What to Expect in 2024 IECC

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El trabajo que hacen es muy IMPORTANTE!

Un recibo de la luz que es mas barato puede hacer la diferencia en una pareja de ancianos poder comprar medicamentos y también una madre comprar comida para sus hijos.

2024 Residential Code Development

Residential Consensus Committee (48 members, selected in early 2021)

- 16 Code Officials (ID, NJ, NY, MA, ME, TX, GA, NC, IA, FL, VA, LA, CO, MD)
- 10 Builders (NAHB, LBA, Habitat for Humanity, other homebuilders)
- 9 Public Segment (DOE, PNNL, NBI, EECC, SWEEP, MEEA, NRDC)
- 7 Users (Raters, Architects)
- 4 Manufacturers (AHRI, insulation, windows & doors, solar)
- 2 Utilities

Six Sub-Committees: Admin, Envelope, HVAC & HW, EPLR, Existing & Modeling

Heard almost 780 proposals over 2 years and 3 rounds of public comments → 273 changes!

Code Changes to expect in 2024 IECC-R

Before we dive in…

1. We will be talking about changes since the 2021 IECC, so some ‘changes’ may be really new to you if you aren’t familiar with 2021 IECC yet

Good news first… What changed in the 2021 IECC?

Better building thermal envelopes!

R401.2.5 Additional energy efficiency. This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For **Prescriptive**, install **one of the additional efficiency package options** from **R408**.

2. For Simulated Performance (**R405**) do one of the following:
    2.1. **Install one of the R408 efficiency package options and don't model it**; **OR**
    2.2. Modeled home has **annual energy cost that is 5% less than reference design**.

3. For ERI Path (**R406**), **ERI is 5% less than the R406 ERI maximums (e.g., 55x 0.95).**

Now the Bad… Reductions in Envelope in the 2024 IECC

Ceiling Insulation	Climate Zone 1	Climate Zones 2-3	Climate Zones 4-8
2021 / 2024 IECC	R-30 / R-30	~~R-49~~ / R-38	~~R-60~~ / R-49

Other ways to reduce envelope in 2024 IECC:

- **R405:** Long lasting envelope performance can now be “traded-off” in the Simulated Building Performance path by efficient heating, cooling, & water heating equipment and duct location. Due to this trade-off, the 2024 IECC also requires **15-20%** savings over the Standard Reference Design, compared to just **5%** in 2021 IECC.

- **R408:** Lower wall insulation climate zones 4 & 5 allowed if 3 more credits achieved or by installing PV or high performance heat pump equipment.

Code Changes to expect in 2024 IECC-R [R402]

R402 Building Thermal Envelope

- Flipped the rows and columns to match IECC-C format
- Changes to fenestration and ceiling insulation U-factors
- New row for 'Insulation entirely above roof deck'

TABLE R402.1.2 MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	0	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7 AND 8
Vertical fenestration *U*-factor	0.50	0.50	0.40	0.30	0.30	0.28[d]	0.28[d]	0.27[d]
Skylight *U*-factor	0.60	0.60	0.60	0.53	0.53	0.50	0.50	0.50
Glazed vertical fenestration SHGC	0.25	0.25	0.25	0.25	0.40	NR	NR	NR
Skylight SHGC	0.28	0.28	0.28	0.28	0.40	NR	NR	NR
Ceiling *U*-factor	0.035	0.035	0.030	0.030	0.026	0.026	0.026	0.026
Insulation entirely above roof deck	0.039	0.039	0.039	0.039	0.032	0.032	0.032	0.028

Code Changes to expect in 2024 IECC-R [R402]

R402 Building Thermal Envelope

- F-factors for slabs & pointers to a new Appendix RF

TABLE R402.1.2 MAXIMUM ASSEMBLY *U*-FACTORS[a] AND FENESTRATION REQUIREMENTS

CLIMATE ZONE	0	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7 AND 8
Unheated slab *F*-factor[e]	0.73	0.73	0.73	0.54	0.51	0.51	0.48	0.48
Heated slab *F*-factor[e]	0.74	0.74	0.74	0.66	0.66	0.66	0.66	0.66

For SI: 1 foot = 304.8 mm.

a. Nonfenestration *U*-factors and *F*-factors shall be obtained from measurement, calculation, an *approved source*, or Appendix RF where such appendix is adopted or *approved*.

What you won't see:

- Changes to prescriptive wall U-factors
- Anything related to embodied carbon or linear/point thermal bridges

Code Changes to expect in 2024 IECC-R [R402]

Table A6.3.1-1 Assembly *F-Factors* for *Slab-on-Grade Floors*

Insulation Description	*Rated R-Value of Insulation*							
	R-3.5	R-5	R-7.5	R-10	R-15	R-20	R-25	R-30
Unheated Slabs								
Uninsulated: 0.73								
12 in. horizontal		0.72	0.71	0.71	0.71			
24 in. horizontal		0.70	0.70	0.70	0.69			
36 in. horizontal		0.68	0.67	0.66	0.66			
48 in. horizontal		0.67	0.65	0.64	0.63			
12 in. vertical		0.61	0.60	0.58	0.57	0.567	0.565	0.564
24 in. vertical						0.510	0.505	0.502
36 in. vertical				0.51	0.48	0.472	0.464	0.460
48 in. vertical			0.51	0.48	0.45	0.434	0.424	0.419
Fully insulated slab		0.46	0.41	0.36	0.30	0.261	0.233	0.213

TABLE RF102.1
ASSEMBLY *U*-FACTORS FOR WOOD-FRAMED WALLS[a, b, c, d, e, f]

WOOD STUD SIZE AND SPACING	CAVITY INSULATION INSTALLED *R*-VALUE	CONTINUOUS INSULATION *R*-VALUE																	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	25	30
2 × 4 (12 inches o.c)	0	0.324	0.239	0.190	0.158	0.136	0.119	0.106	0.096	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.042	0.035	0.030
	11	0.094	0.085	0.078	0.072	0.067	0.062	0.059	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.032	0.027	0.024
	12	0.090	0.082	0.075	0.069	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.031	0.027	0.024
	13	0.087	0.079	0.072	0.067	0.063	0.059	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.031	0.027	0.023
	14	0.084	0.076	0.070	0.065	0.061	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.030	0.026	0.023
	15	0.082	0.074	0.068	0.063	0.059	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.030	0.026	0.023
	16	0.079	0.072	0.066	0.062	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.029	0.025	0.022
	17	0.077	0.070	0.065	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.029	0.025	0.022
	18	0.076	0.069	0.063	0.059	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.028	0.025	0.022
	19	0.074	0.067	0.062	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032	0.028	0.024	0.022
	20	0.072	0.066	0.061	0.056	0.053	0.050	0.047	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.027	0.024	0.021

Code Changes to expect in 2024 IECC-R [R402]

R402.1.5 ~~Total UA~~ Component performance alternative.

Total "UA" replaced with "TC", where thermal conductance (TC) is UA + FP,

…where F is F-factor and P is slab perimeter.

$$TC_p \leq TC_r$$

where:

$TC_p = U_pA + F_pP$ ← Values from "Proposed" Design

$TC_r = U_rA + F_rP$ ← "Required" Values from Table R402.1.2

U_pA = the sum of proposed *U*-factors times the assembly areas in the proposed building.

F_pP = the sum of the proposed *F*-factors times the slab-on-grade perimeter lengths in the proposed building.

U_rA = the sum of *U*-factors in Table R402.1.2 times the same assembly areas as in the proposed building.

F_rP = the sum of *F*-factors in Table R402.1.2 times the same slab-on-grade perimeter lengths as in the proposed building.

Exception: For Climate Zones 0, 1 and 2, the value of F_rP shall equal the value of F_pP.

Code Changes to expect in 2024 IECC-R [R402]

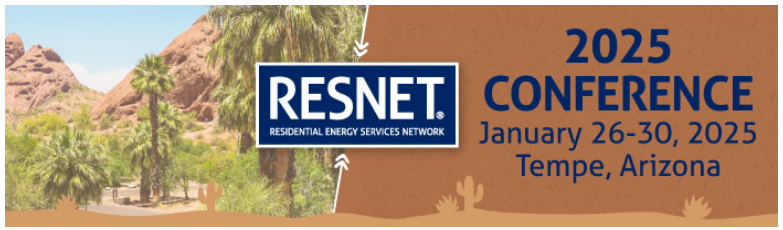
Specific Insulation Requirements

- Attic knee walls
  - Must meet R-value table

Steel Framing

- No more table
  - Must use AISI S250

American Iron and Steel Institute



Code Changes to expect in 2024 IECC-R [R402]

R402 Building Thermal Envelope

Air Leakage (Technical & Organizational changes)

- Clarify the max allowed for each path & home type
- Increased stringency:
  - R405 & R406: 5 ACH50 drops to 4.0 ACH50
  - Prescriptive:
    - 5 ACH50 drops to 4.0 ACH50 in CZ 0-2
    - 3 ACH50 in CZ 3-5 stays but…
    - 3 ACH50 drops to 2.5 ACH50 in CZ 6-8

Multifamily:

- Increased stringency: 0.30 cfm50/ft^2 drops to 0.27
- Add a sampling protocol for buildings with 8+ units (20%)
- Reduced air leakage allowance if using guarded tests

There are 2 Sides to This Story – What is the Intent?

Introduced in 2021: Electrical and communication outlet boxes installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. **Electrical and communication outlet boxes shall be tested in accordance with NEMA OS 4... ...Electrical and communication outlet boxes shall be marked "NEMA OS 4"....**

The language in 2024 is similar. What is the intent?

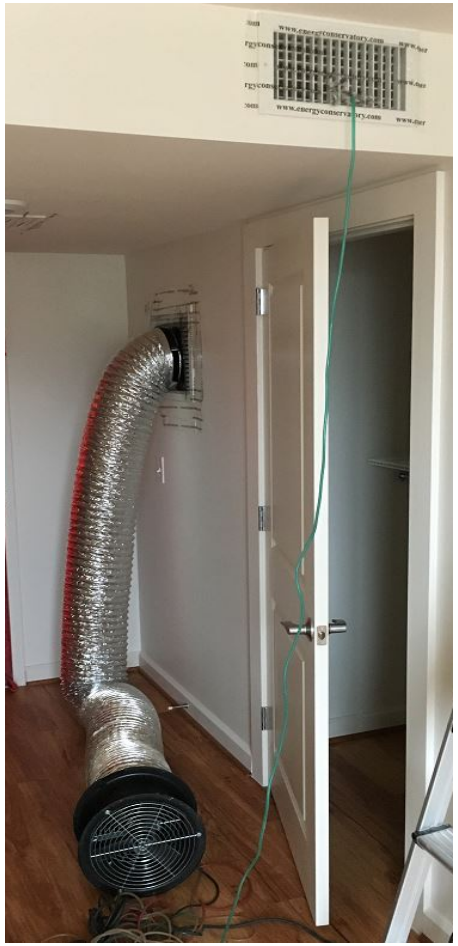
National Electrical Manufacturers Association

Code Changes to expect in 2024 IECC-R [R403]

R403 Systems

R403.3 Ducts (section apples to all paths)

- Technical, Editorial, and Organizational changes
  - Revised and added definitions
  - Created a table for max duct leakage values
  - Provide greater leakage allowance for 3+ returns
  - Provide greater leakage allowance for smaller homes
  - Clarifies that ventilation ducts do not have to be tested
  - Add footnotes for further explanations



Code Changes to expect in 2024 IECC-R [R403]

TABLE R403.3.8
MAXIMUM TOTAL DUCT SYSTEM LEAKAGE

EQUIPMENT AND DUCT CONFIGURATION	DUCT SYSTEMS SERVING MORE THAN 1,000 FT² OF CONDITIONED FLOOR AREA		DUCT SYSTEMS SERVING 1,000 FT² OR LESS OF CONDITIONED FLOOR AREA
	cfm/100 ft²		cfm
	Number of ducted returns[a]		
	< 3	≥ 3	Any
Space conditioning equipment is not installed[b, c]	3	4	30
All components of the duct system are installed[c]	4	6	40
Space conditioning equipment is not installed, but the ductwork is located entirely in conditioned space[c, d]	6	8	60
All components of the duct system are installed and entirely located in conditoned space[c]	8	12	80

Sampling allowed

8+ units -> 20%

Code Changes to expect in 2024 IECC-R [R403]

TABLE R403.6.2
FAN EFFICACY FOR WHOLE-HOUSE MECHANICAL VENTILATION SYSTEMS AND OUTDOOR AIR VENTILATION SYSTEMS[a]

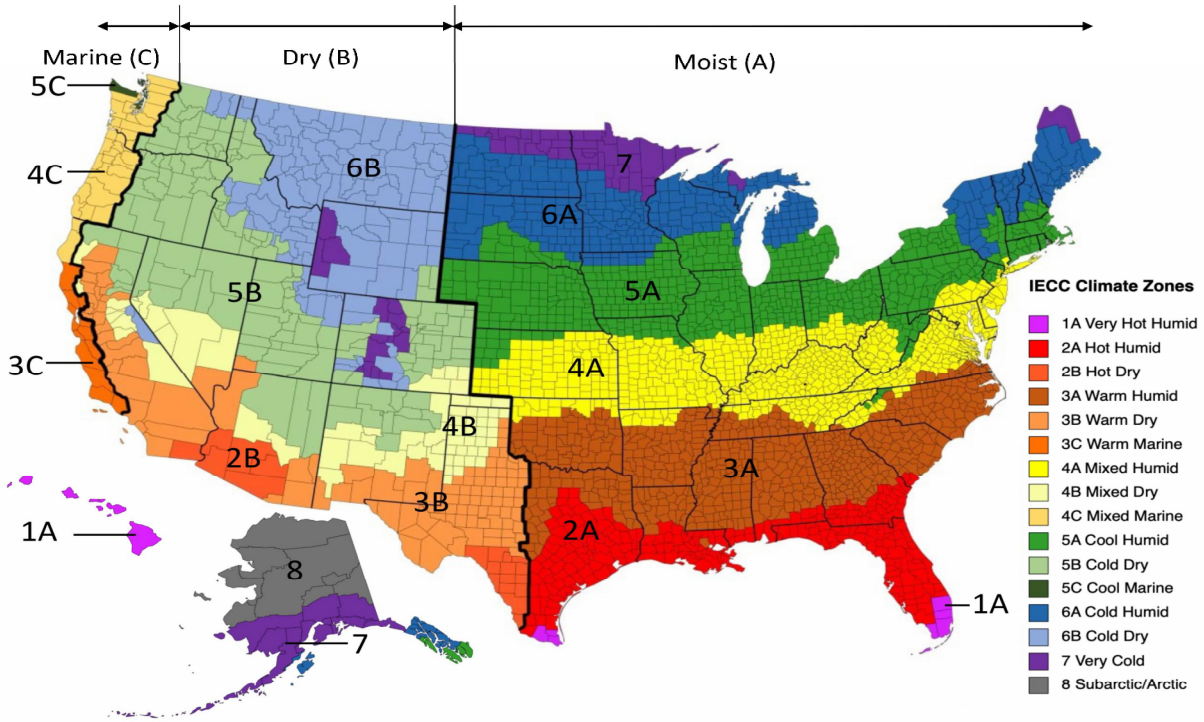
SYSTEM TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/ WATT)	TEST PROCEDURE
HRV or ERV	Any	1.2[a]	CAN/CSA C439
Balanced ventilation system without heat or energy recovery	Any	1.2[a]	ANSI/AMCA 210-ANSI/ASHRAE 51
Range hood	Any	2.8	
In-line supply or exhaust fan	Any	3.8	
Other exhaust fan	< 90	2.8	
	≥ 90 and < 200	3.5	
	≥ 200	4.0	
Air-handling unit that is integrated to tested and listed HVAC equipment	Any	1.2	Outdoor airflow as specified. Air-handling unit fan power determined in accordance with the applicable US Department of Energy Code of Federal Regulations **DOE10 CFR 430** or other approved test method.

Code Changes to expect in 2024 IECC-R [R403]

R403 Systems (continued)

R403.6.1 Heat or energy recovery ventilation

- Expands requirement into **CZ 6**



Code Changes to expect in 2024 IECC-R [R403]

R403 Systems (continued)

R403.7.1 Electric resistance space heating limits

- In CZ 4 to 8, 2 kW max unless at least ONE heat pump is installed
- What you won't see: a prohibition on using gas / oil

Code Changes to expect in 2024 IECC-R [R404]

2021 IECC

R404.2 Interior lighting controls.

Permanently installed lighting fixtures shall be controlled with either a dimmer, an occupant sensor control or other control that is installed or built into the fixture.

Exception: Lighting controls shall not be required for the following:
1.Bathrooms, halls, exterior, safety lighting

2024 IECC

- Habitable spaces: dimmer or occupancy sensor
- Basement, laundry, utility room: occupancy sensor

Code Changes to expect in 2024 IECC-R [R405 & R406]

Code Changes to expect in 2024 IECC-R [R405 & R406]

How to determine if a section is required, based on compliance path chosen?

In 2018 IECC:

SECTION R402
BUILDING THERMAL ENVELOPE ES

R402.1 General (Prescriptive). P

R402.4 Air leakage (Mandatory).

Code Changes to expect in 2024 IECC-R [R405 & R406]

How to determine if a section is required, based on compliance path chosen?

In 2021 IECC:

R405.2 Performance-based compliance. P

Compliance based on total building performance requires that a *proposed design* meets all of the following:

1. The requirements of the sections indicated within Table R405.2.

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION[a]	TITLE
General	
R401.2.5	Additional energy efficiency
R401.3	Certificate
Building Thermal Envelope	
R402.1.1	Vapor retarder

Code Changes to expect in 2024 IECC-R [R405 & R406]

How to determine if a section is required, based on compliance path chosen?

In 2024 IECC:

SECTION[a]	TITLE
R403.5	Service hot water systems
R403.6	Mechanical ventilation
R403.7, except Section R403.7.1	Equipment sizing and efficiency rating
R403.8	Systems serving multiple dwelling units
R403.9.2	Snow melt and ice system controls

a. Reference to a code section includes all of the relative subsections except as indicated in the table.

Code Changes to expect in 2024 IECC-R [R405 & R406]

R405 Simulated Building Performance & R406 Energy Rating Index

- For Multifamily, clarifies that only **dwelling units** are modeled; **common areas** must instead meet prescriptive requirements in R402, R403, and R404
- Envelope backstop updated to **1.08 or 1.15 X $TC_{2024\ IECC}$**
- Requires software to demonstrate compliance with **ASHRAE Std 140**

Code Changes to expect in 2024 IECC-R [R405]

R405 Simulated Building Performance

- Now allows credit for **HVAC & DHW efficiency** and **duct location**

Use the AHRI directory to confirm equipment efficiency

AHRI CERTIFIED®
www.ahridirectory.org

Certificate of Product Ratings

AHRI Certified Reference Number : 2000804 Date : 10-16-2023 Model Status : Discontinued Model Discontinued Date : 08-31-2020

Brand Name : CARRIER

Model Number : 58STA045-12

Rated as follows in accordance with the following test procedures and subject to verification of rating accuracy by AHRI-sponsored, independent, third party testing:

-10 CFR Part 430, Subpart B, Appendix AA-2016, Uniform Test Method for Measuring the Energy Consumption of Furnace Fans and CAN/CSA P.2-13, Test Method for Measuring the Annual Fuel Utilization Efficiency of Residential Gas Fired Furnaces and Boilers for AFUE and Output Heating Capacity

-10 CFR Part 430, Subpart B, Appendix N-2023, Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers for FER

AFUE, (%) : 80.0

Output Heating Capacity (MBTUH) : 36

The following data is for reference only and is not certified by AHRI

Input Rating (MBTUH) : 44

Ef (MMBTU/yr) : 37.7

Eae including Eso(kWh/yr) : 600

PE (watts) : 57

Configuration : Downflow, Horizontal, Upflow

Lowboy : No

Mobile Home? : No

Single Package Unit : No

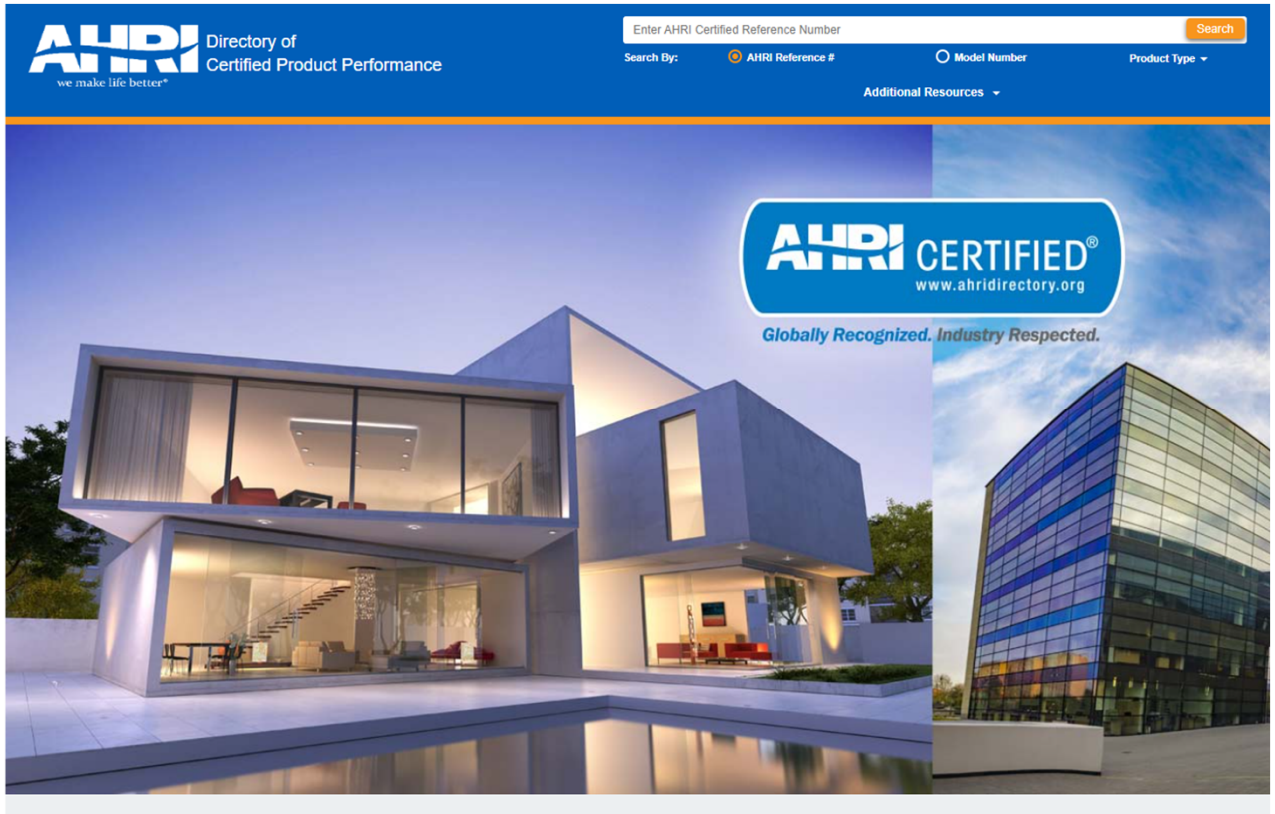
Electronic Ignition : Yes

Electro-Mechanical Vent Damper(s) : No

Power Combustion or Power Vent : Yes

Condensing Type : No

Direct Vent : No



Code Changes to expect in 2024 IECC-R [R405]

R405 Simulated Building Performance

- Now allows credit for **HVAC & DHW efficiency** and **duct location**
- **15%** energy cost savings required for electric; **20%** for mixed-fuel homes
- Homes larger than **5,000 ft^2** have to perform **5%** better (**20** and **25%**)

- New site-to-source multipliers (**2.51** for electric, **1.09** for natural gas)
- New **site** energy savings alternative to energy cost or source savings

- **What you won't see:** credit for lights, appliances, or renewables

Code Changes to expect in 2024 IECC-R [R406]

R406 Energy Rating Index (ERI) Compliance

- Updates to use ANSI 301-**2022** instead of 2019
- Removes the **ventilation rate** deviation introduced in 2018 IECC
- Same envelope backstop as R405, even if on-site power is present
- Reduce the ERI Max by 1 point compared to the 2021 IECC table values
- No limit on how much on-site power production (OPP) can contribute to code compliance, but if you use OPP (e.g., solar PV), ERI Max is lower

Code Changes to expect in 2024 IECC-R [R406]

R406.5 ERI-based compliance. [Each *dwelling unit*...shall have an ERI less than or equal to the applicable value indicated in Table R406.5]:

1. If on-site renewables are not installed, ENERGY RATING INDEX NOT INCLUDING OPP applies.
2. If on-site renewables are installed, ENERGY RATING INDEX WITH OPP applies.

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	51	35
2	51	34
3	50	33
4	53	40
5	54	43
6	53	43
7	52	46
8	52	46

Code Changes to expect in 2024 IECC-R [R406]

Exceptions:

1. Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.
2. …

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	51	35
2	51	34
3	50	33
4	53	40
5	54	43
6	53	43
7	52	46
8	52	46

Code Changes to expect in 2024 IECC-R [R406]

Exceptions:

1. …
2. For buildings with twenty or more *dwelling units*, where *approved* by the *code official*, compliance shall be permitted using the Average Dwelling Unit Energy Rating Index, as calculated in accordance with ANSI/RESNET/ICC 301.

Image: Paul B. Bailey Architects

Code Changes to expect in 2024 IECC-R [R408]

Additional Efficiency Requirements [R408]

Intent

- Improve energy efficiency in residential buildings
  - 2021 IECC – by 5% or more
  - 2024 IECC – by 10% or more
- Provide builders design flexibility to choose measures that make the most sense and readily available in the market

Design

- 2021 IECC mirrors the design of C406 Additional Efficiency Packages
- 2021 IECC required one of five additional efficiency options

Additional Efficiency Requirements [2021 IECC R408]

- Choose one of the five (5) packages

SECTION R408
ADDITIONAL EFFICIENCY PACKAGE OPTIONS

R408.1 Scope. This section establishes additional efficiency package options to achieve additional energy efficiency in accordance with Section R401.2.5.

R408.2 Additional efficiency package options. Additional efficiency package options for compliance with Section R401.2.1 are set forth in Sections R408.2.1 through R408.2.5.

R408.2.1 Enhanced envelope performance option. The total *building thermal envelope* UA, the sum of *U*-factor times assembly area, shall be less than or equal to 95 percent of the total UA resulting from multiplying the *U*-factors in Table R402.1.2 by the same assembly area as in the proposed building. The UA calculation shall be performed in accordance with Section R402.1.5. The area-weighted average SHGC of all glazed fenestration shall be less than or equal to 95 percent of the maximum glazed fenestration SHGC in Table R402.1.2.

R408.2.2 More efficient HVAC equipment performance option. Heating and cooling *equipment* shall meet one of the following efficiencies:

1. Greater than or equal to 95 AFUE natural gas furnace and 16 SEER air conditioner.
2. Greater than or equal to 10 HSPF/16 SEER air source heat pump.
3. Greater than or equal to 3.5 COP ground source heat pump.

R408.2.3 Reduced energy use in service water-heating option. The hot water system shall meet one of the following efficiencies:

1. Greater than or equal to 82 EF fossil fuel service water-heating system.
2. Greater than or equal to 2.0 EF electric service water-heating system.
3. Greater than or equal to 0.4 solar fraction solar water-heating system.

R408.2.4 More efficient duct thermal distribution system option. The thermal distribution system shall meet one of the following efficiencies:

1. 100 percent of ducts and air handlers located entirely within the *building thermal envelope*.
2. 100 percent of ductless thermal distribution system or hydronic thermal distribution system located completely inside the *building thermal envelope*.
3. 100 percent of duct thermal distribution system located in *conditioned space* as defined by Section R403.3.2.

R408.2.5 Improved air sealing and efficient ventilation system option. The measured air leakage rate shall be less than or equal to 3.0 ACH50, with either an Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) installed. Minimum HRV and ERV requirements, measured at the lowest tested net supply airflow, shall be greater than or equal to 75 percent Sensible Recovery Efficiency (SRE), less than or equal to 1.1 cubic feet per minute per watt (0.03 m^3/min/watt) and shall not use recirculation as a defrost strategy. In addition, the ERV shall be greater than or equal to 50 percent Latent Recovery/Moisture Transfer (LRMT).

Additional Efficiency Requirements [2024 IECC R408]

- R408 changed to an Energy Credits methodology for additional efficiency ~ 10% additional efficiency
- Credits for each measure calculated by PNNL
- Aligns with the IECC-Commercial Section C406 Energy Credits

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥ 2.5% Reduction in total TC	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥ 5% reduction in total TC	0	1	1	2	1	2	2	2	2
R408.2.1.1(3)	> 7.5% reduction in total TC	0	1	2	2	2	2	3	3	3
R408.2.1.1(4)	> 10% reduction in total TC	1	1	2	3	3	4	4	5	5
R408.2.1.1(5)	> 15% reduction in total TC	1	2	2	4	4	5	6	7	8
R408.2.1.1(6)	> 20% reduction in total TC	2	4	4	5	6	7	8	9	11
R408.2.1.1(7)	> 30% reduction in total TC	3	6	6	8	8	11	12	13	16
R408.2.1.2(1)	*U*-factor and SHGC for vertical fenestration per Table R408.2.1.2	1	1	1	2	1	1	1	1	1

2024 IECC R408 Energy Credit Requirements

- *Residential buildings* shall earn not less than ten credits from not less than two measures specified in Table R408.2.
- Five additional credits shall be earned for *dwelling units* with more than 5,000 ft^2 of *living space* located above *grade plane*.
- To earn credit as specified in Table R408.2 for the applicable CZ, each measure selected for compliance shall comply with the applicable subsections of Section R408.
- In multifamily, each dwelling or sleeping unit shall comply with the selected measure to earn credit.
- Interpolation of credits between measures is not permitted.

2024 IECC R408 Energy Credit Requirements

- Over 50 measures across 11 Measure Categories
- #6 - #11 are new in 2024 IECC

1. R408.2.1: Enhanced envelope
2. R408.2.2: More efficient HVAC
3. R408.2.3: More efficient water heating
4. R408.2.4: More efficient duct distribution
5. R408.2.5: More efficient air sealing and ventilation
6. R408.2.6: Energy efficient appliances
7. R408.2.7: On-site renewables
8. R408.2.8: Demand response HVAC
9. R408.2.9: Opaque walls
10. R408.2.10: Whole-home lighting control
11. R408.2.11: Higher efficacy lighting

R408.2.1 Enhanced building thermal envelope

R408.2.1 Enhanced building thermal envelope options. To achieve enhanced envelope credits, the building thermal envelope shall comply with one or more of the following:

1. Section R408.2.1.1 (Reduce TC) or R408.2.1.2 (Improved Fenestration)
2. Section R408.2.1.3 (Roof solar reflectance: SRI ≥ 75)
3. Section R408.2.1.4 (Reduced air leakage: 2.0 – 2.5 ACH50)

R408.2.1 Enhanced building thermal envelope

R408.2.1.1 Enhanced building thermal envelope performance. The total building thermal envelope **thermal conductance TC** shall be calculated for the proposed building in accordance with Section R402.1.5 and it **shall be reduced** by not less than the percentage indicated in Table R408.2 in comparison to the reference building.

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥ 2.5% Reduction in total TC	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥ 5% reduction in total TC	0	1	1	2	1	2	2	2	2
R408.2.1.1(3)	> 7.5% reduction in total TC	0	1	2	2	2	2	3	3	3
R408.2.1.1(4)	> 10% reduction in total TC	1	1	2	3	3	4	4	5	5
R408.2.1.1(5)	> 15% reduction in total TC	1	2	2	4	4	5	6	7	8

Remember that TC is the new “UA”

Example:
Code TC = 1,000
Proposed TC = 975

This is a “2.5% reduction in total TC”

R408.2.1 Enhanced building thermal envelope

R408.2.1.2 Improved fenestration. The area weighted average U-factor and SHGC of all vertical fenestration shall be equal to or less than values specified in Table R408.2.1.2.

TABLE R408.2.1.2 IMPROVED FENESTRATION

CLIMATE ZONE	*U*-FACTOR	SHGC
0	0.32	0.23
1	0.32	0.23
2	0.30	0.23
3	0.28	0.23
4 except Marine 4	0.25	0.40
5 and Marine 4	0.25	NR
6	0.25	NR
7 and 8	0.25	NR

R408.2.1.2(1)	*U*-factor and SHGC for vertical fenestration per Table R408.2.1.2	1	1	1	2	1	1	1	1	1

R408.2.2 More efficient HVAC equipment

14 options in total; 1st group of 5, are HVAC options available in all 8 CZ's:

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.2(1)[b]	Ground source heat pump	14	14	14	15	10	15	17	18	21
R408.2.2(2)[b]	High Performance Cooling (Option 1)	5	4	3	2	1	1	1	1	1
R408.2.2(3)[b]	High Performance Cooling (Option 2)	6	4	3	2	1	1	1	1	1
R408.2.2(4)[b]	High Performance Gas furnace (Option 1)	0	1	2	5	3	6	7	7	9
R408.2.2(5)[b]	High Performance Gas furnace (Option 2)	0	1	2	4	3	5	6	7	8

GSHP ≥ 16.1 EER & 3.1 COP

AC ≥ 15.2 SEER2 / 12.0 EER2

AC ≥ 16.0 SEER2 / 12.0 EER2

Furnace ≥ 97 % AFUE

Furnace ≥ 95 % AFUE

R408.2.2 More efficient HVAC equipment

4 HVAC options applicable to climate zones 0 through 3 only

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.2(6)[b]	High Performance Gas furnace (Option 3)	0	1	1	NA	NA	NA	NA	NA	NA
R408.2.2(7)[b]	High Performance Gas furnace and cooling (Option 1)	5	5	4	NA	NA	NA	NA	NA	NA
R408.2.2(8)[b]	High Performance Gas furnace and cooling (Option 2)	6	5	5	NA	NA	NA	NA	NA	NA
R408.2.2(9)[b]	High Performance Gas furnace and heat pump (Option 1)	15	13	11	NA[e]	NA	NA	NA	NA	NA
R408.2.2(10)[b]	High Performance Heat pump with electric resistance backup (Option 1)	13	12	11	12	NA	NA	NA	NA	NA

≥ 90% AFUE fuel gas furnace

≥ 90% AFUE fuel gas furnace and 15.2 SEER2 and 10.0 EER2 AC

≥ 95% AFUE fuel gas furnace and 16.0 SEER2 and 10.0 EER2 AC

≥ 90% AFUE fuel gas furnace and 7.8 HSPF2, 15.2 SEER2/10.0 EER2 ASHP

≥ 7.8 HSPF2, 15.2 SEER2, and 11.7 EER2 air source heat pump

R408.2.2 More efficient HVAC equipment

4 HVAC options applicable to climate zones 0 through 3 only
2 HVAC measures allowed in climate zone 4 as noted below

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.2(6)[b]	High Performance Gas furnace (Option 3)	0	1	1	NA	NA	NA	NA	NA	NA
R408.2.2(7)[b]	High Performance Gas furnace and cooling (Option 1)	5	5	4	NA	NA	NA	NA	NA	NA
R408.2.2(8)[b]	High Performance Gas furnace and cooling (Option 2)	6	5	5	NA	NA	NA	NA	NA	NA
R408.2.2(9)[b]	High Performance Gas furnace and heat pump (Option 1)	15	13	11	NA[e]	NA	NA	NA	NA	NA
R408.2.2(10)[b]	High Performance Heat pump with electric resistance backup (Option 1)	13	12	11	12	NA	NA	NA	NA	NA

≥ 90% AFUE fuel gas furnace

≥ 90% AFUE fuel gas furnace and 15.2 SEER2 and 10.0 EER2 AC

≥ 95% AFUE fuel gas furnace and 16.0 SEER2 and 10.0 EER2 AC

≥ 90% AFUE fuel gas furnace and 7.8 HSPF2, 15.2 SEER2/10.0 EER2 ASHP

≥ 7.8 HSPF2, 15.2 SEER2, and 11.7 EER2 air source heat pump

R408.2.2.1 More efficient HVAC equipment for Climate Zone 4.

For Climate Zone 4, the following HVAC options shall also apply:

2. Heat pump (Option 1): Greater than or equal to 7.8 HSPF2, 15.2 SEER2 and 11.7 EER2 air source heat pump.

R408.2.2 More efficient HVAC equipment

4 HVAC options applicable to climate zones 4 through 8 only

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.2(11)[b]	High Performance Gas furnace and cooling (Option 3)	NA	NA	NA	5	4	6	7	7	9
R408.2.2(12)[b]	High Performance Gas furnace and cooling (Option 4)	NA	NA	NA	6	5	7	8	8	10
R408.2.2(13)[b]	High Performance Gas furnace and heat pump (Option 2)	NA	NA	NA	12	8	11	11	12	12
R408.2.2(14)[b]	High Performance Heat pump with electric resistance backup (Option 2)	NA	NA	NA	12	8	12	13	14	16

≥ 95% AFUE fuel gas furnace and 15.2 SEER2 and 12.0 EER2 AC

≥ 97% AFUE fuel gas furnace and 16.0 SEER2 and 12.0 EER2 AC

≥ 95% AFUE fuel gas furnace and 8.1 HSPF2, 15.2 SEER2 cold climate heat pump

≥ 8.1 HSPF2, 15.2 SEER2 cold climate heat pump

R408.2.3 Reduced energy use in Service Water Heating

R408.2.3(1) through R408.2.3(7), the installed water heater shall meet one of the Uniform Energy Factors (UEF) or Solar Uniform Energy Factors (SUEF) in Table R408.2.3.

TABLE R408.2.3 SERVICE WATER HEATING EFFICIENCIES

MEASURE NUMBER	WATER HEATER	SIZE AND DRAW PATTERN	TYPE	EFFICIENCY
R408.2.3(1)(a)	Gas-fired storage water heaters (Option 1)	All storage volumes, all draw patterns	—	UEF ≥ 0.81
R408.2.3(1)(b)	Gas-fired storage water heaters (Option 2)	≤ 55 gallons, high	—	UEF ≥ 0.86
		> 55 gallons, medium or high	—	UEF ≥ 0.86
		Rated input capacity > 75,000 Btu/h	—	UEF ≥ 0.86 or E_t ≥ 94%
R408.2.3(2)(a)	Gas-fired instantaneous water heaters (Option 1)	All storage volumes, medium or high	—	UEF ≥ 0.92
R408.2.3(2)(b)	Gas-fired instantaneous water heaters (Option 2)	All storage volumes, medium or high	—	UEF ≥ 0.95
R408.2.3(3)	Electric water heaters (Option 1)	All storage volumes, low, medium, or high	Integrated HPWH	UEF ≥ 3.30
R408.2.3(4)	Electric water heaters (Option 2)	All storage volumes, low, medium, or high	Integrated HPWH, 120 volt/15 amp circuit	UEF ≥ 2.20
R408.2.3(5)(a)	Electric water heaters (Option 3)	All storage volumes, low, medium, or high	Split-system HPWH	UEF ≥ 2.20

R408.2.3 Reduced energy use in Service Water Heating

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.3(1) (a)[d]	Gas-fired storage water heaters (Option 1)	8	7	7	5	6	4	4	3	2
R408.2.3(1) (b)[d]	Gas-fired storage water heaters (Option 2)	9	8	8	6	7	5	4	4	3
R408.2.3(2) (a)[d]	Gas-fired instantaneous water heaters (Option 1)	10	9	9	6	7	5	5	4	3
R408.2.3(2) (b)[d]	Gas-fired instantaneous water heaters (Option 2)	11	10	9	6	7	6	5	4	3
R408.2.3(3)[d]	Electric water heaters (Option 1)	10	9	9	7	6	4	3	3	2
R408.2.3(4)[d]	Electric water heaters (Option 2)	8	8	8	6	5	4	3	3	2
R408.2.3(5) (a)[d]	Electric water heaters (Option 3)	7	8	8	6	7	5	4	3	3
R408.2.3(5) (b)[d]	Electric water heaters (Option 4)	8	9	10	7	8	5	5	4	3
R408.2.3(6)[d]	Electric water heaters (Option 5)	10	9	9	7	6	4	3	3	2
R408.2.3(7) (a)[d]	Solar hot water heating system (Option 1)	13	13	13	9	8	5	4	4	3
R408.2.3(7) (b)[d]	Solar hot water heating system (Option 2)	10	9	9	6	7	6	5	4	3
R408.2.3(8)[c]	Compact hot water distribution	2	2	2	2	2	2	2	2	2

UEF ≥ 0.95

UEF ≥ 3.30

R408.2.3 Reduced energy use in Service Water Heating

- Compact hot water distribution shall not store > 16 ounces of water between nearest source of hot water and termination of fixture supply pipe.
- Volume is determined based on pipe length, type and diameter from Table R408.2.3.1

TABLE R408.2.3.1 INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING

OUNCES OF WATER PER FOOT OF TUBE									
Nominal Size (inches)	Copper Type M	Copper Type L	Copper Type K	CPVC CTS SDR 11	CPVC SCH 40	CPVC SCH 80	PE-RT SDR 9	Composite ASTM F1281	PEX CTS SDR 9
3/8	1.06	0.97	0.84	N/A	1.17	—	0.64	0.63	0.64
1/2	1.69	1.55	1.45	1.25	1.89	1.46	1.18	1.31	1.18
3/4	3.43	3.22	2.90	2.67	3.38	2.74	2.35	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	4.57	3.91	5.56	3.91
1 1/4	8.70	8.36	8.09	6.61	9.66	8.24	5.81	8.49	5.81
1 1/2	12.18	11.83	11.45	9.22	13.20	11.38	8.09	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	19.11	13.86	21.48	13.86

R408.2.4 More efficient thermal distribution

Energy credit measures for efficient thermal distribution

1. Ductless systems or hydronic systems within the building thermal envelope
2. 100% of ducts in conditioned space, including air handler
3. 80% of ducts in conditioned space, including air handler
4. Reduced total duct leakage for ducts outside conditioned space
    1. 2.0 CFM25/ft^2 of CFA, with air handler installed
    2. 1.75 CFM25/ft^2 of CFA, with air handler not installed

R408.2.4 More efficient thermal distribution

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.4(1)[c]	Ductless or hydronic thermal distribution	3	4	5	7	8	10	10	10	14
R408.2.4(2)[c]	100% of duct systems in conditioned space	2	3	4	6	7	9	9	9	13
R408.2.4(3)[c]	≥ 80% of ductwork inside conditioned space	2	3	3	5	6	7	7	7	9
R408.2.4(4)[c]	Reduced total duct system leakage	1	1	1	1	1	1	2	2	2

R408.2.5 Improved air sealing and ventilation

Energy credit measures for improved air sealing and efficient ventilation

1. Energy recovery ventilator (ERV) / heat recovery ventilator (HRV) installed*
2. ≤ 2.0 ACH50 with ERV/HRV*
3. ≤ 2.0 ACH50 with balanced ventilation system
4. ≤ 1.5 ACH50 with ERV/HRV*
5. ≤ 1.0 ACH50 with ERV/HRV*

*ERV/HRV need SRE > 75% and ERV LRMT > 50%

R408.2.5 Improved air sealing and ventilation

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.5(1)[c]	ERV or HRV installed	0	0	0	0	1	3	2	2	2
R408.2.5(2)[c]	≤ 2.0 ACH50 with ERV or HRV installed	0	0	0	4	4	8	5	5	5
R408.2.5(3)[c]	≤ 2.0 ACH50 with a balanced ventilation system	0	0	0	0	0	0	4	4	4
R408.2.5(4)[c]	≤ 1.5 ACH50 with ERV or HRV installed	0	0	0	6	5	10	9	9	9
R408.2.5(5)[c]	≤ 1.0 ACH50 with ERV or HRV installed	0	0	1	7	6	12	12	12	12

R408.2.6 Energy efficient appliances

Appliances shall comply with the efficiency requirements specified in Table R408.2.6.

Not less than three (3) appliance types from Table R408.2.6 shall be installed.

Exception: In Group R-2 where a dishwasher is not installed in each dwelling unit, not less than two (2) appliance types complying with Table R408.2.6 shall be installed.

In common areas, each appliance type shall comply with Table R408.2.6.

R408.2.6 Energy efficient appliances

TABLE R408.2.6 MINIMUM EFFICIENCY REQUIREMENTS: APPLIANCES

APPLIANCE TYPES	EFFICIENCY IMPROVEMENT	TEST PROCEDURE
Refrigerator	Maximum Annual Energy Consumption (AEC), not greater than 620 kWh/yr	10 CFR 430, Subpart B, Appendix A
Dishwasher	Maximum Annual Energy Consumption (AEC), not greater than 240 kWh/yr	10 CFR 430, Subpart B, Appendix C1
Clothes washer and clothes dryer	Clothes washer located within dwelling units: Maximum Annual Energy Consumption (AEC), not greater than 130 kWh/yr, and Integrated Modified Energy Factor (IMEF) > 1.84 cu ft/kWh/cycle Clothes washer not located within dwelling units and where dwelling units are not provided with rough-in plumbing for washers: Modified Energy Factor (MEF) > 2.0 cu ft/kWh/cycle	10 CFR 430, Subpart B, Appendices D1, D2 and J2

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.6[a]	Energy efficient appliances	1	1	1	1	1	1	0	0	0

R408.2.7 Renewable energy

Renewable energy resources shall be permanently installed with rated capacity to produce not less than 1 W/ft^2 of on-site renewable energy per sq. ft of conditioned floor area.
REC documentation shall meet the requirements of Section R404.4.

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.7	On-site renewable energy measures	17	16	17	11	11	9	8	7	4

Example:
This house in CZ5 is 2,000 ft^2. It needs 2,000 Watts or 2.0 kW of on-site renewable energy.

This can earn 9 credits with just eight (8) 250-Watt solar panels (18 are pictured).

R408.2.8 Demand response

Thermostat controlling primary heating and cooling systems are provided with demand responsive control to provide ability to participate in utility demand response programs

- Section R408.2.8.1 and R408.2.8.2 describe communication, operation and control requirements based on single stage, two stage or variable-capacity HVAC

MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.8[c]	Demand responsive thermostat	1	1	1	1	1	1	1	1	1

Building solution center

R408.2.9 Opaque Walls

The opaque wall credit is unique that it doesn't have energy credits.

It permits reduced levels of wood-framed wall insulation in CZ 4&5: Max U-0.060 or R-20 or R-13+5 instead of Max U-0.045 or R-30.

But, must be accompanied by one or more of the following:

1. Heat pumps installed meeting efficiency levels in R408.2.2
2. Heat pump water heaters meeting efficiency levels in R408.2.3
3. Three (3) additional energy credits
4. Renewable energy meeting requirements of R408.2.7

R408.2.10 Whole-home lighting control
R408.2.11 Higher efficacy lighting

Whole-home lighting control

- Dwelling has a lighting control system (manual or automated) to turn off all permanent installed interior lighting

Higher efficacy lighting

- All hardwired lighting have lamp efficacy of 90 lumens/watt or luminaire efficacy of 55 lumens per watt

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

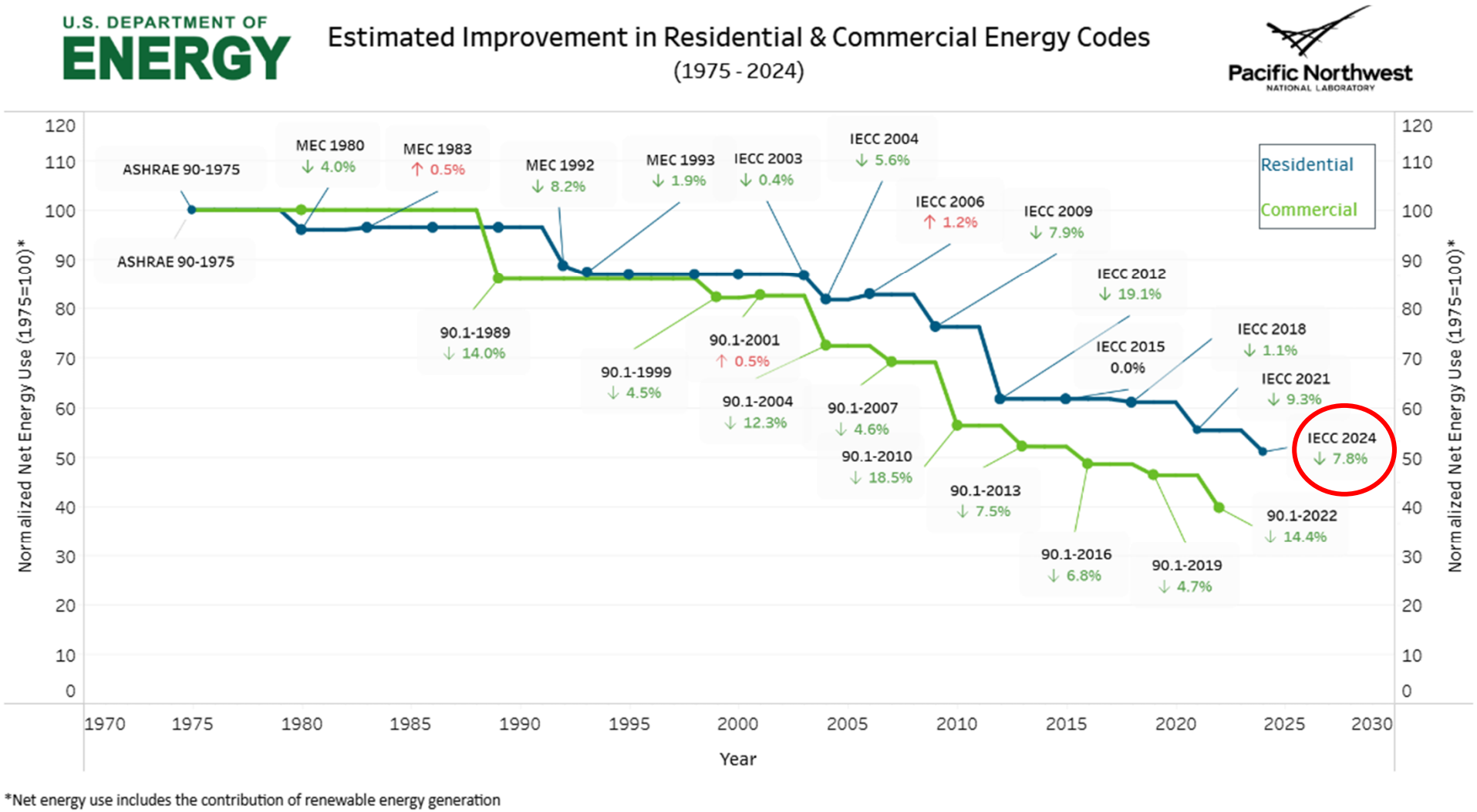
MEASURE NUMBER	MEASURE DESCRIPTION	CREDIT VALUE								
		Climate Zones 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.10	Whole-home lighting control	1	1	1	0	0	0	0	0	0
R408.2.11	Higher efficacy lighting	0	0	0	0	0	0	0	0	0

Building solution center

New (or updated) Appendices in 2024 IECC-R

Appendix RA: Board of Appeals
Appendix RB: Solar-Ready Provisions - detached One- and Two-Family Homes
Appendix RC: Zero Net Energy Residential Building Provisions (updated)
Appendix RD: Electric Energy Storage Provisions (new!)
Appendix RE: Electric Vehicle Charging Infrastructure (new!)
Appendix RF: Alternative Building Thermal Envelope Insulation R-values (new!)
Appendix RG: 2024 IECC Stretch Code (new!)
Appendix RH: Operational Carbon Rating and Energy Reporting (new!)
Appendix RI: On-Site Renewable Energy (new!)
Appendix RJ: Demand Responsive Controls (new!)
Appendix RK: Electric-Ready Residential Provisions (new!)
Appendix RL: Renewable Energy Infrastructure (new!)
Resource RRA: All-Electric Residential Buildings (new!)

2024 IECC-R Performance



Based on the Determination Analysis, the 2024 IECC is 7.8% more efficient than the 2021 IECC and almost 40% more efficient than the 2006 IECC

Thank you