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Vermont Energy Code Collaborative
Cross Cutting Meeting #2

June 8, 2021
11:00 – 1:00

ENERGY FUTURES GROUP

Cx associates LLC

Guidehouse

nbi new buildings institute

Meeting Agenda

1. Overview
2. Background and Goals of the Collaborative
   a. Introductions
   b. Cross cutting topics
   c. Meeting schedule
   d. Ground rules, logistics, and use of chat
3. Policy drivers and energy metric overview
4. National trends from leading jurisdictions
5. Zero Energy/Carbon considerations for Vermont

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Background & Goals

- Not enough time to go into depth during the three-year energy code update cycle
- This is your opportunity to dive into critical topics in more depth
- Listening and gathering information to inform decisions
  - Hoping for diverse set of perspectives and opinions
- PSD is the ultimate decision-maker…
- But feedback and input are essential
- Discuss and provide multiple points of view, don't need to reach consensus

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Code Team: Who

- Lead State Agency
  - Public Service Department
    - Kelly Launder: Assistant Director
    - Keith Levenson: Energy Program Specialist
    - Barry Murphy: EM&V Program Manager
- Code Update Lead and Residential Code
  - Energy Futures Group
    - Richard Faesy, Gabrielle Stebbins & Liz Bourguet
- Commercial Code Update
  - Guidehouse Consulting
    - Keith Downes & Stu Slote
  - Cx Associates
    - Eveline Killian
- National Insights
  - New Building Institute
    - Jim Edelson & Mark Lyles

Introductions

- Name
- Business
- Town
- Building Sector

https://pointroadgroup.com/introduce-yourself-virtually-make-strong-impressions/

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Cross-Cutting Topics

Second meeting: **Scope and pace to get to 2030**

- Net Zero

1. Policy drivers and energy metric overview
2. National trends from leading jurisdictions
3. Zero Energy/Carbon considerations for Vermont

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Meeting Schedule

- Cross Cutting
  - #1 – May 4, 11:00 – 1:00
  - #2 – June 8, 11:00 – 1:00
- C&I
  - #1 – May 11, 11:00 – 1:00
  - #2 – June 2, 2:00 – 4:00
  - #3 – June 15, 9:00 – 11:00
  - Residential
  - #1 – May 13, 3:00 – 5:00
  - #2 – June 15, 3:00 – 5:00
- Multifamily
  - #1 –June 10, 1:00 – 3:00

Yellow means upcoming

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Ground Rules

- Respectful listening
- Limit comments to less than 2 or 3 minutes
- Give everyone a turn to say something before speaking up again
- Use the chat to ask questions/ clarifications –not for having separate discussions.
- Notes attributed or not?
  - Own what you say or hold back from making a comment
  - Notes out for review before posting

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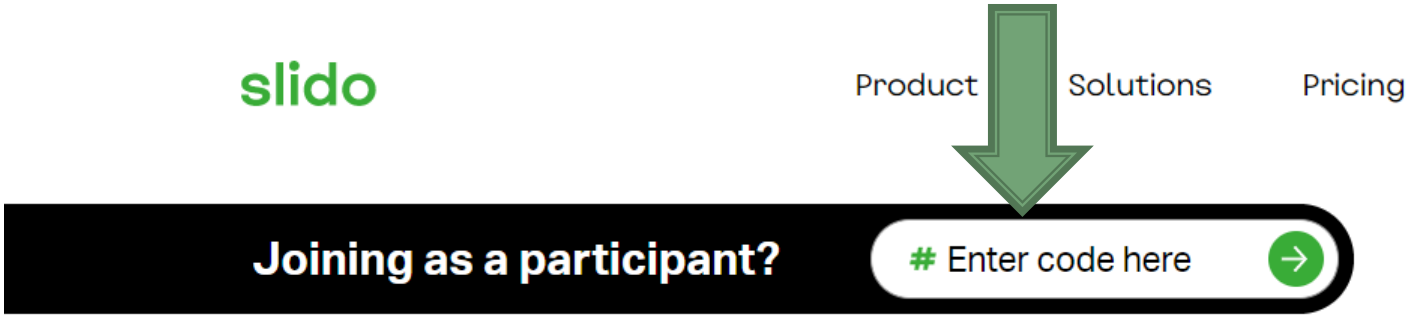
Polling

- Throughout our discussion, we will be asking you to respond to poll questions
- Before we get started, please go to https://www.sli.do/
- Enter **407140** into the field at the top of the website



- Leave this webpage open throughout our discussion
- We will let you know when it is time to answer a question

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Policy Drivers and Energy Metrics

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Guiding Policies and Goals

- Global Warming Solutions Act (2020) statutory requirements:
- Comprehensive Energy Plan (2016)
- Renewable Energy Standard – Tier 3
- Vermont Climate Council is charged with identify, analyze, and evaluate strategies and programs to achieve GHG reductions requirements of GWSA

"DPS is committed to working with stakeholders to develop a definition of "net-zero design" for use in Vermont"

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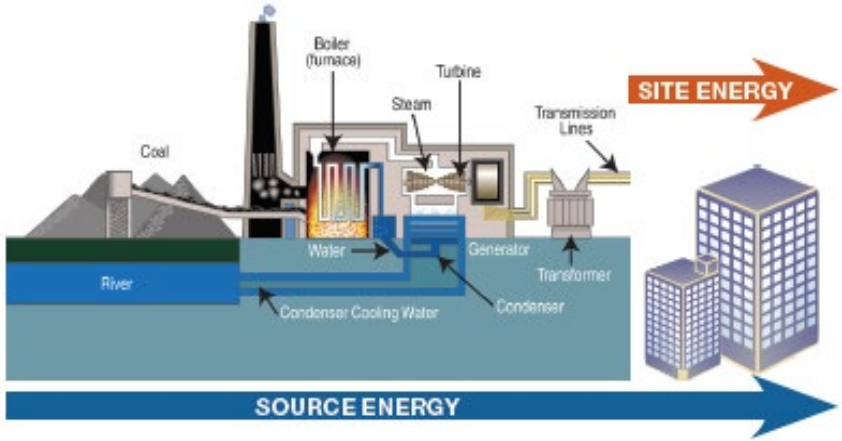
Building Performance Metrics

- **Energy Use Intensity (EUI):** Total energy use per building square foot
- **Site EUI:** Total energy use of the building at the meter or site boundary, on an annual basis
- **Source EUI:** Total upstream energy consumption of the building, including fuel transmission, delivery and production losses, on an annual basis
- **Energy Cost:** Cost of energy or power that is delivered and consumed at the building site



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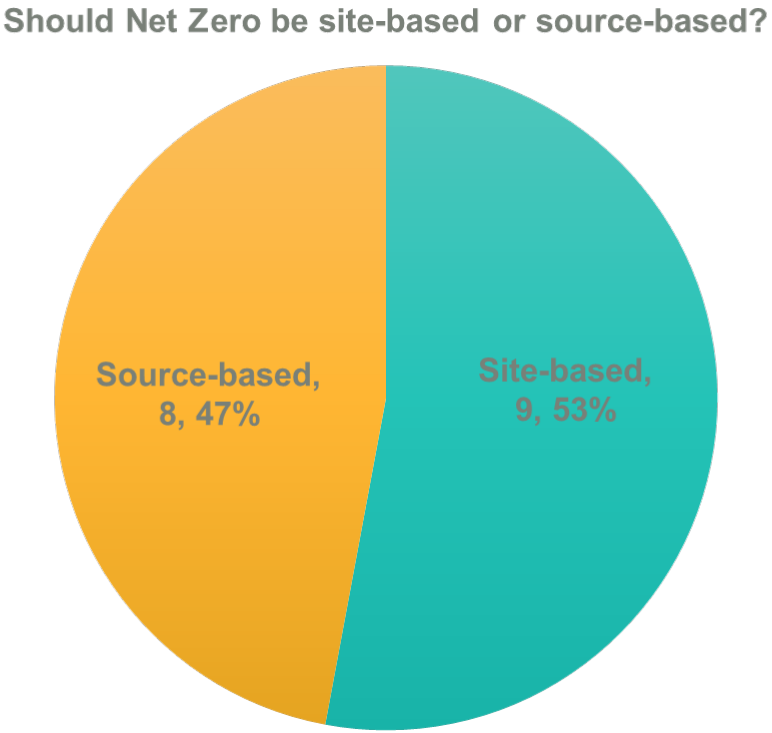
Code Collaborative Survey Feedback



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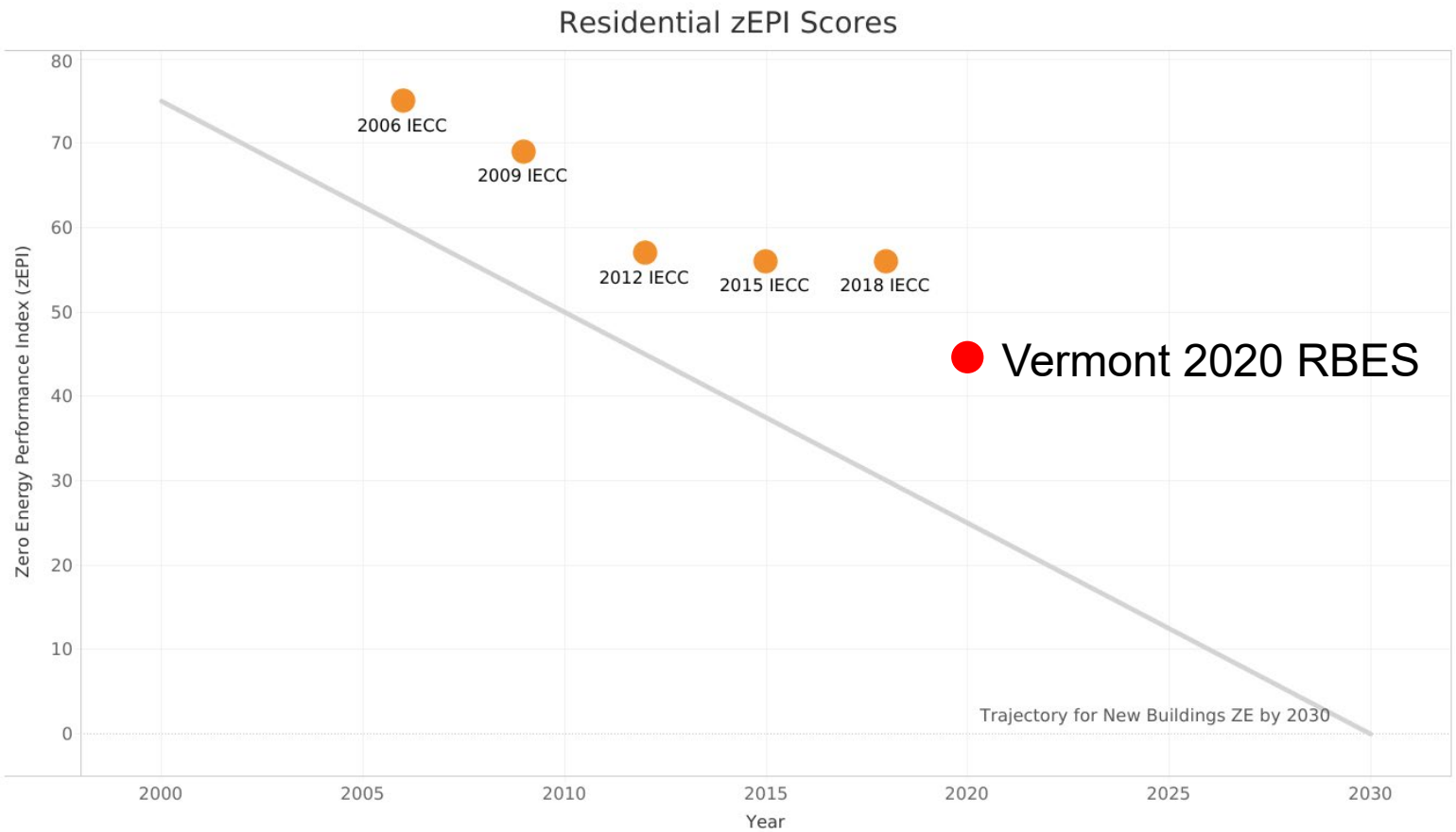
Energy Metrics in Codes and Standards

Metric	Current Applications in Codes	Requirements to Keep Data Current	Key Technical Features
Site Energy	ASHRAE 100	None	Easily applied and widely understood No conversion required from utility meter data or simulation model outputs Does not reflect primary fuel consumption
Source Energy	ASHRAE 189.1 / IgCC	Update: 3-year code cycles	Better reflects primary energy use Conversion required from utility meter data or simulation model outputs
Energy Cost	ASHRAE 90.1	Update: 3-year code cycles	Cost is major criteria for end-user Many factors can impact utility cost which changes rapidly – not just energy (e.g. demand charge, location…)
GHG Emissions	ASHRAE 189.1 / IgCC	Update: 3-year code cycles	Most complete metric for environmental impacts Temporal, locational factors influence conversions from other metric(s)
Energy Rating Index (ERI)	IECC	Update: 3-year code cycles	The ERI approach, which can be met through the HERS program, uses a scale of 0 to 100 to compare a new home to a standard home built to the 2006 code.

Code Compliance Metrics in Vermont

2020 CBES	2020 RBES
C401.2.1 Alternative compliance path (ASHRAE 90.1-2016 Modeling)	R406.1 (HERS provider)
Energy Cost	ERI

Code Progression: Energy Use



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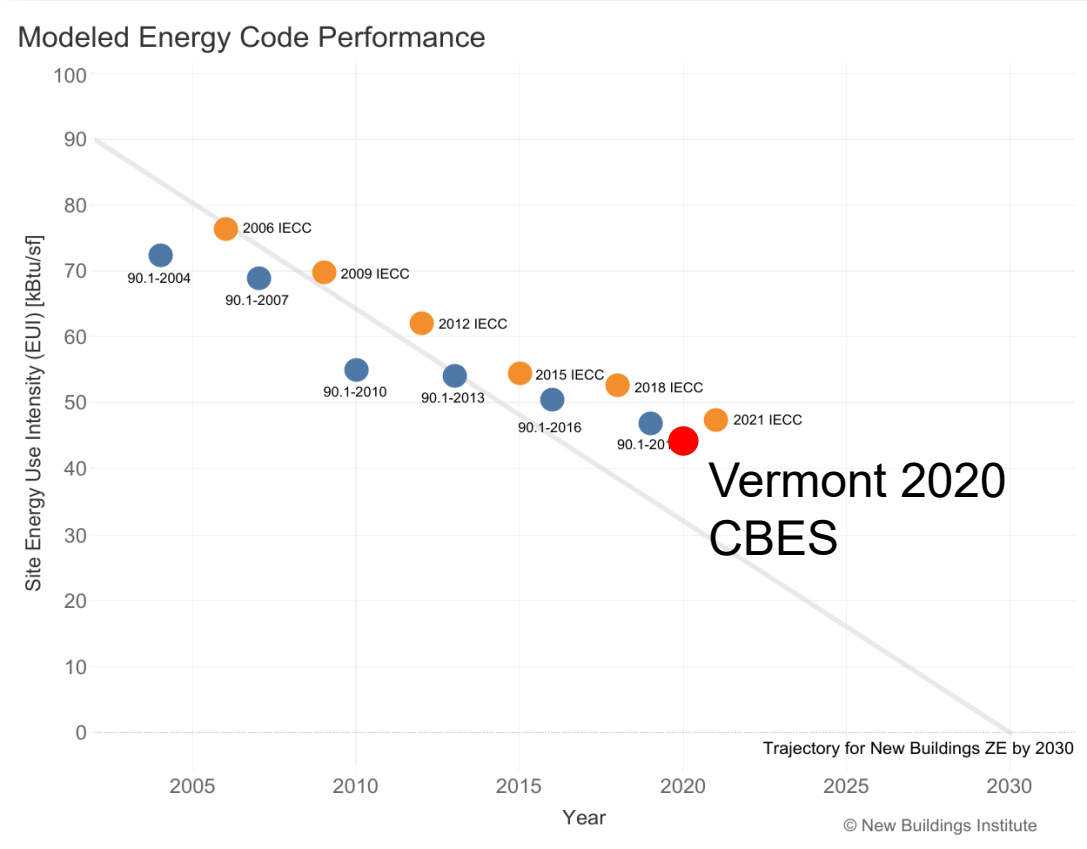
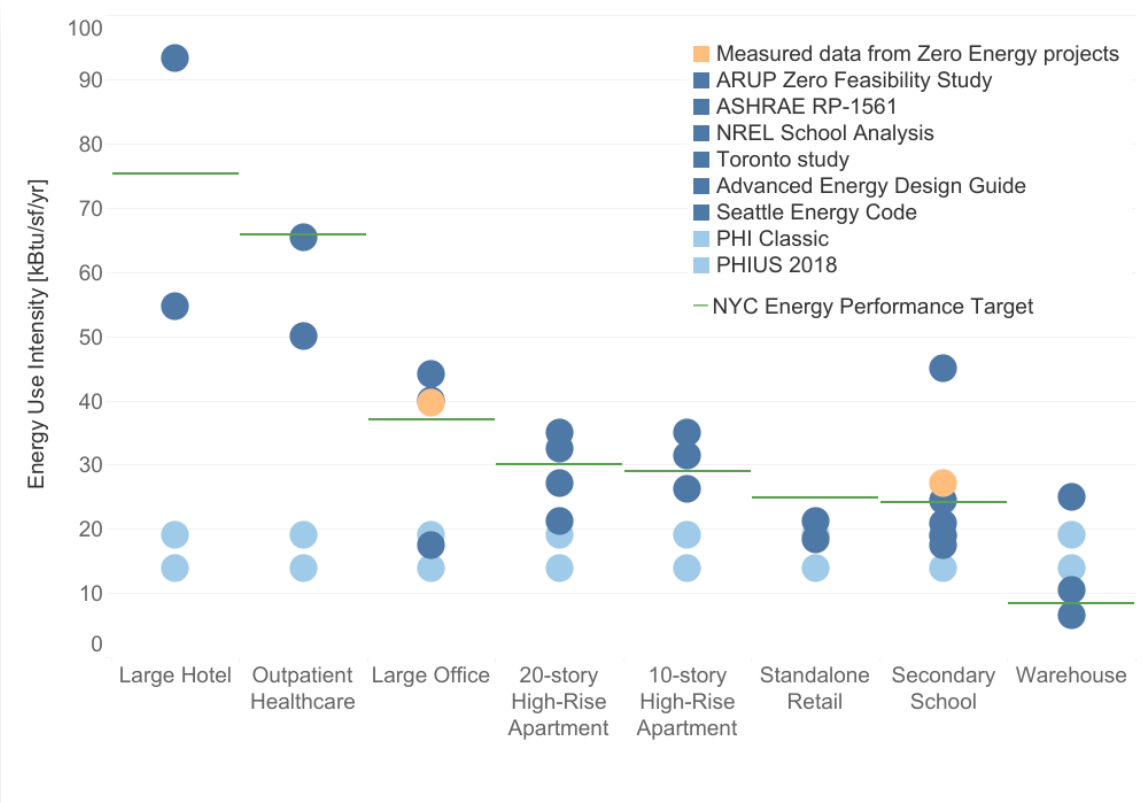
Code Progression: Energy Use



Optimizing Energy Efficiency for "Net Zero Design"



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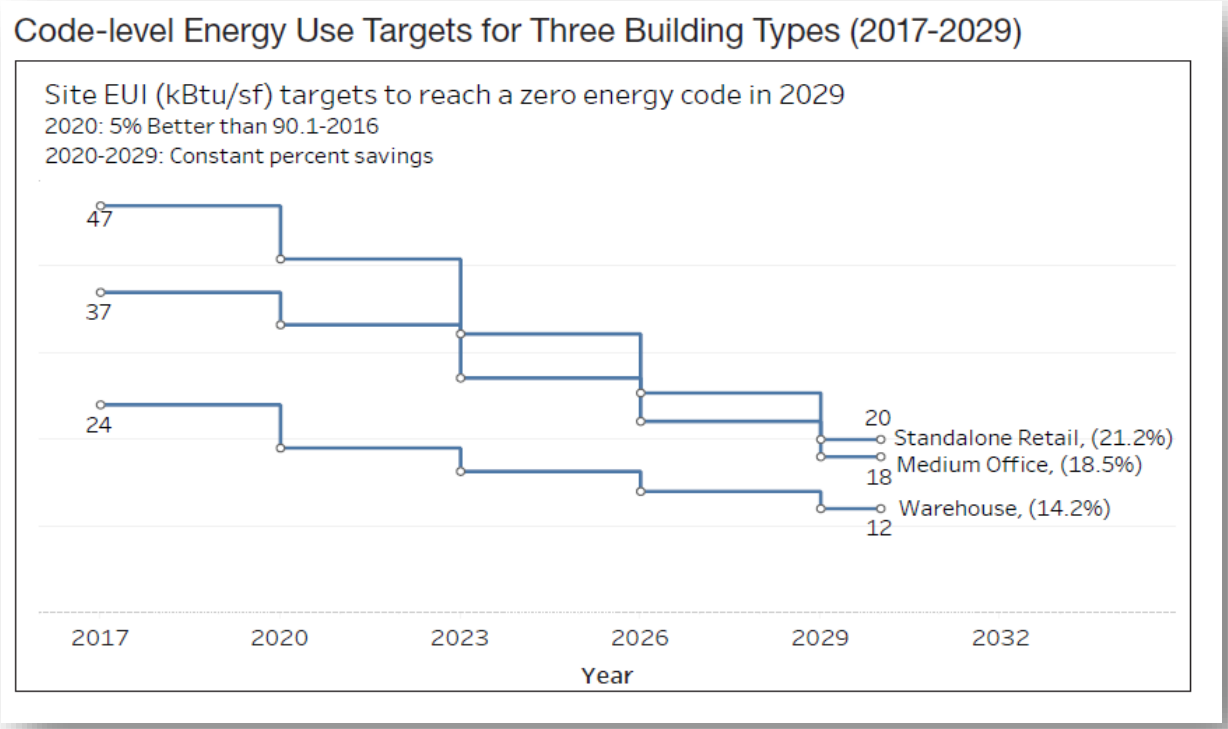
Commercial Targets from 2018 Roadmap



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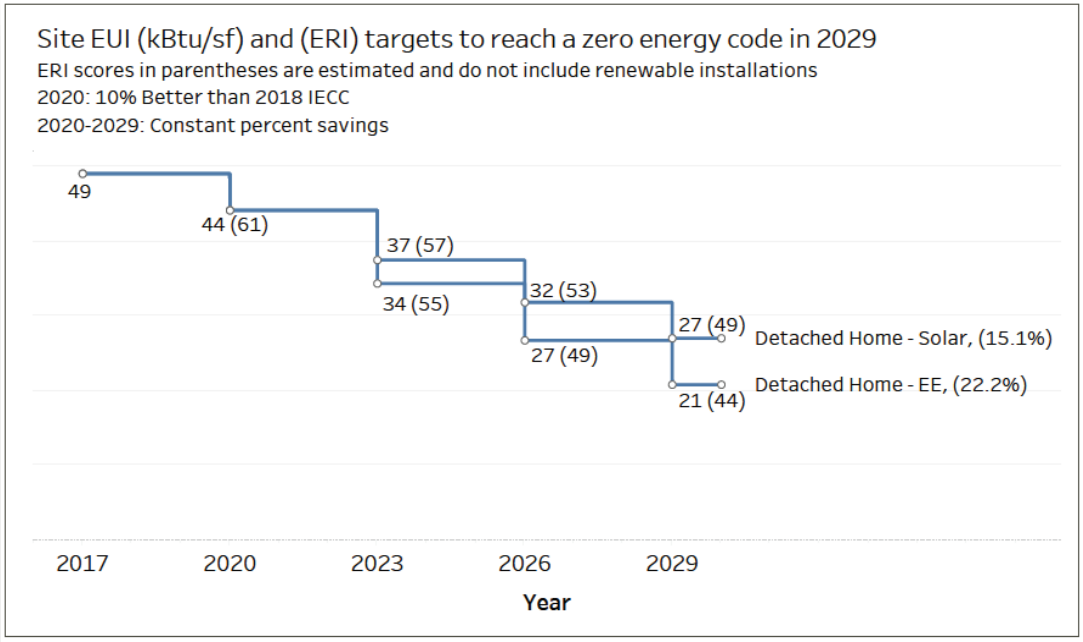
Residential Targets from 2018 Roadmap



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Poll Question #1

- How efficient should Vermont homes and buildings be required to be to be considered "net-zero design" in the next three code cycles?
  a. Incrementally better than national model codes (IECC/ASHRAE)
  b. In line with Efficiency Vermont "High Performance" program
  c. In line with Architecture 2030 net zero energy targets
  d. Equivalent to Passive House levels of efficiency

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Discussion

- Why did you choose your selection?
- What are the cost implications of these different options?
- Should code be based on site or source energy?

National/Global Trends and Drivers

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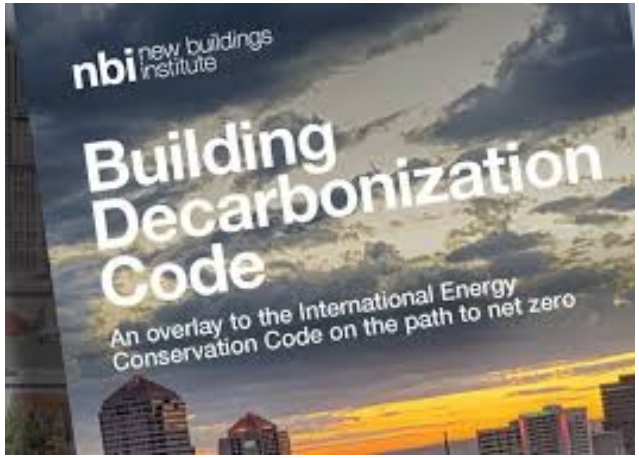
Scope and Goal of a Decarbonization Code

	• Scope	
• Efficiency	• Base Codes / Building Systems	
• Electrification	• Building Systems + Vehicles	
• Renewables	• Onsite, Offsite + Procurement	
• Grid Integration	• Controls, Storage	
• GHG Emissions	• Embodied Carbon, Refrigerants + Deconstruction	
• Equity		



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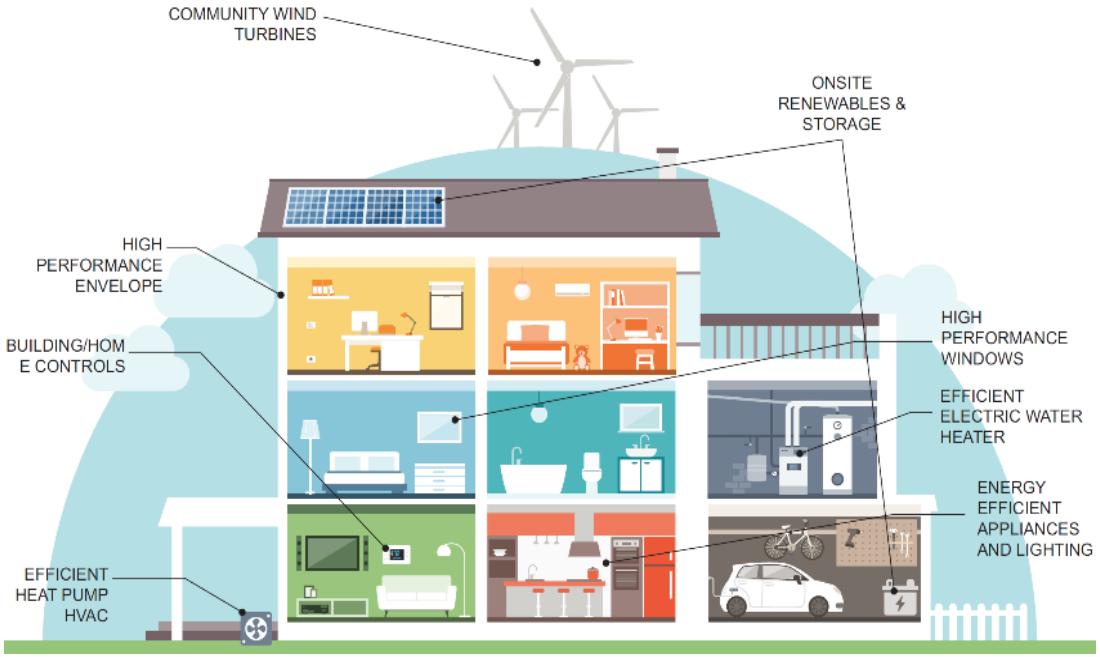
Core and Additional Components for Buildings

Core Components:

- Maximize energy efficiency
- Prioritize on-site renewables
- Utilize off-site renewables
- Measure and manage net zero operations



Credit: NYSERDA

Additional Components:

- Electrification-ready and minimize/eliminate on-site fossil fuels
- Optimize building-grid integration and on-site storage
- Specify low GWP refrigerants
- Consider low embodied carbon materials

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Notable National Code Efforts

- **Washington State:** Statutory requirement that energy code reduces Carbon by 70% from a 2006 baseline
- **New York/NYSERDA**
  - Development of future codes anticipated to consider electrification
  - NYStretch-2023 development in advance of consideration of 2021 IECC
  - Also will be developing NYECCC and Codes to Zero
- **Massachusetts**
  - Senate Bill 9: MA DOER to develop a municipal opt-in stretch code that includes net-zero performance standards
  - Technical feasibility study underway focusing on significantly reducing heating demand and building electrification
- **California**
  - Over 45 communities have adopted partial / full electrification versions of CALGreen
  - Title 24 anticipated to become all-electric

US DOE Definition (2016)

Zero Energy Building: An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

Zero Energy Ready Home: A high performance home which is so energy efficient, that a renewable energy system can offset all or most of its annual energy consumption.

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Poll Question #2

- Which of the following are important to you in achieving "net zero design" in a building or home?
  a. Full renewables,
  b. Grid integration,
  c. Low GWP refrigerants,
  d. Embodied carbon
  e. Other (add in chat)

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Discussion

- Why did you choose your selections?
- What elements should be considered in code?

Zero Energy/Carbon Considerations for Vermont's Code Goal

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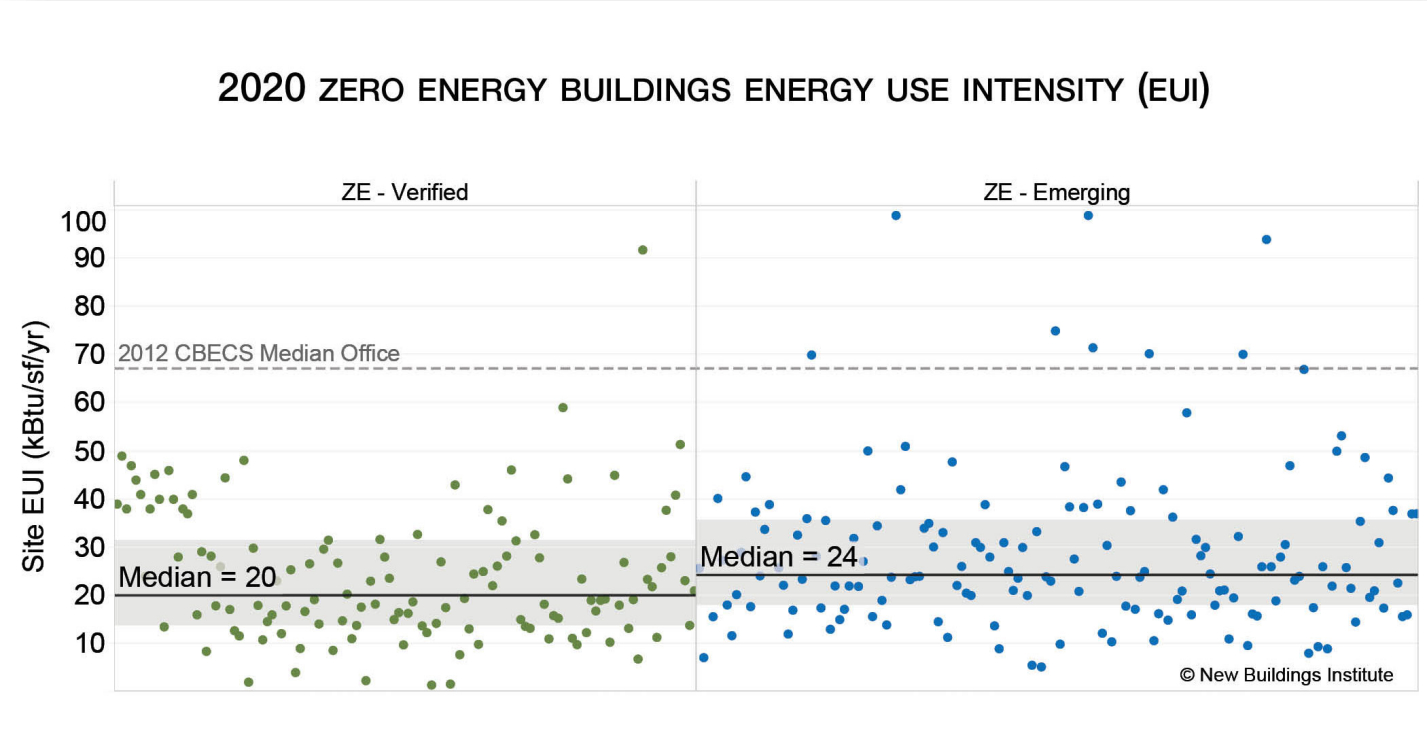
Net Zero Energy Design Targets



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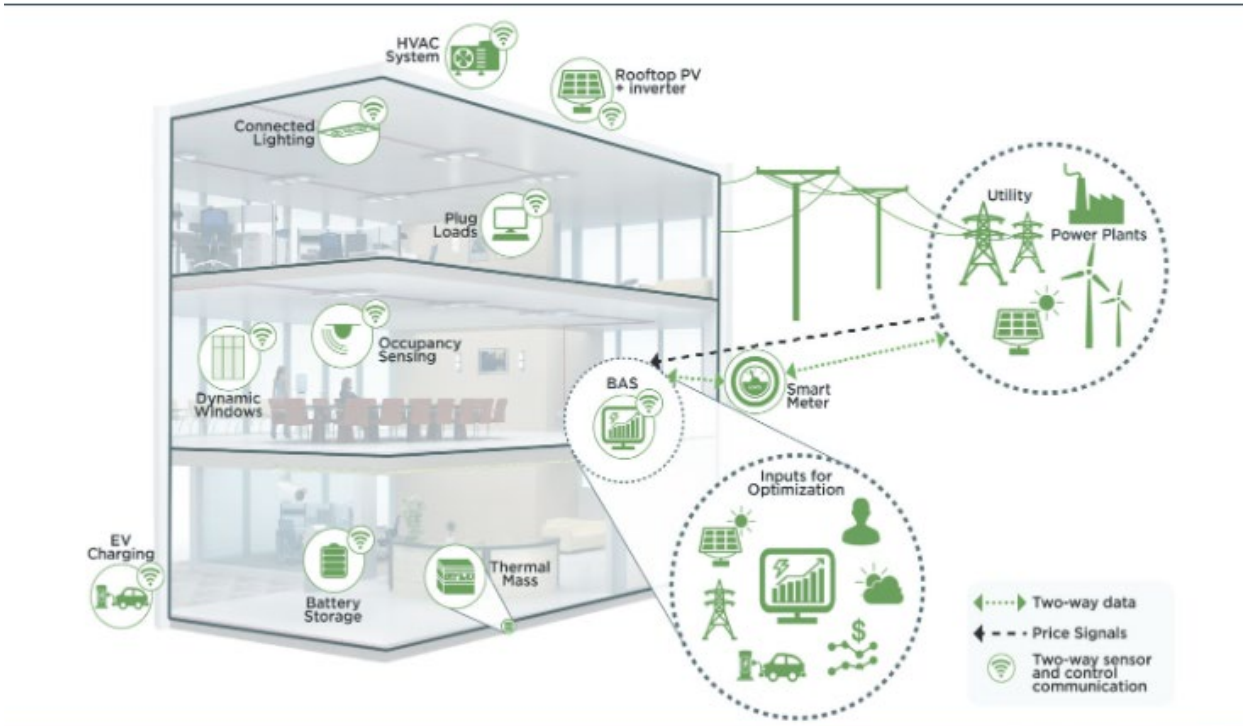
Renewable Energy

- Net Zero Design
- Onsite vs Offsite
- Offsite procurement options
- Prescriptive vs performance
- Biomass
- Renewable natural gas/hydrogen

Grid Integration & Code



Grid-interactive efficient building. *Image courtesy of Navigant Consulting.*

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Code Framework – DC example timeline

	2020	2023	2026	2029	2032
Efficiency (EUI)	90.1-2013+ (54)	Interim Step (39-46)	Max. Tech (23-39)	Passive House Equivalent (22-25)	
Electrification	n/a	Electric Ready + Dual-Fuel Eff. Increase	Prohibit all on-site combustion		
Renewables	Capacity required per square footage		Focus on Community Bldg. Types for Resilience		Grid Side Net Zero
Grid Integration	n/a	Integrated Appliances + Storage Ready	Integrated Appliances + Storage Ready	Storage	Full Integration

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Draft Recommendation for Vermont Net Zero Design definition

A building or home that is highly energy efficient and fully powered, on an annual basis, by on-site and/or off-site renewable energy.

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Feedback to Proposed Definition

- Is the definition right?
- Should it be different for Residential and Commercial?
- Other proposed definitions?

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Thanks!

Mark Lyles and Jim Edelson

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www.newbuildings.org

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Thank You for Participating!

Upcoming meetings:
Multifamily – June 10, 1:00 – 3:00
Commercial & Industrial – June 15, 9:00 – 11:00
Residential – June 15, 3:00 – 5:00

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Appendix: Additional Information on National Trends

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Energy and Carbon

The Paris Agreement marked a turning point in the call to limit global warming. Seizing on that momentum, rapid deployment of energy-efficient and low-carbon solutions for buildings and construction can help put the world on a sustainable trajectory.

The number of high-performance and low-carbon buildings (e.g.nZEBs) needed to achieve the 2DS or below increases six-fold compared to the current global trajectory. This means near-zero energy, zero-emissions buildings need to become the construction standard globally within the next decade.

UN environment

iea

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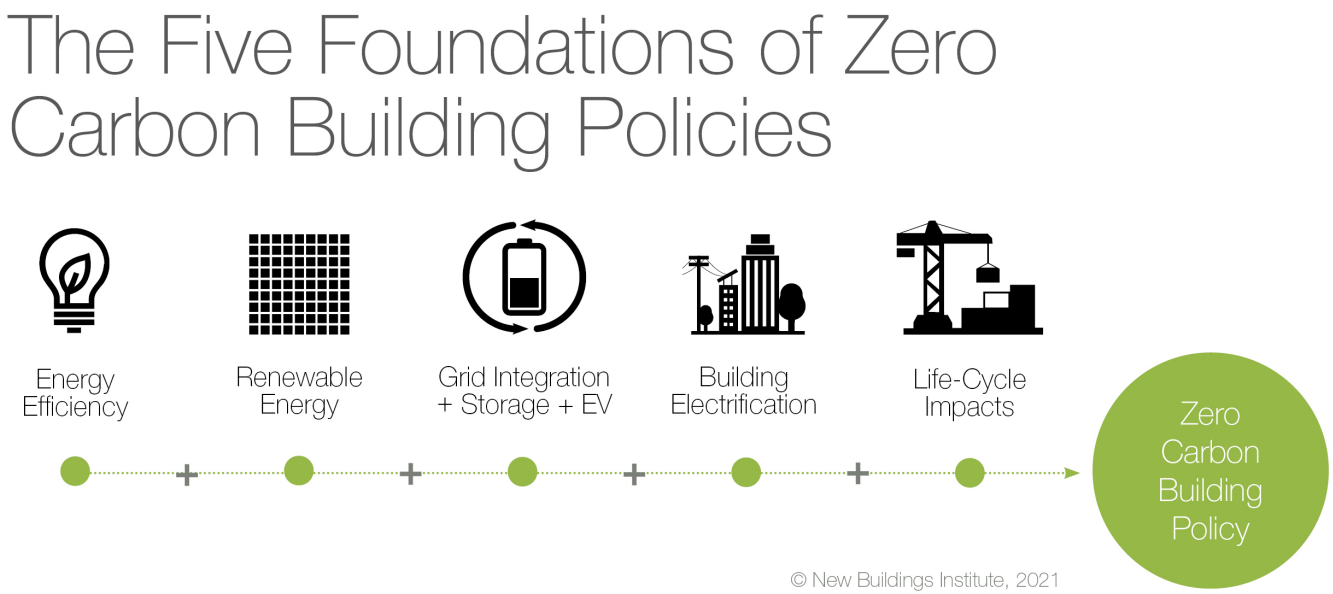
Five Foundations



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Third Party Certifications/Programs

	Performance or Design	Metric	Boundary	Combustion Allowed?	Efficiency Required?	Off-site RE Allowed?	Other Reqs.
LIVING BUILDING CHALLENGE					NC: 70% EBB* EB: 50% EBB (both w/ PV)	Yes. Using the off-site RE exception.	Must include on-site storage; 20% embodied carbon reduction.
ZERO ENERGY CERTIFICATION					Highest efficiency	Yes, must be local. 75% of roof for solar.	
ZERO CARBON CERTIFICATION					NC: 25% < 90.1-2010 EB: 30% < CBECS	Yes. Must be *additional.*	10% Embodied Carbon Reduction + Carbon offsets for the remainder
LEED Zero ENERGY LEED Zero CARBON					No, but LEED Certified	Yes. See tiered structure for on- and off-site RE	Must be LEED-NC or EBOM certified. Performance in Arc. TOU option for LZC.
ZERO CODE					Must meet ASHRAE 90.1-2016	Yes. After on-site. Tiered structure applies discount factor to various	Off-site renewables are discounted
WORLD GREEN BUILDING COUNCIL					Highly energy efficient building	Yes	Embodied carbon may be included later
AIA 2030 Commitment				Not allowed in 2030	70% better than CBECS 2003	Yes, but not counted	Seeking to incorporate refined carbon specific metrics

= Transportation = Embodied Carbon = Site Energy Use = CO2e = Source Energy Use

Credit: WSP with NBI additions

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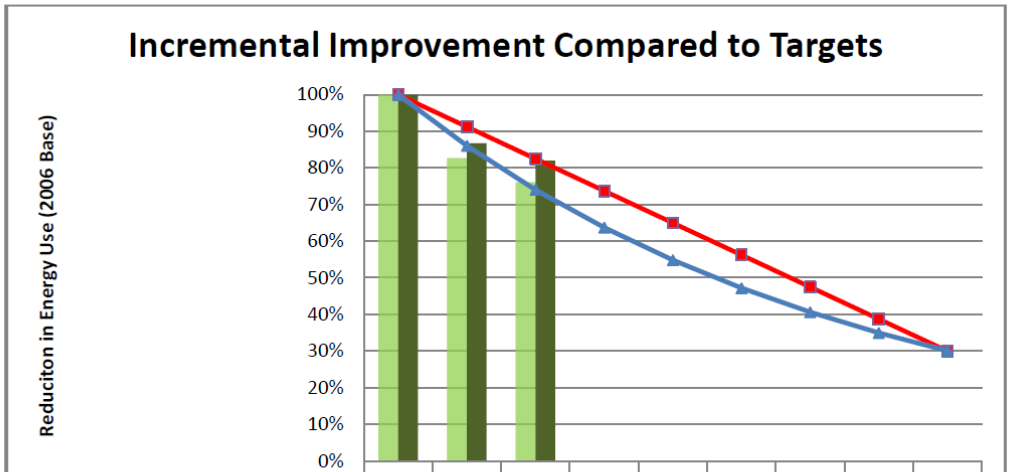
Other Notable References

- **Toronto** has building standard that includes energy and GHG targets for most buildings
- **British Columbia** has implanted a code framework that includes increasingly stringent energy targets for most buildings that can be adopted at the local level
- **Seattle's** energy code includes a Target Performance Path compliance path for a limited set of commercial buildings
- **Boulder's** 2020 energy code includes a fixed EUI Target pathway
- **Washington DC's** Stretch Code (Appendix Z) incorporates zEPI and thermal energy demand targets

The David and Lucile Packard Foundation Headquarters | Los Altos, CA *Photo: Jeremy Bittermann*

Washington State Statutory Code Path



	2006	2009	2012	2015	2018	2021	2024	2027	2030
Residential	100%	82.7%	76.1%						
Commercial	100%	86.8%	82.0%						
Target: 8.75 % savings compared to the 2006 WSEC	100%	91%	83%	74%	65%	56%	48%	39%	30%
Target: 14% savings compared to each previous code	100%	86%	74%	64%	55%	47%	41%	35%	30%

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Carbon based code provisions in WA

- Rosenberg, et al.
  - **C407.3.1** References to energy cost in Section 4.2.1.1 and Appendix G shall be replaced by carbon emissions calculated by multiplying site energy consumption by the carbon emission factor from Table C407.1
- Starr, et al.
  - **Appendix A** Where:

    Annual carbon emissions from energy consumption of the building HVAC systems = sum of the annual carbon emissions in pounds for heating, cooling, fans, energy recovery, pumps, and heat rejection calculated by multiplying site energy consumption by the carbon emission factors from Table A1

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California

- Over 45 communities have adopted partial / full electrification versions of CALGreen
- Title 24 anticipated to become all-electric

SACRAMENTO, Calif. — June 2, 2021
KCRA-TV

In a 7-2 vote, the Sacramento City Council this week approved an ordinance requiring all new homes and commercial buildings to run entirely on electricity.

Mayor Darrell Steinberg says the ordinance is designed to slow climate change by eliminating natural gas and propane from new construction.

The ordinance would be phased in over a couple years.

Starting in 2023, any new low-rise buildings will have to be all-electric. Any new structure above four stories will have to be all-electric by 2026.

New York / NYSERDA

- **Development of future codes anticipated to consider electrification**
- NYStretch-2023 development in advance of consideration of 2021 IECC
- Also will be developing NYECCC and Codes to Zero

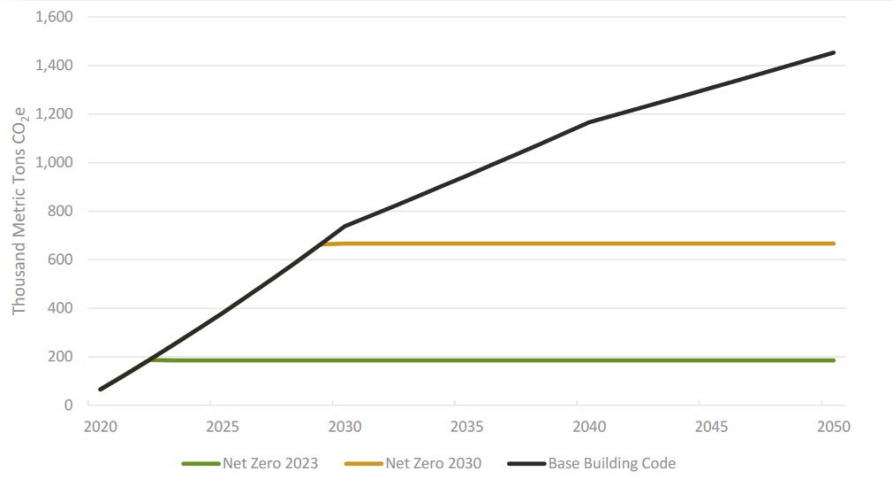
Code changes are a key strategy for realizing the greenhouse gas (GHG) reduction goals established in the Climate Leadership and Community Protection Act (Climate Act). NYSERDA has identified seven priority topic areas for proposed codes to address:

1. electrification,
2. electric vehicles,
3. solar,
4. grid interactivity,
5. energy storage,
6. low-global-warming-potential (low-GWP) refrigerants

Source: NYSERDA Uniform, Energy, and Stretch Code Proposals Targeting Greenhouse Gas Reduction Mini-bid

Massachusetts

- Senate Bill 9: MA DOER to develop a municipal opt-in stretch code that includes net-zero performance standards
- Technical feasibility study underway focusing on significantly reducing heating demand and building electrification



Source: *Massachusetts 2050 Decarbonization Roadmap Study; Buildings Sector Report*

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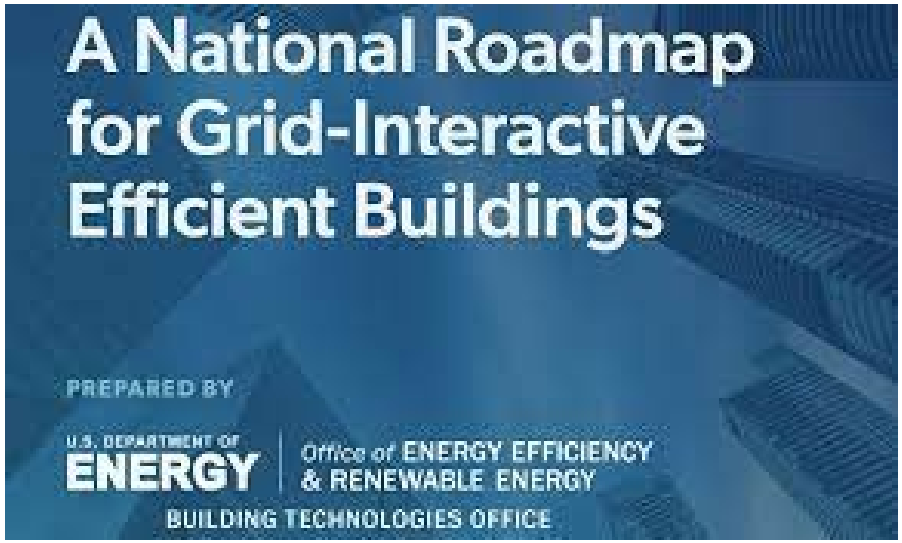
Standards and Demand Flexibility

- **DOE Releases a Roadmap for Grid-Interactive Efficient Buildings**
- States moving forward with standardization
- CTA-2045 (CA, OR, and WA) communications and control of water heaters
- Open-ADR



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Roadmap for Grid-Interactive Efficient Buildings

TIMING FOR RECOMMENDATION 3
Expand Codes and Standards to Incorporate Demand Flexibility

Near Term (0–2 years)	Medium Term (2–5 years)	Long Term (5–10 years)
Determine aspects of DF/GEB ready to be codified. Incorporate DF provisions in codes and standards. Identify opportunities to link funding and programs to DF code actions.	Provide new funding for state and local governments to update DF provisions in cods & standards.	Evaluate, refine, and update codes and standards as appropriate.

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Roadmap for Grid-Interactive Efficient Buildings

- **Increase state technical assistance on EE and DF-related topics.** Regulators need dependable and unbiased information upon which to establish EE and demand flexibility initiatives and rulings. DOE has a long history of supporting state technical assistance through stakeholder workshops, trainings, and state specific analytical research. State technical assistance also could focus on other key issues that are of interest to regulators, such as options for making GEB benefits accessible to underserved communities, maximizing the consumer benefits of GEBs, or improving assessment of GEB performance through enhanced M&V practices.

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