U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

What's in the Latest Residential Model Energy Code: Preparing for the 2024 IECC

Building Energy Code Webinar Series

Building Technologies Office

September 19, 2024

Welcome | Building Energy Code Webinar Series

This webinar is being recorded. The video recording will be available on the webinar webpage next week.

A pdf of the full presentation is available now.

?

Please place all questions for the speakers in the **Zoom Q&A feature**. We will do our best to answer all questions during the Q&A at the end.

Certificates of completion and AIA LUs are available for participating in today's live session. **You can access your certificate on the BECP Resource Hub. Check back on Monday to download your certificate.**

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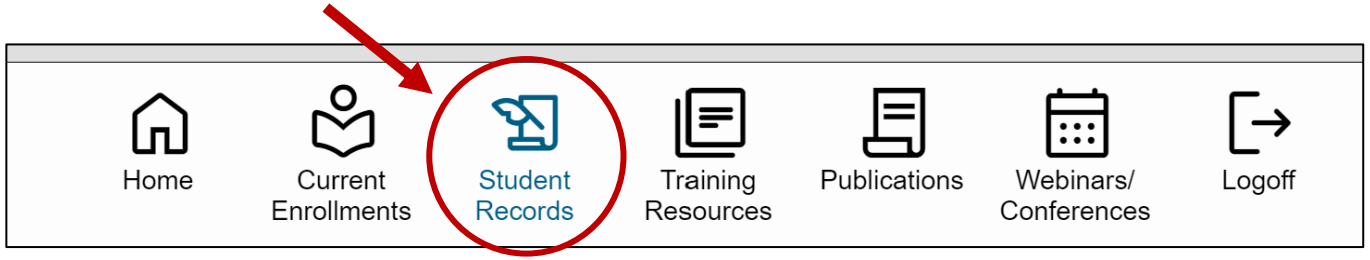

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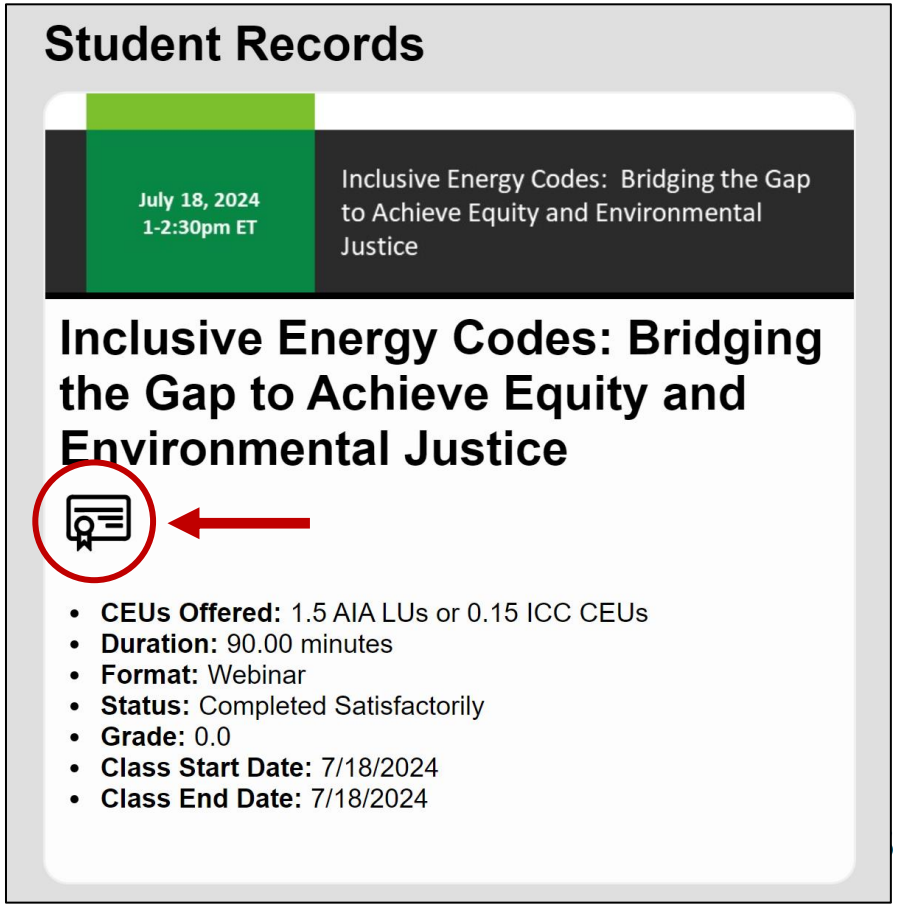

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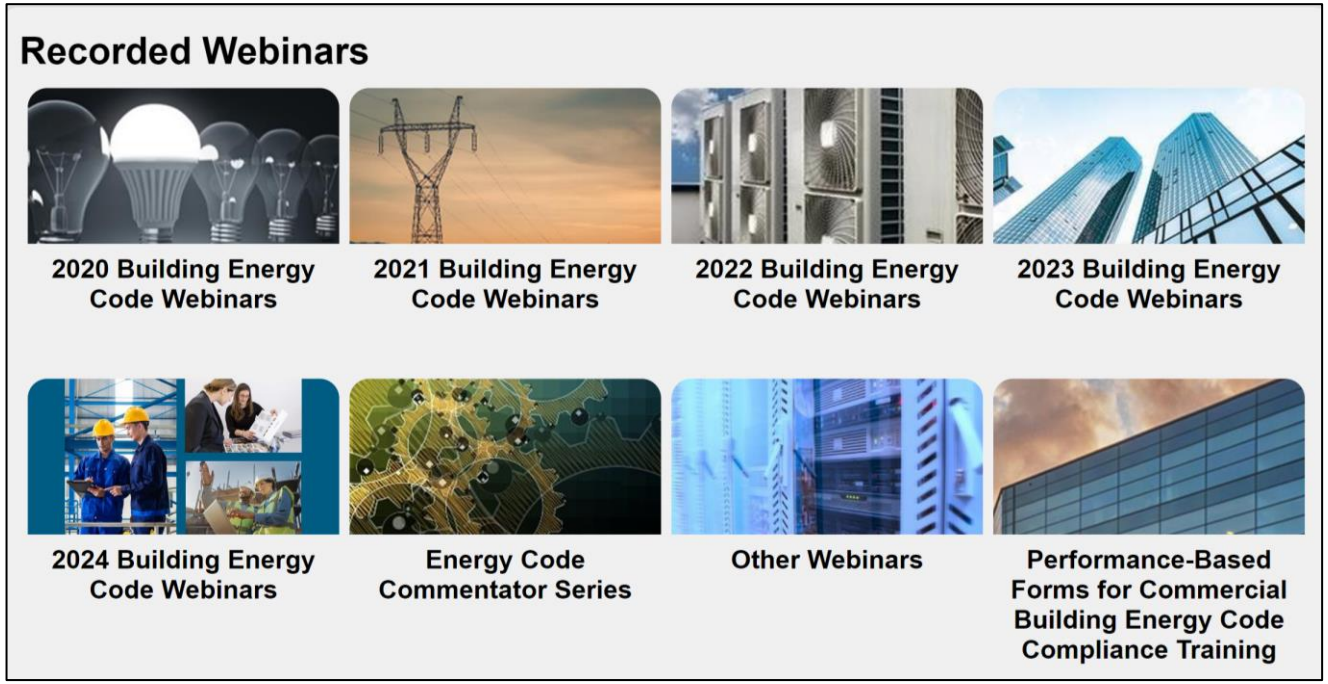

Upcoming BECP Webinars

Catch the entire lineup of sessions the third Thursday of each month @ 1p ET.

- **8/15/24:** Refrigerants and Codes: Understanding the Impact of Refrigerants Requirements on Building Codes and Standards on the Path to Net Zero Greenhouse Gas Emissions
- **9/19/24:** What's in the Latest Residential Model Energy Code: Preparing for the 2024 IECC
- **10/17/24:** Beyond Zero Energy: Balancing Embodied Carbon and Operational Energy Solutions to Achieve Zero Emission Buildings
- **11/21/24:** Resources and Best Practices for Growing the Green Building Workforce
- **1/16/25:** New York City Case Study: Understanding the Relationship between Policy and Actual Building Energy and Emissions Data

> Learn more: www.energycodes.gov/becp-energy-code-webinar-series

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Plug Into the Technical Assistance Network!

Facilitated by Pacific Northwest National Lab (PNNL), in coordination with the six Regional Energy Efficiency Organizations (REEOs) and additional technical assistance providers, the Network includes regional code professionals, building science experts, and experienced trainers to customize technical assistance to states and jurisdictions.

Get in touch: Contact your PNNL Regional Representative or Local REEO

More info: https://www.energycodes.gov/technical-assistance/network

Regional Energy Efficiency Organization	REEO Energy Code Contact	PNNL Regional Representative
Northeast Energy Efficiency Partnerships (NEEP)	Cornelia Wu	Mike Turns
Southeast Energy Efficiency Alliance (SEEA)	Maggie Kelley-Riggins	Kim Cheslak
Midwest Energy Efficiency Alliance (MEEA)	Alison Lindburg	Mark Lyles
South-central Partnership for Energy Efficiency as a Resource (SPEER)	Randy Plumlee	Paula Zimin
Northwest Energy Efficiency Alliance (NEEA)	Kevin Rose	Mark Lyles
Southwest Energy Efficiency Project (SWEEP)	Jim Meyers	Paula Zimin

Today's Speakers

Moderator: Christopher Perry, U.S. Department of Energy (DOE)

Gayathri Vijayakumar, Steven Winter Associates, Inc.

Rob Salcido, Pacific Northwest National Laboratory (PNNL)

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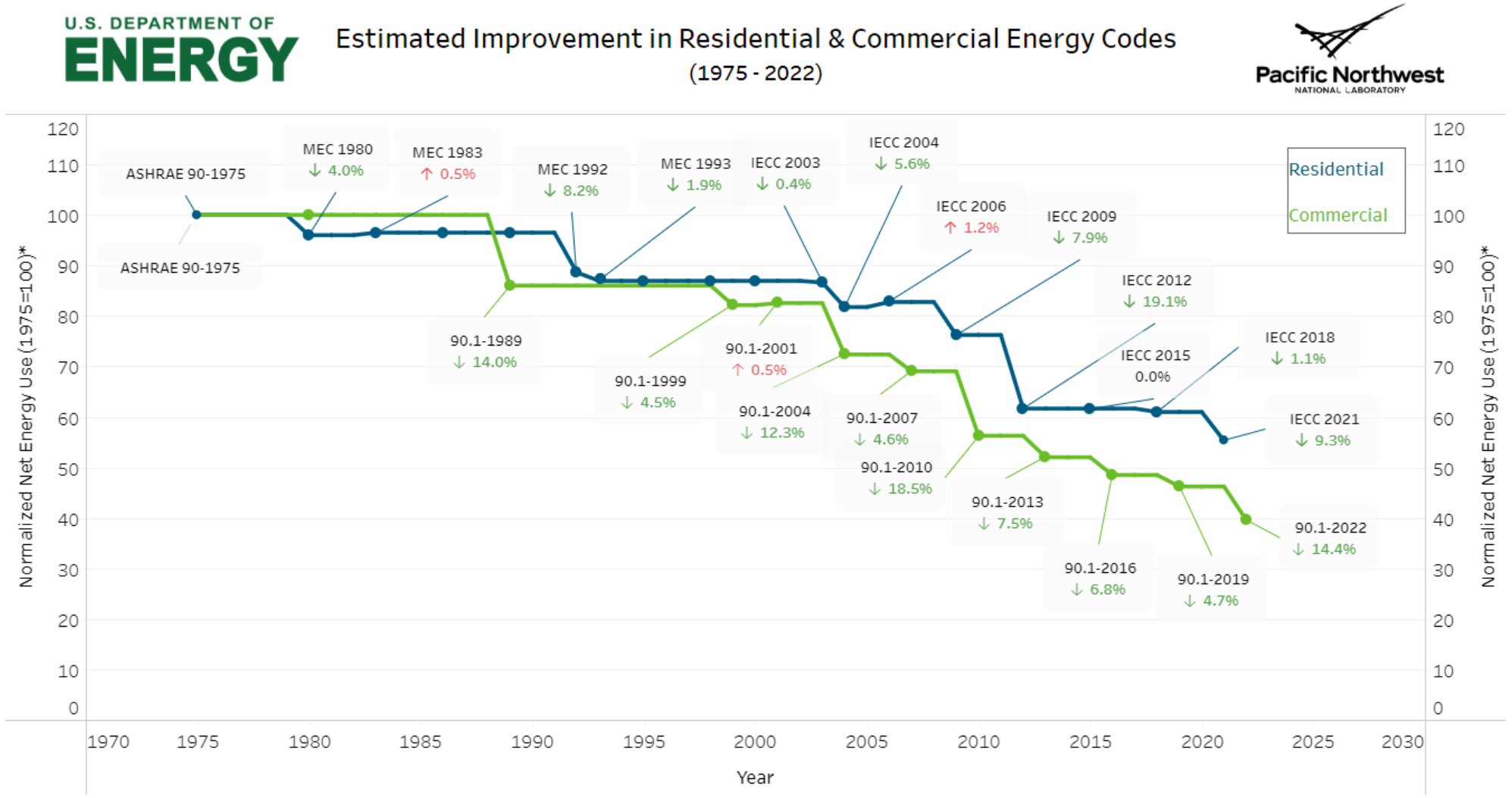
What's in the Latest Residential Model Energy Code: Preparing for the 2024 IECC

BECP Energy Code Webinar Series

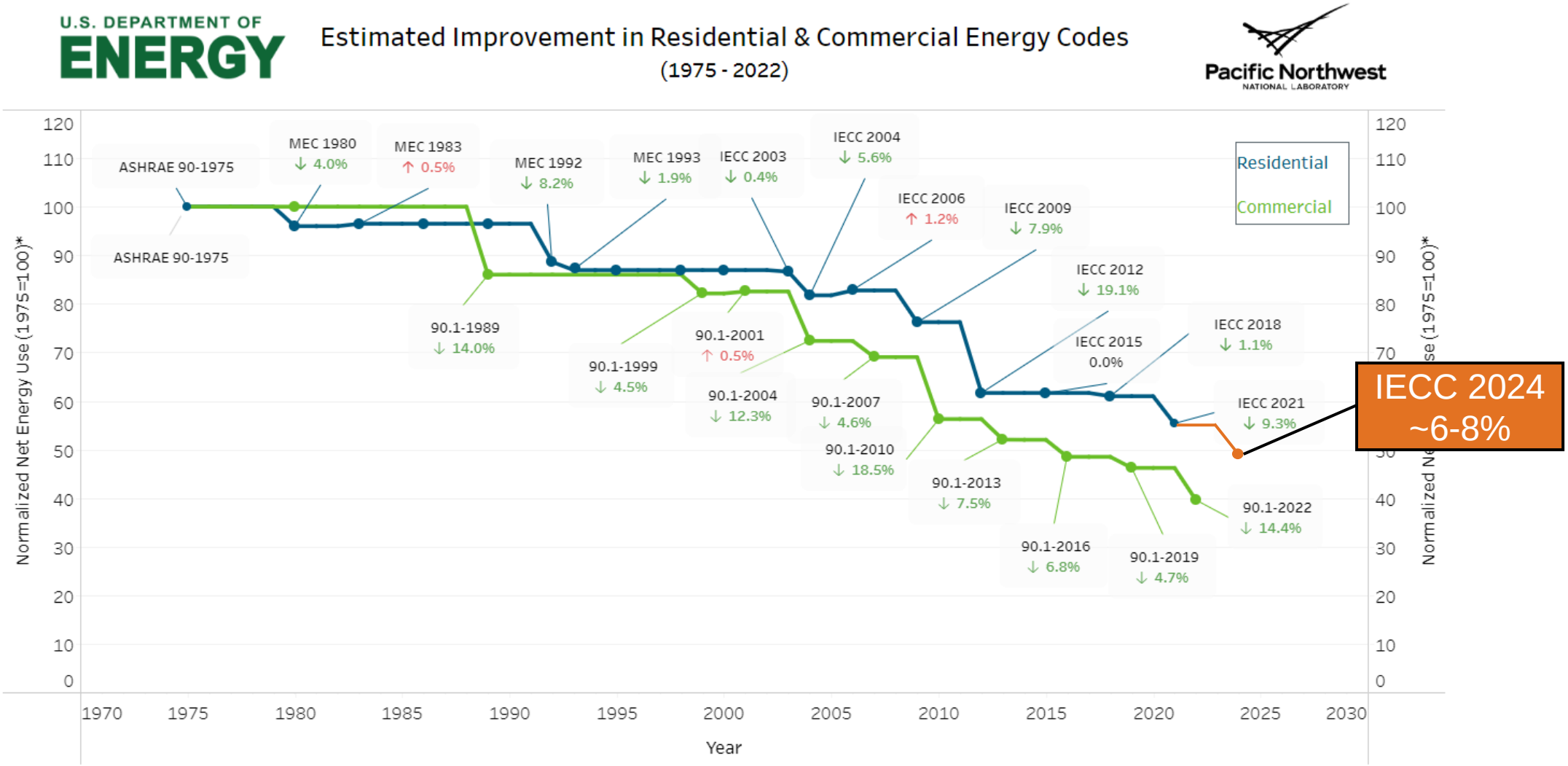
September 19, 2024

Model codes have saved energy for over 40 years



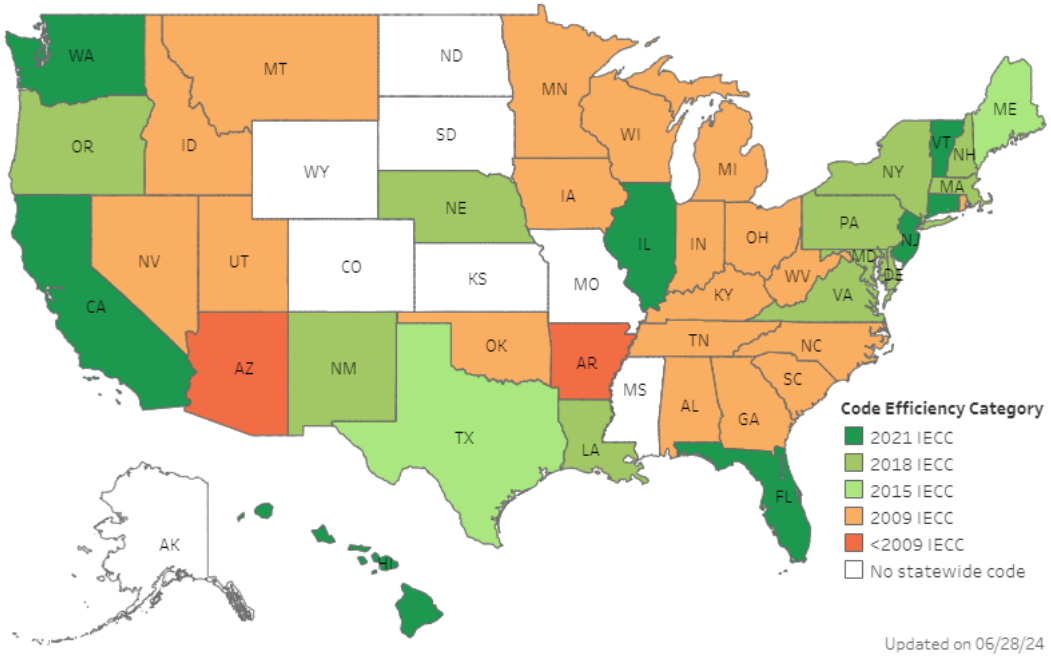
*Net energy use includes the contribution of renewable energy generation

Model codes have saved energy for over 40 years

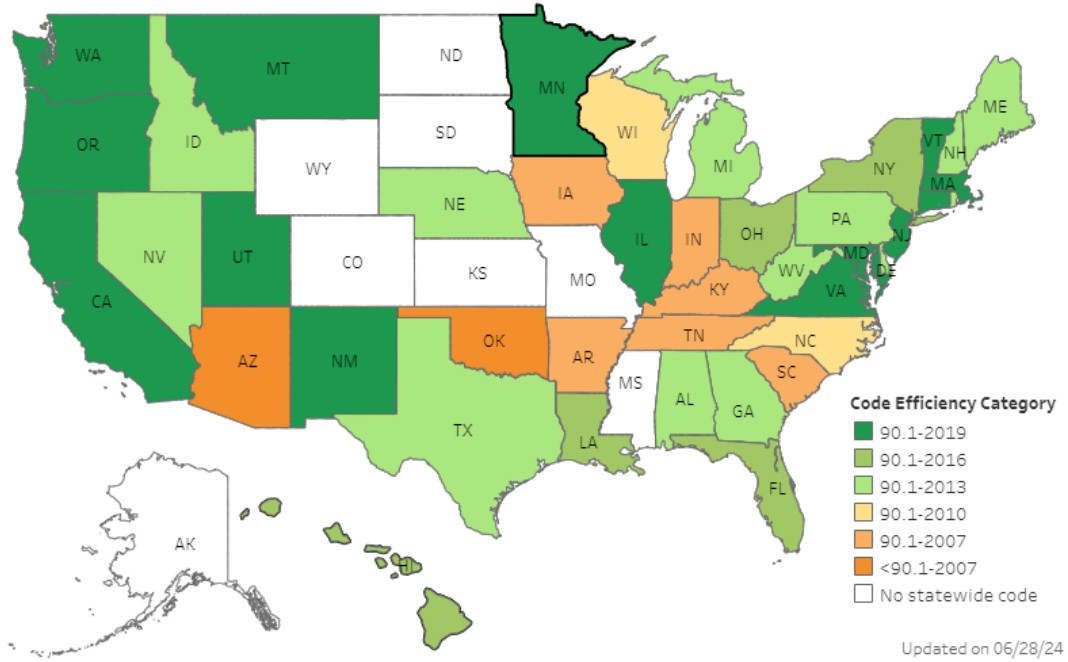


*Net energy use includes the contribution of renewable energy generation

DOE is helping states and jurisdictions update to the modern codes



Residential Buildings (IECC)



Commercial Buildings (Standard 90.1)

BIL and IRA provide over $1.2 billion for energy codes support

Infrastructure Investment and Jobs Act (IIJA)

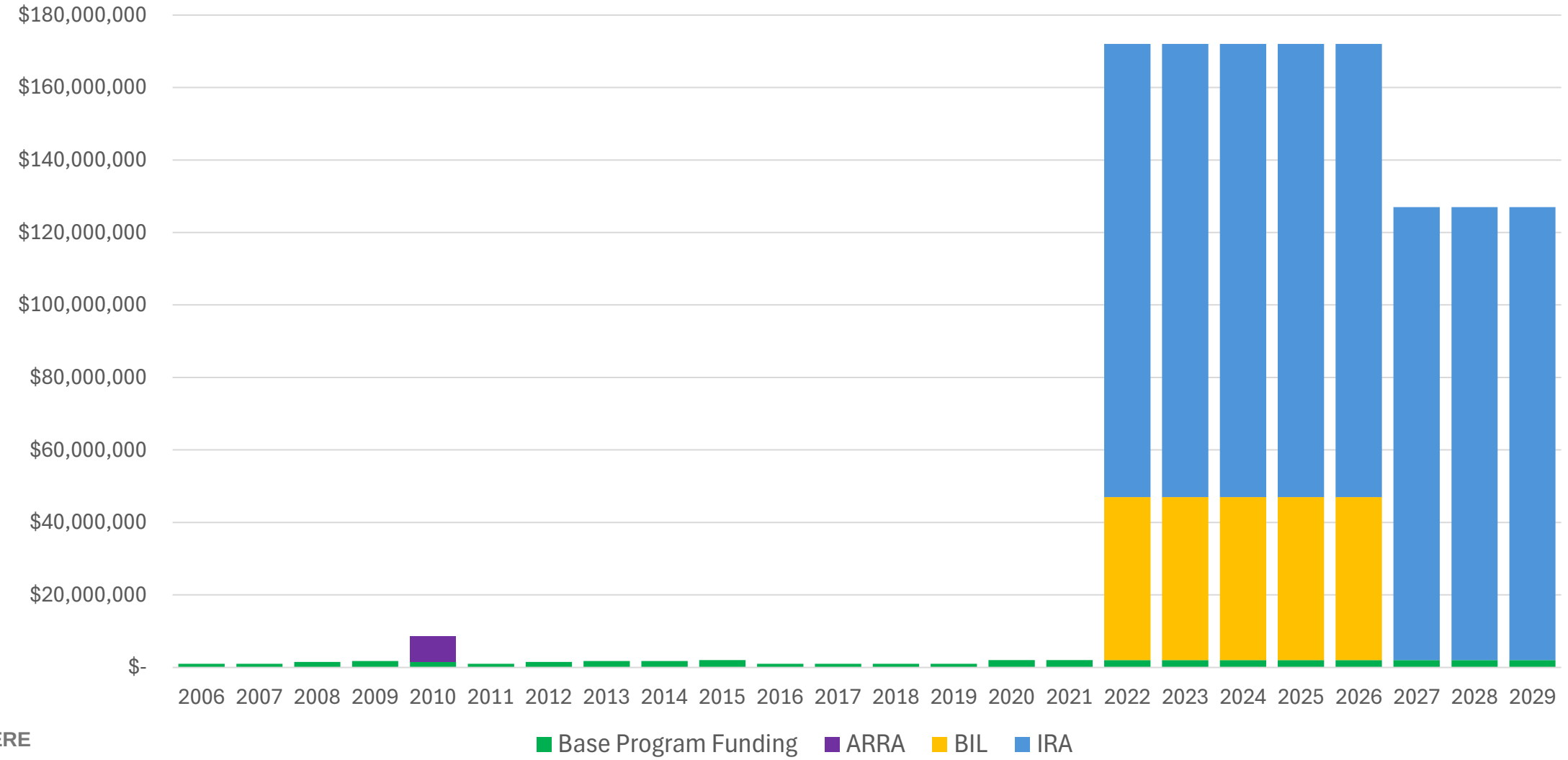
(Resilient and Efficient Codes Implementation)

$225 million to support the implementation of updated energy codes through the development of critical partnerships supporting workforce training, stakeholder engagement, and a broad range of energy code compliance activities.

Inflation Reduction Act (IRA)

$1 billion to support the adoption and implementation of the latest building energy codes, zero energy building codes, and innovative codes such as building performance standards, with equivalent energy savings.

BIL and IRA represent an unprecedented opportunity for energy codes



DOE recently announced $90 million for 25 awards from the second round of RECI funding

Rural Communities

- 3225-1531 - City of Tucson: Strengthening Code Adoption and Implementation Capacity for the Resilient Southwest Building Code Collaborative through Increased Energy Code Focus in Workforce Development Programs
- 3225-1556 – NEEA: Supporting Building Energy Code Compliance Through Replicable Rural Workforce Models
- 3225-1535 – NEEP: National Rural Codes Collaborative

Tribal Nations

- 3225-1522 – Slipstream: Building a strong foundation for lasting energy code adoption by Native Nations in Michigan
- 3225-1541 – MEEA: Focus on Under-Resourced Tribal and Home Rule communities (FURTHR)

Implementation and Compliance

- 3225-1557 – CEC: California Energy Code Documentation, Certification, and Plan Check Support Program
- 3225-1523 – Karpman Consulting: Validate Automation of ASHRAE 90.1 Performance Rating Method in Commonly Used Simulation Tools
- 3225-1533 – NASEO: Establishing and Testing a Building Codes and Resilience Field Study Methodology
- 3225-1511 – NYSERDA: A PARTNERSHIP FOR RESILIENT BUILDING CODE COMPLIANCE IN NEW YORK STATE: Providing innovative online code support for communities

Workforce Development

- 3225-1532 – Newport Partners: Enabling Advanced Codes: Developing and Implementing Tools and Strategies to Overcome Prominent Barriers
- 3225-1555 – Rhode Island Office of Energy Resources: RI Resilient and Efficient Codes Implementation
- 3225-1548 – Virginia Department of Housing and Community Development: Virginia BuildCodeEd
- 3225-1526 – NBI: South-central Energy Code Optimization Project

Stretch Codes

- 3225-1528 – NBI: Optimizing Grid Integration Strategies for Climate Zone 1 Buildings
- 3225-1571 – Utah Clean Energy Alliance: Intermountain Collaborative to Advance Resilient, Low and Zero Emission Homes and Buildings
- 3225-1527 – NBI: Advancing Equitable Energy Codes, Policy and Workforce Development in Illinois
- 3225-1554 – Center for Energy and Environment: A Path to Net Zero: Phase II

BPS

- 3225-1520 – IMT: An Improved Framework for Building Performance Standard Alternative Compliance Pathways
- 3225-1504 – USGBC CA: CA Building Energy Performance Standards & Upskill Pathways (CA BEPS UP)
- 3225-1550 - Resilience Authority of Annapolis and Anne Arundel County: Incorporating Climate Resilience into Building Performance Standards
- 3225-1514 – Rutgers: BPS Ready: Preparing the market for an evidence-based Building Performance Standards

Partnerships

- 3225-1546 – American Council for an Energy-Efficient Economy (ACEEE): Pathway to Zero Codes Coalition
- 3225-1518 – SEEA: Building a Resilient and Efficient Southeast Collaborative
- 3225-1534 – REEOs: Nationwide Energy Code Technical Assistance by Region (NECTAR)
- 3225-1539 – NASEO: State Collaboration on Building Energy Codes and Standards

www.energy.gov/articles/biden-harris-administration-announces-90-million-accelerate-building-code-adoption-and

Thank You

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Pacific Northwest
NATIONAL LABORATORY

What's in the Latest Residential Model Energy Code: Preparing for the 2024 IECC

Rob Salcido
Senior Engineer
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Principal Mechanical Engineer
Steven Winter Associates

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2024 Residential Energy Code Development

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

- 16 Code Officials
- 10 Builders
- 9 Public Segment
- 7 Users
- 4 Manufacturers
- 2 Utilities

Sub-Committees: 1) Consistency & Admin, 2) Envelope & Embodied Carbon, 3) HVAC & HW, 4) Electrical, Light, & Renewables, 5) Existing Bldgs & 6) Modeling

Heard almost 780 proposals over 2 years and 3 public comment rounds!

Approved 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
2. This is a highlight of ‘key’ changes, mostly in Chapter 4 (e.g., we won’t get into details on changes in lighting or other Chapters, like Existing Buildings)

Code Changes to expect in 2024 IECC-R [R401]

R401 General (*Let's start with what was added in 2021 IECC*)

R401.2 Application. Residential buildings shall comply with Section R401.2.5 and either Section R401.2.1, R401.2.2, R401.2.3 or R401.2.4.

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).**

Code Changes to expect in 2024 IECC-R [R401]

R401 General (*This all gets removed in 2024 IECC*)

R401.2 Application. Residential buildings shall comply with ~~Section R401.2.5 and either~~ Section R401.2.1, R401.2.2, R401.2.3 or R401.2.4.

~~**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).~~

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 in some CZ's

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

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

A new Appendix RF to help determine F-factors for other installation configurations

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*.

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

R402.2.10.2 Alternative slab-on-grade insulation configurations.
For buildings complying with Sections **R405** or **R406**, slab-on-grade insulation shall be installed in accordance with the *proposed design* or *rated design*.

R405.4.2 Residence specifications.
Proposed U-factors and slab-on-grade F-factors shall be taken from Appendix RF, ANSI / ASHRAE / IES Standard 90.1 Appendix A, or determined using a method consistent with the ASHRAE Handbook of Fundamentals …

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

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

APPENDIX RF: ALTERNATIVE BUILDING THERMAL ENVELOPE INSULATION R-VALUE OPTIONS

RF106.1 Slabs-on-grade.

F-factors for unheated and heated slabs-on-grade shall be as specified in Table RF106.1. All applicable adjustment factors in the table notes shall apply. *F*-factors for basement floor slabs and crawl space ground surfaces located below exterior grade shall be adjusted in accordance Note f as applicable.

TABLE RF106.1 *F*-FACTORS FOR SLABS-ON-GRADE[a, b, c, d, e, f]

UNHEATED SLABS-ON-GRADE: INSULATION CONFIGURATIONS	*F*-FACTOR (Btu/h × ft ×°F)
Uninsulated slab	—
Horizontal insulation under slab at slab perimeter—slab edge not insulated	—
≥ R-5 for 2 ft	0.70
R-5 for 4 ft	0.67
≥ R-10 for 4 ft	0.64
Vertical insulation on exterior face[g]—slab edge insulated[h]	—
R-2.5 for 2 ft	0.66

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

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]

R402 Building Thermal Envelope

R402.1.5 Total UA alternative (2021 IECC)

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

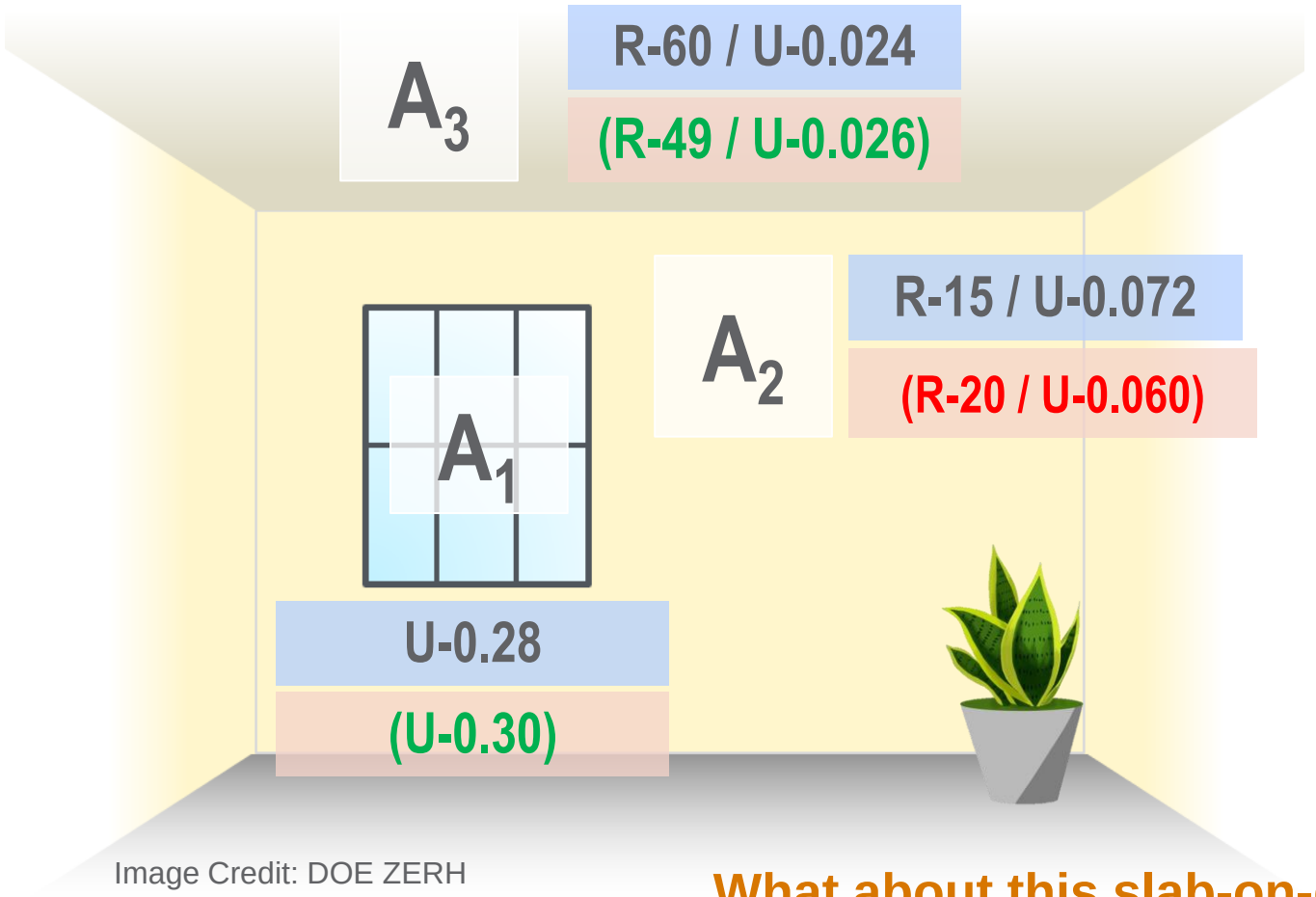


Image Credit: DOE ZERH

What about this slab-on-grade floor?

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]

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 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
- Reduced air leakage allowance if using guarded tests

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

R403 Systems

R403.1.2 Heat Pump Supplementary Heat (applies to all Paths, if applicable)

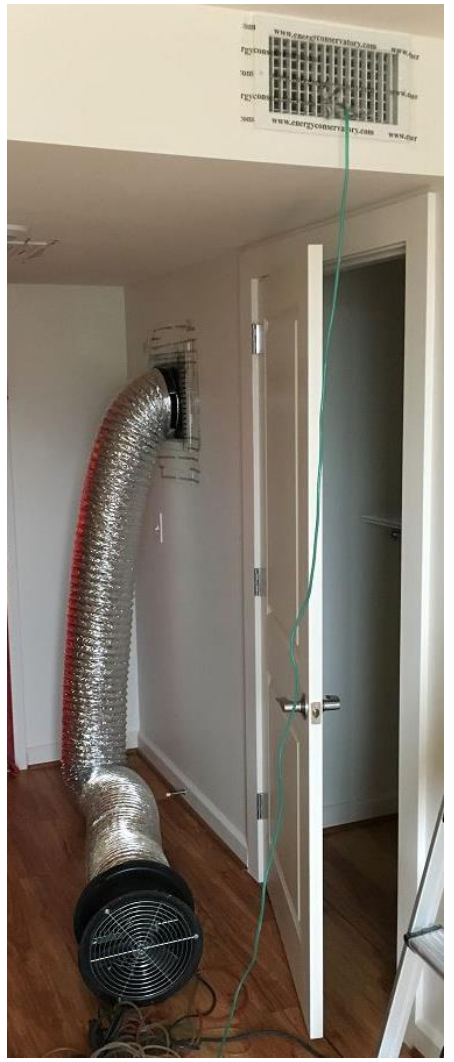
- Now applies to all supplementary heat (electric resistance & other fuels)
- New language to clarify the controls needed

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

R403 Systems

R403.3 Ducts (section applies 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
  - 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 FT^2 OF CONDITIONED FLOOR AREA		DUCT SYSTEMS SERVING 1,000 FT^2 OR LESS OF CONDITIONED FLOOR AREA
	cfm/100 ft^2		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

a. A ducted return is a duct made of sheet metal or flexible duct that connects one or more return grilles to the return-side inlet of the air-handling unit. Any other method to convey air from return or transfer grilles to the air-handling unit does not constitute a ducted return for the purpose of determining maximum total duct system leakage allowance.

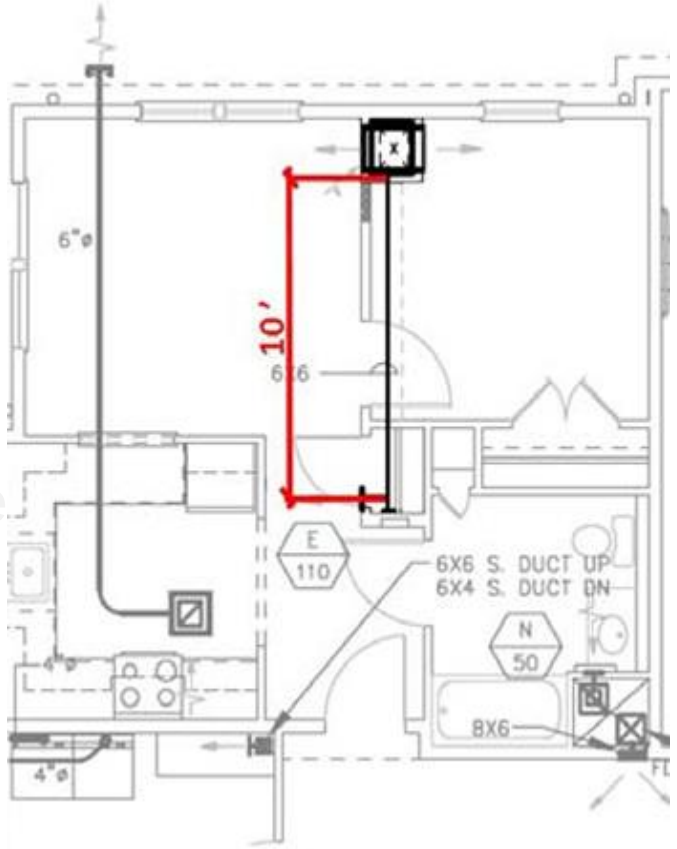
c. For duct systems to be considered inside a conditioned space, where the ductwork is located in ventilated attic spaces or unvented attics with vapor diffusion ports, duct system leakage to outside must comply with Item 2.1 of Section R403.3.4.
d. Prior to the issuance of a certificate of occupancy, where the air-handling unit is not verified as being located in conditioned space, the total duct system leakage must be retested.

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

R403 Systems

R403.3 Ducts

- 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
  - Add footnotes for further explanations
  - Add test exemption for ductless systems (< 10 ft)
  - Add a sampling protocol for buildings with 8+ units
  - Added duct sizing requirements

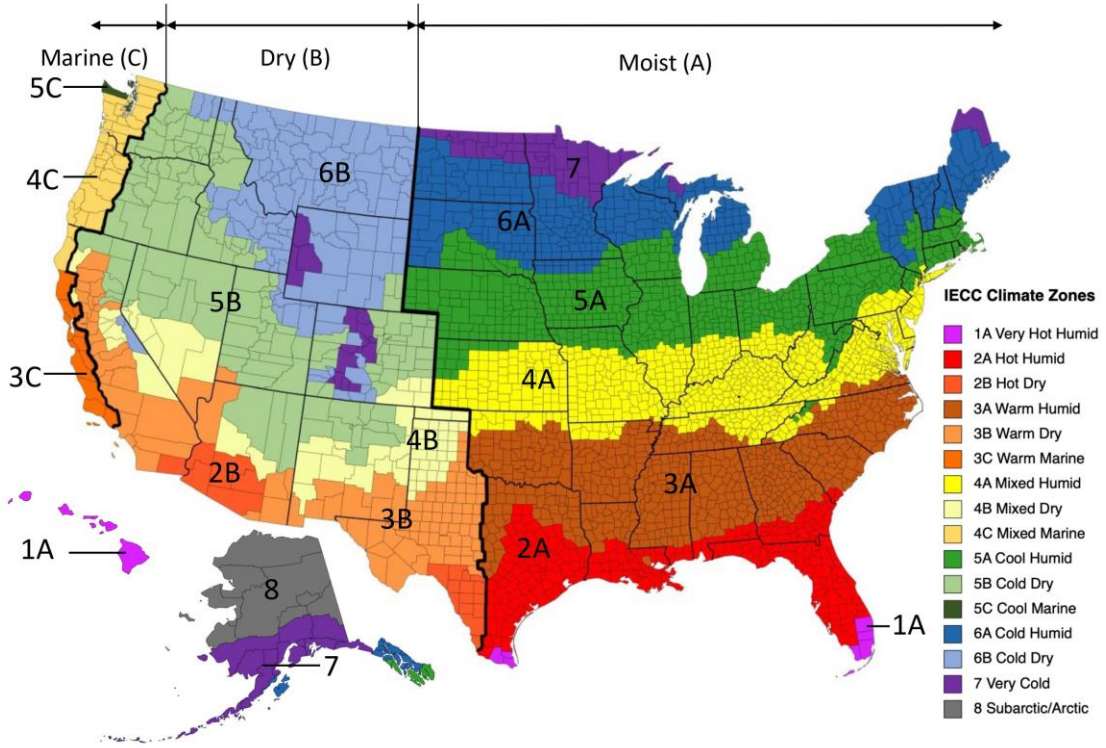


Code Changes to expect in 2024 IECC-R [R403]

R403 Systems (continued)

R403.6.1 Heat or energy recovery ventilation (required in all Paths)

- 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

- Prescriptive path only
- 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 (see Resource RRA)

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

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]

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]

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]

R405 Simulated Building Performance

- For Multifamily, clarifies that only **dwelling units** are modeled; **common areas** must instead meet prescriptive requirements in R402, R403, and R404
- For the 1st time, 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 ft²** have to perform **5%** better (**20** and **25%**)

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

R405 Simulated Building Performance

- Envelope backstop updated from **2009 IECC** to **1.08 or 1.15 X $TC_{2024\ IECC}$**
- 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
- Requires software to demonstrate compliance with **ASHRAE Std 140**
- **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

- For Multifamily, clarifies that only **dwelling units** are modeled; **common areas** must instead meet prescriptive requirements in R402, R403, and R404
- Requires software tools to demonstrate compliance with ASHRAE Std 140
- Updates to use ANSI 301-**2022** instead of 2019
- Removes the **ventilation rate** deviation

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

R406 Energy Rating Index (ERI) Compliance

- Same envelope backstop as R405; no different 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), your ERI Max is much lower
- For Multifamily, allows the average ERI to be used to demonstrate compliance

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

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

Additional Efficiency Requirements

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

2021 IECC R408 Additional Efficiency Requirements-choose **ONE**

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).

2021 IECC R408 intent to reduce total site energy use by 5% in all climate zones

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

- R408 changed to an Energy Credits methodology for additional efficiency requirements
- Credits for each measure calculated by PNNL.
- Aligns with the IECC-Commercial C406 Section approach.

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

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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 shall not be 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

2024 IECC R408 Energy Credit Requirements

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(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)						6	7	7	9
R408.2.3(1)(a)[d]	Gas-fired storage water heaters (Option 1)						4	4	3	2

Furnace ≥ 97 % AFUE

UEF ≥ 0.81

Total energy credits from two measures = 10

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2024 IECC R408 Energy Credit Requirements

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(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	2	1	1	1	1	1
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)			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

U-factor ≤ 0.28, SHGC ≤ 0.23

iHPWH, UEF ≥ 3.3

Total energy credits from two measures = 10

2024 IECC R408 Energy Credit Requirements

Footnotes added to bring clarity to requirements for multifamily (Group R-2)

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
R408.2.6[a]	Energy efficient appliances	1	1	1	1	1	1	0	0	0

a. Where the measure is selected, each dwelling unit, sleeping unit and common area where the measure is applicable must have the measure installed.

b. Where multiple heating or cooling systems are installed, credits shall be determined using a weighted average of the square footage served by each system.

c. Where the measure is selected, each dwelling unit and sleeping unit must comply with the measure.

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. Either Section R408.2.1.1 or R408.2.1.2. Credit shall only be permitted from one measure (TC Reduction)
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

NR = No Requirement.

R408.2.2 More efficient HVAC equipment

14 options in total; 1st 5 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
Two 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 SWH

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(5)(b)	Electric water heaters (Option 4)	All storage volumes, low, medium, or high	Split-system HPWH	UEF ≥ 3.75
R408.2.3(6)	Electric water heaters (Option 5)	Rated input capacity > 12 kW		COP ≥ 3.00
R408.2.3(7)(a)	Solar water heaters (Option 1)	All storage volumes, all draw patterns	Electric backup	SUEF ≥ 3.00
R408.2.3(7)(b)	Solar water heaters (Option 2)	All storage volumes, all draw patterns	Gas backup	SUEF ≥ 1.80

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R408.2.3 Reduced energy use in SWH

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

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R408.2.3 Reduced energy use in SWH

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 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 credits for efficient thermal distribution can be achieved by the following measures

- Ductless systems or hydronic systems within the building thermal envelope
- 100% ducts in conditioned space
- 80% of ducts in conditioned space
- Reduced total duct leakage for ducts outside conditioned space
  - 2.0 CFM25/sq ft of CFA with space conditioning equipment installed
  - 1.75 CFM25/sq ft of CFA with space conditioning equipment 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 credits for improved air sealing and efficient ventilation can be achieved by the following measures

- Energy recovery ventilator (ERV)/heat recovery ventilator (HRV) installed
- <= 2.0 ACH50 with ERV/HRV
- <= 2.0 ACH50 with balanced ventilation system
- <= 1.5 ACH50 with ERV/HRV
- <= 1.0 ACH50 with ERV/HRV

In addition, for measures requiring either an ERV or HRV, HRV and ERV Sensible Recovery Efficiency (SRE) shall be not less than 75 percent at 32°F (0°C) at the lowest *listed* net airflow. ERV Latent Recovery/Moisture Transfer (LRMT) shall be not less than 50 percent at the lowest *listed* net airflow. In Climate Zone 8, recirculation shall not be used as a defrost strategy.

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

For SI: 1 cubic foot per kilowatt hour per cycle = 0.028 m^3/kWh/cycle.

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 Marine	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 eight 250-Watt solar panels (18 are pictured).

R408.2.8 Demand response

Thermostat controlling primary heating and cooling systems are provided with a demand responsive control capable providing 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 does not assign energy credits but permits reduced levels of wood-framed wall insulation in climate zones 4 and 5 in exchange for one or more of the following:

- Heat pumps installed meeting efficiency levels in R408.2.2
- Heat pump water heaters meeting efficiency levels in R408.2.3
- 3 additional energy credits
- 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 lighting control system (manual or automated) at 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!)

Appendix RC – Zero Net Energy

Section RC101 (Scope): Applies to new residential construction and comply with Section R406 ERI compliance.

Section RC102 (General definitions for off-site renewable energy + power purchase agreements)

Section RC103 – ERI Compliance

TABLE RC103.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING RENEWABLE ENERGY	ENERGY RATING INDEX INCLUDING ADJUSTED OPP
0	42	0
1	42	0
2	42	0
3	42	0
4	42	0
5	42	0
6	42	0
7	42	0
8	42	0

Appendix RD – Electric Energy Storage Provisions

Section RD101 (Scope): These provisions shall be applicable for new construction where solar-ready measures or an on-site solar PV system is required.

Section RD102 (General Definition of ESS)

Section RD103 – Electrical Energy Storage

1. ESS w/rated energy capacity ≥ 5 kWh
2. ESS – ‘readiness’
3. Group R-2 & R-4: follow IECC-C, Appendix CJ

Appendix RE – EV Charging Infrastructure

RE101.1 Definitions

- Automobile Parking Space, EV-capable, EV-ready, or EVSE-installed

RE101.2 Electric Vehicle Power Transfer Infrastructure

- RE101.2.1 Quantity
  - Single family (IRC): One (1) space per unit
  - Group R-2: 40% of units or spaces, whichever is less
- RE101.2.2 EV Capable Spaces
- RE101.2.3 EV Ready Spaces
- RE101.2.4 EVSE Spaces
- RE101.2.5 Electrical Distribution System Capacity

Appendix RE – EV Charging Infrastructure

Automobile Parking Space: "A space within a *building* or private or public parking lot, exclusive of driveways, ramps, columns, office and work areas, for the parking of an automobile"

EV-capable: "A designated automobile parking space that is provided with electrical infrastructure, such as, but not limited to, raceways, cables, electrical capacity, and panelboard or other electrical distribution equipment space, necessary for the future installation of an EVSE"

EV-ready: "An automobile parking space that is provided with a branch circuit and either an outlet, junction box or receptacle, that will support an installed EVSE"

EVSE space: "An automobile parking space that is provided with a dedicated EVSE connection"

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Appendix RF –Building Insulation R-Value Options

Helps determine alternative building assembly and insulation component R-values comply with maximum U-factors/F-factors from Table R402.1.2.

Above Grade Wood Framed Walls, Basement and Crawlspace Walls and Slab-on-Grade

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
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
	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
	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
	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
	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
	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
	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
	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
	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
	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
	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

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Appendix RG – Stretch Code Appendix

Adoption of the Stretch Code Appendix results in lower energy consumption compared to adoption of the 2024 IECC-R by:

- Increasing the number of credits required in R408 from 10 to 20
- Increasing the energy cost savings in R405 by 10%
- Reducing the maximum ERI in R406

TABLERG101.2 (R406.5) MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0 and 1	46	27
2	46	26
3	45	24
4	48	32
5	49	37
6	48	39
7	47	43
8	47	43

Appendix RH – Operational Carbon Appendix

Where Appendix RH is adopted, compliance is through R406 only (Energy Rating Index)

Everything in the Appendix is the same as R406, except for two additions:

- The $CO2_e$ Index cannot exceed 65 (if all-electric). Mixed-fuel homes, the AHJ can determine the max allowed.
- The certificate shall report the estimated dwelling unit energy use by fuel type, inclusive of all end-uses. This enables the AHJ to calculate other GHG metrics.

Appendix RI – On-Site Renewable Energy

Adoption of the On-Site Renewable Energy Appendix requires the installation of 2 kW for one/two family dwellings or 0.75 watts/sq ft of conditioned floor area for Group R-2 or R-4 residential buildings.

- Alternative capacity based on R405 performance

TABLE RI103.1.1.1 PERFORMANCE CRITERIA FOR STANDARD REFERENCE DESIGN PHOTOVOLTAIC SYSTEMS

CRITERIA	DESIGN MODEL
Size	Rated capacity not less than required in accordance with Section RI103.1.1.
Module type	Crystalline silicon panel with a glass cover, 19.1% nominal efficiency and temperature coefficient (Tc Power) of -0.37%/°C.
Array type	Rack-mounted array with installed nominal operating cell temperature (INOCT) of 103°F (45°C).
Total system losses (DC output)	11.3%
Tilt	0 degrees (mounted horizontally)
Azimuth	180 degrees

- Alternative compliance with R406 ERI with OPP requirements

TABLE RI103.1.2 MAXIMUM ENERGY RATING INDEX INCLUDING OPP

CLIMATE ZONE	ENERGY RATING INDEX WITH OPP
0 and 1	35
2	34
3	33
4	40
5	43
6	43
7 and 8	46

Appendix RJ – Demand Responsive Controls

Demand Responsive Water Heating

Electric water heaters (40-120 gallons & ≤ 12kW) shall have demand responsive controls in accordance with Table RJ101.1

TABLE RJ101.1 DEMAND RESPONSIVE CONTROLS FOR WATER HEATING

EQUIPMENT TYPE	CONTROLS	
	Manufactured before 7/1/2025	Manufactured on or after 7/1/2025
Electric storage water heaters	AHRI 1430 (I-P) or ANSI/CTA-2045-B Level 1 and also capable of initiating water heating to meet the temperature set point in response to a demand response signal.	AHRI 1430 (I-P).

Note: Demand responsive HVAC is a credit option in all CZs in R408

Appendix RK – Electric–Ready Provisions

Electric Readiness

- Where cooktop, oven, water heater or clothes dryer is not electric, provide sufficient electric infrastructure
- Each requires a 240 volt dedicated circuit labeled “spare”

What you won’t see:

- Electric readiness requirement for space heating

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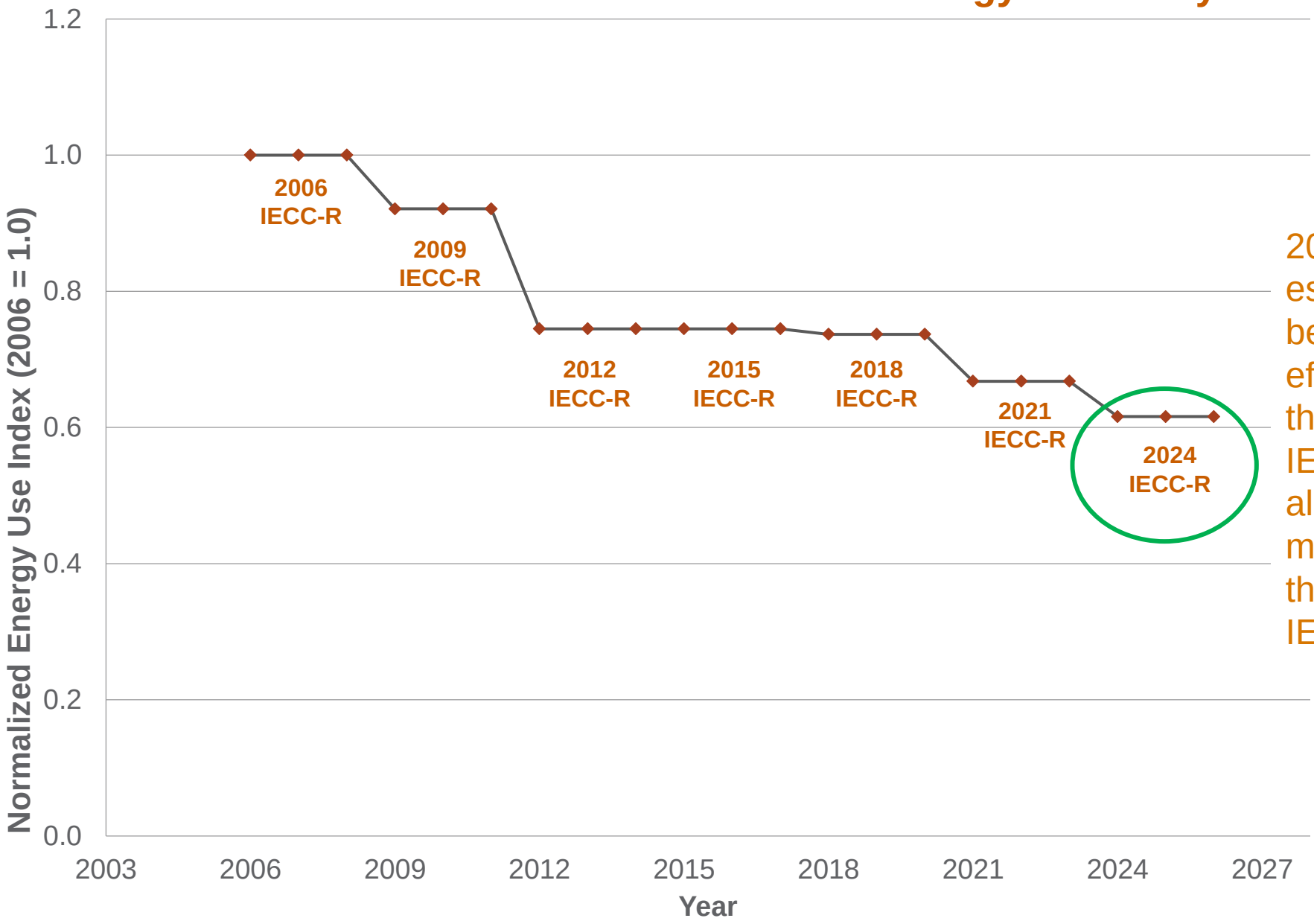
IECC-Residential Advancements in Energy Efficiency



2024 IECC is estimated to be 6-8% more efficient than the 2021 IECC and almost 40% more efficient than the 2006 IECC

Based on Progress Indicator results

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Thank you

Thanks!

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