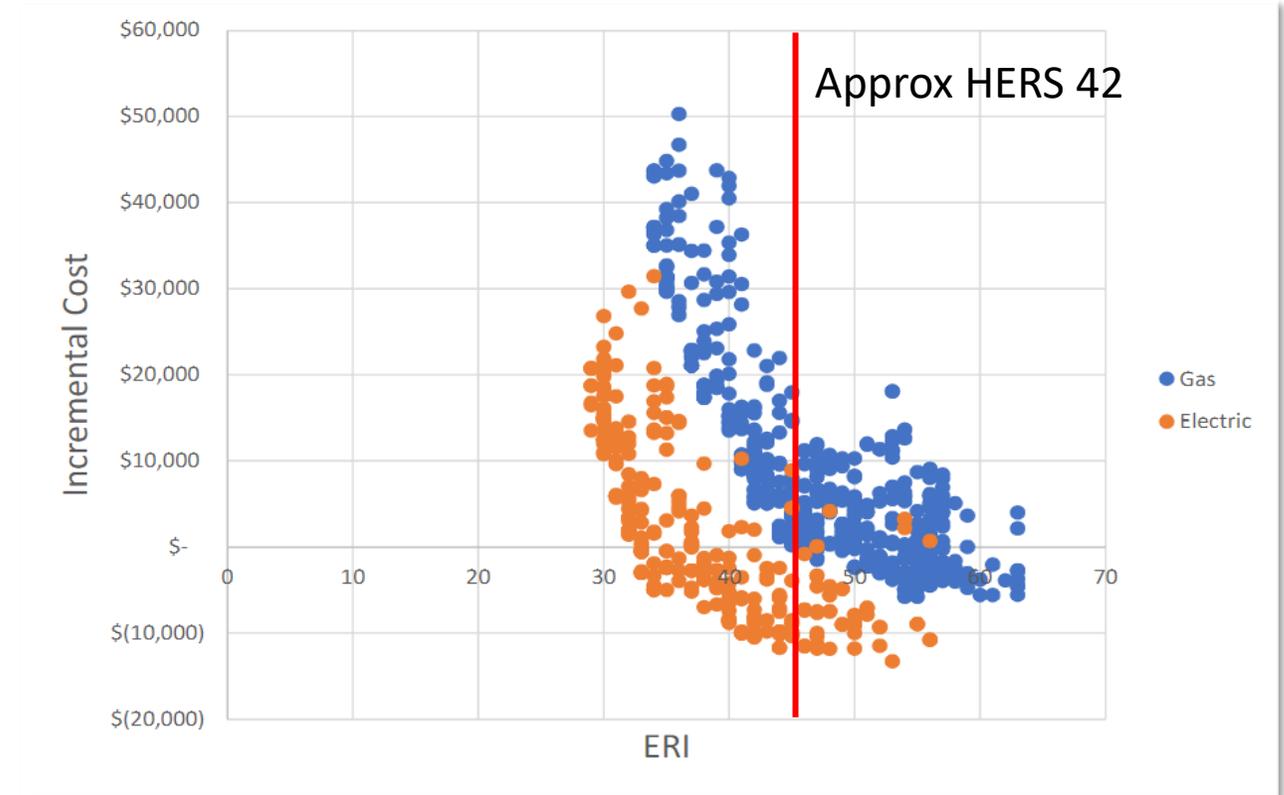
# Residential – HERS Target & Cost Optimization

## Large single-family example

- ~900 Unique Scenarios
- HERS (ERI) Range: 29 – 63, Mean: 44
- 100's of configurations more affordable than base scenario before incentives or solar PV
- Electric (heat pump) heat costs less to build & easier to meet lower HERS scores

### Large Single Family

HERS Rating vs Incremental Cost



The study team analyzed 100's of design configurations for each home type, comparing resulting Energy ratings with incremental construction costs over baseline in order to inform what HERS rating to set. The chart above shows the example of this approach for a Large single-family home using ERI values from Be-Opt software as a proxy for HERS ratings.

# Results of Residential Analysis

## What does HERS 42 mean for builders?

- **Electric-heated homes:** heat pumps significantly improve efficiency; better air sealing and ventilation is all that is needed to reach HERS 42-45
  - Incremental costs savings range from \$11,938 to \$28,597 after incentives
- **Gas-heated homes:** HERS 42 requires some combination of triple-glazed windows, improved insulation, better air sealing and heat recovery ventilation
  - Incremental costs for these improvements range from cost savings of \$570 to an increase of \$7,900 after incentives



**Building with heat pumps will be lower-cost for builders but gas or propane heating is still permitted**

# COMMERCIAL SECTOR

## **Q. About curtain wall buildings and envelope backstop**

**Q.** Could DOER please expand on their thoughts behind the straw proposal's "envelope backstop" (U x A) and permissiveness with regard to 100% curtain wall (R5) buildings?

## **Q. About TEDI performance modelling methodology**

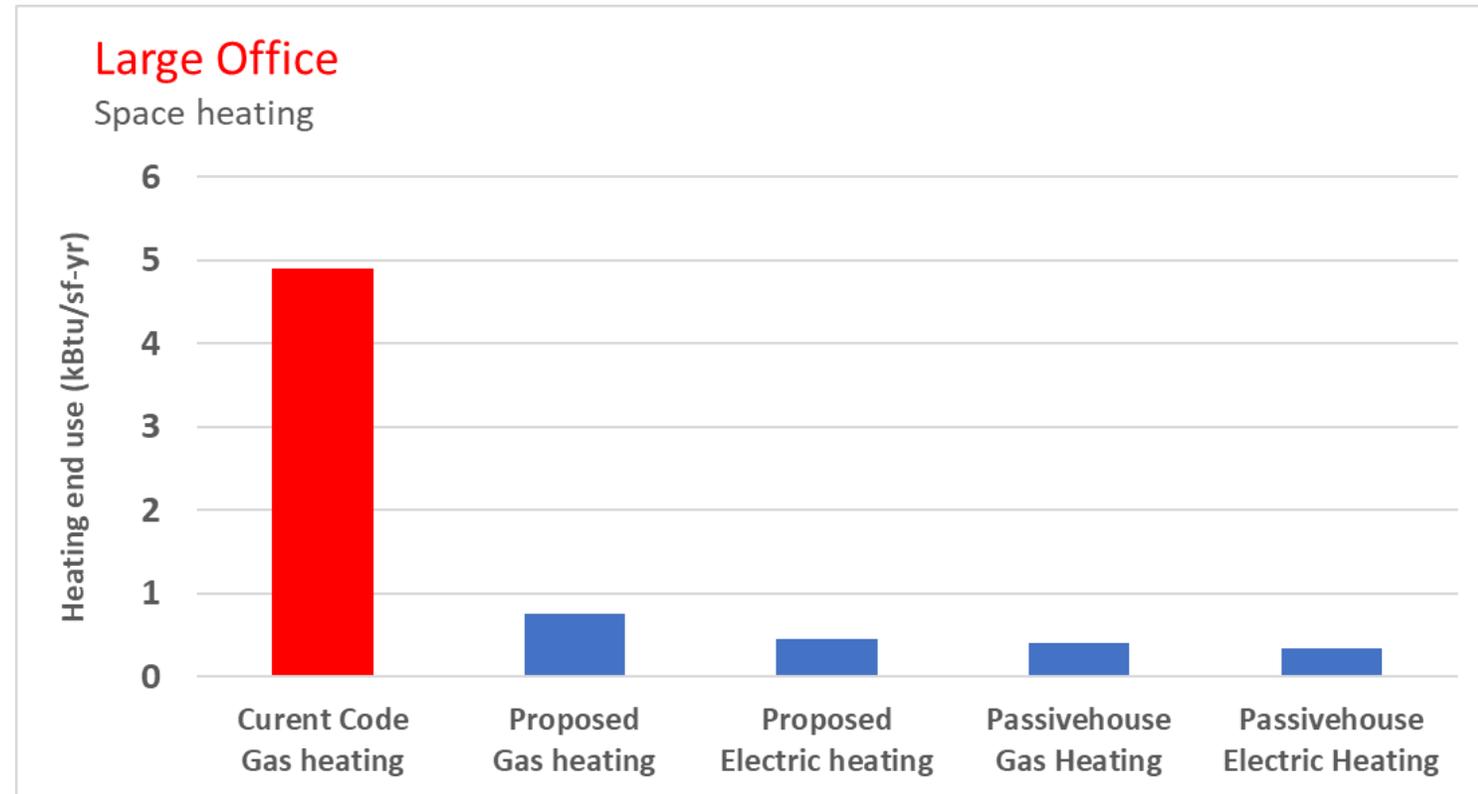
**Q.** Could DOER please expand on the TEDI performance modelling methodology which will be required for code compliance?

# Key Metric – Thermal Energy Demand Intensity (TEDI)

A design approach focused on cost-effective emissions reduction led to a key metric of heating **Thermal Energy Demand Intensity (TEDI)**. TEDI was first used in codes for Vancouver and Toronto in Canada

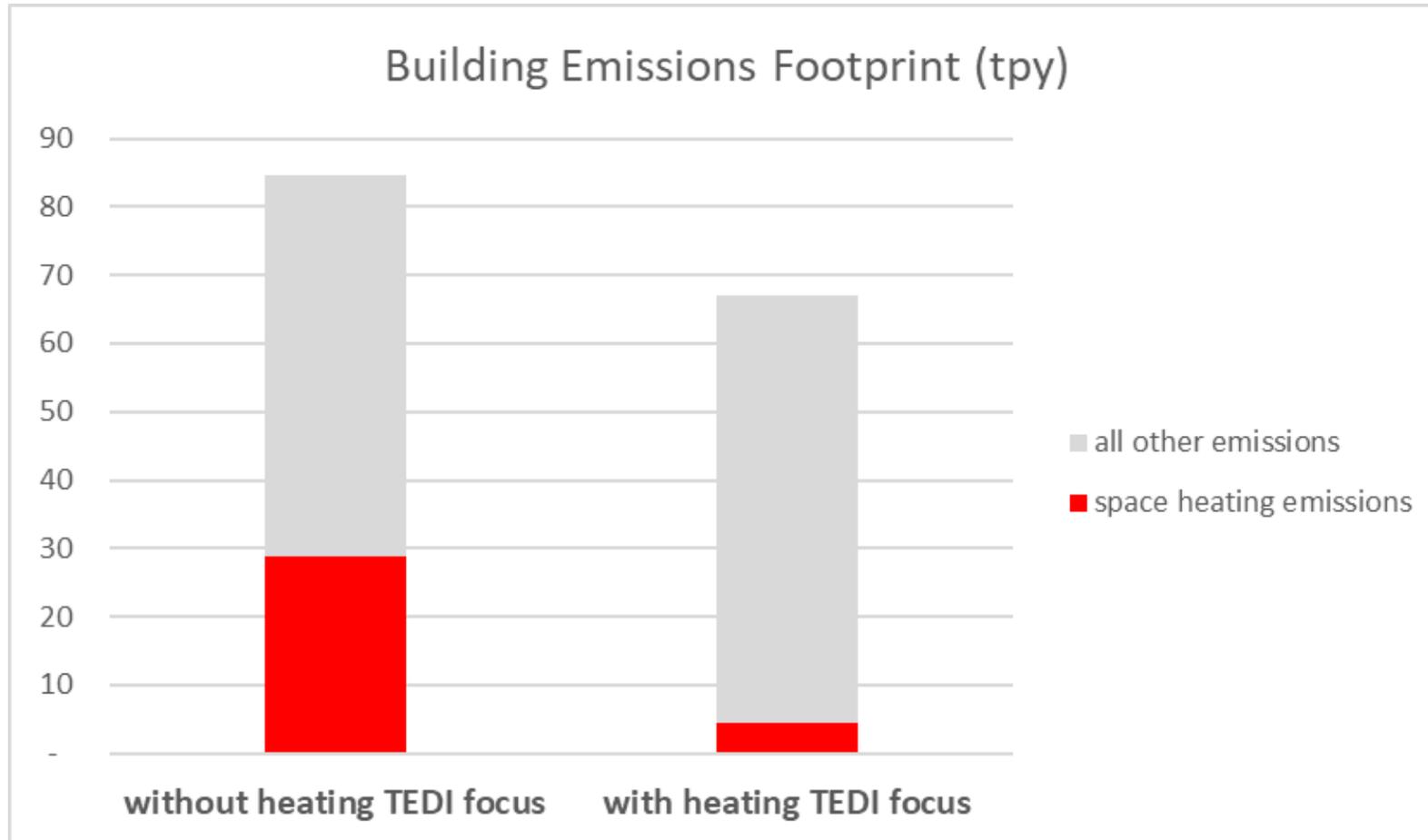
Targeting low heating TEDI means:

- Low emissions
- Easy electrification
- Reduced (or eliminates) fossil fuel
- Improved resiliency
- Improved comfort



With the proposed code, targeting low heating TEDI results in near elimination of space heating end use. Proposed TEDI code path has space heating end use comparable to Passivehouse at lower cost.

# Reduction in heating TEDI yields GHG savings



Codes that focus on achieving low heating TEDI can significantly reduce, and sometimes near eliminate, heating related emissions. Example is shown for secondary school, 2030 emission rates.

# Proposed Stretch Code: TEDI Limits

- **When TEDI applies**

- Schools
- Office (including town hall, courthouse, etc)
- Multifamily (including dormitory)

- **Heating TEDI limits (kBtu/sf-yr)**

- K-12 School < 100,000-sf 2.4
- K-12 School >= 100,000-sf 2.2
- Office < 100,000-sf 2.4
- Office >= 100,000-sf 1.5
- Multifamily TBD

- **Plus**

- Cooling TEDI limits
- Vertical envelope UA backstop
- Thermal bridge accounting
- Infiltration limits and testing



Old Colony - affordable Multi-family - Boston

# NEXT STEPS

# Expected Timeline for code adoption

	Winter 2022	Spring 2022	Summer 2022	Fall 2022	Winter/Spring 2023	Summer 2023 and beyond
<b>Updated Base Code</b>	Draft on BBRS 10 <sup>th</sup> edition code webpage		BBRS Public hearing on 10 <sup>th</sup> edition	BBRS vote on final 10 <sup>th</sup> edition	<b>Effective Jan. 2023</b> as part of 10th edition Code (MA IECC 2021)	
<b>Updated Stretch Code</b>	Outreach, public hearings, and comments on straw proposal	Draft code language available for public comment	Public hearings on draft code	Finalize code proposal & Publish Code	<b>Effective Jan. 2023</b> to align with 10 <sup>th</sup> edition	Phase-in HERS requirements in Dec 2023
<b>New Specialized Opt-in Code</b>	Outreach, public hearings, and comments on straw proposal	Draft code language available for public comment	Public hearings on draft code	Finalize code proposal & Publish Code	<b>Finalized Dec. 2022</b> - Municipal adoption begins	Likely effective dates - July 1, 2023, Jan 1, 2024

## Straw Proposal for Comment

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DOER is seeking comments on its Straw Proposal updating the Stretch Energy Code and Proposing the new, Specialized Stretch Energy Code.

DOER highly encourages written comments be submitted electronically to [stretchcode@mass.gov](mailto:stretchcode@mass.gov) with the subject line “Stretch Code Straw Proposal Comments”. Responses will be accepted until 5 pm on **March 9, 2022**. Written comments may also be submitted via mail to the Department of Energy Resources, 100 Cambridge Street, Suite 1020, Boston, Ma 02114, attention Nina Mascarenhas.