



DEPARTMENT OF ADMINISTRATIVE SERVICES

PROPOSED CHANGE OF THE CONNECTICUT STATE
BUILDING CODE AND FIRE SAFETY CODE

DATE SUBMITTED: _____

CODE INFORMATION

Proposed change to: ☐ Building Code ☐ Fire Safety Code

Code section(s): _____

PROPONENT INFORMATION

Name: _____ Representing: _____

Telephone: _____ Email: _____

Address: _____
Street Address Town State Zip Code

PROPOSAL INFORMATION

Description of change and reason for change (attach additional information as needed):

Proposed text change, addition or deletion (attach additional information as needed):

Supporting data and documents (attach additional information as needed)

☐ **This Proposal is original material.** (Note: Original material is considered to be the submitter's own idea based on or as a result of his/her own experience, thought or research and, to the best of his/her knowledge, is not copied from another source.)

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12/29/16

RMI Proposal 1 to Connecticut's Adoption of the 2024 International Energy Conservation Code for Commercial Buildings

Justification and Analysis

The 2024 International Energy Conservation Code (IECC) allows mixed fuel buildings to be deemed code compliant while using significantly more energy than buildings that use only electricity. This proposal adjusts all compliance options so that mixed fuel and electric-only buildings will be required to attain comparable levels of site energy efficiency. The quantification of all newly proposed and re-baselined credits and conservation objectives is TBD, pending technical assistance from the Pacific Northwest National Laboratory (PNNL) analysts who contributed to the development of the 2024 IECC's credit values and targets, as well as other conservation objectives.

In acknowledgment of Connecticut's unusual average ratio of per-unit-energy electricity and natural gas costs, this proposal additionally adopts Appendix CB: Solar Ready Zone – Commercial and Appendix CC: Zero Energy Commercial Building Provisions. Installation or procurement of renewable energy resources at the time of construction will ensure that this proposal's provision of due credit to efficient heat pump equipment will not inadvertently increase energy costs.

Proposed code text is depicted through underlining while proposed deletions are depicted through ~~strike-through~~ formatting. Explanatory text, not intended to be part of the code, is depicted in italics.

Prescriptive pathway. *It is standard practice for credit values to be determined by calculating the savings from the measure compared to a baseline model building using the same fuel for the relevant end use. The 2024 IECC compares heat pump measures to minimum-efficiency electric resistance space heating, while gas furnace measures are compared to a minimum-efficiency gas furnace. This suggests that a building complying with the prescriptive pathway using a natural gas boiler and gas tank water heater may be less energy efficient than an otherwise identical building using an air source heat pump and heat pump water heater.*

The prescriptive pathway in this proposal would instead compare all efficiency measures against a single site energy use intensity (site EUI) baseline using a minimum-efficiency gas furnace and gas tank water heater. A new measure will award credits based on the energy savings from using heat pump equipment rather than gas equipment, where both appliances meet and do not significantly exceed federal minimum appliance efficiency standards.

Performance pathway. *The simulated building performance pathway requires that the site EUI of the “as-designed” model be at least a certain percentage below the site EUI of the “standard reference design” model. The exact percentage required depends on building type and climate zone are to-be-determined by PNNL analysis, such that this pathway will be equally stringent to the prescriptive pathway.*

ASHRAE 90.1 Appendix G pathway. *This pathway amends ASHRAE 90.1 Informative Appendix I and Appendix G, and removes ASHRAE 90.1 prescriptive and energy cost budget compliance options. The modifications adjust Appendix G’s building performance factors (BFP) to reflect site EUI differences instead of energy cost differences. The BPF required depends on building type and climate zone, and are to-be-determined by PNNL analysis, such that this pathway will be equally stringent to the prescriptive pathway.*

Proposal

General

*Adopt the **2024 International Energy Conservation Code**, including **Appendices CB and CC**.*

Amend as follows:

C101.2 Scope. This code applies to the design and construction of buildings not covered by the scope of the IECC—Residential Provisions.

C101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted [and referenced as a requirement of a compliance option. Appendix CB and Appendix CC are adopted as requirements for compliance paths as specified in Section C401.2.](#)

Amend as follows:

ENERGY USE INTENSITY (EUI). The metric indicating the total amount of [site](#) energy consumed by a building in 1 year divided by the gross floor area of the building.

C401.2 Application. Commercial buildings shall comply with [Appendix CB](#), [Appendix CC](#), and either **Section C401.2.1** or **C401.2.2**.

C401.2.1 International Energy Conservation Code. Commercial buildings shall comply with one of the following:

1. Prescriptive Compliance. The Prescriptive Compliance option requires compliance with **Sections C402** through **C406** and **Section C408**. Dwelling units and sleeping units in Group R-2 buildings shall be deemed to be in compliance with this chapter, provided that they comply with **Section R406**.
2. Simulated Building Performance. The Simulated Building Performance option requires compliance with **Section C407**.

C401.2.2 ASHRAE 90.1 [Appendix G](#). Commercial buildings shall comply with the requirements of ANSI/ASHRAE/IES 90.1 [Appendix G](#).

Prescriptive Pathway

Delete Table C406.1.1(1) and replace with Table CF102.1(1). This partial adoption of Appendix CF is intended to prevent this proposal's provision of due credit to heat pump equipment from inadvertently reducing the overall energy efficiency requirements of the code.

Modify C406.2.2 as follows:

C406.2.2 More efficient HVAC equipment performance. All heating and cooling systems shall meet the minimum requirements of Section C403 and efficiency improvements shall be referenced to minimum efficiencies listed in tables referenced by Section C403.3.2. Where multiple efficiency requirements are listed, equipment shall meet the seasonal or part-load efficiencies including SEER, integrated energy efficiency ratio (IEER), integrated part load value (IPLV) or AFUE. Equipment that is larger than the maximum capacity range indicated in tables referenced by Section C403.3.2 shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table. Where multiple individual heating or cooling systems serve the project, the improvement shall be the weighted-average improvement based on individual system capacity. Systems are permitted to achieve HVAC energy credits by meeting the requirements of one of the following:

1. C406.2.2.1 H01.
2. C406.2.2.2 H02.
3. C406.2.2.3 H03.
4. C406.2.2.4 H04.
5. C406.2.2.5 H05.
6. [C406.2.2.6 H06](#).
7. Any combination of H02, H03, H04, ~~and~~ H05 [and H06](#).

C406.2.2.6 H06 High-Efficiency Heating Equipment Credit Alignment. In accordance with **Section C406.1.1**, not less than 90 percent of the total HVAC heating capacity serving the total *conditioned floor area* of the entire *building* or tenant space shall comply with the requirements of this section. This credit is available for all projects that utilize equipment whose heat efficiencies are listed in tables referenced by **Section C403.3.2**. Energy efficiency credits for heating shall be determined using **Equation 4-19**, rounded to the nearest whole number. Supplemental gas and electric heat for heat pump systems shall be excluded from the weighted-average.

$$EEC_{HEHE} = EEC_{Base} \times \frac{EQ_{Design} - 0.8}{2.1} \quad \text{(not less than zero)} \quad \text{Equation 4-19}$$

where:

EEC_{HEHE} = Energy efficiency credits for utilizing high-efficiency equipment listed in the tables referenced by **Section C403.3.2**.

EEC_{Base} = **C406.2.2.6** credits from **Tables C406.2(1)** through **C406.2(9)**.

EQ_{Design} = Minimum required efficiency metric, part-load or annualized where available from **Section C403.3.2**, for the proposed piece of equipment. For heat pumps rated at multiple ambient temperatures, the efficiency at 47°F (8.3°C) shall be used. E_t , E_c , or AFUE efficiency metrics are allowed to be used for combustion appliances. For heat pumps, COP_H shall be used. HSPF2 values shall be divided by 3 to calculate approximate COP_H .

Modify **Section C406.2.3.1.2** as follows:

$$EC_{HPWH} = (EC_{BASE}/0.5) \times \{(CAP_{HPWH})/(Endload)[\text{not greater than } 2]\} \quad \text{Equation 4-1920}$$

Delete the following from **Section C406.2.3.1.2**:

Where the heat pump capacity at 50°F (10°C) entering air and 70°F (21°C) entering water exceeds 50 percent of the design end-use load, excluding recirculating system losses, the base credits from **Section C406.2** shall be prorated based on **Equation 4-20**.

~~$$W02 \text{ credit} = \text{base W02 table credit} \times (HP_i/50\%) \quad \text{Equation 4-20}$$~~

Where:

HP_i = Heat pump capacity as a fraction of the design end-use SHW requirements, excluding recirculating system losses, not to exceed 80 percent.

Amend **Tables C406.2(1)** through **C406.2(9)** so that all credit values are “TBD.” Credit values for existing measures shall be recalculated to reflect site energy improvements compared to a standard reference design that uses natural gas space and water heating equipment, neither of which may exceed the Department of Energy’s currently effective minimum efficiency standard for those products.

*Add Credit H06 to **Tables C406.2(1) through C406.2(9)** as follows. The “TBD” credit values for these measures shall be calculated to reflect site energy improvements compared to a standard reference design that uses natural gas space heating and a package terminal heat pump, neither of which may exceed the Department of Energy’s currently effective minimum efficiency standard for those products.*

[illegible][illegible][illegible][illegible][illegible]

TABLE C406.2(6)
BASE ENERGY CREDITS FOR GROUP M OCCUPANCIES

[illegible]

TABLE C406.2(7)
BASE ENERGY CREDITS FOR GROUP E OCCUPANCIES

[illegible]

TABLE C406.2(8)
BASE ENERGY CREDITS FOR GROUP S-1 AND S-2 OCCUPANCIES

[illegible]

TABLE C406.2(9)
BASE ENERGY CREDITS FOR OTHER OCCUPANCIES

[illegible]

Simulated Building Performance Compliance

Modify **Section C407.2** as follows.

C407.2 Mandatory requirements. Compliance based on simulated building performance requires that a *proposed design* meet all of the following:

1. The requirements of the sections indicated within **Table C407.2(1)**.
2. ~~An annual energy cost that is less than or equal to t~~The required percentage reduction of the annual ~~energy cost energy use intensity~~ (PA_{EUI-EC}) of the proposed design compared to the standard reference design shall be calculated in according to Equation 4-34. ~~Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.~~ The reduction in ~~energy cost energy use intensity~~ of the *proposed design* associated with on-site renewable energy shall be not more than 5 percent of the total ~~energy cost energy use intensity~~. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

$$PAEC = 100 \times (0.80 + 0.025 - EC_r/1000)$$

$$PR_{EUI} = \frac{EUI_{PD}}{EUI_{SRD}}$$

where:

PAEC PR_{EUI} = The percentage reduction of the annual ~~energy cost energy use intensity~~ of the proposed design compared to the standard reference design as required by Table C407.2(2).

~~EC_r = Energy efficiency credits required for the building in accordance with Section C406.1 (do not include load management and renewable credits).~~

EUI_{PD} = The Energy Use Intensity of the proposed design.

EUI_{SRD} = The Energy Use Intensity of the standard reference design.

Exceptions:

1. ~~Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.~~

~~2. Where energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area is substituted for the energy cost, the energy use shall be calculated using source energy factors from Table C407.2(2). For electricity, US locations shall use values from eGRID subregions. Locations outside the United States shall use the value for "All other electricity" or locally derived values.~~

Delete **Table C407.2(2)** and replace with the following. TBD values shall be replaced by required percent reduction figures consistent with the site energy outcomes of compliance with the prescriptive option as specified in **Section C401.2.1**.

TABLE C407.2(2)
REQUIRED PERCENT REDUCTION OF PROPOSED DESIGN COMPARED TO THE
STANDARD REFERENCE DESIGN

BUILDING OCCUPANCY GROUPS	CLIMATE ZONE																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4 and I-1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
I-2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R-1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
B	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
A-2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
M	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
E	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
S-1 and S-2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
All other	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

ASHRAE 90.1 Appendix G Pathway

Modify Section 3 as follows:

baseline building performance: the annual site energy ~~cost~~ for a building design intended for use as a baseline for rating above-standard design or when using the *Performance Rating Method* as an alternative path for minimum standard compliance in accordance with Section 4.2.1.1.

proposed building performance: the annual site energy ~~cost~~ calculated for a proposed design.

Modify Section 4.2.1.1 as follows:

4.2.1.1 New Buildings. New buildings shall comply with Section 4.2.2 through 4.2.5 and ~~either the provisions of~~

~~a. Sections 5, “Building Envelope”; 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; 10, “Other Equipment”; and 11, “Additional Efficiency Requirements,” or~~

~~b. Section 12, “Energy Cost Budget Method,” or~~

~~c. Normative Appendix G, “Performance Rating Method.”~~

Modify Section 4.2.1.2 as follows:

4.2.1.2 Additions to Existing Buildings. *Additions to Existing Buildings* shall comply with Section 4.2.2 through 4.2.5 and ~~one of the following:~~

~~a. Sections 5, “Building Envelope”; 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; 10, “Other Equipment”; and 11, “Additional Efficiency Requirements,” or~~

~~b. Section 12, “Energy Cost Budget Method,” or~~

~~c. Normative Appendix G, “Performance Rating Method.”~~

4.2.1.2.1 When an *addition* to an *existing building* cannot comply by itself, trade-offs will be allowed by modification to one or more of the existing components of the *existing building*. Modeling of the modified components of the *existing building* and *addition* shall employ the procedures ~~of Section 12 or~~ Normative Appendix G; the *addition* shall not increase the *energy* consumption of the *existing building* plus the *addition* beyond the *energy* that would be consumed by the *existing building* plus the *addition* if the *addition* alone did comply.

Modify Section 4.2.1.3 as follows:

4.2.1.3 Alterations of Existing Building Assemblies, Systems, and Equipment. *Alterations of existing building assemblies, systems, and equipment* shall comply with the provisions of Section 4.2.2 through 4.2.5 and ~~one of the following:~~

~~a. Sections 5, “Building Envelope”; 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; 10, “Other Equipment”; and 11, “Additional Efficiency Requirements,” or~~

~~b. Section 12, “Energy Cost Budget Method,” or~~

~~c. Normative Appendix G, “Performance Rating Method,” in accordance with Section 4.2.1.1 with the following modifications:~~

~~1. *Alterations that meet the criteria in Section G3.1.4(a)* shall use the BPF from Table 4.2.1.1 multiplied by 1.05.~~

~~2. All other *alterations modeled following Section G3.3* shall use BPF = 1. Exceptions to 4.2.1.3: A *building* that has been specifically designated as historically significant by the *adopting authority* or is listed in The National Register of Historic Places or has been~~

determined to be eligible for listing by the U.S. Secretary of the Interior need not comply with these requirements.

Modify Section 4.2.1.1 as follows:

[. . .]

When using Normative Appendix G, the Performance ~~Cost~~ Index (~~PCI~~Site Energy) of new *buildings, additions to existing buildings, and/or alterations to existing buildings* shall be less than or equal to the Performance ~~Cost~~ Index Target (~~PCI_t~~) when calculated in accordance with the following:

$$PCI_t = [BBUE_{\text{G}} + (BPF_{\text{Site}} \times BBRE_{\text{G}}) - PRE] / BBP$$

where

~~PCI~~ = Performance ~~Cost~~ Index (Site Energy) calculated in accordance with Section G1.2.

~~BBUE_G~~ = baseline *building* unregulated site energy-cost, the portion of the annual site energy-cost of a *baseline building design* that is due to *unregulated energy use*.

~~BBRE_G~~ = baseline *building* regulated site energy-cost, the portion of the annual site energy-cost of a *baseline building design* that is due to *regulated energy use*.

BPF = *building* performance factor from Table 4.2.1.1. For *building* area types not listed in Table 4.2.1.1 use “All others.” Where a *building* has multiple *building* area types, the required BPF shall be equal to the area-weighted average of the *building* area types based on their *gross floor area*. Where a project includes an *existing building* and an *addition*, the required BPF shall be equal to the area-weighted average, based on the *gross floor area*, of the *existing building* BPF determined as described in Section 4.2.1.3 and the *addition* BPF from Table 4.2.1.1

BBP = baseline *building* performance.

PBP = *proposed building performance*, including the reduced, annual ~~purchased-site energy-cost~~ associated with all *on-site renewable energy* generation systems.

PBP_{nre} = *proposed building performance* without any credit for reduced annual *energy costs* from *onsite renewable energy* generation systems.

PBP_{pre} = *proposed building performance*, excluding any *renewable energy system* in the *proposed design* and including an *on-site renewable energy system* that meets but does not exceed the requirements of Section 10.5.1.1 modeled following the requirements for a *budget building design* in Table 12.5.1.

PRE = PBP_{nre} – PBP_{pre}

When $(PBP_{pre} - PBP)/BBP > 0.05$, new buildings, additions to existing buildings, and/or alterations to existing buildings shall comply with the following:

$$PCI + [(PBP_{pre} - PBP)/BBP] - 0.05 < PCI_t$$

Informative Notes:

1. PBP_{nre} = proposed building performance, no renewable energy
2. PBP_{pre} = proposed building performance, prescriptive renewable energy
3. PRE = prescriptive renewable energy

~~Regulated site energy cost shall be calculated by multiplying the total site energy cost by the ratio of regulated energy use to total energy use for each fuel type. Unregulated energy cost shall be calculated by subtracting regulated energy cost from total energy cost.~~

Replace Table 4.2.1.1 with the Table below. TBD values shall be replaced by building performance factors consistent with the site energy outcomes of compliance with the prescriptive option of this Overlay as specified in **Section C401.2.1**.

Table 4.2.1.1 Building Performance Factors (BPF), Site Energy

Building Area Type	Climate Zone																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Multifamily	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Healthcare/hospital	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Hotel/motel	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Restaurant	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Retail	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
School	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Warehouse	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
All other	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Modify Section G1.2.2 as follows:

The performance of the *proposed design* is calculated in accordance with provisions of this appendix using the following formula:

Performance-~~Cost~~ Index = Proposed building performance/Baseline building performance

Both the *proposed building performance* and the *baseline building performance* shall include all enduses load components within and associated with the *building* when calculating the Performance-~~Cost~~ Site Energy Index.

Modify Section G1.3.2(a) and G1.3.2(p) as follows:

[...]

The following documentation shall be submitted to the *rating authority*:

- a. The *simulation program* used, the version of the *simulation program*, and the results of the *energy analysis* including the calculated values for the baseline *building* unregulated site energy cost (BBUE~~C~~), baseline *building* regulated site energy cost (BBRE~~C~~), *building performance factor* (BPF), *baseline building performance*, the *proposed building performance*, ~~Performance Cost~~ Site Energy Index (P~~C~~I), and Performance Cost-Site Energy Index Target (P~~C~~I_t).

[...]

- p. For any exceptional calculation methods employed, document the predicted *energy savings* by *energy type*, the site energy cost savings, a narrative explaining the exceptional calculation method performed, and theoretical or empirical information supporting the accuracy of the method.

Modify Section G2.4.2 as follows:

G2.4.2 Annual-~~Energy Costs~~ Site Energy. ~~The design energy cost and baseline energy cost shall be determined using either actual rates for purchased energy or state average energy prices published by DOE's Energy Information Administration (EIA) for commercial building customers, but rates from different sources may not be mixed in the same project.~~

G2.4.2.1 The *baseline building performance* and *proposed building performance* shall be determined using conversion factors in Table G2.1.

Table G2.1 Units of Fuel to Site Energy Conversion Factor

<u>Building Project Energy</u>	<u>Units</u>	<u>Site Energy, Btu/unit</u>
<u>Electricity</u>	<u>kWh</u>	<u>3,412</u>
<u>Natural Gas</u>	<u>Therm</u>	<u>100,000</u>
<u>Propane</u>	<u>Therm</u>	<u>100,000</u>
<u>Distillate fuel oil</u>	<u>Gal</u>	<u>137,600</u>

G2.4.2.2 Where *on-site renewable energy* or *site-recovered energy* is used, the *baseline building design* shall be based on the *energy source* used as the *backup energy source*, or the *baseline system energy source* in that category if

no backup *energy* source has been specified, except where the baseline *energy* source is prescribed in Table G3.1.1-2 and G3.1.1-3. Where the *proposed design* includes *on-site electricity generation systems* other than *on-site renewable energy systems*, the *baseline design* shall include the same generation systems excluding its *site-recovered energy*.

~~**Informative Note:** The above provision allows users to gain credit for features that yield load management benefits. Where such features are not present, users can simply use state average unit prices from EIA, which are updated annually and readily available on EIA's web site (<http://www.eia.gov>).~~

Modify Section G2.5(e) as follows:

[. . .]

e. The Performance ~~Cost~~ Index calculated with and without the exceptional calculation method

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Justification and Analysis

The 2024 International Energy Conservation Code (IECC) allows mixed fuel buildings to be deemed code compliant while using significantly more energy than buildings that use only electricity. This proposal adjusts all compliance options so that mixed-fuel and heat pump buildings will be required to meet comparable levels of site energy efficiency. The quantification of all newly proposed and re-baselined credits and conservation objectives is TBD, pending technical assistance from the Pacific Northwest National Laboratory (PNNL) analysts who contributed to the development of the 2024 IECC's Section R408 credit values and targets, as well as other residential conservation objectives.

This proposal adopts the conservation objectives of Appendix RG, with the intention of ensuring that the proposal's provision of due credit for energy savings from heat pump equipment does not inadvertently reduce the energy efficiency requirements of the code.

In acknowledgment of Connecticut's unusual average ratio of per-unit-energy electricity and natural gas costs, this proposal additionally adopts Appendix RL: Renewable Energy Infrastructure. This appendix will ease building owner access to low-cost renewable energy and reduce reliance on expensive, cost-volatile, and higher-emission energy types.

Proposed code text is depicted through underlining while proposed deletions are depicted through ~~strike-through formatting~~. Explanatory text, not intended to be part of the code, is depicted in italics.

Prescriptive pathway. *It is standard practice for credit values to be determined by calculating the savings from the measure compared to a baseline model building using the same fuel for the relevant end use. The baseline model compares heat pump measures to minimum-efficiency electric resistance space heating, while gas furnace measures are compared to a minimum-efficiency gas furnace. This suggests that a*

home complying with the prescriptive pathway using a natural gas furnace and gas tank water heater may be less energy efficient than an otherwise identical home using an air source heat pump and heat pump water heater.

The prescriptive pathway in this proposal would instead compare all efficiency measures against a single site energy use baseline using a minimum-efficiency gas furnace and gas tank water heater. A new measure will award credits based on the energy savings from using an air source heat pump rather than a gas furnace, where the installed and comparison systems each meet and do not exceed federal minimum appliance efficiency standards. A second, analogous new measure will award credits based on the energy savings from using a heat pump water heater rather than a gas tank water heater, where the installed and the comparison appliances each meets and does not exceed federal minimum appliance efficiency standards.

ERI pathway. *The Energy Rating Index (ERI) metric is a relative rating against a building of the same fuel type complying with the 2006 IECC. A home earning an ERI score of 48 that uses gas for space and water heating may, therefore, be less efficient than another home with an ERI score of 48 that uses electric equipment for space and water heating. To compensate for this issue and ensure all homes reach the same conservation outcome regardless of fuel type, this proposal's ERI pathway allows a higher maximum ERI score if a building does not use purchased energy other than electricity for space or water heating. The amount of the ERI value increase is to-be-determined by PNNL or HERS rater analysis and will be calculated such that mixed fuel and electricity-heated buildings will be required to attain equal site energy use in each climate zone.*

Performance pathway. *The proposed simulated building performance pathway uses natural gas space and water heating products for the standard reference design regardless of the fuels used in the proposed design. This ensures homes of any fuel type must meet the same conservation objective. Notably, this proposal eliminates a provision that allows all-electric buildings to comply while reducing energy cost less than combustion buildings compared to their respective standard reference designs.*

Additionally, performance is quantified in site energy use, rather than energy cost. Site energy use is the performance metric over which the designer has the greatest control. Site energy use can also be estimated with greater confidence than energy cost because the occupant's energy provider or rate will not affect it.

Finally, this option increases the stringency of the envelope backstop to ensure any reduction in efficiency of the standard reference design does not inadvertently allow installation of an outdated envelope.

Proposal

General

*Adopt the **2024 International Energy Conservation Code**, including **Appendix RG** and **Appendix RL**, with the following language.*

R101.2 Scope. This code applies to the design and construction of detached one- and two-family dwellings and multiple single-family dwellings (townhouses) and Group R-2, R-3 and R-4 buildings three stories or less in height above *grade plane*.

R101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted and referenced as a requirement of a compliance option. **Appendix RG** and **Appendix RL** are adopted as requirements for compliance paths as specified in **Section R401.2**.

Amend as follows.

R401.2 Application. Residential buildings shall comply with **Appendix RL** and one of **Sections R401.2.1, R401.2.2, R401.2.3** or **R401.2.4**.

R401.2.1 Prescriptive Compliance Option. The Prescriptive Compliance Option requires compliance with **Sections R401** through **R404** and **R408**, as amended by **Appendix RG Section RG101.3**.

R401.2.2 Simulated building Performance Option. The Simulated building Performance Option requires compliance with **Section R405** as amended by **Appendix RG Section RG101.1**.

R401.2.3 Energy Rating Index Option. The *Energy Rating Index* (ERI) Option requires compliance with **Section R406** as amended by **Appendix RG Section RG101.2**.

ERI Compliance

*Amend as follows. The to-be-determined ERI values in the new **Table RG101.2** columns shall be calculated such that they result in equivalent site energy outcomes for a building that uses natural gas for space and water heating and attains the ERI indicated in the model code's **Table RG101.2** and a building that meets the enumerated requirements and attains the increased, electric-heat-building ERI.*

RG101.2 (R406.5) ERI-based compliance. Compliance based on an *Energy Rating Index* (ERI) analysis requires that the *rated design* and each confirmed as-built *dwelling unit* be shown to have an *ERI* less than or equal to the applicable value indicated in **Table RG101.2** where compared to the *ERI reference design* as follows:

1. Where the building uses *purchased energy* that is not electricity for space heating or service water heating and on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP, MIXED-FUEL BUILDING applies.
2. Where the building does not use *purchased energy* that is not electricity for space heating or service water heating and on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP, ELECTRIC HEAT BUILDING applies.
- ~~2.~~ 3. Where the building uses *purchased energy* that is not electricity for space heating or service water heating and on-site renewables are installed, the maximum ENERGY RATING INDEX WITH OPP, MIXED-FUEL BUILDING applies.
4. Where the building does not use *purchased energy* that is not electricity for space heating or service water heating and on-site renewables are installed, the maximum ENERGY RATING INDEX WITH OPP, ELECTRIC HEAT BUILDING applies.

Amend table as follows.

TABLE RG101.2
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP		ENERGY RATING INDEX WITH OPP	
	<u>MIXED-FUEL BUILDING</u>	<u>ELECTRIC HEAT BUILDING</u>	<u>MIXED-FUEL BUILDING</u>	<u>ELECTRIC HEAT BUILDING</u>
0 and 1	46	TBD	27	TBD
2	46	TBD	26	TBD
3	45	TBD	24	TBD
4	48	TBD	32	TBD
5	49	TBD	37	TBD
6	48	TBD	39	TBD
7	47	TBD	43	TBD
8	47	TBD	43	TBD

Prescriptive Compliance

Amend **Table R408.2** so that all credit values are “TBD.” Credit values for existing measures shall be recalculated to reflect site energy improvements compared to a standard reference design that uses a natural gas furnace and natural gas tank water heater, neither of which may exceed the Department of Energy’s currently effective minimum efficiency standard for those products.

Add rows to **Table R408.2** as follows. The “TBD” credit values for these new measures shall be calculated to reflect site energy improvements compared to a standard reference design that uses a natural gas furnace and a natural gas tank water heater, neither of which may exceed the Department of Energy’s currently effective minimum efficiency standard for those products.

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE			
		Climate Zone 4	Climate Zone 5	Climate Zone 6	Climate Zone 7
<u>R408.2.2(15)</u>	<u>Federal Minimum Efficiency Heat pump</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
<u>R408.2.3(8)</u>	<u>Federal Minimum Efficiency Heat pump water heater</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>

Add option under **R408.2.2** as follows:

15. Federal Minimum Efficiency Heat pump: Air source heat pump having an efficiency rating equal to or exceeding the minimum required by federal law for the geographic location where the equipment is installed.

Add a row in **Table R408.2.3** as follows:

MEASURE NUMBER	WATER HEATER	SIZE AND DRAW PATTERN	TYPE	EFFICIENCY
<u>R408.2.3(8)</u>	<u>Federal Minimum Efficiency Heat pump water heater</u>	<u>Any</u>	<u>HPWH with or without hybrid electric resistance element</u>	<u>Any efficiency equal to or exceeding currently effective US Department of Energy minimum energy efficiency standards</u>

Simulated Building Performance Compliance

Amend **Section R202** as follows:

SITE ENERGY USE. The metric indicating the total amount of energy consumed by a *building* in 1 year.

Amend as follows:

RG101.1 (R405.2) Simulated building performance compliance. Compliance based on *simulated building performance* requires that a *building* comply with the following:

1. The requirements of the sections indicated within **Table R405.2**.
2. The proposed total *building thermal envelope* thermal conductance, TC, shall be less than or equal to the *building thermal envelope* TC using the prescriptive *U*-factors and *F*-factors from **Table R402.1.2** multiplied by ~~1.08~~ 1.05 in Climate Zones 0, 1 and 2, and ~~1.15~~ in Climate Zones 3 through 8 in accordance with **Equation 4-2** and **Section R402.1.5**. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.
3. ~~For each dwelling unit with one or more fuel-burning appliances for space heating, water heating, or both, the~~ The annual energy cost site energy use of the each dwelling unit shall be less than or equal to 70 percent of the annual ~~energy cost~~ site energy use of the *standard reference design*. ~~For all other dwelling units, the annual energy cost of the dwelling unit shall be less than or equal to 75 percent of the annual energy cost of the~~

~~standard reference design.~~ For each *dwelling unit* with greater than 5,000 square feet (465 m²) of *living space* located above *grade plane*, the annual ~~energy cost~~ site energy use of the *dwelling unit* shall be reduced by an additional 5 percent of annual ~~energy cost~~ site energy use of the *standard reference design*. ~~Energy prices shall be taken from an approved source, such as the US Energy Information Administration's state energy data system prices and expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.~~

Exceptions:

- ~~1. The energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 2.51. The source energy multiplier for fuels other than electricity shall be 1.09.~~
- ~~2. The energy use based on site energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost.~~

Amend **Table R405.4.2(1)** to require a standard reference design that uses minimum-efficiency natural gas equipment for space and water heating as follows. Rows not depicted, including sub-rows, are unchanged.

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems ^{d, e, j-k}	Fuel type/capacity: <u>natural gas, with capacity the same as proposed design.</u>	As proposed.
	Product class: <u>if the proposed design uses only natural gas heating systems, same as proposed design. For any proposed heating systems</u>	As proposed.

	that do not use natural gas, <u>the standard reference design</u> shall include a <u>heating system of a product class that uses natural gas. For proposed designs with forced air or electric resistance radiative heating systems, substitute a furnace. For proposed designs with hydronic heating systems, substitute a boiler.</u>	
	Efficiencies:	
	Heat pump: complying with 10 CFR §430.32.	As proposed.
	Fuel gas and liquid fuel furnaces: complying with <u>and having efficiency ratings equal to the minimum requirements of 10 CFR §430.32.</u>	Forced air and electric resistance heating systems as proposed.
	Fuel gas and liquid fuel boilers: complying with <u>and having efficiency ratings equal to the minimum requirements of 10 CFR §430.32.</u>	Hydronic heating systems as proposed.
Service water heating ^{d, g, k}	Fuel type <u>and product class: same as proposed design-natural gas tank water heater complying with and having efficiency ratings equal to the minimum requirements of 10 CFR §430.32.</u>	As proposed.

Thermal distribution systems	Duct insulation: in accordance with Section R403.3.3.	Duct insulation: as proposed. ^{mk}
	Duct location:	Duct location: as proposed. ^{lj}

SI unit information and footnotes a, b, and c are unchanged. Amend footnote d as follows:

d. For a proposed design with multiple heating, cooling or water heating systems using different ~~fuel types-product classes~~, the applicable standard reference design system capacities and ~~fuel types-product classes~~ shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each ~~equipment and fuel type-product class~~ present.

Footnotes e and f are unchanged. Amend footnote g as follows:

g. For a proposed design without a proposed water heater, the following assumptions shall be made for ~~both~~ the proposed design and the standard reference design. ~~For a proposed design with a heat pump water heater, the following assumptions shall be made for the standard reference design, except the fuel type shall be electric.~~

Fuel type: for the standard reference design, natural gas. For the proposed design, the same as the predominant heating fuel type in the proposed design.

Rated storage volume: 40 gallons

Draw pattern: medium

Efficiency: Uniform Energy Factor complying with and not exceeding the minimum efficiency requirements of 10 CFR § 430.32

Footnotes h and i are unchanged. Delete footnotes j and k. Renumber footnote l as footnote j. Renumber footnote m as footnote k.

RMI Proposal 1 to Connecticut's Adoption of the 2024 International Energy Conservation Code for Commercial Buildings

Justification and Analysis

The 2024 International Energy Conservation Code (IECC) allows mixed fuel buildings to be deemed code compliant while using significantly more energy than buildings that use only electricity. This proposal adjusts all compliance options so that mixed fuel and electric-only buildings will be required to attain comparable levels of site energy efficiency. The quantification of all newly proposed and re-baselined credits and conservation objectives is TBD, pending technical assistance from the Pacific Northwest National Laboratory (PNNL) analysts who contributed to the development of the 2024 IECC's credit values and targets, as well as other conservation objectives.

In acknowledgment of Connecticut's unusual average ratio of per-unit-energy electricity and natural gas costs, this proposal additionally adopts Appendix CB: Solar Ready Zone – Commercial and Appendix CC: Zero Energy Commercial Building Provisions. Installation or procurement of renewable energy resources at the time of construction will ensure that this proposal's provision of due credit to efficient heat pump equipment will not inadvertently increase energy costs.

Proposed code text is depicted through underlining while proposed deletions are depicted through ~~strike-through~~ formatting. Explanatory text, not intended to be part of the code, is depicted in italics.

Prescriptive pathway. *It is standard practice for credit values to be determined by calculating the savings from the measure compared to a baseline model building using the same fuel for the relevant end use. The 2024 IECC compares heat pump measures to minimum-efficiency electric resistance space heating, while gas furnace measures are compared to a minimum-efficiency gas furnace. This suggests that a building complying with the prescriptive pathway using a natural gas boiler and gas tank water heater may be less energy efficient than an otherwise identical building using an air source heat pump and heat pump water heater.*

The prescriptive pathway in this proposal would instead compare all efficiency measures against a single site energy use intensity (site EUI) baseline using a minimum-efficiency gas furnace and gas tank water heater. A new measure will award credits based on the energy savings from using heat pump equipment rather than gas equipment, where both appliances meet and do not significantly exceed federal minimum appliance efficiency standards.

Performance pathway. *The simulated building performance pathway requires that the site EUI of the “as-designed” model be at least a certain percentage below the site EUI of the “standard reference design” model. The exact percentage required depends on building type and climate zone are to-be-determined by PNNL analysis, such that this pathway will be equally stringent to the prescriptive pathway.*

ASHRAE 90.1 Appendix G pathway. *This pathway amends ASHRAE 90.1 Informative Appendix I and Appendix G, and removes ASHRAE 90.1 prescriptive and energy cost budget compliance options. The modifications adjust Appendix G’s building performance factors (BFP) to reflect site EUI differences instead of energy cost differences. The BPF required depends on building type and climate zone, and are to-be-determined by PNNL analysis, such that this pathway will be equally stringent to the prescriptive pathway.*

Proposal

General

*Adopt the **2024 International Energy Conservation Code**, including **Appendices CB and CC**.*

Amend as follows:

C101.2 Scope. This code applies to the design and construction of buildings not covered by the scope of the IECC—Residential Provisions.

C101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted [and referenced as a requirement of a compliance option. Appendix CB and Appendix CC are adopted as requirements for compliance paths as specified in Section C401.2.](#)

Amend as follows:

ENERGY USE INTENSITY (EUI). The metric indicating the total amount of [site](#) energy consumed by a building in 1 year divided by the gross floor area of the building.

C401.2 Application. Commercial buildings shall comply with [Appendix CB](#), [Appendix CC](#), and either **Section C401.2.1** or **C401.2.2**.

C401.2.1 International Energy Conservation Code. Commercial buildings shall comply with one of the following:

1. Prescriptive Compliance. The Prescriptive Compliance option requires compliance with **Sections C402** through **C406** and **Section C408**. Dwelling units and sleeping units in Group R-2 buildings shall be deemed to be in compliance with this chapter, provided that they comply with **Section R406**.
2. Simulated Building Performance. The Simulated Building Performance option requires compliance with **Section C407**.

C401.2.2 ASHRAE 90.1 [Appendix G](#). Commercial buildings shall comply with the requirements of ANSI/ASHRAE/IES 90.1 [Appendix G](#).

Prescriptive Pathway

Delete Table C406.1.1(1) and replace with Table CF102.1(1). This partial adoption of Appendix CF is intended to prevent this proposal's provision of due credit to heat pump equipment from inadvertently reducing the overall energy efficiency requirements of the code.

Modify C406.2.2 as follows:

C406.2.2 More efficient HVAC equipment performance. All heating and cooling systems shall meet the minimum requirements of Section C403 and efficiency improvements shall be referenced to minimum efficiencies listed in tables referenced by Section C403.3.2. Where multiple efficiency requirements are listed, equipment shall meet the seasonal or part-load efficiencies including SEER, integrated energy efficiency ratio (IEER), integrated part load value (IPLV) or AFUE. Equipment that is larger than the maximum capacity range indicated in tables referenced by Section C403.3.2 shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table. Where multiple individual heating or cooling systems serve the project, the improvement shall be the weighted-average improvement based on individual system capacity. Systems are permitted to achieve HVAC energy credits by meeting the requirements of one of the following:

1. C406.2.2.1 H01.
2. C406.2.2.2 H02.
3. C406.2.2.3 H03.
4. C406.2.2.4 H04.
5. C406.2.2.5 H05.
6. [C406.2.2.6 H06](#).
7. Any combination of H02, H03, H04, ~~and~~ H05 [and H06](#).

C406.2.2.6 H06 High-Efficiency Heating Equipment Credit Alignment. In accordance with **Section C406.1.1**, not less than 90 percent of the total HVAC heating capacity serving the total *conditioned floor area* of the entire *building* or tenant space shall comply with the requirements of this section. This credit is available for all projects that utilize equipment whose heat efficiencies are listed in tables referenced by **Section C403.3.2**. Energy efficiency credits for heating shall be determined using **Equation 4-19**, rounded to the nearest whole number. Supplemental gas and electric heat for heat pump systems shall be excluded from the weighted-average.

$$EEC_{HEHE} = EEC_{Base} \times \frac{EQ_{Design} - 0.8}{2.1} \quad \text{(not less than zero)} \quad \text{Equation 4-19}$$

where:

EEC_{HEHE} = Energy efficiency credits for utilizing high-efficiency equipment listed in the tables referenced by **Section C403.3.2**.

EEC_{Base} = **C406.2.2.6** credits from **Tables C406.2(1)** through **C406.2(9)**.

EQ_{Design} = Minimum required efficiency metric, part-load or annualized where available from **Section C403.3.2**, for the proposed piece of equipment. For heat pumps rated at multiple ambient temperatures, the efficiency at 47°F (8.3°C) shall be used. E_t , E_c , or AFUE efficiency metrics are allowed to be used for combustion appliances. For heat pumps, COP_H shall be used. HSPF2 values shall be divided by 3 to calculate approximate COP_H .

Modify **Section C406.2.3.1.2** as follows:

$$EC_{HPWH} = (EC_{BASE}/0.5) \times \{(CAP_{HPWH})/(Endload)[\text{not greater than } 2]\} \quad \text{Equation 4-1920}$$

Delete the following from **Section C406.2.3.1.2**:

Where the heat pump capacity at 50°F (10°C) entering air and 70°F (21°C) entering water exceeds 50 percent of the design end-use load, excluding recirculating system losses, the base credits from **Section C406.2** shall be prorated based on **Equation 4-20**.

~~$$W02 \text{ credit} = \text{base W02 table credit} \times (HP_i/50\%) \quad \text{Equation 4-20}$$~~

Where:

HP_i = Heat pump capacity as a fraction of the design end-use SHW requirements, excluding recirculating system losses, not to exceed 80 percent.

Amend **Tables C406.2(1)** through **C406.2(9)** so that all credit values are “TBD.” Credit values for existing measures shall be recalculated to reflect site energy improvements compared to a standard reference design that uses natural gas space and water heating equipment, neither of which may exceed the Department of Energy’s currently effective minimum efficiency standard for those products.

*Add Credit H06 to **Tables C406.2(1) through C406.2(9)** as follows. The “TBD” credit values for these measures shall be calculated to reflect site energy improvements compared to a standard reference design that uses natural gas space heating and a package terminal heat pump, neither of which may exceed the Department of Energy’s currently effective minimum efficiency standard for those products.*

[illegible][illegible][illegible][illegible][illegible]

TABLE C406.2(6)
BASE ENERGY CREDITS FOR GROUP M OCCUPANCIES

[illegible]

TABLE C406.2(7)
BASE ENERGY CREDITS FOR GROUP E OCCUPANCIES

[illegible]

TABLE C406.2(8)
BASE ENERGY CREDITS FOR GROUP S-1 AND S-2 OCCUPANCIES

[illegible]

TABLE C406.2(9)
BASE ENERGY CREDITS FOR OTHER OCCUPANCIES

[illegible]

Simulated Building Performance Compliance

Modify **Section C407.2** as follows.

C407.2 Mandatory requirements. Compliance based on simulated building performance requires that a *proposed design* meet all of the following:

1. The requirements of the sections indicated within **Table C407.2(1)**.
2. ~~An annual energy cost that is less than or equal to t~~The required percentage reduction of the annual ~~energy cost energy use intensity~~ (PA_{EUI-EC}) of the proposed design compared to the standard reference design shall be calculated in according to Equation 4-34. ~~Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.~~ The reduction in ~~energy cost energy use intensity~~ of the *proposed design* associated with on-site renewable energy shall be not more than 5 percent of the total ~~energy cost energy use intensity~~. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

$$PAEC = 100 \times (0.80 + 0.025 - EC_r/1000)$$

$$PR_{EUI} = \frac{EUI_{PD}}{EUI_{SRD}}$$

where:

PAEC PR_{EUI} = The percentage reduction of the annual ~~energy cost energy use intensity~~ of the proposed design compared to the standard reference design as required by Table C407.2(2).

~~EC_r = Energy efficiency credits required for the building in accordance with Section C406.1 (do not include load management and renewable credits).~~

EUI_{PD} = The Energy Use Intensity of the proposed design.

EUI_{SRD} = The Energy Use Intensity of the standard reference design.

Exceptions:

1. ~~Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.~~

~~2. Where energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area is substituted for the energy cost, the energy use shall be calculated using source energy factors from Table C407.2(2). For electricity, US locations shall use values from eGRID subregions. Locations outside the United States shall use the value for "All other electricity" or locally derived values.~~

Delete **Table C407.2(2)** and replace with the following. TBD values shall be replaced by required percent reduction figures consistent with the site energy outcomes of compliance with the prescriptive option as specified in **Section C401.2.1**.

TABLE C407.2(2)
REQUIRED PERCENT REDUCTION OF PROPOSED DESIGN COMPARED TO THE
STANDARD REFERENCE DESIGN

BUILDING OCCUPANCY GROUPS	CLIMATE ZONE																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4 and I-1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
I-2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R-1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
B	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
A-2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
M	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
E	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
S-1 and S-2	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
All other	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

ASHRAE 90.1 Appendix G Pathway

Modify Section 3 as follows:

baseline building performance: the annual site energy ~~cost~~ for a building design intended for use as a baseline for rating above-standard design or when using the *Performance Rating Method* as an alternative path for minimum standard compliance in accordance with Section 4.2.1.1.

proposed building performance: the annual site energy ~~cost~~ calculated for a proposed design.

Modify Section 4.2.1.1 as follows:

4.2.1.1 New Buildings. New buildings shall comply with Section 4.2.2 through 4.2.5 and ~~either the provisions of~~

~~a. Sections 5, “Building Envelope”; 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; 10, “Other Equipment”; and 11, “Additional Efficiency Requirements,” or~~

~~b. Section 12, “Energy Cost Budget Method,” or~~

~~c. Normative Appendix G, “Performance Rating Method.”~~

Modify Section 4.2.1.2 as follows:

4.2.1.2 Additions to Existing Buildings. *Additions to Existing Buildings* shall comply with Section 4.2.2 through 4.2.5 and ~~one of the following:~~

~~a. Sections 5, “Building Envelope”; 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; 10, “Other Equipment”; and 11, “Additional Efficiency Requirements,” or~~

~~b. Section 12, “Energy Cost Budget Method,” or~~

~~c. Normative Appendix G, “Performance Rating Method.”~~

4.2.1.2.1 When an *addition* to an *existing building* cannot comply by itself, trade-offs will be allowed by modification to one or more of the existing components of the *existing building*. Modeling of the modified components of the *existing building* and *addition* shall employ the procedures ~~of Section 12 or~~ Normative Appendix G; the *addition* shall not increase the *energy* consumption of the *existing building* plus the *addition* beyond the *energy* that would be consumed by the *existing building* plus the *addition* if the *addition* alone did comply.

Modify Section 4.2.1.3 as follows:

4.2.1.3 Alterations of Existing Building Assemblies, Systems, and Equipment. *Alterations of existing building assemblies, systems, and equipment* shall comply with the provisions of Section 4.2.2 through 4.2.5 and ~~one of the following:~~

~~a. Sections 5, “Building Envelope”; 6, “Heating, Ventilating, and Air Conditioning”; 7, “Service Water Heating”; 8, “Power”; 9, “Lighting”; 10, “Other Equipment”; and 11, “Additional Efficiency Requirements,” or~~

~~b. Section 12, “Energy Cost Budget Method,” or~~

~~c. Normative Appendix G, “Performance Rating Method,” in accordance with Section 4.2.1.1 with the following modifications:~~

~~1. Alterations that meet the criteria in Section G3.1.4(a) shall use the BPF from Table 4.2.1.1 multiplied by 1.05.~~

~~2. All other alterations modeled following Section G3.3 shall use BPF = 1. Exceptions to 4.2.1.3: A building that has been specifically designated as historically significant by the adopting authority or is listed in The National Register of Historic Places or has been~~

determined to be eligible for listing by the U.S. Secretary of the Interior need not comply with these requirements.

Modify Section 4.2.1.1 as follows:

[. . .]

When using Normative Appendix G, the Performance ~~Cost~~ Index (~~PCI~~Site Energy) of new *buildings, additions to existing buildings, and/or alterations to existing buildings* shall be less than or equal to the Performance ~~Cost~~ Index Target (~~PCI_t~~) when calculated in accordance with the following:

$$PCI_t = [BBUE_{\text{G}} + (BPF_{\text{Site}} \times BBRE_{\text{G}}) - PRE] / BBP$$

where

~~PCI~~ = Performance ~~Cost~~ Index (Site Energy) calculated in accordance with Section G1.2.

~~BBUE_G~~ = baseline *building* unregulated site energy-cost, the portion of the annual site energy cost of a *baseline building design* that is due to *unregulated energy use*.

~~BBRE_G~~ = baseline *building* regulated site energy-cost, the portion of the annual site energy cost of a *baseline building design* that is due to *regulated energy use*.

BPF = *building* performance factor from Table 4.2.1.1. For *building* area types not listed in Table 4.2.1.1 use “All others.” Where a *building* has multiple *building* area types, the required BPF shall be equal to the area-weighted average of the *building* area types based on their *gross floor area*. Where a project includes an *existing building* and an *addition*, the required BPF shall be equal to the area-weighted average, based on the *gross floor area*, of the *existing building* BPF determined as described in Section 4.2.1.3 and the *addition* BPF from Table 4.2.1.1

BBP = baseline *building* performance.

PBP = *proposed building performance*, including the reduced, annual ~~purchased-site energy cost~~ associated with all *on-site renewable energy* generation systems.

PBP_{nre} = *proposed building performance* without any credit for reduced annual *energy costs* from *onsite renewable energy* generation systems.

PBP_{pre} = *proposed building performance*, excluding any *renewable energy system* in the *proposed design* and including an *on-site renewable energy system* that meets but does not exceed the requirements of Section 10.5.1.1 modeled following the requirements for a *budget building design* in Table 12.5.1.

PRE = PBP_{nre} – PBP_{pre}

When $(PBP_{pre} - PBP)/BBP > 0.05$, new buildings, additions to existing buildings, and/or alterations to existing buildings shall comply with the following:

$$PCI + [(PBP_{pre} - PBP)/BBP] - 0.05 < PCI_t$$

Informative Notes:

1. PBP_{nre} = proposed building performance, no renewable energy
2. PBP_{pre} = proposed building performance, prescriptive renewable energy
3. PRE = prescriptive renewable energy

~~Regulated site energy cost shall be calculated by multiplying the total site energy cost by the ratio of regulated energy use to total energy use for each fuel type. Unregulated energy cost shall be calculated by subtracting regulated energy cost from total energy cost.~~

Replace Table 4.2.1.1 with the Table below. TBD values shall be replaced by building performance factors consistent with the site energy outcomes of compliance with the prescriptive option of this Overlay as specified in **Section C401.2.1**.

Table 4.2.1.1 Building Performance Factors (BPF), Site Energy

Building Area Type	Climate Zone																		
	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Multifamily	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Healthcare/hospital	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Hotel/motel	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Office	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Restaurant	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Retail	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
School	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Warehouse	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
All other	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Modify Section G1.2.2 as follows:

The performance of the *proposed design* is calculated in accordance with provisions of this appendix using the following formula:

Performance-~~Cost~~ Index = *Proposed building performance/Baseline building performance*

Both the *proposed building performance* and the *baseline building performance* shall include all enduses load components within and associated with the *building* when calculating the Performance-~~Cost~~ Site Energy Index.

Modify Section G1.3.2(a) and G1.3.2(p) as follows:

[...]

The following documentation shall be submitted to the *rating authority*:

- a. The *simulation program* used, the version of the *simulation program*, and the results of the *energy analysis* including the calculated values for the baseline *building* unregulated site energy cost (BBUEC), baseline *building* regulated site energy cost (BBREC), *building performance factor* (BPF), *baseline building performance*, the *proposed building performance*, ~~Performance Cost~~ Site Energy Index (PCI), and Performance Cost-Site Energy Index Target (PCIT).

[...]

- p. For any exceptional calculation methods employed, document the predicted *energy savings* by *energy type*, the site energy cost savings, a narrative explaining the exceptional calculation method performed, and theoretical or empirical information supporting the accuracy of the method.

Modify Section G2.4.2 as follows:

G2.4.2 Annual ~~Energy Costs~~ Site Energy. ~~The design energy cost and baseline energy cost shall be determined using either actual rates for purchased energy or state average energy prices published by DOE's Energy Information Administration (EIA) for commercial building customers, but rates from different sources may not be mixed in the same project.~~

G2.4.2.1 The baseline building performance and proposed building performance shall be determined using conversion factors in Table G2.1.

Table G2.1 Units of Fuel to Site Energy Conversion Factor

<u>Building Project Energy</u>	<u>Units</u>	<u>Site Energy, Btu/unit</u>
<u>Electricity</u>	<u>kWh</u>	<u>3,412</u>
<u>Natural Gas</u>	<u>Therm</u>	<u>100,000</u>
<u>Propane</u>	<u>Therm</u>	<u>100,000</u>
<u>Distillate fuel oil</u>	<u>Gal</u>	<u>137,600</u>

G2.4.2.2 Where on-site renewable energy or site-recovered energy is used, the baseline building design shall be based on the energy source used as the backup energy source, or the baseline system energy source in that category if

no backup *energy* source has been specified, except where the baseline *energy* source is prescribed in Table G3.1.1-2 and G3.1.1-3. Where the *proposed design* includes *on-site electricity generation systems* other than *on-site renewable energy systems*, the *baseline design* shall include the same generation systems excluding its *site-recovered energy*.

~~**Informative Note:** The above provision allows users to gain credit for features that yield load management benefits. Where such features are not present, users can simply use state average unit prices from EIA, which are updated annually and readily available on EIA's web site (<http://www.eia.gov>).~~

Modify Section G2.5(e) as follows:

[. . .]

e. The Performance ~~Cost~~ Index calculated with and without the exceptional calculation method

RMI Proposal 1 to Connecticut's Adoption of the 2024 International Energy Conservation Code for Residential Buildings

Justification and Analysis

The 2024 International Energy Conservation Code (IECC) allows mixed fuel buildings to be deemed code compliant while using significantly more energy than buildings that use only electricity. This proposal adjusts all compliance options so that mixed-fuel and heat pump buildings will be required to meet comparable levels of site energy efficiency. The quantification of all newly proposed and re-baselined credits and conservation objectives is TBD, pending technical assistance from the Pacific Northwest National Laboratory (PNNL) analysts who contributed to the development of the 2024 IECC's Section R408 credit values and targets, as well as other residential conservation objectives.

This proposal adopts the conservation objectives of Appendix RG, with the intention of ensuring that the proposal's provision of due credit for energy savings from heat pump equipment does not inadvertently reduce the energy efficiency requirements of the code.

In acknowledgment of Connecticut's unusual average ratio of per-unit-energy electricity and natural gas costs, this proposal additionally adopts Appendix RL: Renewable Energy Infrastructure. This appendix will ease building owner access to low-cost renewable energy and reduce reliance on expensive, cost-volatile, and higher-emission energy types.

Proposed code text is depicted through underlining while proposed deletions are depicted through ~~strike-through formatting~~. Explanatory text, not intended to be part of the code, is depicted in italics.

Prescriptive pathway. *It is standard practice for credit values to be determined by calculating the savings from the measure compared to a baseline model building using the same fuel for the relevant end use. The baseline model compares heat pump measures to minimum-efficiency electric resistance space heating, while gas furnace measures are compared to a minimum-efficiency gas furnace. This suggests that a*

home complying with the prescriptive pathway using a natural gas furnace and gas tank water heater may be less energy efficient than an otherwise identical home using an air source heat pump and heat pump water heater.

The prescriptive pathway in this proposal would instead compare all efficiency measures against a single site energy use baseline using a minimum-efficiency gas furnace and gas tank water heater. A new measure will award credits based on the energy savings from using an air source heat pump rather than a gas furnace, where the installed and comparison systems each meet and do not exceed federal minimum appliance efficiency standards. A second, analogous new measure will award credits based on the energy savings from using a heat pump water heater rather than a gas tank water heater, where the installed and the comparison appliances each meets and does not exceed federal minimum appliance efficiency standards.

ERI pathway. *The Energy Rating Index (ERI) metric is a relative rating against a building of the same fuel type complying with the 2006 IECC. A home earning an ERI score of 48 that uses gas for space and water heating may, therefore, be less efficient than another home with an ERI score of 48 that uses electric equipment for space and water heating. To compensate for this issue and ensure all homes reach the same conservation outcome regardless of fuel type, this proposal's ERI pathway allows a higher maximum ERI score if a building does not use purchased energy other than electricity for space or water heating. The amount of the ERI value increase is to-be-determined by PNNL or HERS rater analysis and will be calculated such that mixed fuel and electricity-heated buildings will be required to attain equal site energy use in each climate zone.*

Performance pathway. *The proposed simulated building performance pathway uses natural gas space and water heating products for the standard reference design regardless of the fuels used in the proposed design. This ensures homes of any fuel type must meet the same conservation objective. Notably, this proposal eliminates a provision that allows all-electric buildings to comply while reducing energy cost less than combustion buildings compared to their respective standard reference designs.*

Additionally, performance is quantified in site energy use, rather than energy cost. Site energy use is the performance metric over which the designer has the greatest control. Site energy use can also be estimated with greater confidence than energy cost because the occupant's energy provider or rate will not affect it.

Finally, this option increases the stringency of the envelope backstop to ensure any reduction in efficiency of the standard reference design does not inadvertently allow installation of an outdated envelope.

Proposal

General

*Adopt the **2024 International Energy Conservation Code**, including **Appendix RG** and **Appendix RL**, with the following language.*

R101.2 Scope. This code applies to the design and construction of detached one- and two-family dwellings and multiple single-family dwellings (townhouses) and Group R-2, R-3 and R-4 buildings three stories or less in height above *grade plane*.

R101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted and referenced as a requirement of a compliance option. **Appendix RG** and **Appendix RL** are adopted as requirements for compliance paths as specified in **Section R401.2**.

Amend as follows.

R401.2 Application. Residential buildings shall comply with **Appendix RL** and one of **Sections R401.2.1, R401.2.2, R401.2.3** or **R401.2.4**.

R401.2.1 Prescriptive Compliance Option. The Prescriptive Compliance Option requires compliance with **Sections R401** through **R404** and **R408**, as amended by **Appendix RG Section RG101.3**.

R401.2.2 Simulated building Performance Option. The Simulated building Performance Option requires compliance with **Section R405** as amended by **Appendix RG Section RG101.1**.

R401.2.3 Energy Rating Index Option. The *Energy Rating Index* (ERI) Option requires compliance with **Section R406** as amended by **Appendix RG Section RG101.2**.

ERI Compliance

*Amend as follows. The to-be-determined ERI values in the new **Table RG101.2** columns shall be calculated such that they result in equivalent site energy outcomes for a building that uses natural gas for space and water heating and attains the ERI indicated in the model code's **Table RG101.2** and a building that meets the enumerated requirements and attains the increased, electric-heat-building ERI.*

RG101.2 (R406.5) ERI-based compliance. Compliance based on an *Energy Rating Index* (ERI) analysis requires that the *rated design* and each confirmed as-built *dwelling unit* be shown to have an *ERI* less than or equal to the applicable value indicated in **Table RG101.2** where compared to the *ERI reference design* as follows:

1. Where the building uses *purchased energy* that is not electricity for space heating or service water heating and on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP, MIXED-FUEL BUILDING applies.
2. Where the building does not use *purchased energy* that is not electricity for space heating or service water heating and on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP, ELECTRIC HEAT BUILDING applies.
- ~~2.~~ 3. Where the building uses *purchased energy* that is not electricity for space heating or service water heating and on-site renewables are installed, the maximum ENERGY RATING INDEX WITH OPP, MIXED-FUEL BUILDING applies.
4. Where the building does not use *purchased energy* that is not electricity for space heating or service water heating and on-site renewables are installed, the maximum ENERGY RATING INDEX WITH OPP, ELECTRIC HEAT BUILDING applies.

Amend table as follows.

TABLE RG101.2
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP		ENERGY RATING INDEX WITH OPP	
	<u>MIXED-FUEL BUILDING</u>	<u>ELECTRIC HEAT BUILDING</u>	<u>MIXED-FUEL BUILDING</u>	<u>ELECTRIC HEAT BUILDING</u>
0 and 1	46	TBD	27	TBD
2	46	TBD	26	TBD
3	45	TBD	24	TBD
4	48	TBD	32	TBD
5	49	TBD	37	TBD
6	48	TBD	39	TBD
7	47	TBD	43	TBD
8	47	TBD	43	TBD

Prescriptive Compliance

Amend **Table R408.2** so that all credit values are “TBD.” Credit values for existing measures shall be recalculated to reflect site energy improvements compared to a standard reference design that uses a natural gas furnace and natural gas tank water heater, neither of which may exceed the Department of Energy’s currently effective minimum efficiency standard for those products.

Add rows to **Table R408.2** as follows. The “TBD” credit values for these new measures shall be calculated to reflect site energy improvements compared to a standard reference design that uses a natural gas furnace and a natural gas tank water heater, neither of which may exceed the Department of Energy’s currently effective minimum efficiency standard for those products.

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE			
		Climate Zone 4	Climate Zone 5	Climate Zone 6	Climate Zone 7
<u>R408.2.2(15)</u>	<u>Federal Minimum Efficiency Heat pump</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
<u>R408.2.3(8)</u>	<u>Federal Minimum Efficiency Heat pump water heater</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>

Add option under **R408.2.2** as follows:

15. Federal Minimum Efficiency Heat pump: Air source heat pump having an efficiency rating equal to or exceeding the minimum required by federal law for the geographic location where the equipment is installed.

Add a row in **Table R408.2.3** as follows:

MEASURE NUMBER	WATER HEATER	SIZE AND DRAW PATTERN	TYPE	EFFICIENCY
R408.2.3(8)	<u>Federal Minimum Efficiency Heat pump water heater</u>	<u>Any</u>	<u>HPWH with or without hybrid electric resistance element</u>	<u>Any efficiency equal to or exceeding currently effective US Department of Energy minimum energy efficiency standards</u>

Simulated Building Performance Compliance

Amend **Section R202** as follows:

SITE ENERGY USE. The metric indicating the total amount of energy consumed by a *building* in 1 year.

Amend as follows:

RG101.1 (R405.2) Simulated building performance compliance. Compliance based on *simulated building performance* requires that a *building* comply with the following:

1. The requirements of the sections indicated within **Table R405.2**.
2. The proposed total *building thermal envelope* thermal conductance, TC, shall be less than or equal to the *building thermal envelope* TC using the prescriptive *U*-factors and *F*-factors from **Table R402.1.2** multiplied by ~~1.08~~ 1.05 in Climate Zones 0, 1 and 2, and ~~1.15~~ in Climate Zones 3 through 8 in accordance with **Equation 4-2** and **Section R402.1.5**. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.
3. ~~For each dwelling unit with one or more fuel-burning appliances for space heating, water heating, or both, the~~ The annual energy cost site energy use of the each dwelling unit shall be less than or equal to 70 percent of the annual energy cost site energy use of the standard reference design. ~~For all other dwelling units, the annual energy cost of the dwelling unit shall be less than or equal to 75 percent of the annual energy cost of the~~

~~standard reference design.~~ For each *dwelling unit* with greater than 5,000 square feet (465 m²) of *living space* located above *grade plane*, the annual ~~energy cost~~ site energy use of the *dwelling unit* shall be reduced by an additional 5 percent of annual ~~energy cost~~ site energy use of the *standard reference design*. ~~Energy prices shall be taken from an approved source, such as the US Energy Information Administration's state energy data system prices and expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.~~

Exceptions:

- ~~1. The energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 2.51. The source energy multiplier for fuels other than electricity shall be 1.09.~~
- ~~2. The energy use based on site energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost.~~

Amend **Table R405.4.2(1)** to require a standard reference design that uses minimum-efficiency natural gas equipment for space and water heating as follows. Rows not depicted, including sub-rows, are unchanged.

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems ^{d, e, j-k}	Fuel type/capacity: <u>natural gas, with capacity the same as proposed design.</u>	As proposed.
	Product class: <u>if the proposed design uses only natural gas heating systems, same as proposed design. For any proposed heating systems</u>	As proposed.

	that do not use natural gas, <u>the standard reference design</u> shall include a <u>heating system of a product class that uses natural gas. For proposed designs with forced air or electric resistance radiative heating systems, substitute a furnace. For proposed designs with hydronic heating systems, substitute a boiler.</u>	
	Efficiencies:	
	Heat pump: complying with 10 CFR §430.32.	As proposed.
	Fuel gas and liquid fuel furnaces: complying with <u>and having efficiency ratings equal to the minimum requirements of 10 CFR §430.32.</u>	Forced air and electric resistance heating systems as proposed.
	Fuel gas and liquid fuel boilers: complying with <u>and having efficiency ratings equal to the minimum requirements of 10 CFR §430.32.</u>	Hydronic heating systems as proposed.
Service water heating ^{d, g, k}	Fuel type <u>and product class: same as proposed design-natural gas tank water heater complying with and having efficiency ratings equal to the minimum requirements of 10 CFR §430.32.</u>	As proposed.

Thermal distribution systems	Duct insulation: in accordance with Section R403.3.3.	Duct insulation: as proposed. ^{mk}
	Duct location:	Duct location: as proposed. ^{lj}

SI unit information and footnotes a, b, and c are unchanged. Amend footnote d as follows:

d. For a proposed design with multiple heating, cooling or water heating systems using different ~~fuel types-product classes~~, the applicable standard reference design system capacities and ~~fuel types-product classes~~ shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each ~~equipment and fuel type-product class~~ present.

Footnotes e and f are unchanged. Amend footnote g as follows:

g. For a proposed design without a proposed water heater, the following assumptions shall be made for ~~both the proposed design and the standard reference design. For a proposed design with a heat pump water heater, the following assumptions shall be made for the standard reference design, except the fuel type shall be electric.~~

Fuel type: for the standard reference design, natural gas. For the proposed design, the same as the predominant heating fuel type in the proposed design.

Rated storage volume: 40 gallons

Draw pattern: medium

Efficiency: Uniform Energy Factor complying with and not exceeding the minimum efficiency requirements of 10 CFR § 430.32

Footnotes h and i are unchanged. Delete footnotes j and k. Renumber footnote l as footnote j. Renumber footnote m as footnote k.