U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

What's New in the Residential Provisions of the 2021 IECC?

National Energy Codes Conference Seminar Series

Building Technologies Office

Fall 2020

NECC Seminar Series Lineup

Catch the entire lineup of sessions weekly—Thursdays @ 1p ET:

- 10/01: Kickoff to the Series
- 10/08: Electronic Permitting
- 10/15: HVAC for Low-Load Homes
- 10/22: Performance-Based Compliance
- 10/29: 2021 IECC Commercial
- 11/05: Remote and Virtual Inspections
- 11/12: New for ASHRAE Standard 90.1
- 11/19: 2021 IECC Residential
- **11/24: Energy Codes Around the World**
  Special Edition (Starts at 10am ET)
- 12/03: Advanced Technology and Codes
- 12/10: Policies for EE + Resilience
- 12/17: Field Studies in the NW Region

> Learn more: energycodes.gov/2020-building-energy-code-webinar-series

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Audience Poll

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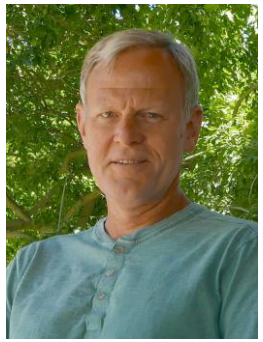
Today's Speakers

Robert Salcido – Senior Building Energy Research Engineer, PNNL



Todd Taylor – Consultant (on behalf of PNNL)

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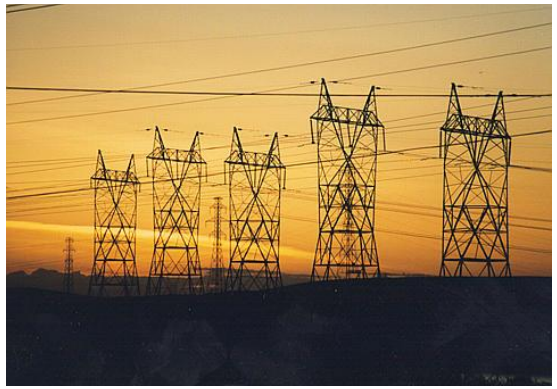
What's New in the Residential Provisions of the 2021 IECC

November 19, 2020

PNNL-SA-157768

V. Robert Salcido, PNNL
Todd Taylor, PNNL Retired



V. Robert Salcido, PE
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Pacific Northwest
NATIONAL LABORATORY

Outline

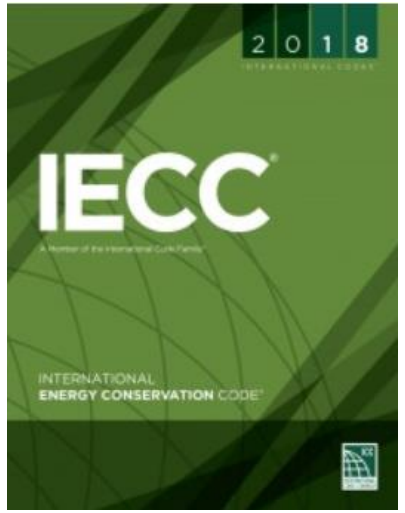
- **Overview of IECC Structure**
- **Summary of what changed between 2018 and 2021 IECC**
  - 118 committee approved changes
  - 4 removed on appeal
- **Show changes in 2021 IECC**
  - Administrative – 66 (58%)
  - Energy Related – Minimal Energy Impact – 22 (19%)
  - Energy Related – Decreases Energy Consumption – 24 (21%)
  - Energy Related – Increases Energy Consumption – 2 (2%)
- **Focus on key energy related changes in the 2021 IECC**
  - Envelope
  - Lighting
  - HVAC
  - SHW
  - Performance Path/Energy Rating Index (ERI)
  - Appendix RB for Zero Energy Homes

Structure of the IECC

Why Care about the IECC?

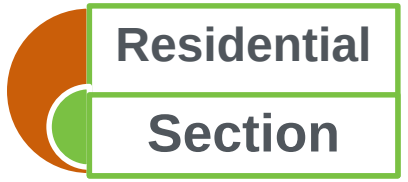
- Energy codes and standards set minimum efficiency requirements for new and renovated buildings, assuring reductions in energy use and emissions over the life of the building. Energy codes are a subset of building codes, which establish baseline requirements and govern building construction.

- Code buildings are more comfortable and cost-effective to operate, assuring energy, economic and environmental benefits.



Structure of the 2021 IECC

Ch. 1 Scope and Application / Administrative and Enforcement
Ch. 2 Definitions
Ch. 3 General Requirements
Ch. 4 Commercial Energy Efficiency
Ch. 5 Existing Buildings
Ch. 6 Referenced Standards
Appendices
Index



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Chapter 4 – Residential Energy Efficiency

Climate-Specific Prescriptive Requirements (mostly envelope)

- ✓ Roofs, walls, foundations R-values
- ✓ U-factors of windows, doors, skylights
- ✓ Solar Heat Gain Coefficient
- ✓ Duct leakage rate

Performance Based Alternatives

- ✓ Performance Compliance
- ✓ Energy Rating Index Compliance

Mandatory Requirements (sometimes climate-specific)

- ✓ Infiltration control
- ✓ Duct insulation, sealing & testing, no use of building cavities
- ✓ HVAC controls
- ✓ Piping Insulation and circulating service hot water requirements
- ✓ Equipment sizing
- ✓ Dampers
- ✓ Lighting

Compliance Terminology

IECC Terminology

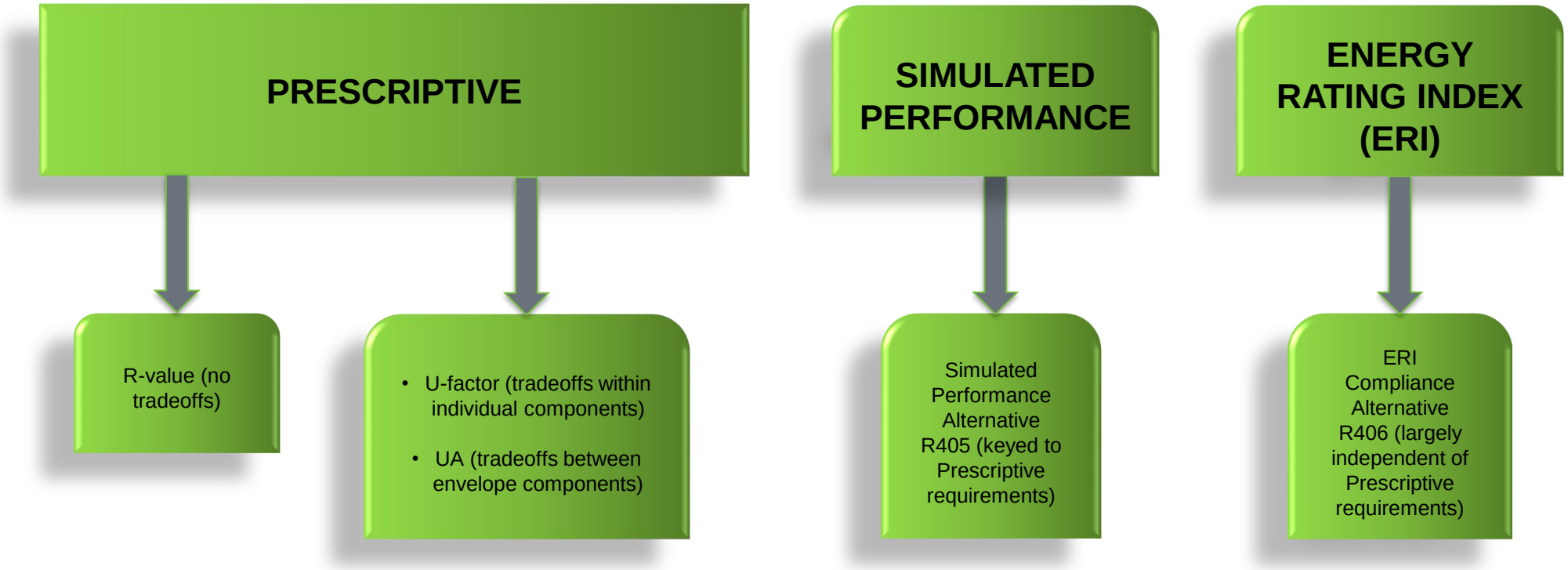
- ✓ **Prescriptive**
  - Component-specific requirements that can be lessened or eliminated in trade for compensating improvements elsewhere

- ✓ **Performance/Energy Rating Index**
  - Compares annual energy performance compared to a standard reference home.

- ✓ **Mandatory**
  - Required and cannot be traded down, even in the simulated performance path or Energy Rating Index path

- – **Note: Unlike simulated performance path, ERI path is not directly based on the prescriptive requirements**
  - Some elements have “hard limits”
  - AKA, “trade-off limits” or "backstops"
  - Puts limits on how far a component-specific prescriptive requirement can be reduced in trade-offs against other components

IECC Residential Compliance – 5 Pathway Options



Audience Poll

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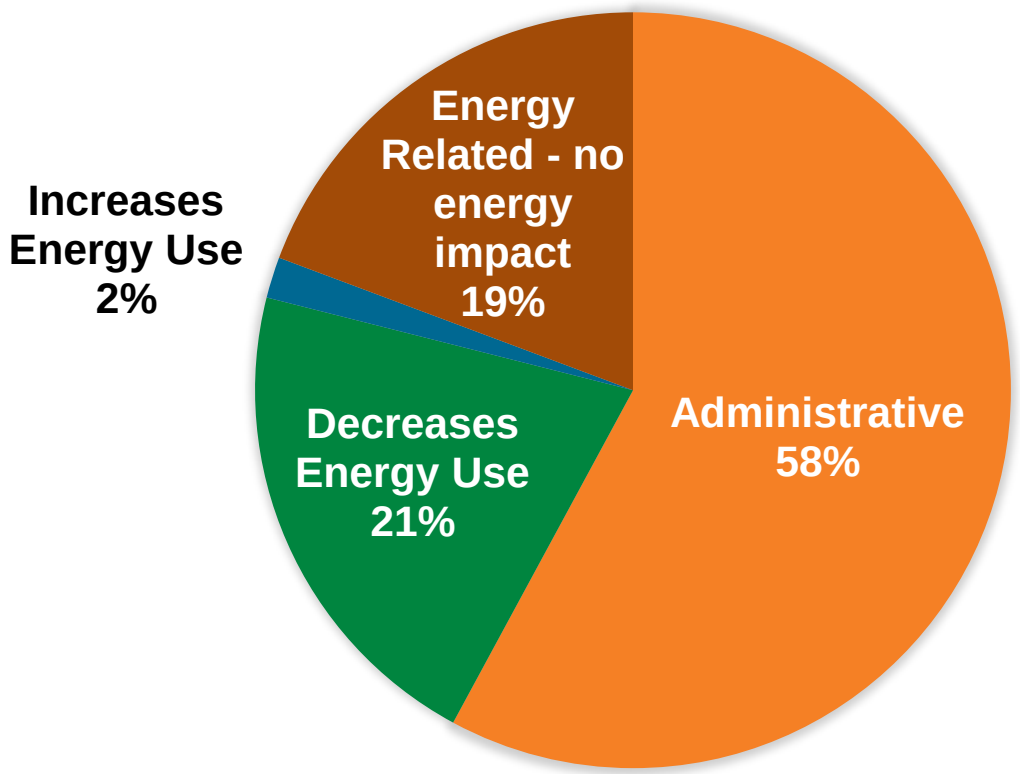
What has changed in the 2021 IECC?

114 Residential Building Proposals approved for IECC 2021



Administrative (66)

ADM31 P III – Notice of Approval and Revocation
ADM40 P IV – Board of Appeals
ADM41 P IV – Stop Work Orders
ADM46 P IV – Digital Submissions
CE 10 P II – Alternative Designs
CE 12 P II – Above code programs
CE 13 P II – Energy compliance path in documents
CE 19 P II – Air-impermeable insulation definition
CE 22 P II – Demand recirculation water system
CE 29 P II – Ready access definition
CE 31 P II – Renewable energy definitions
CE 36 P II – Update climate zones
CE 40 P II – Insulation certificate
CE 42 P II – Clarifies mandatory sections
CE 60 P II – Cavity insulation definition
CE151 P II – Thermal distribution efficiency definition
CE217 P II – EV charging and readiness
RE 4 – Cavity insulation definition
RE 6 – Amends fenestration definition
RE 9 P I – Roof recover definition
RE 15 – Clarifies compliance requirements
RE 18 – Amends compliance certificate
RE 20 – Amends compliance certificate

RE 21 – Amends compliance certificate
RE 28 – Alternative wall options
RE 42 – Editorial changes to ceilings
RE 49 – Editorial changes to attic access hatch
RE 50 – Adds mass timber as mass wall
RE 51 – Adds equivalents for steel framing
RE 52 – Deletes partial structural sheathing
RE 58 – Removes language from air barrier table
RE 59 – Basement wall insulation adjustments
RE 60 – Slab floor insulation adjustments
RE 62 – Crawl space wall insulation adjustments
RE 68 – Editorial changes to air sealing table
RE 70 – Editorial changes to air sealing table
RE 71 – Editorial changes to air sealing table
RE 72 – Editorial changes to air sealing table
RE 73 – Editorial changes to air sealing table
RE 74 – Editorial changes to air sealing table
RE 82 – Editorial changes to air sealing table
RE 86 – Editorial changes to air sealing table
RE 88 – Dwelling unit enclosure area
RE 98 – Add digit to air leakage rate
RE114 – RESNET 380 for duct testing
RE118 – Editorial change for duct leakage

RE122 – Effective R-value of buried ducts
RE123 – Pipe insulation mandatory
RE125 – Recirculation control mandatory
RE127 – Clarifies hot water pipe requirements
RE132 P I – Editorial change to ventilation
RE132 P II – Dwelling unit ventilation
RE136 – Test specifications for ventilation
RE137 – Ventilation fan efficacy requirements
RE144 – Pool and spa requirements
RE147 – Electric readiness
RE157 – Removes sampling for MF units
RE158 – Performance path reporting
RE159 – Statement of performance compliance
RE172 – Duct location for performance path
RE178 – Ventilation for performance path
RE199 – Expands third party requirements
RE202 – ERI compliance report requirements
RE204 – Renewable Energy Credits
RE205 – ERI compliance path reporting
RE215 – Removes alteration redundancy
RE221 – Clarifies change of occupancy
RE222 – Clarifies shading requirements

Energy Related – Minimal Impact or Increase Energy (24)

Minimal Energy Impact

CE159 P II – Relocates demand recirculation control requirements

RE 23 – Alternative basement and crawlspace wall options

RE 27 – Alternative wood frame wall options

RE 34 – Eliminate footnote g as option for floor insulation

RE 37 – New fenestration SHGC requirement in CZ 4C and 5

RE 38 – U-Factor compliance default for prescriptive compliance

RE 41 – Fenestration U-Factor of 0.32 for CZ 4C, 5-8 above 4000 ft elev

RE 47 – Adds exception for horizontal pull down stair access hatch

RE 55 – Expands language for basement wall requirements

RE 96 – Sets maximum air leakage rate to 5.0 ACH50 for tradeoffs

RE100 – Adds air leakage and thermal isolation requirements in garages

RE103 – Adds requirements for air-sealed electrical boxes

RE105 – Lowers area-weighted maximum U-Factor and SHGC

RE106 – Clarfies programmable thermostat requirements

RE108 – Expands options for hot water boiler temperature reset

RE111 – Revises duct insulation requirements into one section

RE112 – Removes duct testing requirement exception for ducts in CFA

RE129 – Drain water heat recovery unit requirements mandatory

RE150 – Adjusts UA backstop for ERI compliance

RE151 – Performance path envelope backtop at 2009 IECC

RE163 – Adjusts calculation for service hot water consumption

RE173 – New section for dehumidistats

Increase Energy Consumption

CE160 P II – Modifies pool and spa requirements

RE130 – Adds testing requirements for ventilation systems

Energy Related – Decrease Energy (24)

RE 7 – Increases lighting efficacy requirements

RE 29 – Increases R-Value of wood frame wall insulation in CZ 4-5

RE 32 – Increases R-Value of slab insulation and depth in CZ 3-5

RE 33 – Increases R-Value of ceiling insulation in CZ 2-3

RE 35 – Reduces U-Factor of fenestration in CZ 2-4

RE 36 – Increases R-Value of ceiling insulation in CZ 4-8

RE 44 – Adds specific requirements for eave baffles

RE 45 – Makes eave baffles requirement mandatory

RE 46 – Design and installation requirements for attic hatches

RE 53 – Expands language of floor insulation installation

RE107 – Bans continuous burning pilot lights in certain applications

RE109 – Clarifies duct insulation requirements based on location

RE126 – Increases hot water heater equipment efficiency

RE133 – Increases ventilation system fan efficacy requirements

RE134 – Adds air-handler ventilation system fan efficacy requirements

RE139 – Requires HRV or ERV ventilation in CZ 7-8

RE145 – Increases efficacy for high efficiency lighting

RE148 – Requires exterior lighting comply with C405.4 in MF cases

RE149 – Adds new automated control requirements for exterior lighting

RE162 – Adds hot water distribution compactness factor

RE182 – Envelope backstop for ERI compliance to 2018 IECC

RE184 – Renewable energy <= 5% of total energy use for ERI

RE192 – Reduces ERI compliance targets to 2015 IECC levels

RE209 – Adds section for Additional Efficiency Package options

RE218 – Revises exception for 10% luminaires to 50%

RE223 – Adds Appendix RB for Zero Energy Residential Buildings

Envelope Changes

Envelope Changes

RE29 – Increase R-Value of wood frame wall insulation in CZ 4-5

- **Increases wood frame wall R-values by R-5 from 2018 IECC in Climate Zones 4 & 5**

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	~~20 or 13+5~~ 20+5 or 13+10[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	~~20 or 13+5~~ 20+5 or 13+10[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Envelope Changes

RE32 – Increase R-Value of slab on grade insulation/depth in CZ 3-5

- **New R-10 slab insulation at 2 ft depth for climate zone 3**
- **Increase slab depth to 4 ft for climate zone 4 & 5**

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INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	~~0~~ 10, 2 ft	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, ~~2~~ 4 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 4 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Envelope Changes

RE33 & RE36 – Increase ceiling insulation R-Values

- **RE33 increases ceiling insulation from R-38 to R-49 in climate zones 2 & 3**

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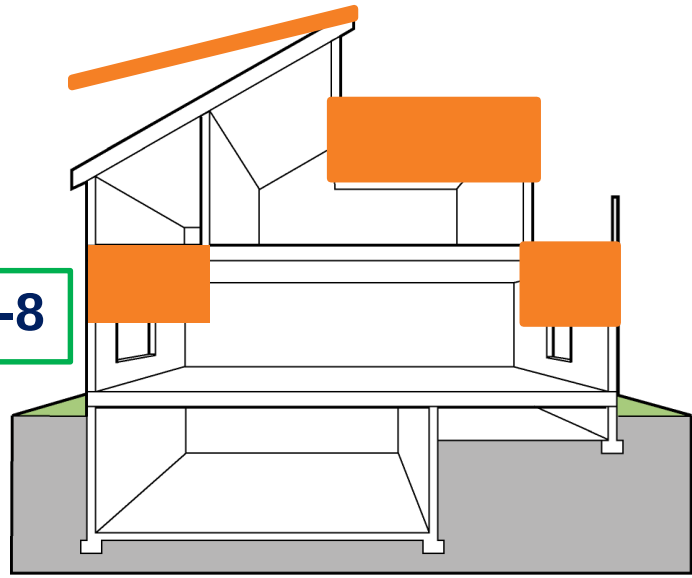
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	~~38~~ 49	13	4/6	13	0	0	0
3	0.32	0.55	0.25	~~38~~ 49	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19



- **RE36 increases ceiling insulation from R-49 to R-60 in climate zones 4-8**

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
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2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	~~49~~ 60	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	~~49~~ 60	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	~~49~~ 60	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	~~49~~ 60	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

Envelope Changes

RE35, RE37 & RE41 – Fenestration U-Factor and SHGC requirements

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- **RE35 – Reduce fenestration U-Factors to 0.35 for CZ 2 and 0.30 in CZ 3 & 4**
- **RE37 – Sets required SHGC for CZ 4C & 5**
- **RE41 – Allows fenestration U-Factor of 0.32 for residences located above 4,000 ft in elevation in CZ 5 - 8**

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INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	~~0.40~~ 0.35	0.65	0.25	38	13	4/6	13	0	0	0
3	~~0.32~~ 0.30[j]	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	~~0.32~~ 0.30[j]	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30[j]	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30[j]	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30[j]	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

TABLE R402.1.2 (IRC N1102.1.2)
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2	0.40	0.55	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR 0.40	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

j. A maximum U-factor of 0.32 shall apply in Climate Zone Marine 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located:

1. Above 4000 feet in elevation above sea level, or
2. In windborne debris regions where protection of openings is required under Section R301.2.1.2 of the International Residential Code.

Envelope Changes

RE105 – Lowers area-weighted maximum U-Factor and SHGC

- **RE105 decreases mandatory backstops for fenestration U-Factors and SHGCs**
  - **Sets area-weighted average maximum fenestration U-factor to 0.40 in climate zones 4 & 5**
  - **Sets area-weighted average maximum fenestration U-factor to 0.35 in climate zones 6 - 8**
  - **Sets area-weighted average maximum fenestration SHGC to 0.40 in climates zones 1 - 3**

R402.5 (IRC N1102.5) Maximum fenestration *U*-factor and SHGC (Mandatory). The area-weighted average maximum fenestration *U*-factor permitted using tradeoffs from Section R402.1.5 or R405 shall be ~~0.48~~ 0.40 in *Climate Zones* 4 and 5 and ~~0.40~~ 0.35 in *Climate Zones* 6 through 8 for vertical fenestration, and 0.75 in *Climate Zones* 4 through 8 for skylights. The area-weighted average maximum fenestration SHGC permitted using tradeoffs from Section R405 in *Climate Zones* 1 through 3 shall be ~~0.50.~~ 0.40.

Envelope Changes

RE23 & RE27 – Alternative wall options

- **RE23 – basement wall alternative prescriptive options**
- **RE27 – above grade wall alternative prescriptive options**

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5ci/13[f]	0	5ci/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10ci/13	10, 2 ft	10ci/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15ci/19 or 13+5ci	10, 2 ft	15ci/19 or 13+5ci
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15ci/19 or 13+5ci	10, 4 ft	15ci/19 or 13+5ci
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15ci/19 or 13+5ci	10, 4 ft	15ci/19 or 13+5ci

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INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13 or 0+10[b]	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13 or 0+10[b]	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h] or 0+15[b]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[h] or 0+15[b]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5[h] or 0+15[b]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	30 or 20+5[h] or 13+10[h] or 0+20[b]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	30 or 20+5[h] or 13+10[h] or 0+20[b]	19/21	38[g]	15/19	10, 4 ft	15/19

Envelope Changes

RE96 – Sets maximum air leakage rate to 5.0 ACH50 for tradeoffs

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Compliance with air leakage Requires BOTH:

- ✓ Whole-house pressure test (2018 IECC)

Air Leakage Rate	Climate Zone	Test Pressure
≤ 5 ACH	1-2	50 Pascals
≤ 3 ACH	3-8	50 Pascals

- ✓ Field verification of items listed in Table R402.5.1.1

- ✓ New language sets a 5.0 ACH50 trade-off limit on tested air leakage for any climate zone

Air Leakage Rate	Climate Zone	Test Pressure
≤ 5 ACH	1-2	50 Pascals
≤ 5 ACH	3-8	50 Pascals

Lighting Changes

Lighting Changes

RE7, RE145, RE148 & RE149 – Efficacy requirements and controls

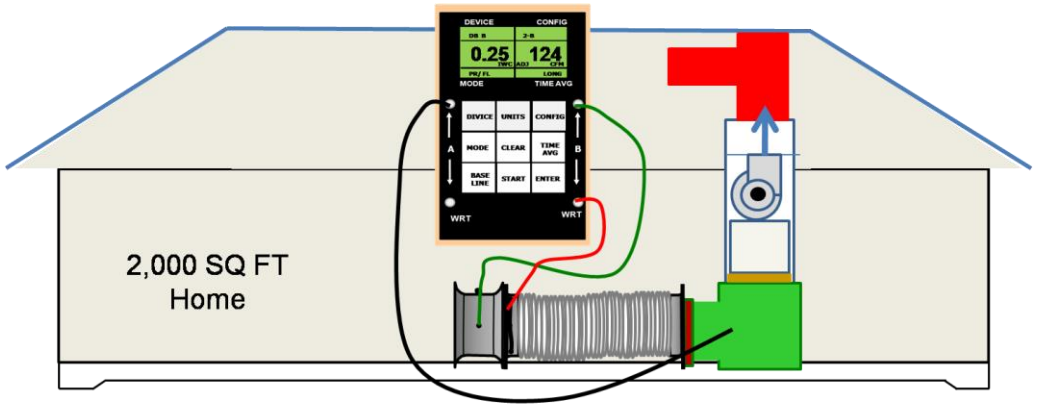
- **RE7 & RE145 – Increase efficacy value of high-efficacy lamps**
  - **RE7 – 65 lumens per watt (90% of lighting)**
  - **RE145 – 70 lumens per watt (100% of lighting)**
- **RE148 – Exterior lighting in low-rise multifamily buildings must comply with IECC Section C405.4 Exterior Lighting Power Requirements**
- **RE149 – Exterior lighting controls**
  - **Manual On/Off switches with automatic shutoff**
  - **Photosensor controls**
  - **Timer switch**
  - **Automatic shutoff allowing override allows return to normal control within 24 hours**

HVAC Changes

HVAC Changes

RE112 – Removes duct testing exception for ducts in conditioned space

- Ducts shall be pressure tested to determine air leakage by either of the following:
  - Rough-in test
    - Total leakage measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system including manufacturer's air handler enclosure
      - All registers taped or otherwise sealed
  - Postconstruction test
    - Total leakage measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system including manufacturer's air handler enclosure
      - All registers taped or otherwise sealed
  - Exceptions
    - ~~Duct air leakage test not required where ducts and air handlers are entirely within the building thermal envelope~~
    - Test not required for ducts serving heat or energy recovery ventilators not integrated with ducts serving heating or cooling systems



Total Duct Leakage Test at Final

The duct system has a leakage rate of 124 CFM25. The quantified (Qn, see RESNET Standards) total rough-in leakage rate is 124 ÷ 2,000 = .062 Qn.
Meets Energy Star requirements at (.062 x 100) 6.2 CFM per 100 SQ FT

HVAC Changes

RE130, R133 & RE134 – Mechanical ventilation requirements

- **RE130 – Mechanical ventilation systems tested and verified to provide minimum flow rates required in Section R403.6**
- **RE133 – Increases minimum ventilation fan efficacy requirements**
- **RE134 – Adds air-handler ventilation system fan efficacy requirements**

TABLE R403.6.1 (IRC N1103.6.1)
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

FAN LOCATION	AIR FLOW RATE MINIMUM(CFM)	MINIMUM EFFICACY(CFM/WATT)	AIR FLOW RATE MAXIMUM(CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	~~2.8~~ 3.8 cfm/watt	Any
Bathroom, utility room	10	~~1.4~~ 2.8 cfm/watt	< 90
Bathroom, utility room	90	~~2.8~~ 3.5 cfm/watt	Any

TABLE R403.6.1 (IRC N1103.6.1)
~~WHOLE-HOUSE~~ WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

FAN LOCATION	AIR FLOW RATE MINIMUM(CFM)	MINIMUM EFFICACY(CFM/WATT)[b]	AIR FLOW RATE MAXIMUM(CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	< 90
Bathroom, utility room	90	2.8 cfm/watt	Any
Air-handler that is integrated to tested and *listed* HVAC equipment	Any	1.2 cfm/watt	Any

HVAC Changes

RE139 – Requires mechanical ventilation for CZ 7 & 8 with HRV/ERV

- **RE139 – Requires mechanical ventilation in climate zones 7 & 8 to be provided by an HRV or ERV**
  - **Prescriptive path only**
  - **PNNL studies have shown HRV/ERV to be cost effective in climate zones 7 & 8**

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). The *building* shall be provided with ventilation that complies with the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Add new text as follows:

R403.6.1 (IRC N1103.6.1) Heat or Energy Recovery Ventilation (Prescriptive). Dwelling units shall be provided with a heat recovery or energy recovery ventilation system in climate zones 7 and 8. The system shall be balanced with a minimum sensible heat recovery efficiency of 65% at 32°F (0°C) at a flow greater than or equal to the design airflow.

Reason: A recent study conducted by Pacific Northwest National Laboratory showed HRVs and ERVs to be cost effective in climate zones 7 and 8, with annual energy savings from $138 to $233 on an initial investment of ~$1500 installed (corresponding to a first cost premium of ~$840 versus an exhaust only system and one entry-level bath fan; yielding simple paybacks of 4-6 years). This proposal is aligned with recent changes across most of Canada to require heat recovery ventilation for dwelling units. This proposal would require heat or energy recovery ventilators only for those dwelling units following the prescriptive path in the coldest climate zones, which represents a conservative improvement to the code.

Service Hot Water Changes

Service Hot Water Changes

RE162 – Hot Water Distribution Compactness Factor

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- **RE162 – Adds Compactness Factor to the Performance Path for hot water usage**
  - **Rewards compact design of hot water and plumbing system**

TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

<table>
<tr><th>BUILDING COMPONENT</th><th>STANDARD REFERENCE DESIGN</th><th>PROPOSED DESIGN</th></tr>
<tr><td rowspan="2">Service water heating[d, e, f, g,]</td><td>As proposed.

~~Use: same as proposed design.~~

Use, in units of gal/day = 30 + (10 × N_{br})

where:

N_{br} = number of bedrooms.</td><td>As proposed
Use, in units of gal/day = (30 + (10 × N_{br})) * (1-HWDS)

where:

N_{br} = number of bedrooms.

HWDS = factor for the compactness of the hot water distribution system

<table><tr><th colspan="2">Compactness Ratio[i]</th><th>HWDS Factor</th></tr><tr><th>1 story</th><th>2 or More Stories</th><th></th></tr><tr><td>> 60%</td><td>>30%</td><td>0</td></tr><tr><td>>30% to ≤ 60%</td><td>>15% to ≤ 30%</td><td>0.05</td></tr><tr><td>>15% to ≤ 30%</td><td>>7.5% to ≤ 15%</td><td>0.10</td></tr><tr><td>≤ 15%</td><td>≤ 7.5%</td><td>0.15</td></tr></table></td></tr>
</table>

Service Hot Water Changes

RE162 – Hot Water Distribution Compactness Factor (cont)

1. Locate the water heater and the hot water fixtures and appliances
2. Draw a rectangle through the center line of the water heater and the plumbing walls next to the hot water fixtures and appliances
3. Calculate the area of this rectangle
4. Divide this area by the conditioned floor area of the home to get the Compactness Ratio
5. Determine if a credit can be taken and how large it can be

Service Hot Water Changes

RE162 – Hot Water Distribution Compactness Factor (cont)

1-Story, 3 Bedroom, 2 Bath

1. Conditioned floor space: 1,147 SF
2. Hot water system rectangle: 36x23 = 828 SF
3. Compactness Ratio: 828/1,147 = 72%
4. HWDS Factor for 1-Story: 0.0

1-Story, 3 Bedroom, 2 Bath

1. Move the water heater into the corner near the center of the garage.
2. Conditioned floor space: 1,147 SF
3. Hot water system rectangle: 25x23 = 575 SF
4. Compactness Ratio: 575/1,147 = 50%
5. HWDS Factor for 1-Story: 0.05

- **RE163 – Reduces Proposed and Reference hot water usage in Performance Path**
  - **Hot water usage has been the same since the 1998 IECC**
  - **Proposed and Reference designs have the same usage**

TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Service water heating[d, e, f, g]	As proposed. Use: same as proposed design.	As proposed Use, in units of gal/day = ~~30~~ 25.5 + (~~10~~ 8.5 × N_{br}) where: N_{br} = number of bedrooms.

Performance/ERI Changes

Performance/ERI Changes

CE36 – Update climate zone map to align with ASHRAE 169-2013

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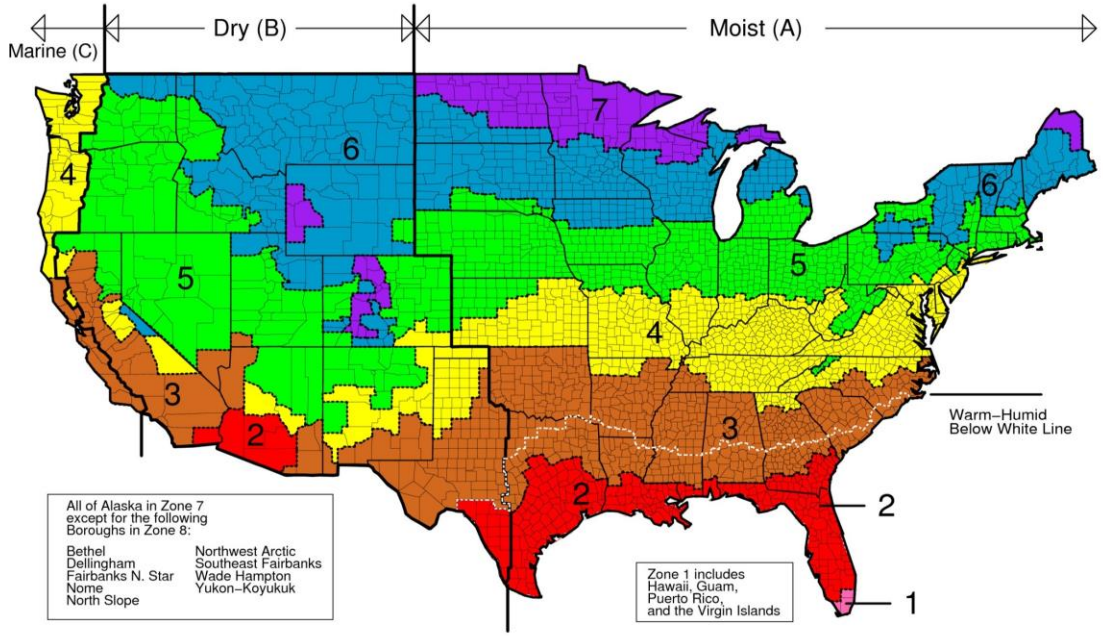
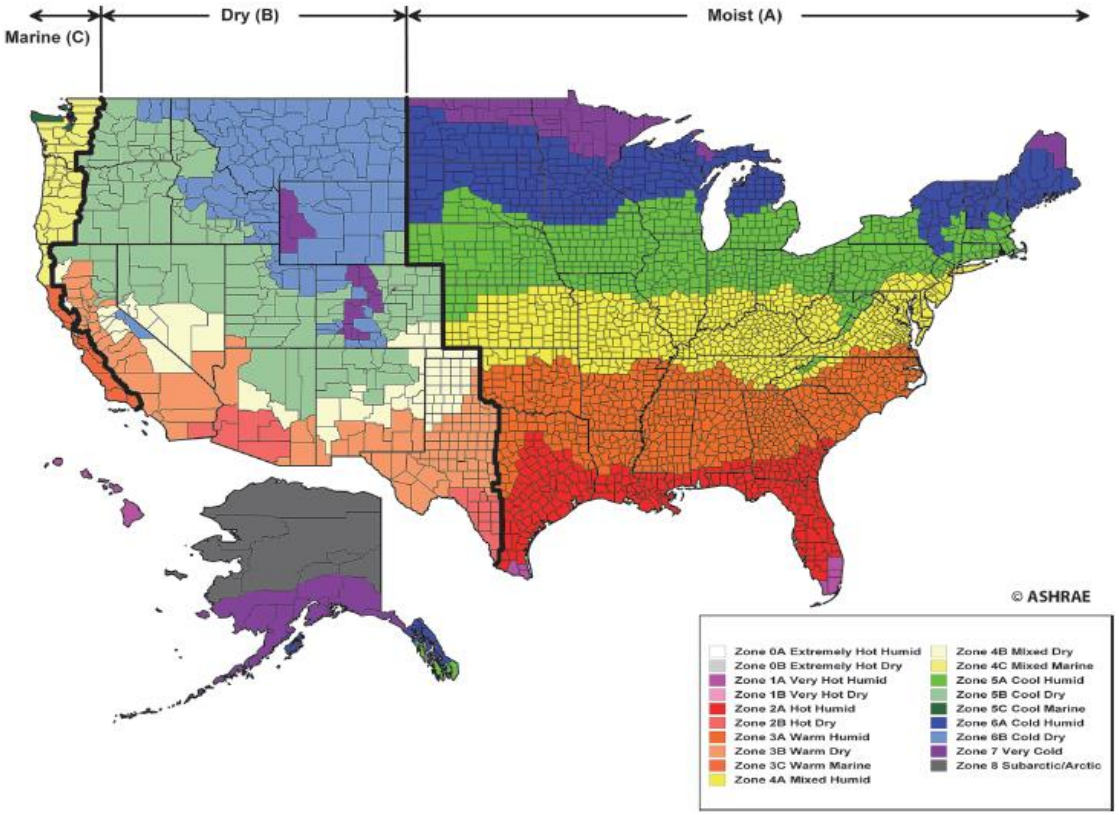
Climate Zones for 2018 IECC



Climate Zones for 2021 IECC

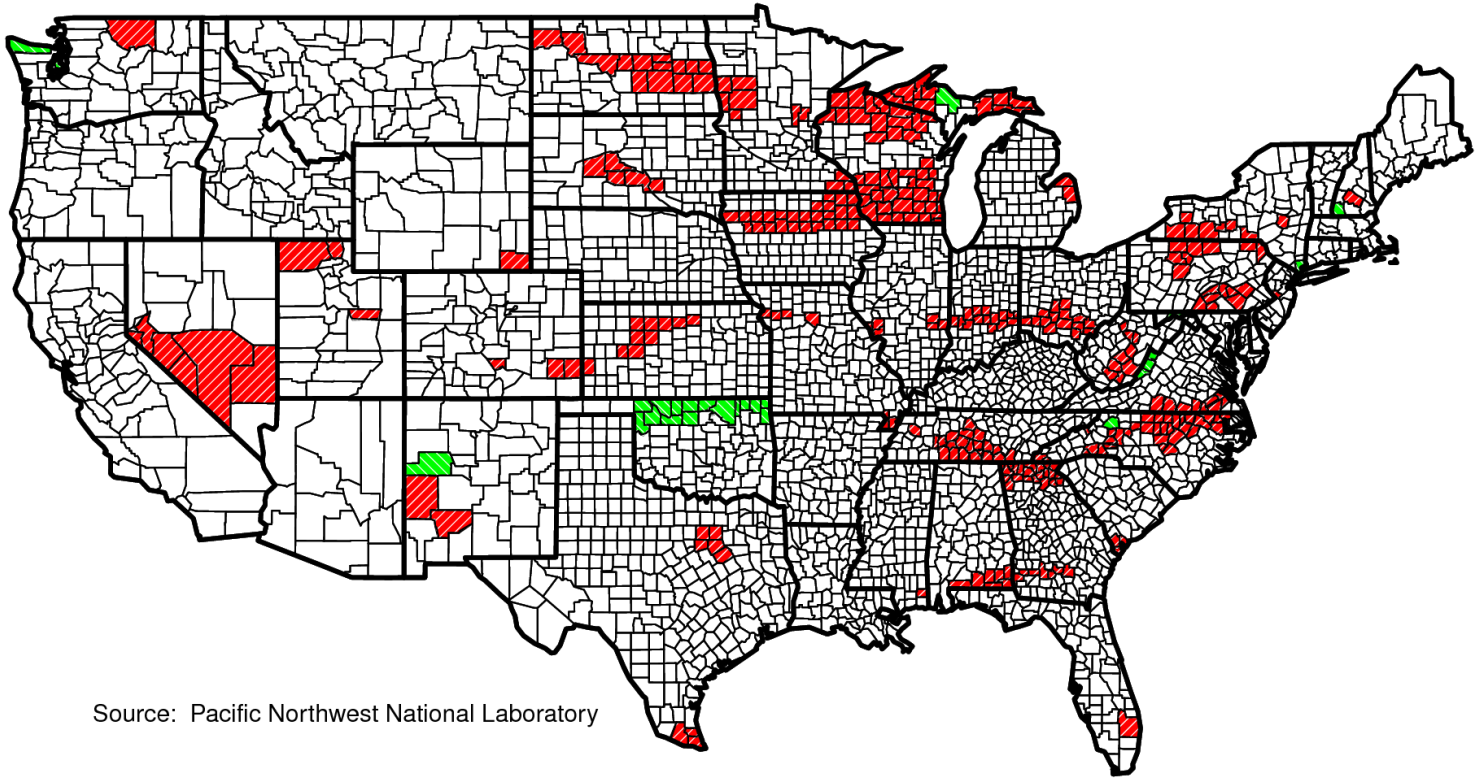


ASHRAE Standard 169-2013 reassigned counties to climate zones based on new climatic data

Performance/ERI Changes

CE36 – Update climate zone map to ASHRAE 169

Counties that are reassigned to milder zones have generally less stringent code requirements



Source: Pacific Northwest National Laboratory

RED: Counties moving to milder zones

Green: Counties moving to colder zones

Performance/ERI Changes

RE150 & RE 182 – Adjusts envelope backstop for ERI Compliance

➢ RE150 – Sets ERI envelope backstop to 115% of 2021 IECC Reference UA

R406.2 (IRC N1106.2) Mandatory requirements. Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as "Mandatory" and Section R403.5.3 be met. The proposed total building thermal envelope UA which is sum of U-factor times assembly area, shall be ~~greater~~ less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.2 multiplied by 1.15 in accordance with Equation 4-1. ~~levels of efficiency and *Solar Heat Gain Coefficients* in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code.~~

~~Exception:~~ Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to ~~an~~ a *R*-value of not less than R-6.

$$UA_{Proposed\ design} = 1.15 \times UA_{Prescriptive\ reference\ design}$$ Equation 4-1

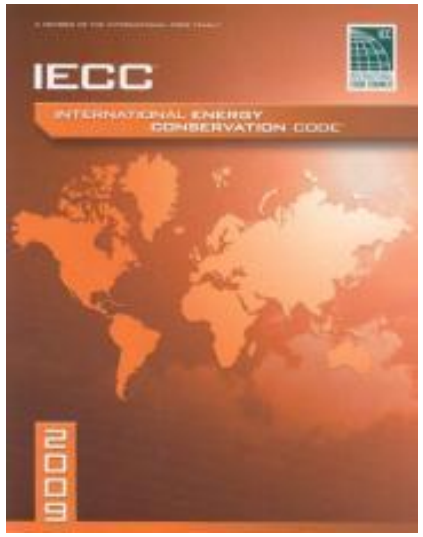
➢ RE182 – Sets ERI envelope backstop to 2018 IECC with on-site renewable energy

R406.2 (IRC N1106.2) Mandatory requirements. Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as "Mandatory" and Section R403.5.3 be met. The *building thermal envelope* shall be greater than or equal to levels of efficiency and *Solar Heat Gain Coefficients* in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2018 *International Energy Conservation Code*.

Performance/ERI Changes

RE151 – Performance path envelope backstop at 2009 IECC

- **Sets envelope backstop to 2009 IECC**
  - **First time for an envelope backstop in the Performance Path**



R405.2 (IRC N1105.2) Mandatory requirements. Compliance with this section requires that the mandatory provisions identified in Section R401.2 be met. The *building thermal envelope* shall be greater than or equal to levels of efficiency and *Solar Heat Gain Coefficients* in Table R402.1.1 or R402.1.3 of the 2009 *International Energy Conservation Code*. Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*-value of not less than R-6.

Performance/ERI Changes

RE173 – Adding dehumidistats to Performance path

- **Includes humidistats in Performance Path models**
  - **Accounts for latent loads in humid climates**
  - **Humidistat specifications same for Proposed and Reference homes**

TABLE R405.5.2(1) [IRC N1105.5.2(1)]
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Dehumidistat	Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery: Dehumidistat type: Manual, setpoint = 60% relative humidity. Dehumidifier: whole-home with integrated energy factor = 1.77 liters/kWh.	Same as standard reference design.

Performance/ERI Changes

RE184 – Renewable energy production limits with ERI compliance

- **Puts a cap on renewable energy trade-off credit to 5% of total energy use**
  - Aligns with IECC & ASHRAE Commercial Simulated Performance requirements
  - Ensures homes are built to appropriate level of efficiency

R406.3 (IRC N1106.3) Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ICC 301 except for buildings covered by the International Residential Code , the ERI Reference Design Ventilation rate shall be in accordance with Equation ~~4-1.~~ 4-1.

Ventilation rate, CFM = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)]
(Equation 4-1)

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

For compliance purposes, any reduction in energy use of the rated design associated with on-site renewable energy shall not exceed 5 percent of the total energy use.

Performance/ERI Changes

RE192 – Reduce ERI compliance targets to 2015 IECC levels

- **Sets ERI Target scores to 2015 IECC levels**

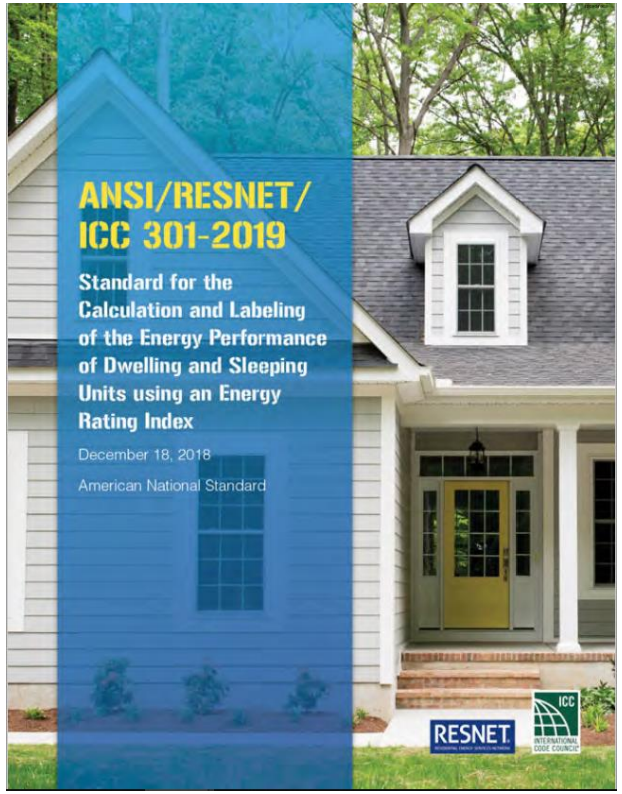
2015 IECC ERI Targets

TABLE R406.4
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX
1	52
2	52
3	51
4	54
5	55
6	54
7	53
8	53

2021 IECC ERI Targets

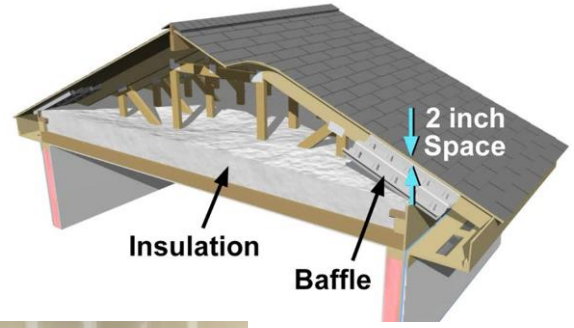
CLIMATE ZONE	ENERGY RATING INDEX[a]
1	~~57~~ 52
2	~~57~~ 52
3	~~57~~ 51
4	~~62~~ 54
5	~~61~~ 55
6	~~61~~ 54
7	~~58~~ 53
8	~~58~~ 53



Additional Efficiency Option Packages

RE209 – Increase energy efficiency by 5% beyond prescriptive

- **R407.2.1 – Enhanced envelope performance option**
  - Design UA <= Standard UA * 0.95
- **R407.2.2 – Efficient HVAC equipment performance option**
  - Furnace >= 95 AFUE and AC >= 16 SEER
  - Air Source Heat Pump >= 10 HSPF/16 SEER
  - Ground Source Heat Pump >= 3.5 COP
- **R407.2.3 – Reduced energy use in service water heating option**
  - Fossil fuel water heater >= 0.82 EF
  - Electric water heater >= 2.0 EF
  - Solar water heater >= 0.4 Solar Fraction
- **R407.2.4 – More efficient duct thermal distribution system option**
  - 100% of ducts and air handler inside building thermal envelope
  - 100% of ductless or hydronic system inside building thermal envelope
  - 100% of duct thermal distribution system located in conditioned space
- **R407.2.5 – Improved air sealing and efficient ventilation system option**
  - Air Leakage <= 3.0 ACH50
  - HRV (75% Sensible Recovery Efficiency) or ERV (50% Latent Recovery/Moisture Transfer)



Appendix RB – Zero Energy Home

RE223 – Adds Appendix RB for Zero Energy Residential Buildings

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- **Allows jurisdictions to adopt a model for zero energy home designation**

RB103 (IRC AQ 103)
ZERO ENERGY RESIDENTIAL BUILDINGS

RB103.1 (IRC AQ103.1) General. New *residential buildings* shall comply with Section RB103.

RB103.2 (IRC AQ103.2) Energy Rating Index Zero Energy Score. Compliance with this section requires that the *rated design* be shown to have a score less than or equal to the values in Table RB103.2 when compared to the *ERI reference design* determined in accordance with RESNET/ICC 301 for each of the following:

1. ERI value not including net onsite power production calculated in accordance with RESNET/ICC 301, and
2. ERI value including net onsite power production calculated in accordance with RESNET/ICC 301

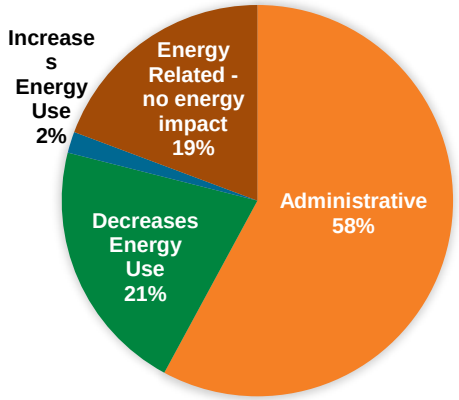
TABLE RB103.2 (IRC AQ103.2)
MAXIMUM ENERGY RATING INDEX[a]

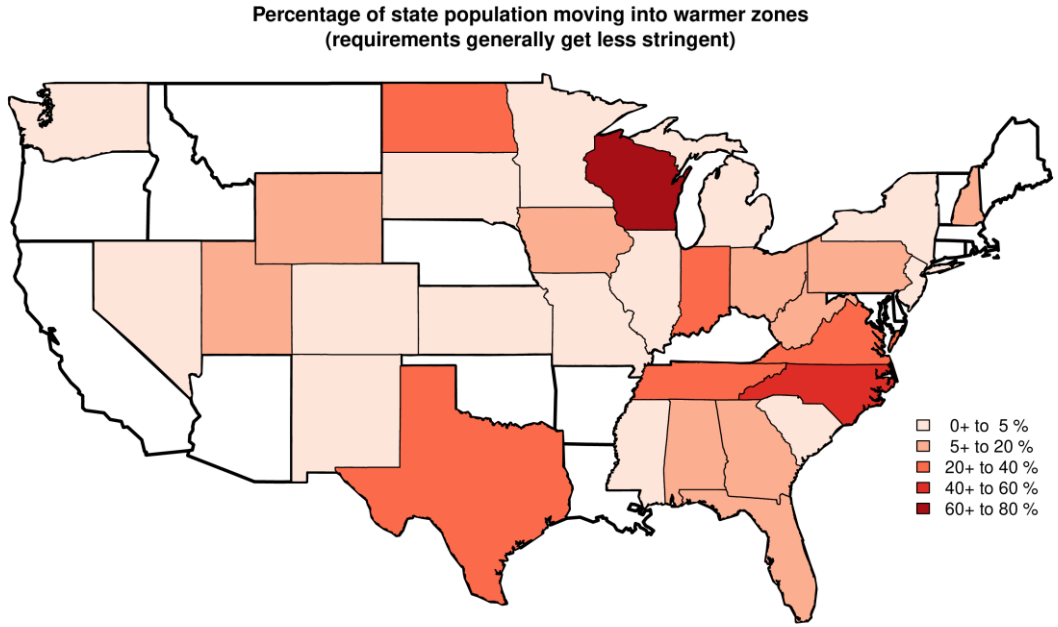
CLIMATE ZONE	ENERGY RATING INDEX not including onsite power	ENERGY RATING INDEX including onsite power (as proposed)
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	45	0

➢ Summary of changes in 2021 IECC

Changes in 2021 IECC

- Administrative – 66 (58%)
- Energy Related – Minimal Energy Impact – 22 (19%)
- Energy Related – Decreases Energy Consumption – 24 (21%)
- Energy Related – Increases Energy Consumption – 2 (2%)





➢ Overall energy efficiency impact based on Determination Study as mandated by DOE

➢ Plan to implement 2021 IECC into REScheck (Spring 2021) and COMcheck (Fall 2021)

Thank You!

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