The Energy Code Safe Harbor

How to Adopt Ambitious Building Energy Codes That Boost Efficiency, Reduce Pollution, and Comply with Federal Law

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RMI is an independent nonprofit, founded in 1982 as Rocky Mountain Institute, that transforms global energy systems through market-driven solutions to align with a 1.5°C future and secure a clean, prosperous, zero-carbon future for all. We work in the world's most critical geographies and engage businesses, policymakers, communities, and NGOs to identify and scale energy system interventions that will cut climate pollution at least 50 percent by 2030. RMI has offices in Basalt and Boulder, Colorado; New York City; Oakland, California; Washington, D.C.; Abuja, Nigeria; and Beijing.

PUBLIC HEALTH LAW CENTER
at Mitchell Hamline School of Law

About Public Health Law Center

Public Health Law Center (PHLC) collaborates with others to reduce and eliminate commercial tobacco, promote healthy food, support physical activity, pursue climate justice, and address other causes of chronic disease. We partner with Tribal health leaders, federal agencies, national health advocacy organizations, state and local governments, planners, researchers, attorneys, community coalitions, and individuals working on public health issues to create healthier communities around the country. PHLC is a nonprofit affiliate of Mitchell Hamline School of Law in Saint Paul, Minnesota, and was founded in 2000.

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Abbreviations

ASHRAE Standard 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings	ASHRAE 90.1
Building performance standards	BPS
Carbon dioxide equivalent	CO_2e
Energy Policy and Conservation Act	EPCA
Energy Rating Index	ERI
ENERGY STAR New Construction	ESNC
Energy use intensity	EUI
Greenhouse gas emissions	GHGe
Home Energy Rating System	HERS
International Energy Conservation Code	IECC
International Code Council	ICC
Thousand British thermal units	kBtu
New Buildings Institute	NBI
United States Department of Energy	US DOE
Zero-Energy Ready Home	ZERH

Introduction

Energy use in buildings causes about 30% of total greenhouse gas emissions (GHGe) in the United States.[1] States, cities, counties, and towns (collectively referred to as jurisdictions) across the nation — about 140 in all at the time of publication — have taken action to reduce GHGe in buildings in order to protect residents' health and safety, lower costs, and achieve climate goals.[2] These diverse jurisdictions have developed different policy mechanisms to reduce building emissions, with variations based on the local legal landscape and climate zones.

However, recent federal court decisions have caused confusion among several jurisdictions that want to enact building decarbonization codes.[3] Notably, the US Court of Appeals for the Ninth Circuit recently struck down the City of Berkeley's gas hookup ordinance, finding it preempted by the federal Energy Policy and Conservation Act (EPCA). However, that court acknowledged a critical exception within EPCA that ensures a "safe harbor" for building codes that meet a seven-factor requirement.[4] The EPCA Safe Harbor allows jurisdictions to remove the current bias in model codes that favors fossil fuel space and water heating over energy-efficient electric equipment. This report describes how to safely remove that bias and provide a clear pathway to implement building decarbonization codes.[i]

This report begins with a description of how building energy codes are developed and structured. It then describes the EPCA Safe Harbor and its relationship to compliance pathways within energy codes. Next, it explains the tendency of model codes to implicitly favor gas appliances over electric heat pump appliances and provides methods of reducing that bias. Finally, the report introduces residential and commercial Zero Fuel Bias Overlays that amend the 2024 International Energy Conservation Code (IECC) and ASHRAE Standard 90.1-2022.[5] It describes how the Overlays conform to the EPCA Safe Harbor, examining each of the seven factors in depth. Along the way, key issues that include relevant case law and performance metrics are explored in sidebar discussion boxes.

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i Note that this report does not constitute legal advice. Jurisdictions should consult their own counsel to ensure they are complying with applicable laws.

How Building Energy Codes Work

Building energy codes are a key tool to reduce energy usage and emissions in the building sector, both in the United States and globally. Energy codes set minimum energy efficiency standards applicable to building construction and certain renovations. Typically, energy codes are split into two portions: residential and commercial. Multifamily buildings up to three stories above grade are typically included in the residential code, while taller multifamily buildings are included in the commercial building code. Each code typically includes multiple compliance pathways, or ways a builder can show that a building meets the code. Compliance pathways often work by setting requirements relative to a baseline or reference building and its modeled energy efficiency. Those requirements result in the building reaching an efficiency goal, also called a conservation objective. The baseline and the conservation objective function as the start and finish lines of the code.

The problem: Model energy codes have judged compliance on an unequal basis across building fuel types for decades. Buildings with combustion appliances often benefit from more favorable start lines, finish lines, or ways of measuring the distance between the two. As a result, mixed-fuel buildings can comply with the code more easily than buildings with electric heat pumps, locking in higher energy use and GHGe across a building's lifetime. Although code experts widely recognize and understand this issue, it has yet to be solved comprehensively through model codes. The current structure of most energy codes continues to favor gas appliances, despite the ability of heat pumps to improve building performance and reduce climate pollution by 35%–93%, depending on state and region.[6] Enacting revised energy codes, including by adopting the Zero Fuel Bias Overlays, can help counteract this bias, save energy, and reduce pollution. This report further explores compliance pathways, baselines, conservation objectives, and how each structure can cause or counteract fuel bias in later sections.

Energy Code Development and Adoption

Most energy codes in the United States are based on one of two model codes. States (and, in some cases, local governments) may choose to adopt these model codes as enforceable rules, modify them with strengthening or weakening amendments, or develop their own codes. The model codes are updated every three years.

- The **IECC**, published by the International Code Council (ICC), is the most widely adopted and used model energy code for residential buildings in the United States. Some version of the IECC, although often modified, is used as the statewide energy code in 40 states and the District of Columbia.[7]

- The second commonly referenced model code is **ASHRAE 90.1**. The commercial version of the IECC includes ASHRAE 90.1 as a compliance pathway, so even in jurisdictions that do not expressly adopt ASHRAE 90.1, commercial building designers likely have the option to comply with it.[ii]

Both the residential IECC and ASHRAE 90.1 are routinely evaluated for their energy efficiency and cost-effectiveness by the US Department of Energy (US DOE), and their adoption and enforcement by

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ii The overlays published with this report reference the 2024 edition of the IECC and the 2022 edition of ASHRAE 90.1.

subnational jurisdictions are frequently incentivized with federal funding. For example, the Inflation Reduction Act authorized $1 billion for the adoption and enforcement of energy codes equivalent to or more stringent than the latest model codes or the zero-energy appendices to those codes.[iii] Although federal agencies like the Departments of Housing and Urban Development and Agriculture refer to model codes in their rules or practices, there is no national energy code that applies to all new construction in the United States.

Federal law allows states to adopt model codes or develop their own energy codes that satisfy EPCA requirements, as described in the next section.[8] States also govern whether and how localities may set energy codes, and as a result, localities' authority varies widely from state to state.[iv] Some states fully defer their code adoption authority to cities, towns, and counties, and do not adopt a statewide code; these are often referred to as home rule states. Other states may have statewide energy codes but still grant local jurisdictions home rule authority, allowing them to adopt codes that differ from the state energy code. Some states set minimum energy codes, effectively setting a floor for locally adopted codes' energy efficiency. A few states that set a floor also develop specific, more stringent stretch codes. Stretch code states offer jurisdictions two or three options and may disallow or require state review of local amendments, aiming to limit statewide variation. Several states set a single energy code and do not grant local jurisdictions authority to set a different energy code.[v]

Since many jurisdictions amend the IECC to better serve their specific policy aims, ICC and other organizations develop and publish code language to "overlay" on top of the base IECC to standardize and streamline amendments. Code overlays developed by IECC consensus committees are included in each published version of the IECC as appendices, while additional code overlays are generated by third parties, such as the New Buildings Institute's (NBI's) Building Decarbonization Code.[9] The US DOE publishes resources with the same function called plug-ins.[10]

The 2024 IECC development cycle and the appeal process that followed it resulted in an unprecedented number of appendices with additional efficiency and decarbonization requirements. However, due to the number and overlapping goals of these appendices, jurisdictions may face challenges determining which are suitable for their goals or navigating the adoption process. The energy code overlays published with this report are intended to provide straightforward options for jurisdictions interested in near-term, climate-aligned code adoption.

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iii As of the publication of this report, the latest Administrative and Legal Requirements Document (ALRD) for energy code adoption and implementation formula funding (Modification 5) includes the 2024 IECC as an approved code. It additionally allows states to plan to adopt qualifying amendments that meet requirements listed in Appendix A of the ALRD. Although the Zero Fuel Bias Overlays would be expected to improve energy efficiency outcomes, they include amendments that are not listed in Appendix A. Jurisdictions are recommended to confer with the Office of State and Community Energy Programs (SCEP) regarding the eligibility of any target energy code for formula funding. Competitive SCEP funding of energy code adoption and implementation, as well as Resilient and Efficient Code Implementation funding, is not subject to these restrictions and should also be considered. Jurisdictions interested in applying the principles described in this report using eligibility-adapted code amendments may also contact RMI directly for assistance.

iv US DOE provides information about which states grant localities which types of authority on their **Infographics hub for municipal building energy policies**.

v Locality authority over codes varies in a manner similar, though not identical, to their authority over other matters of governance; for example, states that generally grant localities home rule likely also grant localities the authority to adopt their own codes, but there are exceptions. States that reserve all powers to themselves except those granted to localities in statute (a pattern sometimes called Dillon's rule) are less likely to grant localities the authority to adopt their own codes.

The Energy Policy and Conservation Act Safe Harbor

An energy code's structure is influenced not only by the preferences of its stakeholders, but also by EPCA, a federal law that condones specific building energy code features while disallowing others. Here, we explore the specific constraints set by EPCA and the structures codes most often employ within those constraints. EPCA allows US DOE to set energy efficiency standards for appliances.[11] It also overrides, or preempts, state and local regulations "concerning the energy efficiency" or "energy use" of any appliance covered by these standards (an "EPCA-covered" appliance).[12] By preempting such regulations, Congress intended to prevent conflicting efficiency standards from being applied to appliance manufacturers from state to state.

Building energy codes are generally within the scope of EPCA preemption because they often contain standards or requirements that regulate the energy efficiency of appliances. EPCA, though, created an exception for certain types of building energy codes that apply to new construction (here referred to as the Safe Harbor). Codes that meet Safe Harbor requirements are exempt from EPCA preemption.

To qualify for the Safe Harbor, a code generally must not require any EPCA-covered appliance to exceed federal standards. The code must also offer certain flexibility options. For example, if a code allows the energy conservation from higher-efficiency appliances that exceed federal standards (here referred to as higher-efficiency appliances) to count toward compliance, the code must allow reduced attainment of other efficiency requirements proportionate to those appliances' energy or energy cost savings.

More specifically, a code is exempt from EPCA preemption if it meets the following seven requirements:[13]

A. The code must allow builders to select measures to meet an ends-oriented energy objective.

B. The code cannot set a mandatory energy consumption or efficiency standard for a specific EPCA-covered appliance that is more stringent than EPCA standards require.

C. If the code awards builders credits for using higher-efficiency appliances, those credits must be provided on a one-for-one basis, based either on cost or site energy savings. In other words, builders must receive reductions to other efficiency requirements substantially equivalent to the efficiency gains from using a higher-efficiency appliance and cannot receive extra credit that is disproportionate to the appliance's efficiency gains.

D. If the code allows builders to comply by showing that their proposed building would match or exceed the efficiency of a baseline design, and the baseline design incorporates EPCA-covered appliances, the baseline design cannot be based on versions of those appliances that are more efficient than federal standards.

E. If the code allows builders to use a package approach — whereby the builder selects from one or more packages of energy efficiency measures, each sufficient to meet the objective — at least one of the packages must include no higher-efficiency appliances. Additionally, for every package that includes higher-efficiency appliances, there must be a package that includes appliances that are not more than 5% more efficient than federal standards require.

F. The code's energy objective must be specified in terms of energy consumption or cost.

G. Finally, the code must use the same testing procedures that EPCA uses for determining appliances' energy usage.

Case Law Pertaining to the EPCA Safe Harbor

The requirements of the EPCA Safe Harbor have been interpreted by federal courts in two cases. In *Building Industry Association of Washington v. Washington State Building Code Council* (*Washington*), the Ninth Circuit Court of Appeals upheld Washington's energy code as protected from preemption by the EPCA Safe Harbor. The district court in *Washington* reviewed the code under Requirements B, C, E, and F, finding in each case that the state code met the EPCA Safe Harbor's requirements.[14] The challengers appealed the case as to Requirements B and C, and the Ninth Circuit affirmed that the state code met those requirements.[15]

In *Air Conditioning, Heating, and Refrigeration Institute v. City of Albuquerque* (*Albuquerque*), a federal district court reviewed a local energy code amendment for compliance with each requirement of the Safe Harbor, finding it likely that each of the amended code's alternative paths failed to meet at least one of the requirements.[16] The court later confirmed that the code's compliance paths that explicitly required the use of higher-efficiency appliances did not meet Requirement B, and that another compliance path that used a baseline design with higher-efficiency appliances did not meet Requirement D.[17] Note that this district court decision, while providing a helpful perspective for understanding the statute, is not a binding legal precedent in future cases concerning energy codes.

The key statutory elements discussed in these cases are applied in more detail in the *Application of the EPCA Safe Harbor Requirements to the Zero Fuel Bias Overlays* section.

Energy Code Compliance Pathways

To ensure the flexibility required by the EPCA Safe Harbor, energy codes commonly offer builders choices between pathways and measures to achieve compliance. Both ASHRAE 90.1 and the IECC include several pathways through which builders may prove compliance with the code. The two most common pathways are the **performance pathway** and the **prescriptive pathway**. The IECC sections associated with each pathway are enumerated in Exhibit 1.

The **performance pathway** provides the greatest flexibility by requiring code-compliant performance to be demonstrated through building energy simulations. Designers following this pathway may incorporate features that would not meet the rigid requirements of the prescriptive pathway while still satisfying the code's performance threshold. The designer inputs building parameters into an as-designed model, which is usually required to match or outperform a standard reference model with parameters specified by the code. In ASHRAE 90.1 Appendix G, the percentage of the standard reference model's energy use that sets the maximum energy use for the as-designed model is referred to as a building performance factor.

The standard reference model often reflects prescriptive code requirements. Requirements can be made mandatory by not only including them in the prescriptive pathway, but also requiring their incorporation into the as-designed model in the performance pathway. Model performance is usually quantified in either energy cost or energy use intensity (EUI), which is the annual amount of energy (in thousand British thermal units or kBtu) a building uses per square foot of floor space.

Energy modeling can be costly. As a result, smaller or less well-resourced builders or developers are less likely to use this pathway. Large commercial and multifamily projects with architects incorporated into the development team, as well as noncustom tract homes, are most likely to comply via the performance pathway.

The **prescriptive pathway** typically requires a building to meet certain specifications in a given situation; for example, "insulation in cavities of wood-framed walls shall be labeled with an R-value no less than R-30." Designers must meet or exceed each requirement. The prescriptive pathway is most popular with homebuilders.

Recent versions of IECC and ASHRAE 90.1 prescriptive pathways have also included a section requiring additional energy efficiency credits. This section requires each project to achieve a certain number of credits from a table of energy efficiency measures, where many more credits are available to choose from than are required for any project. The credit table section is designed to provide builders with flexibility like that of the performance path without imposing costly energy modeling requirements.

The residential IECC also includes an **energy rating index (ERI) pathway**, which functions similarly to the performance pathway but uses a metric specialized for dwelling units. ERI scores, provided by home energy assessment professionals through systems such as the Home Energy Rating System (HERS), index a home's likely performance against past energy codes and assign a single number to quantify that performance.

ENERGY STAR New Construction (ESNC) and Zero-Energy Ready Home (ZERH) certification also require ERI scores, and many federally or utility-funded new construction incentive programs require ESNC or ZERH certification. The ERI pathway is relatively popular in areas where such incentives are heavily utilized because it allows simultaneous incentive qualification and code compliance. As of the time of publication, ICC and

Residential Energy Services Network, the primary institution that provides ERI score credentials, are collaborating to launch the IECC/HERS Code Compliance Program, which will seek to train HERS raters to certify additional dimensions of code compliance.[18]

Exhibit 1 2024 IECC Compliance Paths

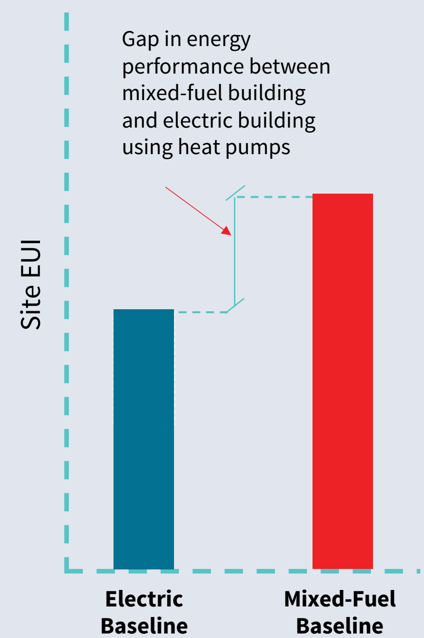
Path	Residential	Commercial
Prescriptive	R401 through R404 and R408	C402 through C406 and C408
Performance	R405	C407
Other	R406: Energy Rating Index (ERI) Compliance Alternative	ASHRAE 90.1, which provides a choice between a prescriptive path and two performance path options

RMI Graphic. Source: 2024 IECC

Anti-Electric Fuel Bias in Existing Model Energy Codes

Model codes like IECC and ASHRAE 90.1 set an energy conservation objective for buildings to reach and allow buildings to attain the objective through any of the above-described performance pathways. However, the existing structure of most compliance pathways in IECC and ASHRAE 90.1 creates a bias against efficient electric heat pumps. This is simply a historical practice, and is not required for an energy code to qualify for the EPCA Safe Harbor so long as the code does not force the use of EPCA-covered appliances that exceed minimum standards.

Exhibit 2 Fuel Bias in Energy Codes



RMI Graphic.

Model energy codes have historically left energy savings on the table. Electric heat pumps are dramatically more efficient than gas alternatives: EPCA minimum-efficiency electric heat pumps use only 25%–50% as much energy as their fossil fuel counterparts. A building that uses minimum-efficiency heat pumps will use less energy when it complies with model codes compared to an otherwise identical mixed-fuel building. Although buildings with combustion appliances use more energy, they are not required to take any additional measures to catch up to the performance of buildings with minimum-efficiency heat pumps. Nor are buildings with minimum-efficiency heat pumps allowed to relax any of the code's requirements. Exhibit 2 illustrates this performance gap. The gap creates bias by implicitly incentivizing lower-efficiency buildings that use gas appliances and disincentivizing higher-efficiency buildings that use electric heat pumps.

Structural Bias in Compliance Pathways

Most compliance pathways embed fuel bias into their structure, sometimes in a manner that is invisible to a reader unfamiliar with how energy codes are developed. In every case, either the conservation objective — the code's finish line — or the baseline building — the start line — is set to a fuel-specific value instead of a single objective value for all buildings. This section describes how this bias is built into most model code compliance pathways.

Three structural decisions are particularly important: the metrics used, the baseline used, and how the conservation objective is set relative to the baseline. Metrics are discussed in depth in the box titled *Energy Credit and Performance Pathway Metrics*.

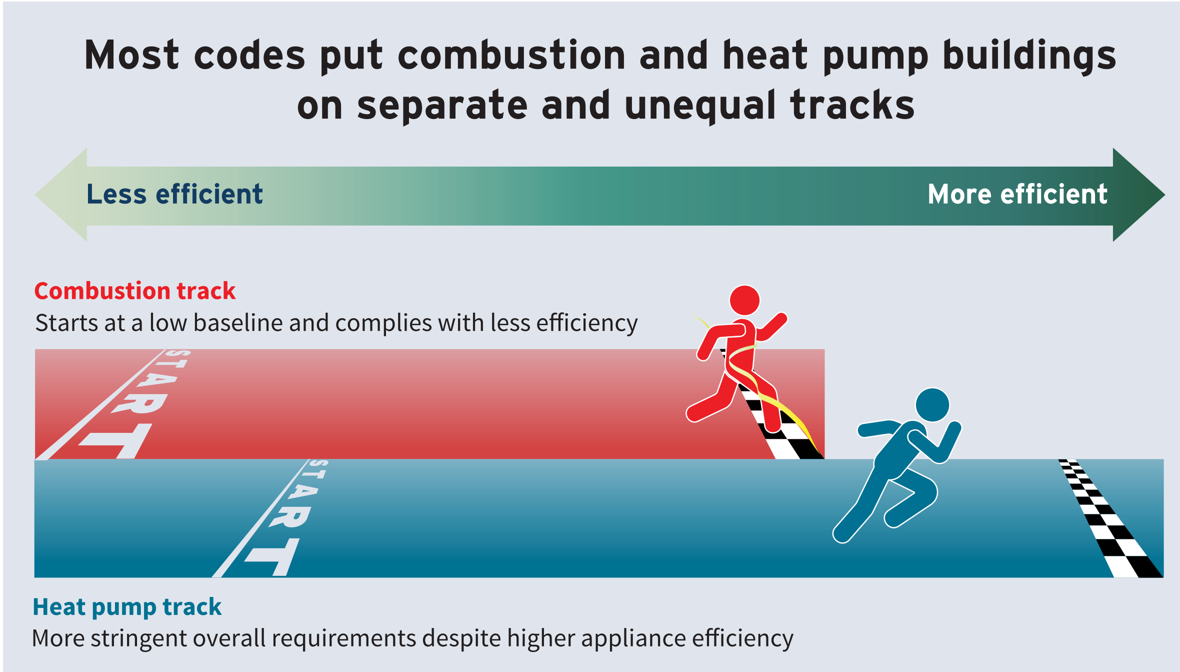
Performance pathway. Typical performance pathways include a standard reference design to set a baseline, then require the as-proposed design's modeled energy use or cost to be no greater than a set percentage of the baseline design's energy use or cost. Either the standard reference design or the required performance improvement can exhibit bias.

Standard reference design. Most performance pathways in model codes — and the modeling tools that support compliance with them — set every EPCA-covered appliance in the standard reference design to a minimum-efficiency appliance of the same fuel type as the appliance in the proposed design. As a result, electric appliances in the proposed design are compared to relatively efficient electric appliances in the standard reference design, while other appliances are compared to relatively inefficient standard reference appliances. This creates the unequal baselines, and thus unequal conservation objectives, described in the previous section. ASHRAE 90.1-2022 Appendix G is an exception: it sets the fuel type for the standard reference design to be constant for a given building size, type, and/or occupancy in each climate zone, so that designers' appliance choices can be fully credited against that baseline.[19]

Percent improvement required. Model codes have generally required the same percentage improvement from the baseline to the conservation objective, regardless of the designer's fuel decisions. For codes that set fuel-specific standard reference designs, this practice results in unequal conservation objectives. Notably, this has started to change, albeit not in a way that totally eliminates bias from model codes. For example, the 2024 IECC's residential performance path includes the following:

> For each *dwelling unit* with one or more fuel-burning appliances for space heating, water heating, or both, the annual *energy cost* of the *dwelling unit* shall be less than or equal to 80 percent of the annual *energy cost* of the *standard reference design*. For all other *dwelling units*, the annual *energy cost* of the proposed design shall be less than or equal to 85 percent of the annual *energy cost* of the *standard reference design*.[20]

The actual energy use difference between a building using combustion appliances and all-electric appliances is likely significantly larger than the 5% offset incorporated into the above passage. A 2022 study considering the New York State context estimated that all-electric single-family homes may use up to 34% less energy than mixed-fuel homes following a similar energy code.[21]



Prescriptive pathway. Where buildings are required to earn credits to comply with the prescriptive pathway, the credit table functions like a simplified performance pathway. The sources of bias in credit tables are therefore very similar to those in the performance pathway: the baseline against which credit values are calculated, and how many credits are required.

Credit calculation baselines. Credit values for each measure, such as a high-performance heat pump or more efficient windows, are calculated with respect to the performance of a baseline model. The baseline used to calculate space and water heating appliance credits in the 2024 IECC and ASHRAE 90.1-2022 prescriptive pathways matches the fuel type of the appliance; in other words, a high-performance gas system is compared to a minimum-efficiency gas system, and a high-performance electric heat pump is compared to a minimum-efficiency electric heater. Because the all-electric baseline is generally more energy efficient than the mixed-fuel baseline, this structure undervalues the efficiency of electric heat pumps.

Total credits required. Model codes generally require the same number of credits regardless of the fuels or appliance types used in buildings. Mixed-fuel buildings are therefore deemed compliant when they are less efficient than compliant all-electric buildings. Although the final consensus committee–approved draft of the 2024 IECC for commercial buildings included a provision to require 25% more credits for buildings without heat pumps, that provision was moved to an optional appendix upon appeal.[22]

ERI pathway. ERI ratings are indexed against previous iterations of the relevant energy code, which themselves incorporate the fuel biases described above. Therefore, like prescriptive path credits, they are indexed against fuel type–specific baselines. As a result, a home that uses minimum-efficiency gas appliances will generally use more energy than a home with minimum-efficiency heat pump equipment that earns the same ERI score.

How to Eliminate Fuel Bias

The fuel bias against electric heating can be reduced in any compliance pathway. The following section briefly describes debiasing approaches for each pathway and provides examples of energy codes that follow each approach. The Zero Fuel Bias Overlays level the playing field between all-electric and mixed-fuel buildings in every 2024 IECC pathway and ASHRAE 90.1-2022 to provide users with maximum flexibility, as further described below.

In all approaches, the metric that underlies energy efficiency credits, scores, or simulated performance has a significant influence on the magnitude and direction of any underlying fuel bias. Site energy is a useful metric to reduce bias against electric heat pumps and is used by the Zero Fuel Bias Overlays in every compliance pathway. The *Energy Credit and Performance Pathway Metrics* box compares metrics in greater detail.

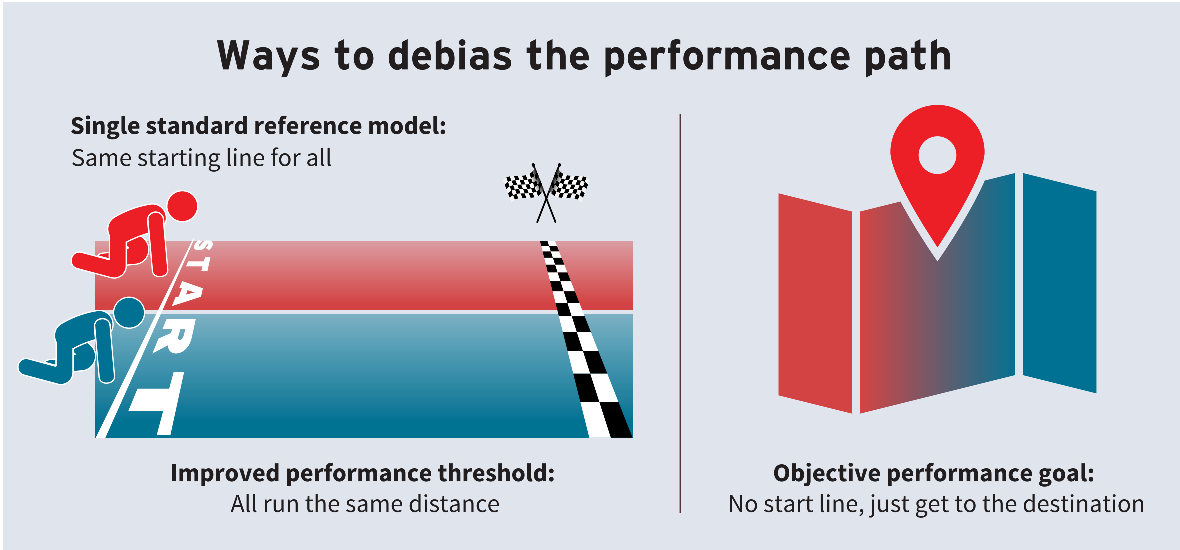
Performance Pathway

Codes can be structured to ensure an unbiased performance path through multiple approaches: by specifying a ***single standard reference model***, setting an ***improved performance threshold*** by which a building's performance must exceed the standard reference model, and/or setting an ***objective performance goal***.

Single standard reference model: To reduce fuel bias, performance pathways should refer to a single standard reference model regardless of the fuels used by appliances in the as-designed model. ASHRAE 90.1-2022 Appendix G takes this approach, as described in the previous section. The Zero Fuel Bias Overlays also incorporate this strategy.

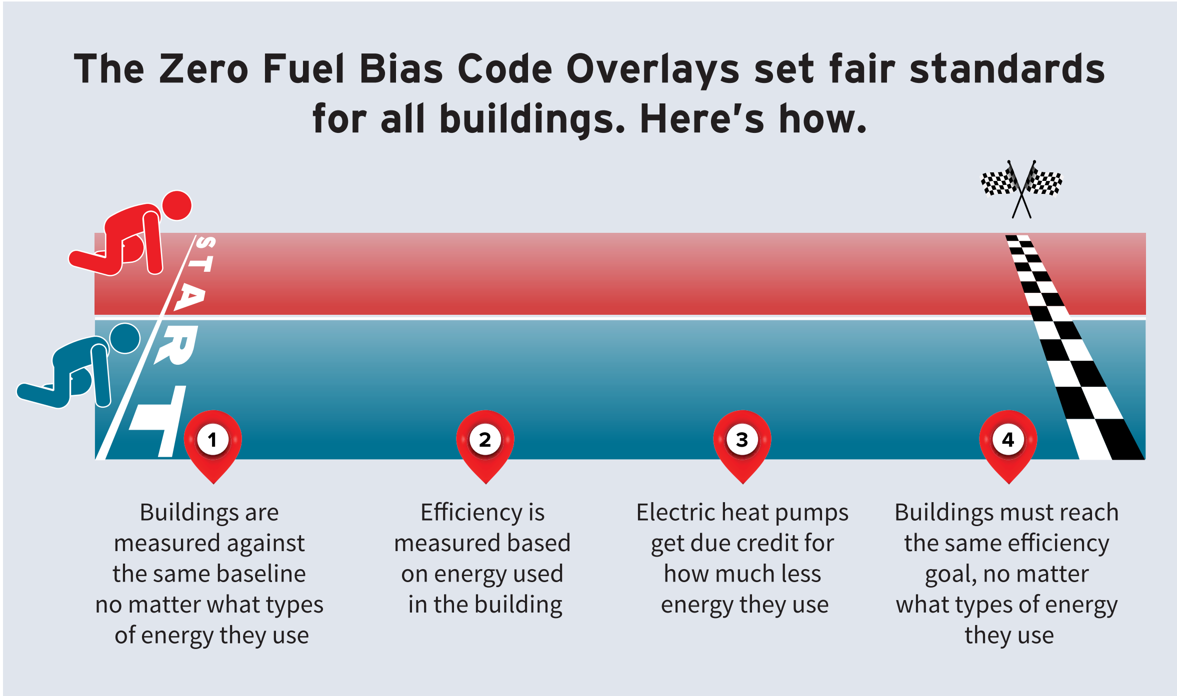
To directly require performance similar to that of a heat pump building, a code could specify a minimum-efficiency heat pump as the primary space heating equipment within the standard reference model. California's Title 24 energy code takes this approach.[23]

Improved performance threshold and building performance factors: A code with a single, combustion appliance–based standard reference model that uses the same performance threshold as the model code would allow buildings to be less energy efficient than the model code. To reduce fuel bias without sacrificing energy efficiency, a code should combine a more stringent performance threshold with a single standard reference model. The Zero Fuel Bias Overlays take this approach. The overlay for commercial and taller multifamily buildings combines the single standard reference model of ASHRAE 90.1-2022 Appendix G with a higher-stringency set of building performance factors consistent with the efficiency of heat pump buildings. The overlay for residential low-rise buildings sets a standard reference design that uses gas for space and water heating and adopts the higher performance threshold of Appendix RG, the IECC Stretch Code.



Objective performance goal: Model codes generally require two steps to comply with the performance path: first, designers determine a conservation objective by modeling a standard reference design, then they comply with that objective by modeling the as-designed building to achieve equal or better performance. An energy code may alternatively or additionally require the as-designed model to meet an objective performance goal. For example, a performance pathway could require that the simulated performance of a proposed design meet a site EUI target based on building occupancy group and climate. Jurisdictions with building performance standards (BPSs) may find this approach especially useful to better align their policies across new construction and occupied buildings. For example, Louisville, Colorado, requires certain building types to demonstrate that they have met a set conservation objective in addition to complying with ASHRAE 90.1 Appendix G.[24]

Although this approach is straightforward at face value, it is challenging to implement as the sole performance threshold. Different approved modeling software programs may estimate different site EUI outcomes for the same building, and unregulated configuration choices, such as operational schedules and assumed number of occupants, may also affect modeled site EUI estimates. Variation in the same parameters may also affect real, measured energy use, which jurisdictions should account for when attempting to align energy codes and BPSs through site EUI targets. Overall, single conservation objective pathways are uncommon, vulnerable to exploitation via custom software configuration, and unlikely to predict measured energy use, and they are not recommended as the sole method for setting an energy code's performance threshold.



Prescriptive Pathway

The main method to eliminate fuel bias in the prescriptive pathway is through the additional energy efficiency credit or package section. Given the credit section's flexible structure, it is possible to allow for minimum-efficiency covered products to be installed while also requiring the building to achieve an ambitious site EUI objective. To close the gap in energy performance between all-electric and mixed-fuel buildings, the prescriptive pathway can include a ***debiasing credit multiplier***, a ***debiasing credit table***, and/or a ***debiasing credit measure***. Although all three options reduce fuel bias, we recommend the debiasing credit measure approach due to its precise and comprehensive debiasing effect. The Zero Fuel Bias Overlays take this approach.

Debiasing credit multiplier

NBI's Building Decarbonization Code includes an example of fuel debiasing credit multiplier language.[25] This language creates a higher credit requirement for mixed-fuel buildings than for all-electric buildings, applying the same increase in credits across all climate zones and building types. This approach's advantages include its simplicity and ease of adoption: it may be added to any code and requires no modeling of credit tables or measures.

> **C406.1 Additional energy efficiency credit requirements.** New all-electric buildings shall achieve a total of 10 credits and new mixed-fuel buildings shall achieve a total of 15 credits from Tables C406.1(1) through C406.1(5)…

A version of this language is included in the 2024 IECC's Appendix CF, Section CF103.1.[26]

Debiasing credit table

The January 2024 update to the Washington State Energy Code requires buildings using fossil fuels to achieve additional points equivalent to the EUI difference between buildings using gas appliances and buildings using electric heat pumps for the applicable end uses.[27] A fuel debiasing credit table specifies how many additional points are required for each end use and occupancy group, as depicted in Exhibit 3. This approach allows the application of different credit requirements to reflect the context-dependent performance differences between buildings of different fuel types.

Exhibit 3 Excerpt from Washington State Energy Code

TABLE C401.3.3
ADDITIONAL CREDITS REQUIRED

MEASURE TITLE	APPLICABLE SECTION	OCCUPANCY GROUP					
		Group R-1	Group R-2	Group B	Group E	Group M	All Others
New building — Additional efficiency credits required for space heating systems using the fossil fuel pathway	C401.3.3.1	7	24	101	38	111	56
New building — Additional efficiency credits required for service water heating systems using the fossil fuel pathway	C401.3.3.2	198	212	27	17	79	107
Building additions — Additional efficiency credits required for space heating systems using the fossil fuel pathway	C401.3.3.1	4	12	51	19	56	28
Building additions — Additional efficiency credits required for service water heating systems using the fossil fuel pathway	C401.3.3.2	99	106	14	9	40	54

Source: 2021 Washington State Energy Code, Washington State Building Code Council

Energy Credit and Performance Pathway Metrics

Energy codes use metrics to quantify building performance and the relative impact of energy efficiency measures, whether in credit-based prescriptive pathways or in performance pathways. The choice of metric affects the code's fuel bias. Below is a partial list of metrics that have been used in energy codes.

1. **Site energy *(recommended)*:** The simplest metric is site energy, measured in kBtu. Site energy is the amount of energy used in a building. The EPCA Safe Harbor's Requirement C allows site energy to be used to set relative values of above-minimum-efficiency appliance measures.[28] The Zero Fuel Bias Overlays use site energy as their performance metric to simplify compliance and enforcement while reducing fuel bias.

2. **Energy cost:** Energy cost is the default metric used in the IECC and ASHRAE 90.1 and is referenced as an acceptable metric by the EPCA Safe Harbor's Requirement C.[29] To calculate energy cost, model codes usually include assumed rates for electricity and gas; for example, ASHRAE 90.1-2022 C3.3 specifies $0.1063/kilowatt-hour for electricity and $0.98/therm for heating in envelope performance factor calculations.[30] Actual energy rates vary widely.[31] Additionally, energy costs (especially of hydrocarbon fuels) are volatile due to events outside the control of the designer or occupant. These sources of variation introduce bias in different directions depending on the circumstances.

3. **Source energy:** Source energy is intended to reflect not only the energy used in a building, but also the energy lost in transit to the building. As with energy cost, the loss coefficient of each fuel is provided in the energy code and does not reflect actual variation in energy losses across geographies or time. Source energy calculation methods either only account for off-site losses for electricity (such as generation and transmission losses) and not for other fuel types (such as storage and pipeline leakage losses) or estimate electricity losses to be vastly higher than other fuel types'. They also do not consistently account for renewable electricity generation's increasing market share and lack of generation losses.[32] Because of these practices, source energy metrics consistently introduce bias in favor of nonelectricity fuels.

4. **Greenhouse gas emissions:** GHGe are typically measured in carbon dioxide equivalent (CO_2e), or the mass of carbon dioxide that would cause the same amount of warming. As with energy cost and source energy, GHGe code metrics usually assume the same GHGe intensity across time and geographies, causing similar inconsistency with actual outcomes. CO_2e coefficients based on historical emissions will also inflate CO_2e associated with electricity due to the increasing market share of lower- and zero-carbon generation technologies over time.

5. **Innovative metrics,** such as California's Time Dependent Valuation and Hourly Source Energy and New York State's life-cycle costs including secondary and societal effects,[33] incorporate multiple parameters into more detailed, potentially lower-bias metrics. Because of their complexity, these metrics may be challenging for resource-limited jurisdictions outside these states to incorporate into codes. They are most often used to inform code development at the policy level, rather than to meet code compliance requirements at the building level.

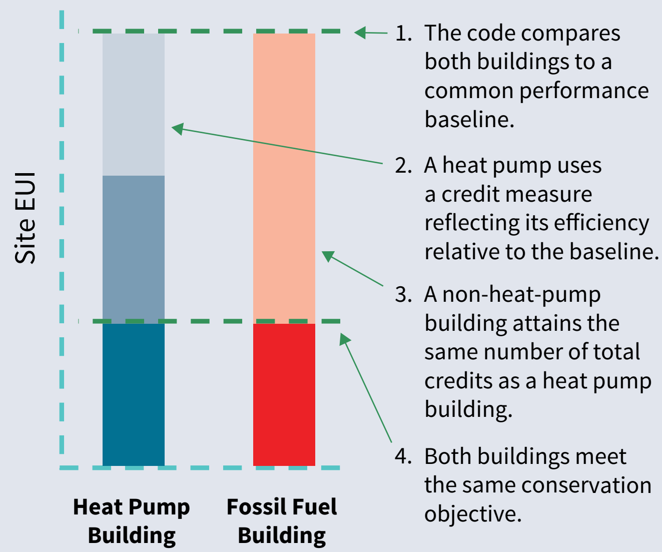
These metrics have most often been modeled in terms of annual outcomes, though longer-term metrics to reflect outcomes over the building's useful life may also be considered.[34] Metrics are usually normalized by either gross or conditioned square footage and may be considered on a gross or net (i.e., accounting for on-site and/or off-site renewable energy) basis.

Debiasing credit measure

Instead of requiring buildings reliant on fossil fuel combustion equipment to attain additional credits, codes may provide a credit for buildings that install heat pumps equivalent to their performance improvement over buildings that install combustion equipment. The main benefit of using this approach is that it sets a common baseline for all buildings (regardless of fuel type) and then credits buildings that use electric heat pumps instead of penalizing non-heat-pump buildings.

The Zero Fuel Bias Overlays adopt the debiasing credit measure approach and combine it with credit values calculated from a single site energy baseline, as depicted in Exhibit 4. The next section also describes how the Zero Fuel Bias Overlays align with the EPCA Safe Harbor.

Exhibit 4 Debiasing Credit Measure

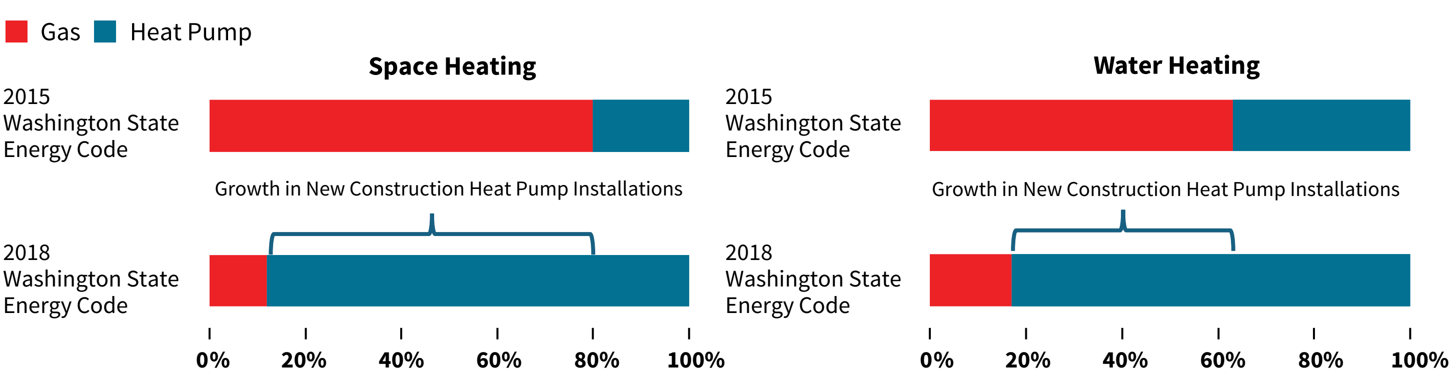


RMI Graphic.

Impact of Fuel Debiasing

Although fuel debiasing is a relatively new concept, early data from jurisdictions with debiased codes suggests that they may increase heat pump adoption without a mandate. In the 2018 Washington State Energy Code, a credit incentive was added to partially correct the fuel bias that existed in prior versions. In 2022, several years after the adoption of the 2018 code, Northwest Energy Efficiency Alliance conducted a survey to evaluate the code's impact.[35] They found significant growth in heat pump and heat pump water heater installations, as depicted in Exhibit 5. The 2021 code update was designed to send an even stronger signal and will include similar provisions covering commercial buildings, but a survey on its impact has not been completed as of October 2024. Similarly, the California Energy Commission has projected that 500,000 heat pumps will be installed between 2026 and 2029 due to the fuel debiasing measures in the 2025 code update.[36]

Exhibit 5 New Home Heating Fuel Types in Washington State



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

Application of the EPCA Safe Harbor Requirements to the Zero Fuel Bias Overlays

The Zero Fuel Bias Overlays are designed to comply with EPCA's Safe Harbor requirements to avoid preemption. They are intended to correct a bias in how the IECC measures energy use, which currently disadvantages all-electric buildings. This adjustment aligns with the Safe Harbor's goal by ensuring builders receive credit for efficiency improvements while preserving the flexibility of the IECC's compliance pathways.

As a result, the Zero Fuel Bias Overlays satisfy all seven Safe Harbor requirements. They are discussed in detail below, but broadly speaking: The overlays (A) set a conservation objective (B) without requiring any specific appliance to be more efficient than EPCA's standards, and while (C) giving builders due credit when they use appliances that do exceed federal standards. They use a baseline design (D) that does not exceed EPCA standards, and (E) they do not require any packages of efficiency measures beyond those required by the IECC itself. Finally, the overlays retain the core energy conservation requirements and testing protocols of the IECC (which already satisfy F and G).

Below is a detailed explanation of how the Zero Fuel Bias Overlays meet all seven EPCA Safe Harbor requirements.

1. **Requirement A: All pathways allow for a choice of energy efficiency measures around a common energy goal**

First, the EPCA Safe Harbor requirement says that a code has "an energy consumption or conservation objective for a building" and that builders have flexibility to select different energy efficiency measures to meet that objective.[37] As explained in *Albuquerque*, this does not require that each pathway in a code set out a list of options, only that builders have some choice in the measures they take to comply with the code.[vi]

All pathways in the Zero Fuel Bias Overlays satisfy this requirement. The energy consumption or conservation objectives are rooted in the IECC itself, and are altered primarily to ensure that the same baseline and conservation objective are applied equally to similar buildings of differing fuel types. The overlays' changes adjust the metrics for evaluating proposed buildings so that they more closely track achievement of the conservation objectives.

2. **Requirement B: No pathway requires that an EPCA-covered product exceed EPCA standards**

The EPCA Safe Harbor requires that there be at least one way for builders to satisfy the code's requirements without using any higher-efficiency appliances.[38] In other words, the code cannot functionally require a builder to use higher-efficiency appliances by, for example, imposing a requirement that is impossible

vi "There is no requirement, however, that the building code provide a list of items from which a builder may select options; [Requirement A] simply requires that the building code allow a builder to select various items whose combined energy efficiencies meet the objective." *Albuquerque I*, 2008 WL 5586316, at *9.

to satisfy without such appliances.[vii] Where a code imposes a penalty for failing to use higher-efficiency appliances, this may be considered a de facto requirement to use those appliances, disqualifying the code for the exception.[viii]

There are many ways for builders to satisfy the Zero Fuel Bias Overlays' provisions without needing higher-efficiency appliances, so Requirement B is met. None of the overlays' paths explicitly require specific appliances, and all pathways provide flexibility in appliance selection. Higher-efficiency products are not the "only way to comply with the code."[39]

There are also no impermissible penalties in the Zero Fuel Bias Overlays for failing to use higher-efficiency appliances. As the federal appeals court in *Washington* described it, only "compulsion backed by force of law" constitutes a "require[ment]" to use higher-efficiency appliances.[40] A code that "does not create any penalty or legal compulsion to use higher efficiency products" satisfies Requirement B.[41] Mere economic incentive — such as that created when one option for compliance costs less than another — is permissible under the exception.[42]

The Zero Fuel Bias Overlays adjust the IECC pathways to better reflect the energy efficiency of electric heat pumps when compared to other technologies. They do not penalize a builder for using gas appliances that meet minimum EPCA standards. Instead, they aim for accuracy in crediting efficiency measures without affecting credits for high-efficiency gas appliances. The ERI path is also adjusted to address a bias against all-electric buildings, ensuring all homes achieve the same conservation goal.[ix] Compliance costs will vary based on the chosen pathway and design approach, but there are no penalties for using minimally EPCA-compliant appliances.

3. Requirement C: All pathways allow for builders to receive credit for exceeding EPCA standards on a roughly one-to-one basis

Requirement C ensures that, when builders choose to use appliances that are more energy efficient than EPCA requires, they can receive credits for those efficiency gains. The amount of credits earned in this way does not have to be exactly equal to the reduction in energy used; they can be "closely proportional."[43] For example, the *Washington* case upheld a code that awarded the same amount of credits for measures that averaged a 6% reduction in energy efficiency as for measures averaging a 10% reduction.[44]
The Zero Fuel Bias Overlays provide credits at a very granular level of proportionality. Indeed, the goal of the overlays is to help ensure a more accurate comparison of measuring energy use between heat pumps and fossil fuel appliances. For example, the calculations under the ERI pathway will require gas- and electric-only buildings to attain equal site energy use in each climate zone. The new measurements clear the bar for close proportionality.

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vii "A building code that effectively requires the installation of products that exceed federal energy standards cannot satisfy [Requirement B]." *Albuquerque I*, 2008 WL 5586316, at *9; additionally, under Requirement B, a code must "not require use of covered products exceeding federal efficiency standards as the only way to comply with the code." *Washington I*, 2011 WL 485895, at *9.

viii "The state would effectively require higher efficiency products, in violation of [Requirement B], if the code itself imposed a penalty for not using higher efficiency products." *Washington II*, 683 F.3d at 1151.

ix As discussed above, the IECC uses different baselines for different energy sources, and therefore creates an inherent bias against the use of certain efficiency measures. Because the ERI measures change against old IECC requirements, it inherits that bias. The adjustments in the Model Code Overlay correct for that by providing a separate ERI target for buildings disadvantaged by that bias, so that the buildings that achieve the same level of efficiency will receive the same ERI score.

4. Requirement D: The Zero Fuel Bias Overlays' baseline designs use minimally EPCA-compliant products

Requirement D applies in cases where a "code uses one or more baseline building designs against which all submitted building designs are to be evaluated."[45] It requires that, whenever these designs base their efficiency requirements on an EPCA-covered product, that product's efficiency level "meets but does not exceed" the relevant EPCA standard.[46] The overlays' performance pathways use standard reference designs that comply with the EPCA requirement not to be based on appliances exceeding the relevant EPCA standard. The pathways use natural gas space and water heating products for the standard reference design regardless of the fuels used in the proposed design. These products meet but do not exceed the EPCA standards for space and water heating and satisfy Requirement D.

The use of separate baselines for all-electric and mixed-fuel buildings is not required by EPCA. The Safe Harbor does not require treating buildings with different fuel types differently. The Safe Harbor requires that, when a code specifies the efficiency of an EPCA-covered appliance in a baseline, that efficiency level must be equal to, not greater than, the federal efficiency standard for that appliance. The Safe Harbor does not require code baselines to use a particular type of appliance, or to use multiple baselines for different types of buildings. In fact, the use of a unified baseline advances the general Safe Harbor goals of making the credit awarded to builders as even-handed as possible.[47]

5. Requirement E: The Zero Fuel Bias Overlays do not add new requirements for "optional combinations of items"

Requirement E stipulates that code paths requiring builders to select from "optional combinations of items" must ensure that at least one such combination includes no higher-efficiency appliances. It also requires the full set of optional combinations to include at least as many combinations with appliances that exceed EPCA efficiency standards by less than 5% as combinations with more efficient appliances. This requirement applies most straightforwardly to code paths that use precalculated packages. Precalculated packages are a mix between prescriptive and performance-based paths: they allow builders to select from a menu of preconfigured designs, each of which has been calculated to meet a specified level of performance.

There is one instance in which a federal court applied Requirement E to a credit-based approach, somewhat similar to the approach used by the prescriptive path in the 2021 IECC for residential buildings: the code analyzed in the *Washington* case had a prescriptive path, to which builders were required to add one credit's worth of efficiency measures. Most of the options available were worth exactly one credit and involved multiple efficiency measures, making the code's credit system more like a precalculated package than most.[48] Possibly as a result of this similarity, the district court in that case applied Requirement E to that approach, treating each credit-granting option as a separate "combination of items," and testing each option for whether it required the use of higher-efficiency appliances.[x] The plaintiffs did not appeal this part of the lower court's decision, and therefore the Ninth Circuit did not consider whether this was a correct interpretation of Requirement E.

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x The court found that the code met Requirement E, and took the opportunity to reiterate that the fact that one option is cheaper than another does not mean that the code "requires" that option for purposes of the EPCA exception. *Washington I*, 2011 WL 485895, at *13–14 ("EPCA does not require that the various options provided in the state codes be financially cost equivalent to the builder").

The Zero Fuel Bias Overlays do not use a precalculated-package approach or a single-credit system like the one analyzed in the *Washington* case. The only changes they make to the IECC's credit approach are to debias the credits allotted to existing measures, and to provide additional measures designed to debias the prescriptive path as a whole. None of the new measures require using higher-efficiency appliances. Therefore, a court would be unlikely to find that Requirement E applies to the Zero Fuel Bias Overlays, and if it did apply Requirement E, it would likely find it satisfied.

6. Requirement F: The code has an overall objective specified in terms of equivalent energy

Requirement F specifies that the energy objective in Requirement A must be "specified in terms of an estimated total consumption of energy...utilizing an equivalent amount of energy (which may be specified in units of energy or equivalent cost)."[49] The Zero Fuel Bias Overlays do so because each pathway has an objective defined in terms of energy used: either site energy, site EUI, ERI, or the credits that are themselves calculated based on relative energy consumption.

7. Requirement G: Testing mechanisms for EPCA-covered appliances are identical to those required by EPCA

The amendments would not change the testing mechanisms of the IECC, which are themselves based on EPCA for EPCA-covered appliances. The IECC residential code simply requires that all appliances at least meet the level of efficiency required by federal law.[50] The IECC commercial code incorporates a variety of testing requirements, but those for EPCA-covered appliances either use EPCA testing methods explicitly or use testing methods that are themselves based on EPCA's testing methods, such as those of the Air Conditioning, Heating, and Refrigeration Institute.[51]

Conclusion

New construction offers the best opportunity to build right the first time to reduce GHGe, energy costs, and negative impacts on occupant health and comfort. Building energy codes remain one of the most powerful mechanisms available to accelerate deployment of zero-emissions and energy-efficient equipment such as electric heat pumps. This report and the Zero Fuel Bias Overlays provide a useful pathway for jurisdictions to enable climate-friendly new construction and major renovations while operating under a risk-conscious interpretation of federal statute, consistent with case law in the US Court of Appeals' Ninth Circuit.

Parties interested in advancing building codes to achieve pollution reduction and energy efficiency goals are invited to contact the Public Health Law Center and RMI to discuss this report, the options it summarizes, and additional building decarbonization policy approaches. We look forward to supporting the many forward-looking governments and constituents determined to solve these problems in the months and years ahead.

In a fair race, heat pumps win.

Appendix: The EPCA Safe Harbor Statutory Text, 42 U.S.C. § 6297(f)(3)

The full text of the safe-harbor requirements is as follows:

> (3) Effective on the effective date of an energy conservation standard for a covered product established in or prescribed under section 6295 of this title, a regulation or other requirement contained in a State or local building code for new construction concerning the energy efficiency or energy use of such covered product is not superseded by this part if the code complies with all of the following requirements:
>
> > (A) The code permits a builder to meet an energy consumption or conservation objective for a building by selecting items whose combined energy efficiencies meet the objective.
> >
> > (B) The code does not require that the covered product have an energy efficiency exceeding the applicable energy conservation standard established in or prescribed under section 6295 of this title, except that the required efficiency may exceed such standard up to the level required by a regulation of that State for which the Secretary has issued a rule granting a waiver under subsection (d).
> >
> > (C) The credit to the energy consumption or conservation objective allowed by the code for installing covered products having energy efficiencies exceeding such energy conservation standard established in or prescribed under section 6295 of this title or the efficiency level required in a State regulation referred to in subparagraph (B) is on a one-for-one equivalent energy use or equivalent cost basis.
> >
> > (D) If the code uses one or more baseline building designs against which all submitted building designs are to be evaluated and such baseline building designs contain a covered product subject to an energy conservation standard established in or prescribed under section 6295 of this title, the baseline building designs are based on the efficiency level for such covered product which meets but does not exceed such standard or the efficiency level required by a regulation of that State for which the Secretary has issued a rule granting a waiver under subsection (d).
> >
> > (E) If the code sets forth one or more optional combinations of items which meet the energy consumption or conservation objective, for every combination which includes a covered product the efficiency of which exceeds either standard or level referred to in subparagraph (D), there also shall be at least one combination which includes such covered product the efficiency of which does not exceed such standard or level by more than 5 percent, except that at least one combination shall include such covered product the efficiency of which meets but does not exceed such standard.
> >
> > (F) The energy consumption or conservation objective is specified in terms of an estimated total consumption of energy (which may be calculated from energy loss- or gain-based codes) utilizing an equivalent amount of energy (which may be specified in units of energy or its equivalent cost).
> >
> > (G) The estimated energy use of any covered product permitted or required in the code, or used in calculating the objective, is determined using the applicable test procedures prescribed under section 6293 of this title, except that the State may permit the estimated energy use calculation to be adjusted to reflect the conditions of the areas where the code is being applied if such adjustment is based on the use of the applicable test procedures prescribed under section 6293 of this title or other technically accurate documented procedure.

Endnotes

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13 See 42 U.S.C. § 6297(f)(3), (i).

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