

Overview of Key 2021 IECC Residential Changes

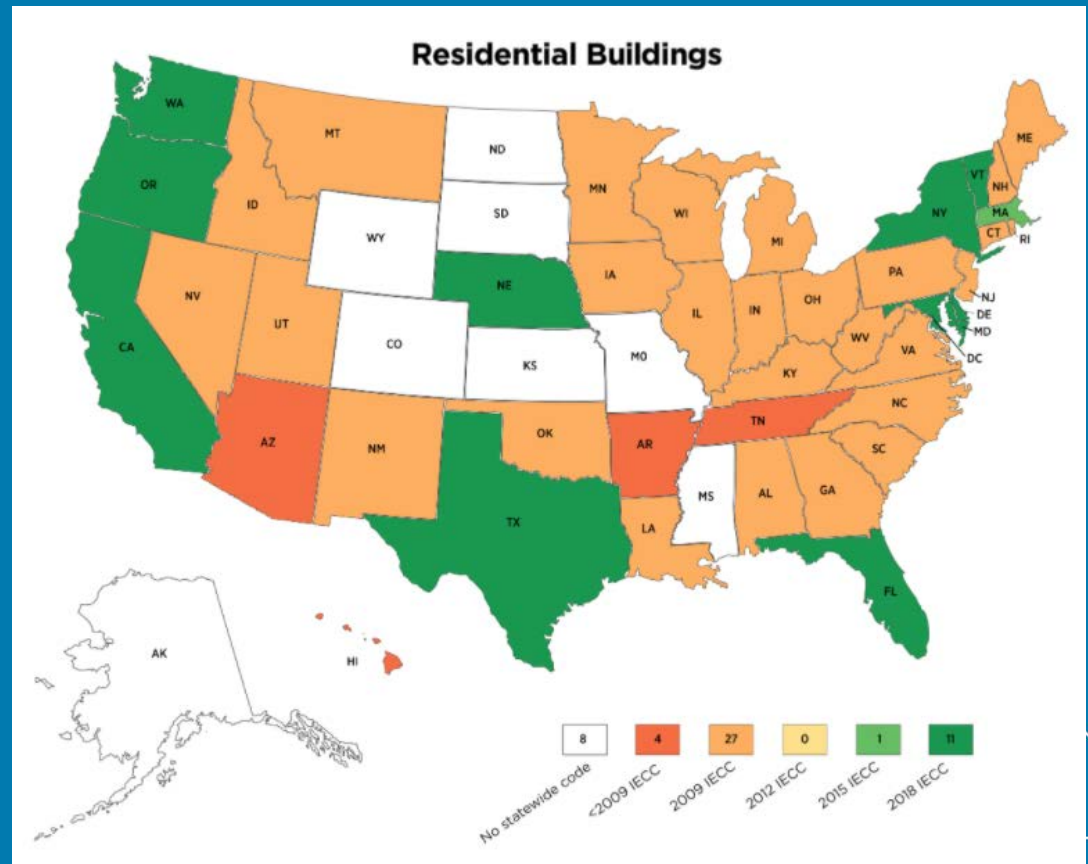
**October 20, 2020
Presentation for
Midwest Energy Efficiency Alliance**

**Eric Lacey
RECA Chairman**

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Fast Facts about IECC

- Result of multi-year consensus-based process that involves the nation's code officials and building code experts.
- Adopted by the vast majority of U.S. States.
- The most widely-adopted and successful residential energy code in the country.
- Important tool for policymakers interested in reducing waste, building resiliency, and minimizing environmental impact of buildings.



Map from www.energycodes.gov

Fast Facts about 2021 IECC



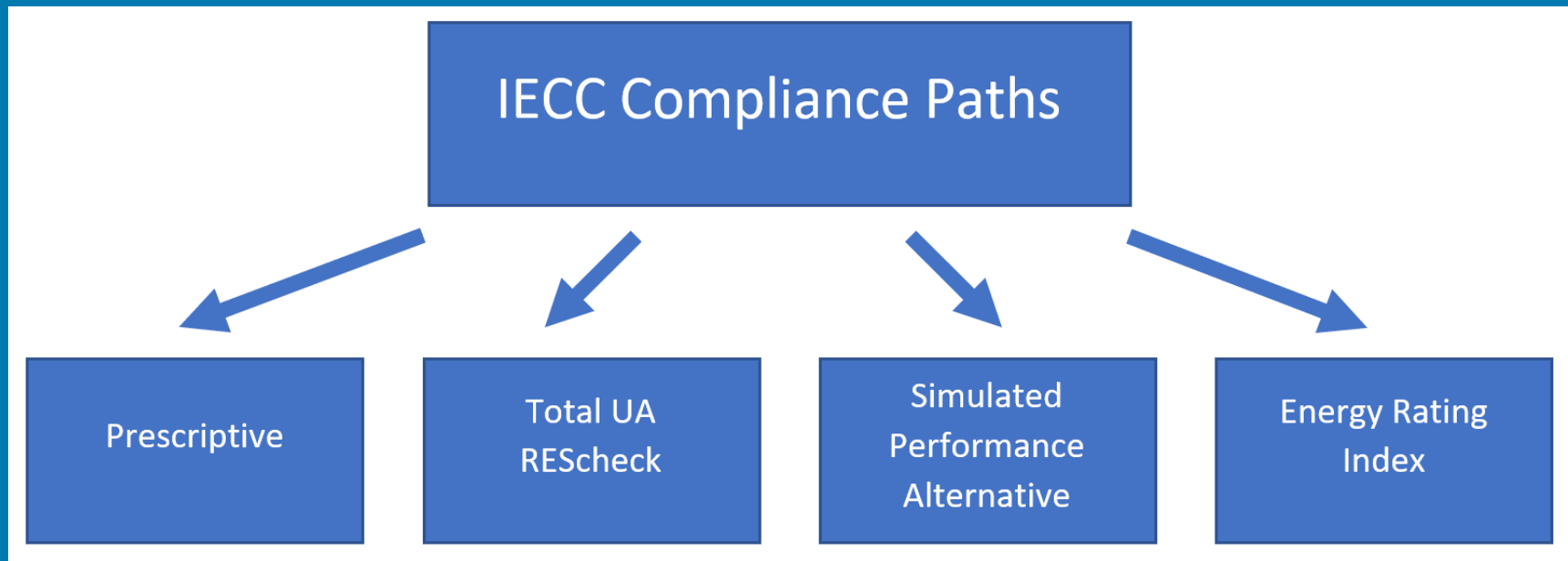
- 2021 IECC results finalized and approved by ICC Board, appeals process now complete, publication likely Fall 2020.
- Earliest statewide adoptions likely in 2021.
- Substantial energy savings, reformatting, new provisions.



2021 IECC: Residential Improvements by compliance path

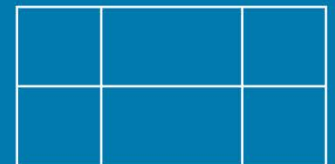


2021 IECC: Residential Improvements by compliance path



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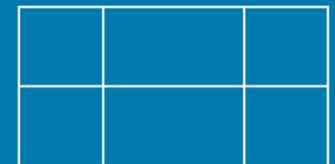
- Overview
 - Improved insulation and fenestration efficiency
 - Eliminated loopholes for floor and wall insulation
 - Additional options for cavity-only or continuous-only insulation
 - New exception for windows in high-altitude or wind-borne debris protection areas
 - Prescriptive + 1 Additional Efficiency Option
 - R-value/U-factor table swap



2021 IECC: Prescriptive

TABLE R402.1.4 R402.1.2
EQUIVALENT MAXIMUM ASSEMBLY U-FACTORS AND FENESTRATION REQUIREMENTS^a

| CLIMATE ZONE | FENESTRATION U-FACTOR ^f | SKYLIGHT U-FACTOR | <u>GLAZED FENESTRATION SHGC^{d, e}</u> | CEILING U-FACTOR | FRAME WALL U-FACTOR | MASS WALL U-FACTOR ^b | FLOOR U-FACTOR | BASEMENT ^c WALL U-FACTOR | CRAWL SPACE WALL U-FACTOR |
|-----------------|------------------------------------|-------------------|--|-------------------------------|-------------------------------|---------------------------------|----------------|-------------------------------------|---------------------------|
| 1 | 0.50 | 0.75 | <u>0.25</u> | 0.035 | 0.084 | 0.197 | 0.064 | 0.360 | 0.477 |
| 2 | 0.40 | 0.65 | <u>0.25</u> | 0.030 <u>0.026</u> | 0.084 | 0.165 | 0.064 | 0.360 | 0.477 |
| 3 | 0.32 <u>0.30</u> | 0.55 | <u>0.25</u> | 0.030 <u>0.026</u> | 0.060 | 0.098 | 0.047 | 0.091 ^c | 0.136 |
| 4 except Marine | 0.32 <u>0.30</u> | 0.55 | <u>0.40</u> | 0.026 <u>0.024</u> | 0.060 <u>0.045</u> | 0.098 | 0.047 | 0.059 | 0.065 |
| 5 and Marine 4 | 0.30 | 0.55 | NR <u>0.40</u> | 0.026 <u>0.024</u> | 0.060 <u>0.045</u> | 0.082 | 0.033 | 0.050 | 0.055 |
| 6 | 0.30 | 0.55 | NR | 0.026 <u>0.024</u> | 0.045 | 0.060 | 0.033 | 0.050 | 0.055 |
| 7 and 8 | 0.30 | 0.55 | NR | 0.026 <u>0.024</u> | 0.045 | 0.057 | 0.028 | 0.050 | 0.055 |



2021 IECC: Prescriptive

TABLE R402.1.2 R402.1.3
INSULATION MINIMUM R-VALUE AND FENESTRATION REQUIREMENTS BY COMPONENT^a

| CLIMATE ZONE | FENESTRATION U-FACTOR ^{b,j} | 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 ^h | 3/4 | 13 | 0 | 0 | 0 |
| 2 | 0.40 | 0.65 | 0.25 | 38 49 | 13 or 0+10 ^h | 4/6 | 13 | 0 | 0 | 0 |
| 3 | 0.32 0.30 ^j | 0.55 | 0.25 | 38 49 | 20 or 13+5ci ^h or 0+15 ^h | 8/13 | 19 | 5ci or 13 ^f | 0 10, 2 ft | 5ci or 13 |
| 4 except Marine | 0.32 0.30 ^j | 0.55 | 0.40 | 49 60 | 20+5 or 13+510ci ^h or 0+20 ^h | 8/13 | 19 | 10ci or 13 | 10ci, 2 4 ft | 10ci or 13 |
| 5 and Marine 4 | 0.30 ^j | 0.55 | NR 0.40 | 49 60 | 20+5 or 13+510ci ^h or 0+20 ^h | 13/17 | 30 [#] | 15ci or 19 or 13+5ci | 10ci, 2 4 ft | 15ci or 19 |
| 6 | 0.30 ^j | 0.55 | NR | 49 60 | 30 or 20+5ci ^h or 13+10ci ^h or 0+20 ^h | 15/20 | 30 [#] | 15ci or 19 or 13+5ci | 10ci, 4 ft | 15ci or 19 |
| 7 and 8 | 0.30 ^j | 0.55 | NR | 49 60 | 30 or 20+5ci ^h or 13+10ci ^h or 0+20 ^h | 19/21 | 38 [#] | 15ci or 19 or 13+5ci | 10ci, 4 ft | 15ci or 19 |

New exception for windows in high-altitude or wind-borne debris protection areas

U-factor Table new fenestration footnote

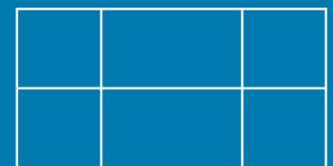
A maximum U-factor of 0.32 shall apply in Climate zone Marine 4 and Climate Zones 5 through 8 to vertical fenestration products installed in buildings located either:

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

R-value Table new fenestration footnote

A maximum U-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:

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

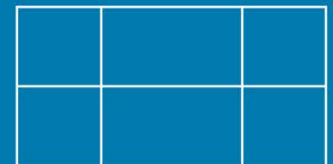


Eliminated loophole for floor insulation

Table R402.1.2, footnote g. [Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.]

Eliminated loophole for wall insulation

R402.2.7 [Walls with partial structural sheathing. Where Section R402.1.2 requires continuous insulation on *exterior walls* and structural sheathing covers 40 percent or less of the gross area of all *exterior walls*, the required continuous insulation R-value shall be permitted to be reduced by an amount necessary, but not more than R-3 to result in a consistent total sheathing thickness on areas of the walls covered by structural sheathing. This reduction shall not apply to the *U-factor* alternative in Section R402.1.4 and the Total UA alternative in Section R402.1.5.]



Envelope Tightness and Testing

- All new homes still required to be blower door tested.
- Baseline for envelope leakage is still ≤ 3.0 ACH50.
 - However, in performance path and ERI, envelope leakage may be traded up to ≤ 5.0 ACH50 in Performance or ERI, as long as efficiency losses are accounted for.
- Small units (<1500 sq. ft.) may be tested to ≤ 0.30 cfm/sq.ft enclosure area.
- No sampling allowed.
- Note: One of the Additional Efficiency Options is a measured air leakage rate ≤ 3.0 ACH50 plus HRV/ERV.



Duct Tightness and Testing

- All new homes required to have ducts tested.
 - No more exception for homes with ducts/air handler inside conditioned space.
- Maximum leakage allowable for systems located inside conditioned space AND maximum trade-off for duct leakage is ≤ 8.0 cfm/sq.ft.
 - Prescriptive requirement and baseline for performance path trade-offs is ≤ 4.0 cfm/sq.ft. or ≤ 3.0 cfm/sq.ft if air handler is not installed.
- No sampling allowed.
- Note: One of the Additional Efficiency Options is to locate 100% of ducts and air handlers inside the envelope/inside conditioned space.



2021 IECC: Prescriptive



Prescriptive: (pick one)

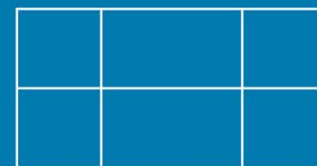
- 5% improved envelope UA and SHGC
- Improved heating and cooling equipment
 - ≥ 95 AFUE nat. gas + 16 SEER air conditioner
 - ≥ 10 HSPF/16 SEER air source heat pump
 - ≥ 3.5 COP ground source heat pump
- Improved water heating equipment
 - ≥ 82 EF fossil fuel water heater
 - ≥ 2.0 EF electric water heater
 - ≥ 0.4 SF solar water heater
- Ducts inside conditioned space
 - 100% ducts/air handler entirely within thermal envelope
 - 100% ductless system or hydronic system entirely within thermal envelope
 - 100% thermal distribution system inside conditioned space (per R403.3.7)
- Air leakage ≤ 3 ACH50 + ERV/HRV



2021 IECC: Prescriptive Trade-off Backstops



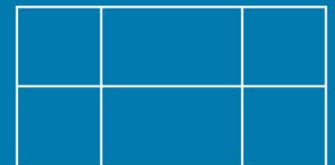
| Trade-Off | 2018 IECC | 2021 IECC |
|----------------------|--|--|
| Envelope Air Leakage | ≤ 3 ACH50 in cz 3-8 ≤ 5 ACH50 in cz 1-2 | ≤ 3.0 ACH50 ≤ 5.0 ACH50 in cz 1-2 Or for small units (<1500 sq. ft.), ≤ 0.30 cfm/sq.ft. enclosure area |
| Duct Tightness | Exemption for system with all ducts & air handler inside conditioned space | Maximum leakage limit for all systems: ≤ 8.0 cfm/sq.ft. |



2021 IECC: Performance



- Overview
 - Includes improvements in prescriptive tables
 - Requires compliance with Additional Efficiency Options
 - New thermal envelope backstop for trade-offs (2009 IECC)
 - No new loopholes for equipment or renewable energy trade-offs
 - New Table of Mandatory Measures



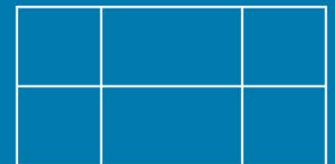
Additional Efficiency Options - Performance

Pick one:

- 5% improved envelope UA and SHGC
- Improved heating and cooling equipment
- Improved water heating equipment
- Ducts inside conditioned space
- Air leakage ≤ 3 ACH50 + ERV/HRV

OR:

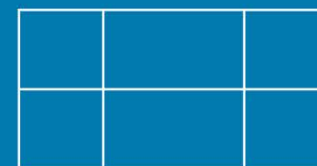
- Demonstrate 5% improvement over standard reference design



2021 IECC: Performance Trade-off Backstops



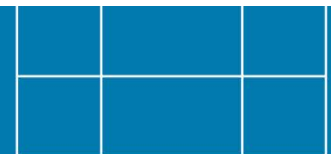
| Trade-Off | 2018 IECC | 2021 IECC |
|----------------------|--|---|
| Envelope Air Leakage | ≤ 3 ACH50 in cz 3-8 ≤ 5 ACH50 in cz 1-2 | Baseline: ≤ 3.0 ACH50 in cz 3-8, ≤ 5.0 ACH50 in cz 1-2 Mandatory trade-off maximum for all cz: ≤ 5.0 ACH50 for all cz |
| Duct Tightness | Exemption for system with all ducts & air handler inside conditioned space | Maximum leakage limit for all systems: ≤ 8.0 cfm/sq.ft. |
| | No limit on duct leakage in trade-offs | Maximum trade-off limit for duct leakage: ≤ 8.0 cfm/sq.ft. |
| Envelope Efficiency | No limit on envelope trade-offs | Envelope efficiency must be no weaker than 2009 IECC prescriptive table |



2021 IECC: Energy Rating Index



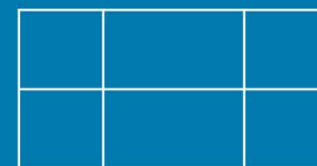
| CLIMATE ZONE | 2015 IECC | 2018 IECC | 2021 IECC BASELINE | BASELINE + 5% EFFICIENCY |
|--------------|-----------|-----------|--------------------|--------------------------|
| 1 | 52 | 57 | 52 | 49 |
| 2 | 52 | 57 | 52 | 49 |
| 3 | 51 | 57 | 51 | 48 |
| 4 | 54 | 62 | 54 | 51 |
| 5 | 55 | 61 | 55 | 52 |
| 6 | 54 | 61 | 54 | 51 |
| 7 | 53 | 58 | 53 | 50 |
| 8 | 53 | 58 | 53 | 50 |



2021 IECC: Energy Rating Index Trade-off Backstops



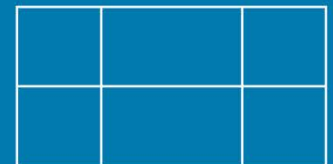
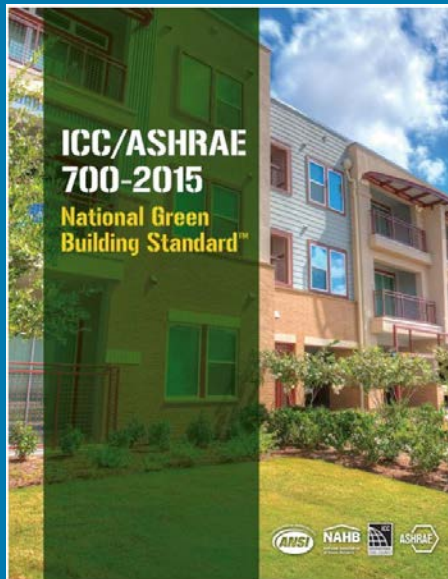
| Trade-Off | 2018 IECC | 2021 IECC |
|--|--|--|
| Envelope Air Leakage | ≤3 ACH50 in cz 3-8 ≤5 ACH50 in cz 1-2 | Mandatory trade-off maximum: ≤5.0 ACH50 for all cz |
| Duct Tightness | Exemption for system with all ducts & air handler inside conditioned space | Maximum leakage limit for all systems: ≤8.0 cfm/sq.ft. |
| | No limit on duct leakage in trade-offs | Maximum trade-off limit for duct leakage: ≤8.0 cfm/sq.ft. |
| Envelope Efficiency (No onsite power production) | 2009 IECC prescriptive table | Total UA of 2021 IECC X 1.15 |
| Envelope Efficiency (including onsite power production) | 2015 IECC prescriptive table | 2018 IECC prescriptive table |
| Onsite power production | No limit to trade-off credit | Limited to 5% credit for onsite power production |



2021 IECC: Above-Code Program Backstops



| Trade-Off | 2018 IECC | 2021 IECC |
|------------------------|--|--|
| Envelope Efficiency | No limit on envelope trade-offs | 2009 IECC prescriptive table |
| Mandatory Requirements | Project must meet all mandatory requirements | Project must meet all mandatory requirements |



2021 IECC: Sustainability/Electrification



- EV Readiness

- New requirement for EV charging in residential homes with designated parking
- Rejected by ICC Board

- Electrification Readiness

- Requirement for electric receptacles near gas receptacles for future electrification
- Rejected by ICC Board

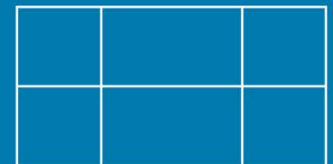
- Net-Zero Appendix

- Available for adoption by jurisdictions with net-zero goals

Table R404.2.2 (IRC N1104.2.2)
EV Ready Space and EV Capable Space requirements.

| Total Number of Parking Spaces | Minimum number of EV Ready Spaces | Minimum number of EV Capable Spaces |
|--------------------------------|-----------------------------------|-------------------------------------|
| 1 | 1 | - |
| 2 - 10 | 2 | - |
| 11 - 15 | 2 | 3 |
| 16 - 19 | 2 | 4 |
| 21 - 25 | 2 | 5 |
| 26+ | 2 | 20% of total parking spaces |

| Climate Zone | 2021 IECC ERI Baseline (including 5% improvement) | Net-Zero Appx (not including OPP) | Net-Zero Appx (including OPP) |
|--------------|---|-----------------------------------|-------------------------------|
| 1 | 49 | 43 | 0 |
| 2 | 49 | 45 | 0 |
| 3 | 48 | 47 | 0 |
| 4 | 51 | 47 | 0 |
| 5 | 52 | 47 | 0 |
| 6 | 51 | 46 | 0 |
| 7 | 50 | 46 | 0 |
| 8 | 50 | 45 | 0 |



2021 IECC: Other Changes

- Improved Lighting Efficiency
 - ≥ 70 lumens/watt, controls
- Water Heating Efficiency
 - 6 efficient options
 - **Rejected by ICC Board**
- Energy Recovery Ventilation
 - Required in cz 7-8
- Mechanical Ventilation
 - Required for all homes
- Certificate Improvements



Generated by REScheck-Web Software
Compliance Certificate



Project: 2015 IECC Residential

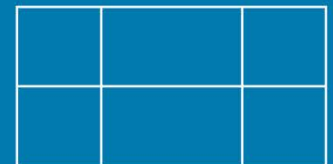
Energy Code: 2015 IECC
Location: Berlin, Connecticut
Construction Type: Single-family
Project Type: New Construction
Orientation: Bldg. faces 180 deg. from North
Conditioned Floor Area: 2,492 ft²
Slabbing Area: 12%
Climate Zone: 5 (5945 HDD)
Permit Date:
Permit Number:

Construction Site: Owner/Agent: Designer/Contractor:

Compliance: Passes using UA trade-off

Compliance: **8.5% Better Than Code** Maximum UA: **376** Floor UA: **344**

The % Better or Worse Than Code index reflects how close to compliance the house is based on code trade-off rules.
It does not provide an estimate of energy use or cost relative to a minimum code house.



Large-Scale, Reformatting Changes Impacting Energy Efficiency

- Updated Climate Zones

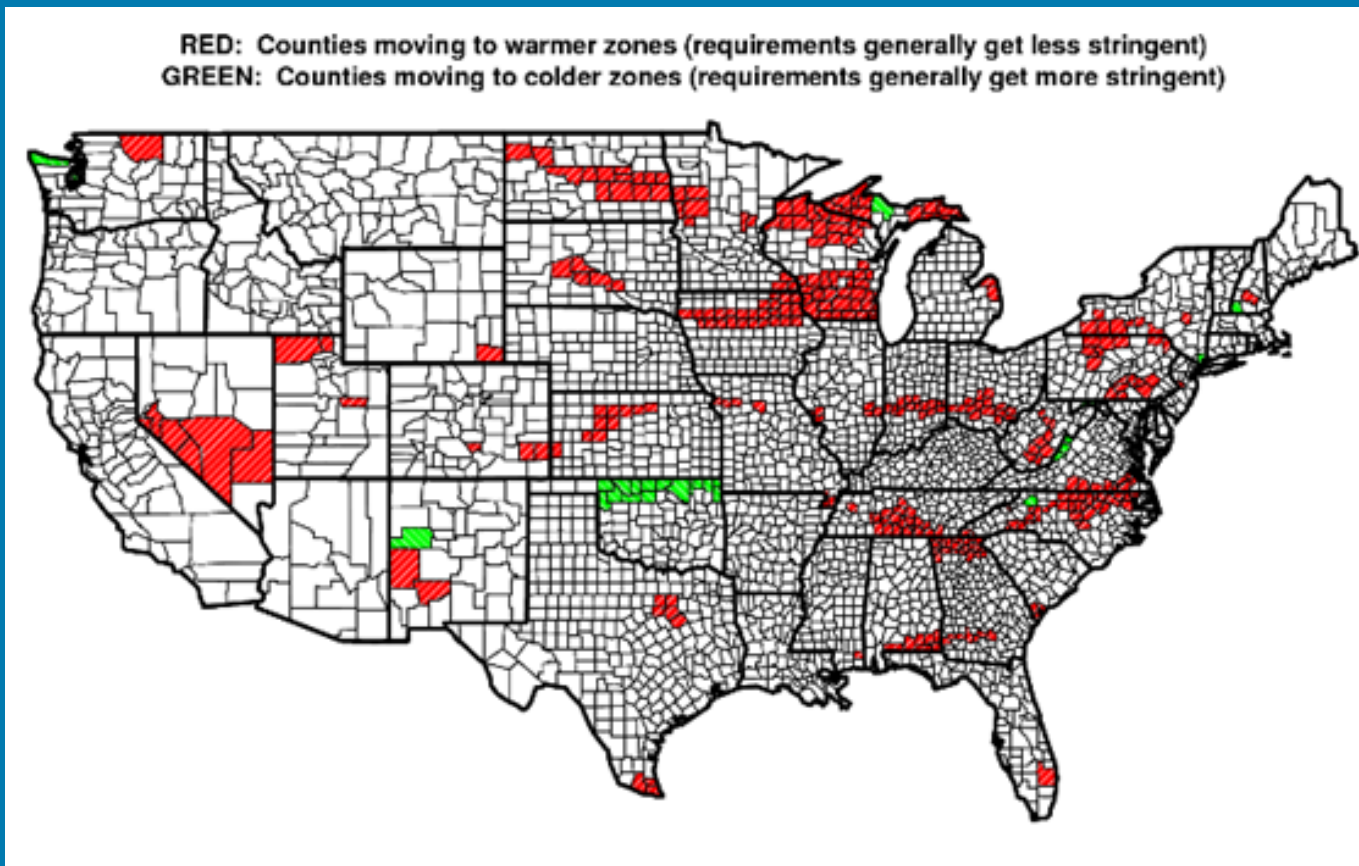


Figure 2 from Pacific Northwest National Laboratory, *Impact of ASHRAE Standard 169-2013 on Building Energy Codes and Energy Efficiency* (Aug. 2016).

Large-Scale, Reformatting Changes Impacting Energy Efficiency

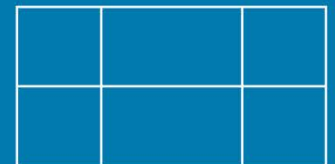
- “Mandatory” Provisions Move into Tables

| TABLE R406.2 (IRC N1106.2) REQUIREMENTS FOR ENERGY RATING INDEX | |
|--|---|
| Section ^a | Title |
| General | - |
| <u>R401.3</u> | <u>Certificate</u> |
| Building Thermal Envelope | |
| <u>R402.1.1</u> | <u>Vapor Retarder</u> |
| <u>R402.4</u> | <u>Air Leakage</u> |
| <u>R406.3</u> | <u>Building Thermal Envelope</u> |
| Systems | |
| <u>R403.1</u> | <u>Controls</u> |
| <u>R403.3 except sections R403.3.1, R403.3.4, R403.3.6, and R403.3.7</u> | <u>Ducts</u> |
| <u>R403.4</u> | <u>Mechanical system piping insulation</u> |
| <u>R403.5.1</u> | <u>Heated water circulation and temperature maintenance systems</u> |
| <u>R403.6</u> | <u>Mechanical ventilation</u> |
| <u>R403.7</u> | <u>Equipment sizing and efficiency rating</u> |
| <u>R403.8</u> | <u>Systems serving multiple dwelling units</u> |
| <u>R403.9</u> | <u>Snow melt and ice systems</u> |
| <u>R403.10</u> | <u>Pools and permanent spa energy consumption</u> |
| <u>R403.11</u> | <u>Portable spas</u> |
| <u>R403.12</u> | <u>Residential pools and permanent residential spas</u> |
| Electrical Power and Lighting Systems | |
| <u>R404.1</u> | <u>Lighting equipment</u> |

2021 IECC: What Was **NOT** Approved



- No new trade-offs for equipment efficiency or renewable energy
- No sampling
- No efficiency rollbacks in any compliance path
- No new compliance paths that skip mandatory requirements or backstops
- No changes to scope or intent of IECC





Please Note: This presentation is based on my notes and information available to the public, and I cannot guarantee 100% accuracy. It should not be used as a replacement for the actual printed code, nor should it be treated as an official interpretation of code requirements.

Thank You

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