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

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- 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

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Audience Poll
Today’s Speakers

Robert Salcido – Senior Building Energy Research Engineer, PNNL

Todd Taylor – Consultant (on behalf of PNNL)
What's New in the Residential Provisions of the 2021 IECC

November 19, 2020

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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

**Commercial Section**

- 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

**Residential Section**

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

**PRESCRIPTIVE**
- R-value (no tradeoffs)
- • U-factor (tradeoffs within individual components)
- • UA (tradeoffs between envelope components)

**SIMULATED PERFORMANCE**
- Simulated Performance Alternative R405 (keyed to Prescriptive requirements)

**ENERGY RATING INDEX (ERI)**
- ERI Compliance Alternative R406 (largely independent of Prescriptive requirements)
Audience Poll
What has changed in the 2021 IECC?
114 Residential Building Proposals approved for IECC 2021
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 – Clarifies 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 backstop 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
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>RE 7</td>
<td>Increases lighting efficacy requirements</td>
</tr>
<tr>
<td>RE 29</td>
<td>Increases R-Value of wood frame wall insulation in CZ 4-5</td>
</tr>
<tr>
<td>RE 32</td>
<td>Increases R-Value of slab insulation and depth in CZ 3-5</td>
</tr>
<tr>
<td>RE 33</td>
<td>Increases R-Value of ceiling insulation in CZ 2-3</td>
</tr>
<tr>
<td>RE 35</td>
<td>Reduces U-Factor of fenestration in CZ 2-4</td>
</tr>
<tr>
<td>RE 36</td>
<td>Increases R-Value of ceiling insulation in CZ 4-8</td>
</tr>
<tr>
<td>RE 44</td>
<td>Adds specific requirements for eave baffles</td>
</tr>
<tr>
<td>RE 45</td>
<td>Makes eave baffles requirement mandatory</td>
</tr>
<tr>
<td>RE 46</td>
<td>Design and installation requirements for attic hatches</td>
</tr>
<tr>
<td>RE 53</td>
<td>Expands language of floor insulation installation</td>
</tr>
<tr>
<td>RE107</td>
<td>Bans continuous burning pilot lights in certain applications</td>
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<tr>
<td>RE109</td>
<td>Clarifies duct insulation requirements based on location</td>
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<tr>
<td>RE126</td>
<td>Increases hot water heater equipment efficiency</td>
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<td>RE133</td>
<td>Increases ventilation system fan efficacy requirements</td>
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<td>RE134</td>
<td>Adds air-handler ventilation system fan efficacy requirements</td>
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<td>RE139</td>
<td>Requires HRV or ERV ventilation in CZ 7-8</td>
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<tr>
<td>RE145</td>
<td>Increases efficacy for high efficiency lighting</td>
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<td>RE148</td>
<td>Requires exterior lighting comply with C405.4 in MF cases</td>
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<td>RE149</td>
<td>Adds new automated control requirements for exterior lighting</td>
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<td>RE152</td>
<td>Adds hot water distribution compactness factor</td>
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<td>RE182</td>
<td>Envelope backstop for ERI compliance to 2018 IECC</td>
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<tr>
<td>RE184</td>
<td>Renewable energy &lt;= 5% of total energy use for ERI</td>
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<tr>
<td>RE192</td>
<td>Reduces ERI compliance targets to 2015 IECC levels</td>
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<td>RE209</td>
<td>Adds section for Additional Efficiency Package options</td>
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<td>RE218</td>
<td>Revises exception for 10% luminaires to 50%</td>
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<tr>
<td>RE223</td>
<td>Adds Appendix RB for Zero Energy Residential Buildings</td>
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</table>
Envelope Changes
Increases wood frame wall R-values by R-5 from 2018 IECC in Climate Zones 4 & 5
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

**TABLE R402.1.2 (IRC N1102.1.2)**

<table>
<thead>
<tr>
<th>CLIMATEZONE</th>
<th>FENESTRATION U-FACTOR</th>
<th>SKYLIGHT U-FACTOR</th>
<th>GLAZED FENESTRATION SHGC</th>
<th>CEILING R-VALUE</th>
<th>WOODFRAME WALL R-VALUE</th>
<th>MASSWALL R-VALUE</th>
<th>FLOOR R-VALUE</th>
<th>BASEMENT R-VALUE</th>
<th>SLAB R-VALUE &amp; DEPTH</th>
<th>CRAWLSPACE WALL R-VALUE</th>
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<td>20 or 13+3^b</td>
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<td>19</td>
<td>5/13</td>
<td>9</td>
<td>10, 2 ft</td>
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<tr>
<td>4 except Marine</td>
<td>0.32</td>
<td>0.55</td>
<td>0.40</td>
<td>49</td>
<td>20 or 13+3^b</td>
<td>8/13</td>
<td>19</td>
<td>10/13</td>
<td>10.2 ft</td>
<td>10.13</td>
</tr>
<tr>
<td>5 and Marine 4</td>
<td>0.30</td>
<td>0.55</td>
<td>NR</td>
<td>49</td>
<td>20 or 13+3^b</td>
<td>13/17</td>
<td>30^G</td>
<td>14/19</td>
<td>10.2 ft</td>
<td>15/19</td>
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<tr>
<td>6</td>
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<td>0.55</td>
<td>NR</td>
<td>49</td>
<td>20+3^b or 13+10^G</td>
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<td>30^G</td>
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<td>15/19</td>
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<td>7 and 9</td>
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<td>30^G</td>
<td>15/19</td>
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<td>15/19</td>
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</table>
**Envelope Changes**

**RE33 & RE36 – Increase ceiling insulation R-Values**

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

<table>
<thead>
<tr>
<th>CLIMATEZONE</th>
<th>ENVELOPE R-VALUE</th>
<th>SKYLIGHT-U-FACTOR</th>
<th>GLAZED ENVELOPE R-VALUE</th>
<th>CEILING-VALUE</th>
<th>WOODFRAME WALL R-VALUE</th>
<th>MASS WALL R-VALUE</th>
<th>FLOOR-R-VALUE</th>
<th>SLAB R-VALUE</th>
<th>CRAWLSPACE-WALL R-VALUE</th>
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<td>49</td>
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<td>4/5</td>
<td>13</td>
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<td>0</td>
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<td>0.32</td>
<td>0.55</td>
<td>0.25</td>
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<td>0.55</td>
<td>0.49</td>
<td>20 or 13+5</td>
<td>8/13</td>
<td>19</td>
<td>0/13</td>
<td>0</td>
<td>0.2 ft</td>
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<td>0.55</td>
<td>NR</td>
<td>49</td>
<td>13</td>
<td>1/17</td>
<td>30</td>
<td>15/19</td>
<td>10.2 ft</td>
</tr>
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<td>6</td>
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<td>0.55</td>
<td>NR</td>
<td>49</td>
<td>13</td>
<td>1/20</td>
<td>30</td>
<td>15/19</td>
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</tr>
<tr>
<td>7 and 8</td>
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<td>NR</td>
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<td>13</td>
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<td>30</td>
<td>15/19</td>
<td>10.4 ft</td>
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</table>

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

<table>
<thead>
<tr>
<th>CLIMATEZONE</th>
<th>ENVELOPE R-VALUE</th>
<th>SKYLIGHT-U-FACTOR</th>
<th>GLAZED ENVELOPE R-VALUE</th>
<th>CEILING-VALUE</th>
<th>WOODFRAME WALL R-VALUE</th>
<th>MASS WALL R-VALUE</th>
<th>FLOOR-R-VALUE</th>
<th>SLAB R-VALUE</th>
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<tr>
<td>1</td>
<td>NR</td>
<td>0.75</td>
<td>0.25</td>
<td>30</td>
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<td>13</td>
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<td>0.55</td>
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<td>0.40</td>
<td>20 or 13+5</td>
<td>8/13</td>
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<tr>
<td>5 and Marine 4</td>
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<td>0.30</td>
<td>0.55</td>
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<tr>
<td>7 and 8</td>
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<td>NR</td>
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<td>13</td>
<td>1/21</td>
<td>30</td>
<td>15/19</td>
<td>10.4 ft</td>
</tr>
</tbody>
</table>
Enumal Changes

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

- **RE35** – Reduce fenestration U-Factor 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

### TABLE R402.1.2 (IRC N1102.1.2)

**INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT**

<table>
<thead>
<tr>
<th>CLIMATEZONE</th>
<th>FENESTRATION U-FACTOR</th>
<th>SKYLIGHT U-FACTOR</th>
<th>GLAZED FENESTRATION SHGC</th>
<th>CELLCIPIR WALL R-VALUE</th>
<th>WOODFRAME WALL R-VALUE</th>
<th>MASSWALL R-VALUE</th>
<th>FLOOR R-VALUE</th>
<th>BASEMENT WALL R-VALUE</th>
<th>WALL R-VALUE</th>
<th>CRAWLSPACE WALL R-VALUE</th>
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<td>4/6</td>
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<td>3</td>
<td>0.50</td>
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<td>50</td>
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<td>8/13</td>
<td>19</td>
<td>5/13</td>
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<td>5/13</td>
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<tr>
<td>4 except marine</td>
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<td>0.30</td>
<td>10</td>
<td>20 or 13+5</td>
<td>8/13</td>
<td>19</td>
<td>10/13</td>
<td>10, 2 ft</td>
<td>10/13</td>
</tr>
<tr>
<td>5 and Marine 4</td>
<td>0.30</td>
<td>0.50</td>
<td>NR</td>
<td>49</td>
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<tr>
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<td>20 or 13+5</td>
<td>10/13</td>
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<td>7 and 8</td>
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<td>10/13</td>
<td>19</td>
<td>10/13</td>
<td>10, 2 ft</td>
<td>10/13</td>
</tr>
</tbody>
</table>

**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 climate 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.
Envelop Changes
RE23 & RE27 – Alternative wall options

- **RE23** – basement wall alternative prescriptive options
- **RE27** – above grade wall alternative prescriptive options
Envelope Changes
RE96 – Sets maximum air leakage rate to 5.0 ACH50 for tradeoffs

Compliance with air leakage Requires BOTH:

✓ Whole-house pressure test (2018 IECC)

<table>
<thead>
<tr>
<th>Air Leakage Rate</th>
<th>Climate Zone</th>
<th>Test Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5 ACH</td>
<td>1-2</td>
<td>50 Pascals</td>
</tr>
<tr>
<td>≤ 3 ACH</td>
<td>3-8</td>
<td>50 Pascals</td>
</tr>
</tbody>
</table>

✓ 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

<table>
<thead>
<tr>
<th>Air Leakage Rate</th>
<th>Climate Zone</th>
<th>Test Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5 ACH</td>
<td>1-2</td>
<td>50 Pascals</td>
</tr>
<tr>
<td>≤ 5 ACH</td>
<td>3-8</td>
<td>50 Pascals</td>
</tr>
</tbody>
</table>
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
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**

<table>
<thead>
<tr>
<th>FAN LOCATION</th>
<th>AIR FLOW RATE MINIMUM(CFM)</th>
<th>MINIMUM EFFICACY(CFM/WATT)</th>
<th>AIR FLOW RATE MAXIMUM(CFM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRV or ERV</td>
<td>Any</td>
<td>1.2 cfm/watt</td>
<td>Any</td>
</tr>
<tr>
<td>Range hoods</td>
<td>Any</td>
<td>2.8 cfm/watt</td>
<td>Any</td>
</tr>
<tr>
<td>In-line fan</td>
<td>Any</td>
<td>2.8 cfm/watt</td>
<td>Any</td>
</tr>
<tr>
<td>Bathroom, utility room</td>
<td>10</td>
<td>1.4 cfm/watt</td>
<td>&lt; 90</td>
</tr>
<tr>
<td>Bathroom, utility room</td>
<td>90</td>
<td>2.8 cfm/watt</td>
<td>Any</td>
</tr>
</tbody>
</table>

**Notes:**
- Air-handler that is integrated to tested and listed HVAC equipment
- Any

---

**TABLE R403.6.1 (IRC N1103.6.1)**
**WHOLE-DWELLING MECHANICAL VENTILATION SYSTEM FAN EFFICACY**

<table>
<thead>
<tr>
<th>FAN LOCATION</th>
<th>AIR FLOW RATE MINIMUM(CFM)</th>
<th>MINIMUM EFFICACY(CFM/WATT)²</th>
<th>AIR FLOW RATE MAXIMUM(CFM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRV or ERV</td>
<td>Any</td>
<td>1.2 cfm/watt</td>
<td>Any</td>
</tr>
<tr>
<td>Range hoods</td>
<td>Any</td>
<td>2.8 cfm/watt</td>
<td>Any</td>
</tr>
<tr>
<td>In-line fan</td>
<td>Any</td>
<td>2.8 cfm/watt</td>
<td>Any</td>
</tr>
<tr>
<td>Bathroom, utility room</td>
<td>10</td>
<td>1.4 cfm/watt</td>
<td>&lt; 90</td>
</tr>
<tr>
<td>Bathroom, utility room</td>
<td>90</td>
<td>2.8 cfm/watt</td>
<td>Any</td>
</tr>
<tr>
<td>Air-handler that is integrated to tested and listed HVAC equipment</td>
<td>Any</td>
<td>1.2 cfm/watt</td>
<td>Any</td>
</tr>
</tbody>
</table>
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

- **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**

<table>
<thead>
<tr>
<th>BUILDING COMPONENT</th>
<th>STANDARD REFERENCE DESIGN</th>
<th>PROPOSED DESIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service water heating</td>
<td>As proposed.</td>
<td>Use, in units of gal/day = ((30 + (10 \times N_{BR})) \times (1 - HWDS))</td>
</tr>
<tr>
<td></td>
<td>Use, same as proposed design.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use, in units of gal/day = 30 + (10 \times N_{BR})</td>
<td></td>
</tr>
<tr>
<td></td>
<td>where:</td>
<td>(N_{BR} = \text{number of bedrooms.})</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Compactness Ratio(^1)</th>
<th>HWDS Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 story</td>
<td>(\geq 30%)</td>
</tr>
<tr>
<td>&gt; 60%</td>
<td>(\geq 30%)</td>
</tr>
<tr>
<td>&gt; 30% to ≤ 60%</td>
<td>&gt; 15% to ≤ 30%</td>
</tr>
<tr>
<td>&gt; 15% to ≤ 30%</td>
<td>&gt; 7.5% to ≤ 15%</td>
</tr>
<tr>
<td>&lt; 15%</td>
<td>&lt; 7.5%</td>
</tr>
<tr>
<td>2 or More Stories</td>
<td>0</td>
</tr>
<tr>
<td>&gt; 30% to ≤ 60%</td>
<td>0.05</td>
</tr>
<tr>
<td>&gt; 15% to ≤ 30%</td>
<td>0.10</td>
</tr>
<tr>
<td>&lt; 15%</td>
<td>0.15</td>
</tr>
</tbody>
</table>
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
Service Hot Water Changes

RE163 – Reduces daily hot water consumption in Performance Path

- 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.

<table>
<thead>
<tr>
<th>BUILDING COMPONENT</th>
<th>STANDARD REFERENCE DESIGN</th>
<th>PROPOSED DESIGN</th>
</tr>
</thead>
</table>
| Service water heating | As proposed. Use: same as proposed design. | As proposed
|                     |                           | Use, in units of gal/day = 25.5 + \(8.5 \times N_{BR}\) |
|                     |                           | where:  |
|                     |                           | \(N_{BR}\) = number of bedrooms. |
Performance/ERI Changes
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

**RED:** Counties moving to milder zones
**Green:** Counties moving to colder zones

Source: Pacific Northwest National Laboratory
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 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 a R-value of not less than R-6.

**UA\text{Proposed design} = 1.15 \times UA\text{Prescriptive reference design},\text{ 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 R405.2(1) [IRC N1105.5.2(1)]**

**SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

Portions of table not shown remain unchanged.

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

\[ \text{Ventilation rate, CFM} = (0.01 \times \text{total square foot area of house}) + [7.5 \times (\text{number of bedrooms} + 1)] \]  
(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>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>ENERGY RATING INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>52</td>
</tr>
<tr>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td>3</td>
<td>51</td>
</tr>
<tr>
<td>4</td>
<td>54</td>
</tr>
<tr>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>6</td>
<td>54</td>
</tr>
<tr>
<td>7</td>
<td>53</td>
</tr>
<tr>
<td>8</td>
<td>53</td>
</tr>
</tbody>
</table>

### 2021 IECC ERI Targets

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>ENERGY RATING INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>57 52</td>
</tr>
<tr>
<td>2</td>
<td>57 52</td>
</tr>
<tr>
<td>3</td>
<td>57 54</td>
</tr>
<tr>
<td>4</td>
<td>61 55</td>
</tr>
<tr>
<td>5</td>
<td>61 54</td>
</tr>
<tr>
<td>6</td>
<td>61 53</td>
</tr>
<tr>
<td>7</td>
<td>58 53</td>
</tr>
<tr>
<td>8</td>
<td>58 53</td>
</tr>
</tbody>
</table>
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

➢ Allows jurisdictions to adopt a model for zero energy home designation

RB103 (IRC AQ 103)
ZERO ENERGY RESIDENTIAL BUILDINGS

RB103.1 (IRC AQ 103.1) General. New residential buildings shall comply with Section RB103.

RB103.2 (IRC AQ 103.2) 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>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>ENERGY RATING INDEX not including onsite power</th>
<th>ENERGY RATING INDEX including onsite power (as proposed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>47</td>
<td>0</td>
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<tr>
<td>4</td>
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<td>0</td>
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<tr>
<td>7</td>
<td>46</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>45</td>
<td>0</td>
</tr>
</tbody>
</table>
2021 IECC Summary

➢ 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!

Building Energy Codes Program
www.energycodes.gov/training

BECP help desk
https://www.energycodes.gov/HelpDesk

If you want AIA LUs, ICC CEUs and Certificate of Attendance for self-reporting, WRITE DOWN THIS LINK:
https://www.energycodes.gov/residential-iecc-credit-request
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