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Zero Fuel Bias Energy Codes

A Safe, Effective Path to Promote Electric Heat Pumps in New Buildings

December 2024



The Energy Code Safe Harbor Toolkit

Code proposals for jurisdictions considering 2024 model codes now and in coming months

RMI



Erin Sherman



Jonny Kocher, P.E.

RMI – Energy. Transformed.

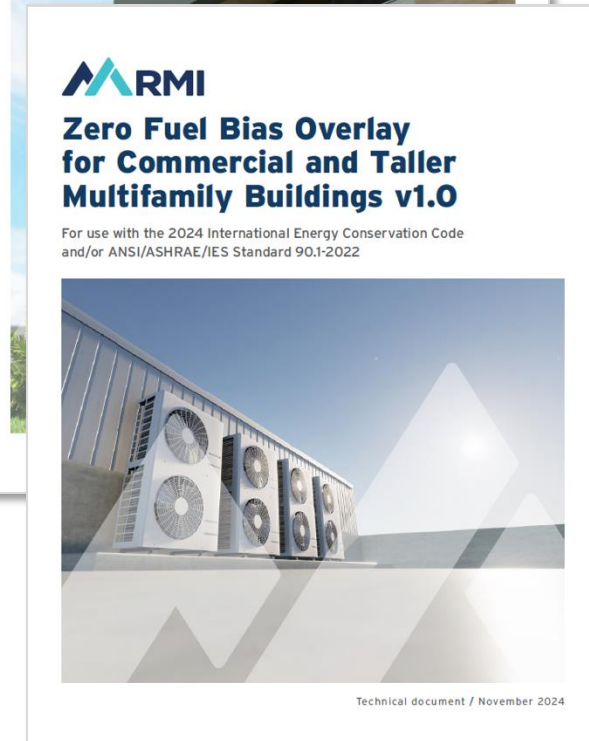
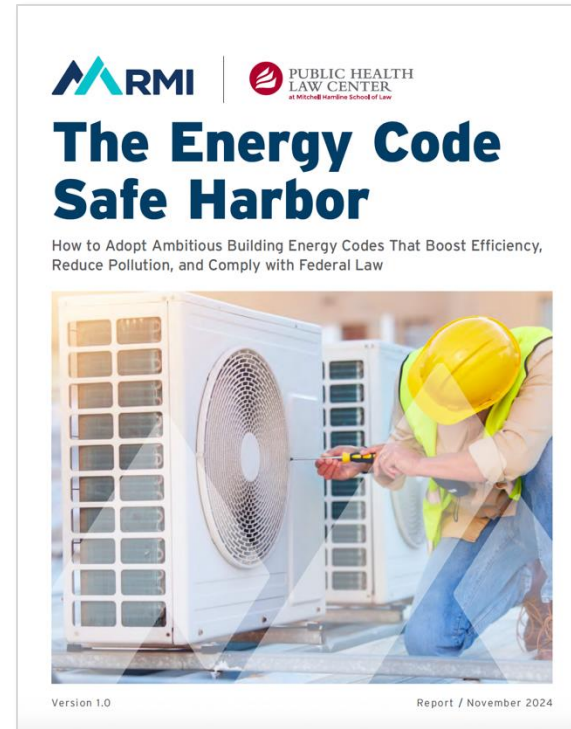
Public Health Law Center



Daniel Carpenter-Gold, J.D.



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- 1. Introduction: Energy Codes as a Decarbonization Tool**
- 2. This Moment: Federal Law and Energy Codes**
- 3. The Problem: Anti-Electric Fuel Bias in Model Codes**
- 4. How to Fix It: The Zero Fuel Bias Energy Code Overlays**
- 5. Questions and Answers**

But first, two quick polls



**WHO IS IN
ATTENDANCE?**



**WHERE ARE YOU
JOINING FROM?**



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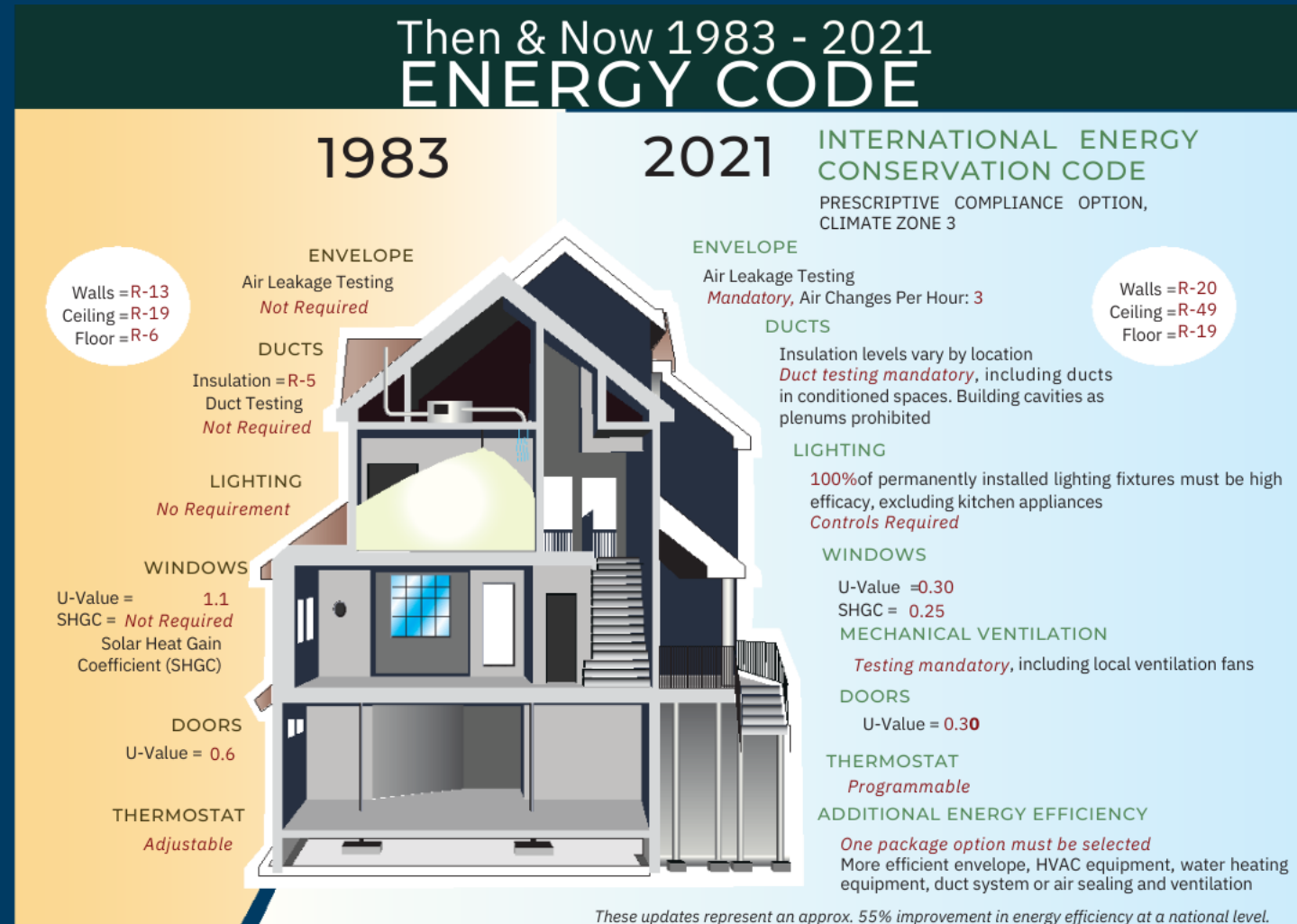
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Energy codes as a decarbonization tool

A very short introduction to energy code development, adoption, and more

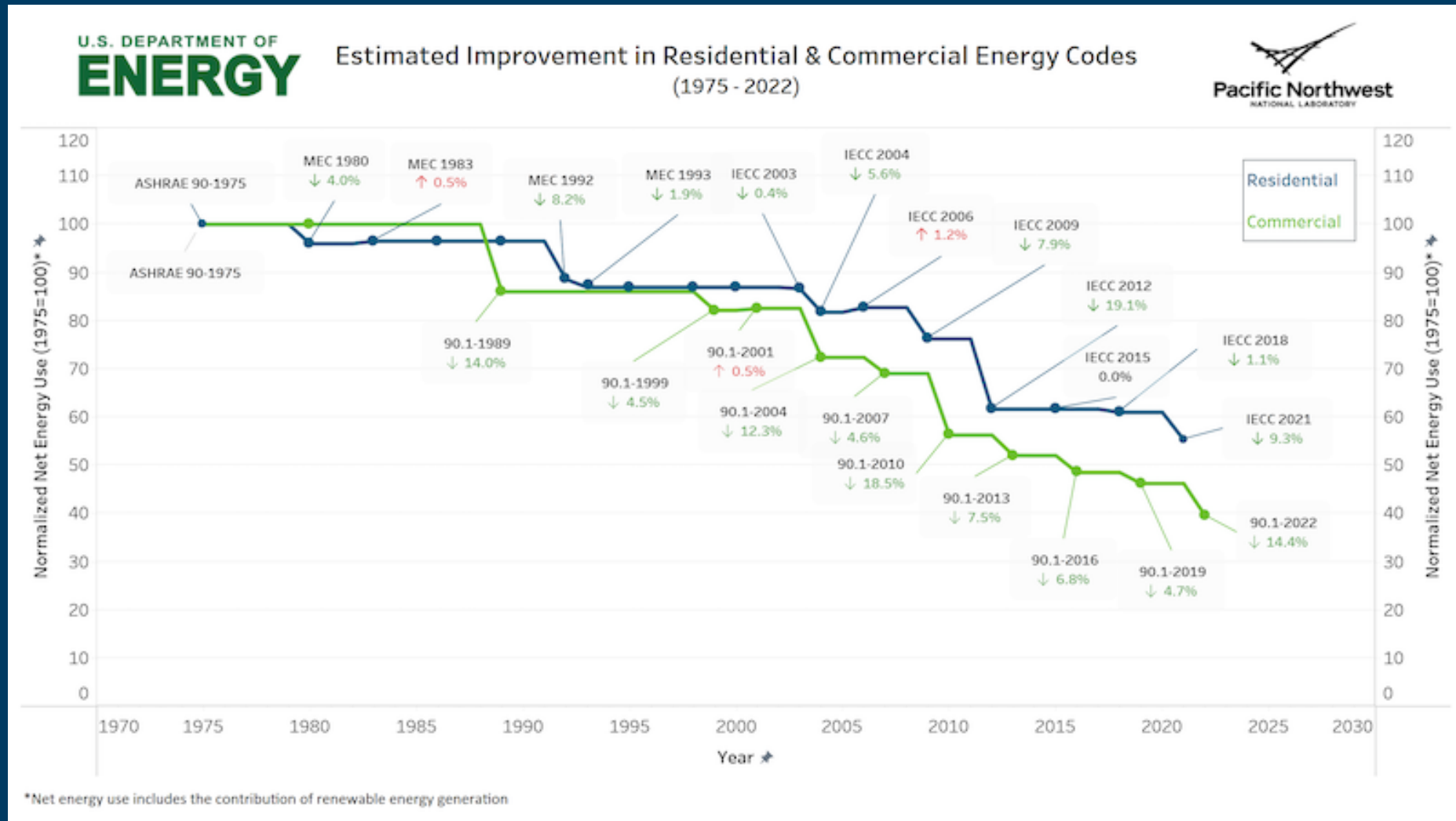
• What energy codes do

- Define the least energy efficient building that is legal to build
- Influence buildings when a permit is required: new construction, additions, and major renovations

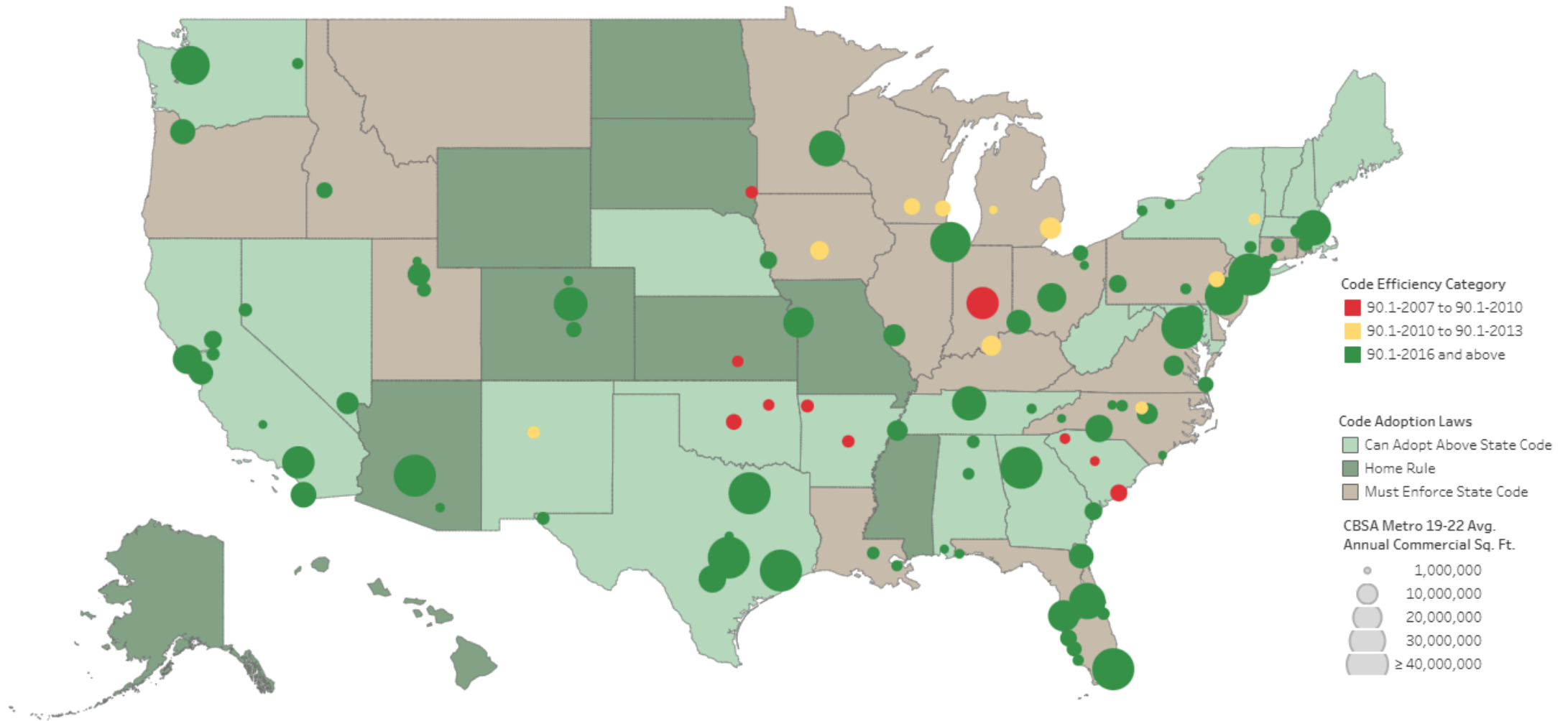


Energy codes as a decarbonization tool

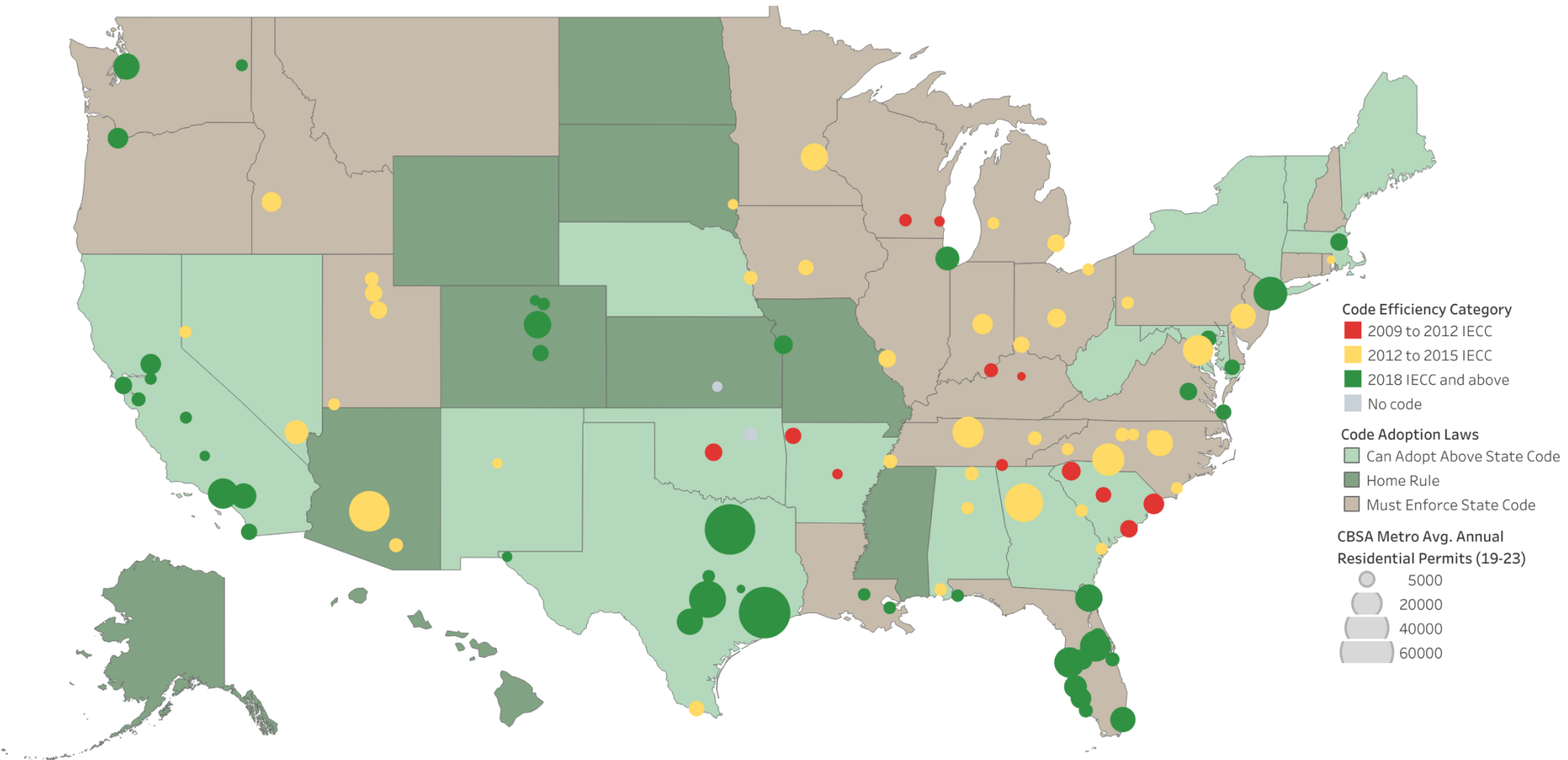
A very short introduction to energy code development, adoption, and more



Can your state, city, or county adopt a commercial energy code?

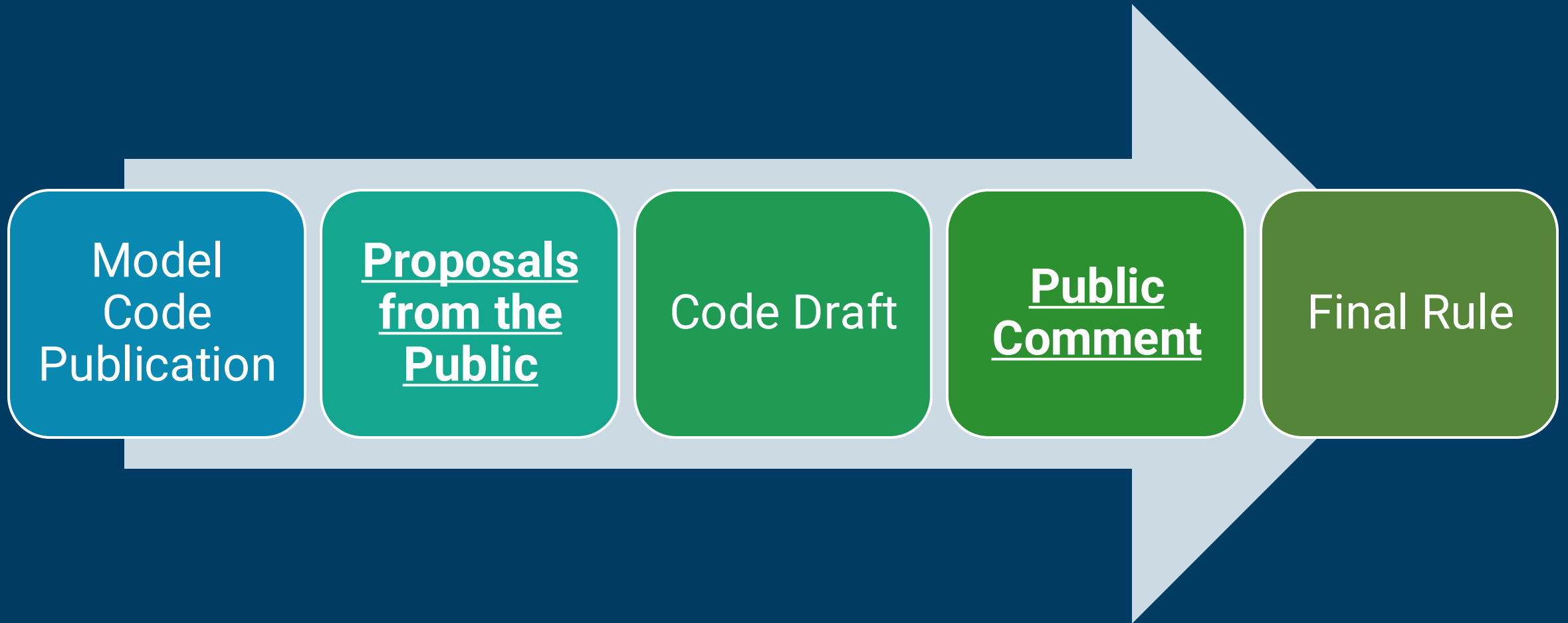


Can your state, city, or county adopt a residential energy code?



A typical energy code adoption process

The details will vary depending on your jurisdiction





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Federal law and energy codes

Federal and state/local roles under the Energy Policy and Conservation Act

- **The Energy Policy and Conservation Act (EPCA)**
 - Passed after 1970s energy crisis
 - Sets federal efficiency standards
- **EPCA preempts state and local efficiency standards**
 - Regulations “concerning the energy efficiency, energy use, or water use of [a] covered product”
 - “Covered product” = type of product specified in EPCA or added by Department of Energy

The EPCA Safe Harbor

EPCA's provision to allow for state and local energy codes

- **Most energy codes would be preempted by EPCA**
 - They specifically regulate the efficiency of EPCA-covered products
 - EPCA covers most space heaters, water heaters, and air conditioners
- **EPCA's Safe Harbor regulation prevents this**
 - Allows energy codes to include efficiency standards
 - For consumer products, must meet certain requirements:
 - No *mandatory* efficiency requirements higher than those in EPCA
 - Builders receive appropriate credit for *voluntary* use of higher-efficiency appliances
 - Additional requirements if using standard reference designs or precalculated packages
 - For industrial products, must not require greater efficiency than ASHRAE 90.1

But what about *Berkeley*?

The situation in the Ninth Circuit and risk perception through the rest of the US

- ***California Restaurant Association v. Berkeley***

- Berkeley prohibited gas infrastructure in certain buildings
- Ninth Circuit found that EPCA preempted the ordinance because it “concerned” the “energy use” of gas appliances
- Did not directly address energy-efficiency regulations or the EPCA Safe Harbor

- **Several copycat lawsuits since**

- Attempting to expand application of *Berkeley* to other types of regulations
- Will help to understand scope of preemption

Pending EPCA preemption lawsuits

Rivera v. Anderson: strong, but not all-electric, energy code

Mulhern Gas Co. v. Rodriguez: electrification code

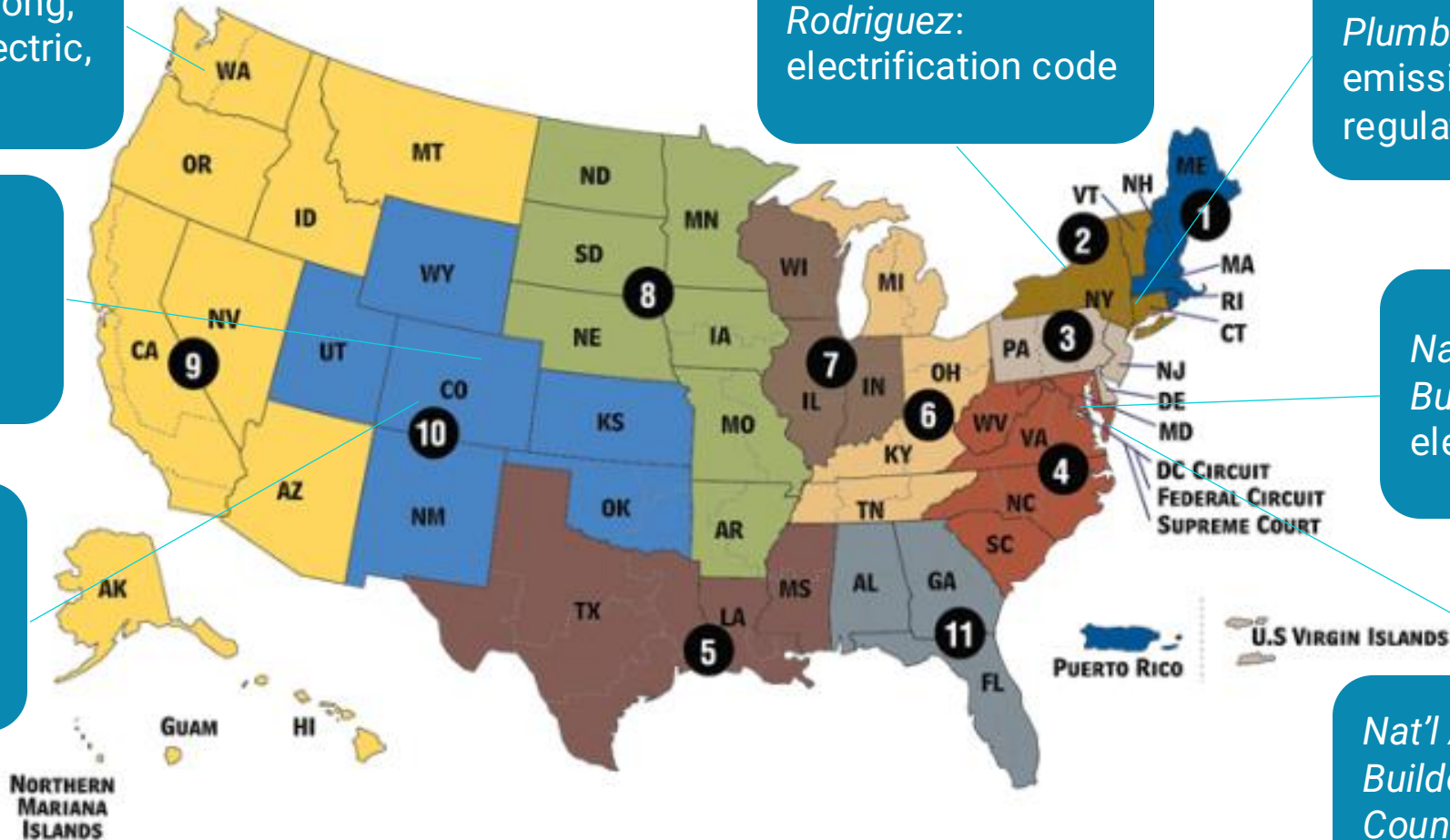
Ass'n of Contracting Plumbers v. NYC: emissions-based regulations

Restaurant Law Center v. Denver: electrification code

Nat'l Ass'n of Home Builders v. DC: electrification code

Colorado Apt. Ass'n v. Ryan: building performance standards

Nat'l Ass'n of Home Builders v. Montgomery County: electrification code



All-electric energy codes still relevant

Several ways in which electrification requirements may continue

- **Other courts may not follow *Berkeley***
 - Could simply reject Ninth Circuit panel's reasoning
 - Could find that other types of regulation, such as NYC's emissions-based regulation, are different
- **All-electric codes may be covered by Safe Harbor exemption**
 - Electrification requirements are not efficiency regulations
 - "Energy use" language not in Safe Harbor



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Heat pumps are efficient!

Coefficient of Performance (COP)

Heat Pump

3.19

ENERGY STAR Gas
Furnace (southern
states)

0.95

<https://rmi.org/now-is-the-time-to-go-all-in-on-heat-pumps/>

Background on Energy Codes

Common Energy Code Pathways

Prescriptive pathway

Specific code requirements + energy credit table requirements

Performance pathway

Simulation of a building's energy performance against a standard reference baseline

Prescriptive Pathway

R406.3 Additional energy efficiency requirements. Each dwelling unit in a residential building shall comply with sufficient options from Tables R406.2 and R406.3 so as to achieve the following minimum number of credits:

1. Small Dwelling Unit: 5.0 credits
Dwelling units less than 1500 square feet in conditioned floor area with less than 300 square feet of fenestration area. Additions to existing building greater than 500 square feet of heated floor area but less than 1500 square feet.
2. Medium Dwelling Unit: 8.0 credits
All dwelling units that are not included in #1, #3 or #4.
3. Large Dwelling Unit: 9.0 credits
Dwelling units exceeding 5000 square feet of conditioned floor area.

**TABLE R406.3
ENERGY CREDITS**

OPTION	DESCRIPTION	CREDIT(S)	
		All Other	Group R-2 ^b
1. EFFICIENT BUILDING ENVELOPE OPTIONS			
Only one option from Items 1.1 through 1.4 may be selected in this category. Compliance with the conductive UA targets is demonstrated using Section R402.1.5, Total UA alternative, where $[1-(\text{Proposed UA}/\text{Target UA})] >$ the required %UA reduction			
1.1	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.22.	0.5	0.5
1.2	Prescriptive compliance is based on Table R402.1.3 with the following modifications: Vertical fenestration U = 0.25	1.0	1.0

Performance Pathway

R405.2 Performance-based compliance. Compliance based on *total building performance* requires that a *proposed design* meet all of the following:

1. The requirements of the sections indicated within Table R405.2.
2. For structures less than 1,500 square feet of conditioned floor area, the annual site energy consumption shall be less than or equal to 64 percent of the annual site energy consumption of the *standard reference design*.
3. For structures 1,500 to 5,000 square feet of conditioned floor area, the annual site energy consumption shall be no more than 47 percent of the *standard reference design*.
4. For structures over 5,000 square feet of conditioned floor area, the annual site energy consumption shall be no more than 41 percent of the *standard reference design*.

TABLE R405.4.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems ^{d, e}	Where the proposed design utilizes electric heating without a heat pump the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the WSEC—Commercial Provisions. For all other systems, the same system type as proposed, and the same system efficiency required by prevailing minimum federal standard. Capacity: Sized in accordance with Section R403.6	As proposed
Below-grade walls	Type: Same as proposed Gross area: Same as proposed <i>U</i> -factor: From Table R402.1.2, with insulation layer on interior side of walls.	As proposed As proposed As proposed

Model codes are **biased against** buildings that use **electric heat pumps**.

Codes have “start lines” and “end lines.”



Electric buildings “start” ahead of mixed fuel because they’re more efficient.



And while that should make electric buildings more appealing for builders...



Codes don't give electric heat pumps due credit for how much more efficient they are.



??



Mixed fuel buildings can be less efficient...



And electric buildings must be more efficient.



Why anti-electric fuel bias matters: back of the envelope

- **Efficiency:** Heat pumps use $\sim 2/3$ less energy than combustion appliances
- **Space and water heating:** About half of a building's energy needs could be swapped over to heat pumps
- **Total building energy:** $1/2 \times 2/3 = 1/3$ less building energy use that heat pumps do not get credit for in code compliance
- That's the energy savings from **15 years of residential energy code updates** (2006 – 2021 IECC) – and fuel bias leaves it on the table





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Fuel debiasing sets fair standards for all buildings, regardless of fuel type.



Fuel debiasing sets fair standards for all buildings.

Together, four steps remove bias:



1

Buildings are measured against the same baseline no matter what types of energy they use

2

Efficiency is measured based on energy used in the building

3

Electric heat pumps get due credit for how much less energy they use

4

Buildings must reach the same efficiency goal, no matter what types of energy they use

The Zero Fuel Bias Code Overlays



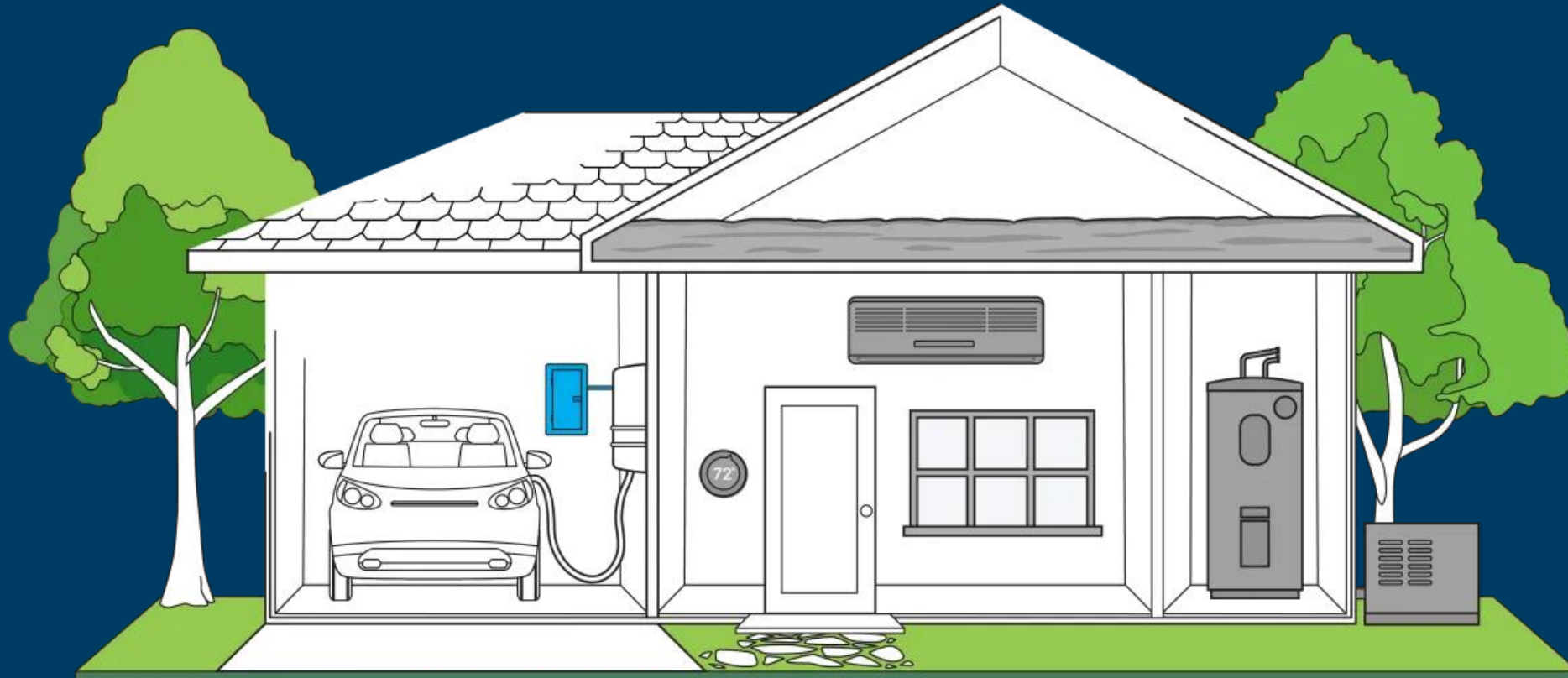
A 2024 IECC amendment package to:

Set equal start and finish lines across fuel types

Give heat pumps credit for being 2-4x more efficient

Adopt electric readiness appendices plus space heating

Electric readiness “futureproofs” buildings



https://www.energystar.gov/products/energy_star_home_upgrade/make_your_home_electric_ready



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In depth: The Zero Fuel Bias Code Overlays

- **General approach**
- **Residential low-rise**
- **Commercial and mid- and high-rise multifamily**
- **Relationship to the EPCA Safe Harbor**
- **How to use the overlays**

Zero Fuel Bias Code Overlays: Structure

Prescriptive pathway

Credit for buildings with electric heat pumps

Performance pathway

Appliance decisions affect performance calculations

Metric: Site energy use

Equal baselines and efficiency goals

Zero Fuel Bias Code Overlays: Structure

Metric: Site energy use

Equal baselines and efficiency goals

Why site energy?

What about energy cost, source energy, greenhouse gas emissions, etc.?

- **The EPCA Safe Harbor explicitly allows codes to use site energy**
 - EPCA also lists energy cost, and model codes use it by default
- **Building designers have the most control over site energy**
 - They can't choose the occupants' utility rates and can't control grid fuel mix
- **Modeling with site energy involves the least error**
 - Most model code compliance pathways use broad energy cost averages
 - Variation in rates and grid fuel mix across time and geography can cause error
 - especially lagging indications of high electricity emissions and line losses
 - Other metrics' extra errors tend to stack the deck against all-electric buildings

Zero Fuel Bias Code Overlays: Structure

Prescriptive pathway

- R408 and C406 credits are recalculated:
 - With respect to a single baseline
 - In site energy terms
- Minimum-efficiency heat pump equipment can earn due credit toward compliance
- Buildings must earn the same number of credits, regardless of fuel type

Zero Fuel Bias Code Overlays: Structure

Performance pathway

- The standard reference model does not vary based on fuels used in the proposed design model
 - Performance is measured in site energy terms
- By choosing efficient appliance types, the designer can improve proposed design performance
 - Buildings must satisfy the same percent improvement, regardless of fuel type

Residential Low-Rise: Start and finish lines

Appendix RG: Stretch Code efficiency goal

Minimum-efficiency gas appliance baseline

Residential Low-Rise

Prescriptive pathway

Credit for buildings with electric heat pumps

Performance pathway

Appliance decisions affect performance calculations

ERI pathway

Metric: Site energy use

Gas appliance baseline

Stretch efficiency goal

What is an ERI score?

The definition according to RESNET:

“The ERI score is defined as a numerical score where 100 is equivalent to the 2006 IECC and 0 is equivalent to a net-zero home.”

Residential Low-Rise

Prescriptive pathway

Credit for buildings with electric heat pumps

Performance pathway

Appliance decisions affect performance calculations

ERI pathway

Higher maximum ERI score for electricity-heated buildings

Metric: Site energy use

Gas appliance baseline

Stretch efficiency goal

Commercial and mid- and high-rise multifamily

Prescriptive pathway

Credit for buildings with electric heat pumps

Performance pathway

Appliance decisions affect performance calculations

ASHRAE 90.1

Appendix G only

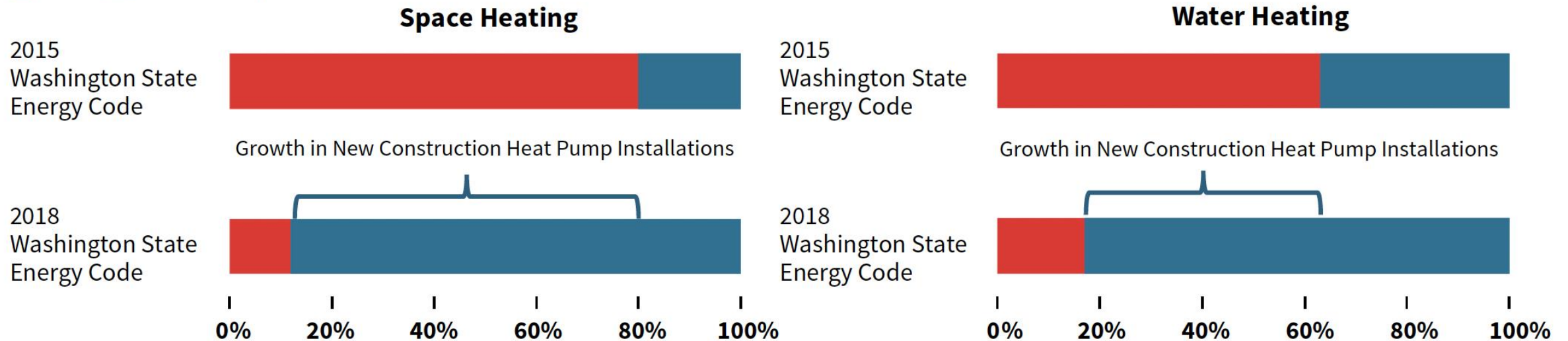
Metric: Site energy use

Equal baselines and efficiency goals

Evidence from Washington State's codes suggests debiasing works

Exhibit 5 New Home Heating Fuel Types in Washington State

■ Gas ■ Heat Pump



RMI Graphic. Source: *Washington Residential Post-Code Market Research Report*, Northwest Energy Efficiency Alliance, May 2022

The EPCA Safe Harbor and the Overlays

The Overlays meet Safe Harbor requirements, even under conservative interpretations

- 1. Provide builders with multiple options to meet specific energy goal**
 - Energy goal derived from IECC
 - De-biasing ensures that goal is applied consistently
- 2. No appliance required to be more efficient than EPCA standard**
 - No requirement to use higher-efficiency appliances
 - No requirement to use specific fuels (if required by Safe Harbor)
- 3. Builders receive 1:1 credit for using higher-efficiency appliances**
 - Prescriptive paths use credits based on actual efficiency gains
 - Other paths use site energy use as a more-or-less direct metric

The EPCA Safe Harbor and the Overlays

The Overlays meet Safe Harbor requirements, even under conservative interpretations

4. **Baselines based on appliance efficiency equal to EPCA standards**

- Standard reference designs based on EPCA standards for gas appliances

5. **Overlays do not use improper “optional combinations of items”**

- Overlays do not use precalculated packages
- Large number of options without higher-efficiency appliances (if required)

6. **Energy goal specified in terms of equivalent energy**

- Site EUI, ERI, and credits all based on energy consumed

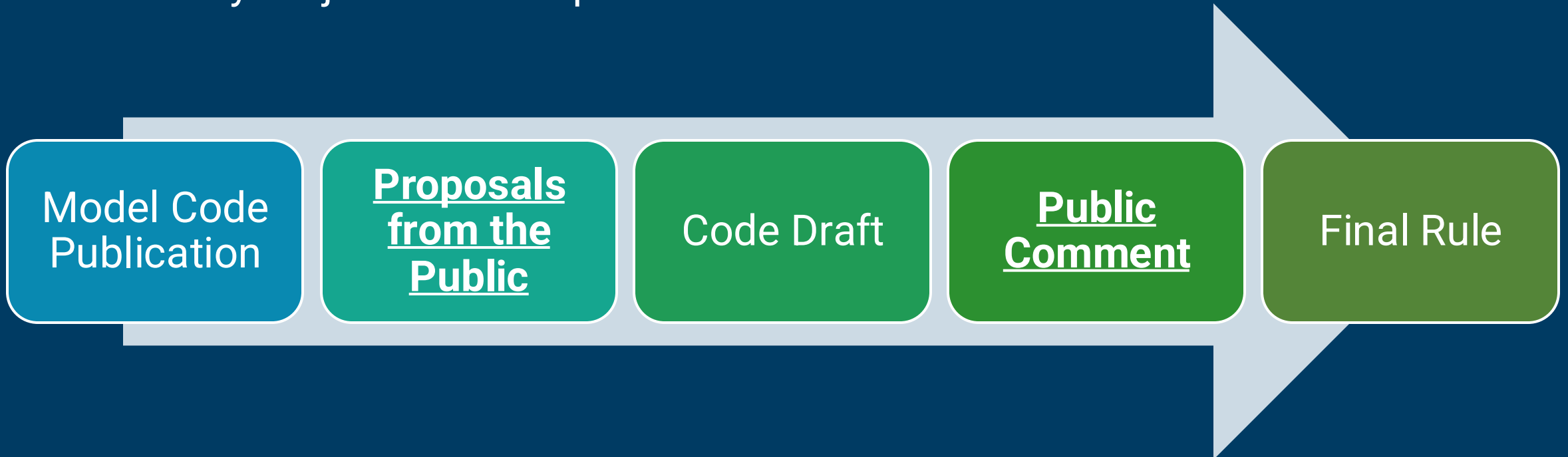
7. **Same testing approaches as used by EPCA**

- Does not change IECC/ASHRAE testing, which uses EPCA protocol

How to use the overlays

Help level the playing field for efficient electric heat pumps in your city, county, or state

- **Submit the overlays to your jurisdiction's code update process**
 - Ready-to-propose language with reasoning and explanation
 - Follow your jurisdiction's process



Electric belt

and

**electric-ready,
zero-fuel-bias suspenders**

How to use the overlays

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Many states and cities
are currently here

Model Code
Publication

Proposals
from the
Public

Code Draft

Public
Comment

Final Rule

How to use the overlays

Finding technical assistance for your jurisdiction

Who to contact for technical assistance

- Code overlay questions:
 - Erin Sherman, esherman@rmi.org
 - Jonny Kocher, jkocher@rmi.org
- EPCA Safe Harbor questions: Daniel Carpenter-Gold, Daniel.CarpenterGold@mitchellhamline.edu
- Assistance customizing “TBD” figures in the overlays for your climate zone(s): Erin Sherman at RMI or [DOE Building Energy Codes Program Technical Assistance Help Desk](#)



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Thank you!



Download the Energy Code Safe Harbor report and Zero Fuel Bias Code Overlays:
rmi.org/insight/the-energy-code-safe-harbor/