From HERS® Rater to Code Official

Presented By Robby Schwarz

About EnergyLogic

Berthoud, Colorado-based EnergyLogic is a software and building consulting company that has provided expert resources, education and support to new home builders and energy raters involved in the construction of high-performance homes since 2006.
Our Plan

- Intent of the code
- Understanding the IECC® structure
  - Pathways through the code
- Understanding the Rater's role in codes
- What is a rating?
- Inspections
- Why Raters are uniquely qualified
- Sustainable business model / business opportunity
- Code development

Change is Hard ... Change is Good... Change can be Made Easier
The 2015 and 2018 IECC are better written versions of the 2012. No significant change in Sections 404 & R405. In 2018 significant change in Section R406.

What will happen in 2021?

The Key Factor of Code Development

Adoption

- A minor change in a document

Amendment

- a· mend·ment
- ә´men(d)mәnt/
- noun
- A change or addition to a legal or statutory document
2018 IECC - Intent

This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.

• Durability
**2018 IECC – Intent**

This code is intended to provide flexibility to permit innovative approaches and techniques to achieve this objective.

“Learn the rules so you know how to break them properly”

Author: Dalai Lama  
Date: Feb 25, 2008

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**2018 IECC – Intent**

The code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.
Building Codes are Life Safety Codes
http://www.swenergy.org/energy-codes-are-life-safety-codes

Energy Codes are the gateway drug of the code world.

The energy codes affect:
- Thermal management and protection from extreme weather events
- Moisture management (rot, mold, and mildew)
- Air management and indoor air quality
- Durability and resiliency of homes and buildings
- Comfort and meeting of customer expectations
- Efficiency – the only code that pays for itself
- The IECC works in tandem with the other model building codes to ensure safe buildings

Pathways = Flexibility/Options
Code Compliance Paths

Prescriptive Path
- Most restrictive path
  - Only option is to do better than
- No compliance tool
- Must declare that this is your method of compliance
- Permitting plan set is the documentation
- Prescriptive installation details carry over to other pathways
  - Eave baffles
  - Crawl space vapor retarder
  - Attic insulation installation requirements
  - Etc.

UA Compliance Path

Simulated Performance Path

Energy Rating Index Path
# 2018 Prescriptive R-value Table Compliance Specification

Declare to the Code official that the pathway for compliance is the prescriptive path

## TABLE R405.1.3

### Insulation and Fenestration Requirements by Component

<table>
<thead>
<tr>
<th>Climate Zone</th>
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</tbody>
</table>

NR = Not Required

**A.** R-values are minimum. U-factors and SHGC are maximum. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed R-value of the insulation shall be not less than the R-value specified in the table.

**B.** The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

**C.** "8/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "10/24" means R-15 continuous insulation on the interior or exterior of the home or R-15 cavity insulation on the interior of the basement wall. Alternatively, compliance with "15/10" shall be R-13 cavity insulation on the interior of the basement wall plus R-3 continuous insulation on the interior or exterior of the home.

**D.** R-10 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation R-value for slabs, as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

**E.** There are no SHGC requirements in the Marine Zone.

**F.** Basement wall insulation is not required in warm-located locations as defined by Figure R301.1 and Table R301.1

**G.** Additional insulation sufficient to fill the framing cavity and provide not less than an R-value of R-15 shall be installed. The first value is cavity insulation, the second value is continuous insulation. Therefore, an example, "13/5" means R-13 cavity insulation plus R-5 continuous insulation.

**H.** Masonry walls shall be in accordance with Section R402.2.5. The second R-value applies where more than half of the insulation is on the interior of the mass wall.

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## Regardless of the Pathway

**International Energy Conservation Code**

### Mandatory Requirements
**Terminology**

- **Mandatory requirements**
  - Requirements that must be met by every building unless there is a specific exception in the code

- **Prescriptive requirements**
  - Requirements that must be met by every building unless an approved tradeoff is utilized or unless there is a specific exception in the code

- **Performance approach**
  - An overall performance requirement for the building that replaces the individual prescriptive requirements for building systems and components

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**Prescriptive/ Mandatory Requirements**

Installation issues required by code

- Eve Baffles
- Attic Insulation
- Crawl Vapor Retarders
- Floor Insulation
All other paths use software
Software allows tradeoffs

UA Compliance Path
Simulated Performance Path
Energy Rating Index Path

What is a Reference Design?

• Reference Design
  • A standard set of house specifications that generate a specific level of quantifiable energy performance

• The concept code is used to show compliance with the UA Trade-Off (REScheck™), the Simulated Performance Path, and the ERI Path

  The home’s actual built performance will be less than or equal to the performance of the code standard reference design

  The standard reference design is defined within the IECC
R402.1.5 Total UA Alternative

A method for performing conductive energy trade-offs

- Trading off the R-values and U-values in the thermal envelope
- Mathematically making the R-value and U-value paths

Twin Houses

2018 IECC Reference Design House
- Geometric Twin
- 2018 IECC prescriptive envelope U-values in (Table 402.1.4)

Builder’s Desired House
- Geometric Twin
- Envelope U-values based on Builder’s specification

If the builder’s house has the same or lower area weighted U-values, then it meets the intent of code.
Simulated Performance Alternative - R405

- This section establishes criteria for compliance using simulated energy performance analysis.
  Such analysis shall include
  - Heating
  - Cooling
  - Service water heating energy only
- Compliance with this section requires that the (Mandatory) items still be met.
**Energy Analysis**

- **Conduction** - Trading off R-values and U-values
- **Radiation** – Trade-offs created by energy moving from areas of high concentrations to low concentration through open space.
- **Convection** – Energy moving with air infiltration and exfiltration

![Energy moves from warm to cold]

**Energy Costs?**

- **405.3 Performance-based compliance.** Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the standard reference design.
Twin Houses

2018 IECC Reference Design House

• Geometric Twin
• 2018 IECC Section R405 Reference Home

Builder’s Desired House

• Geometric Twin
• Builder’s Specification Energy Specifications

If the builder’s house has the same or lower Annual Energy Cost then it meets the intent of code.
Section R406 of the 2018 IECC
Energy Rating Index Compliance Alternative

Mandatory Sections of the 2018 IECC

R401.1 Mandatory Requirements:

- Section R402.4 Air Leakage
  - R402.4.1.2 Testing
    - Air leakage rate not exceeding 5 air changes per hour in Climate Zones 1 and 2, and 3 air changes per hour in Climate Zones 3 through 8
  - Table R402.4.1.1 Air Barriers and Insulation
- Section R403 Systems
- Section R404 Electrical Power and Lighting Systems
- Prescriptive Requirements in R403.5.3
  - Hot water pipe insulation
R406.2 Mandatory Requirements

• The building thermal envelope shall be greater than or equal to levels of efficiency and Solar Heat Gain Coefficient in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code.

2018 IECC

• If solar is installed on a home using the ERI path, builders must also meet the minimum prescriptive envelope efficiency measures in the 2015 IECC

• If there is no solar on the home then the builders must also meet the minimum prescriptive envelope efficiency measures in the 2009 IECC

2009 IECC vs. 2015 IECC Prescriptive Table

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Window U-Factor</th>
<th>Window SHGC</th>
<th>Ceiling R-Value</th>
<th>Wood Framed Wall R-Value</th>
<th>Mass Wall R-Value</th>
<th>Floor R-Value</th>
<th>Basement Wall R-Value</th>
<th>Slab R-Value and Depth</th>
<th>Crawl Space Wall R-Value</th>
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<tbody>
<tr>
<td>1</td>
<td>1.2</td>
<td>0.30</td>
<td>0.25</td>
<td>R-30</td>
<td>R-13</td>
<td>R-3/4</td>
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<td>R-5/8</td>
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<td>R-5/13</td>
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<tr>
<td>4 except Marine</td>
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<td>0.35</td>
<td>0.40</td>
<td>R-38</td>
<td>R-13</td>
<td>R-5/10</td>
<td>R-19</td>
<td>R-10/13</td>
<td>R-10, 2ft</td>
</tr>
<tr>
<td>5 and Marine 4</td>
<td>0.35</td>
<td>0.32</td>
<td>NR</td>
<td>R-38</td>
<td>R-13</td>
<td>R-10/13</td>
<td>R-10/13</td>
<td>R-10/13</td>
<td>R-10/13</td>
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<tr>
<td>Climate Zone 6</td>
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<td>0.32</td>
<td>NR</td>
<td>R-49</td>
<td>R-20 or 13+5</td>
<td>R-13/17</td>
<td>R-30</td>
<td>R-10/13</td>
<td>R-10, 4ft</td>
</tr>
<tr>
<td>Climate Zone 7 &amp; 8</td>
<td>0.35</td>
<td>0.32</td>
<td>NR</td>
<td>R-49</td>
<td>R-21 R20+5 or 13+10</td>
<td>R-19/21</td>
<td>R-38</td>
<td>R-15/19</td>
<td>R-10, 4ft</td>
</tr>
</tbody>
</table>
Compliance based on an ERI analysis requires that the \textit{rated design} be shown to have an ERI less than or equal to the appropriate value listed in Table R406.3, when compared to the \textit{ERI reference design}.
Understanding the Rater’s Role in Codes

2018 IECC Definition:
R105.4 Approved Inspection Agencies

The code official is authorized to accept reports of third-party inspection agencies not affiliated with the building design or construction, provided that such agencies are approved as to qualifications and reliability relevant to the building components and systems that they are inspecting.
2018 IECC Three References to Approved Inspection Agencies

1. **R402.4.1.1 Installation.** ... *building thermal envelope* ... Where required by the *code official*, an *approved* third party shall inspect all components and verify compliance.

2. **R402.4.1.2 Testing.** The *building* or dwelling unit shall be tested and verified as having an air-leakage rate... Where required by the *code official*, testing shall be conducted by an *approved* third party.

3. **R406.5 Verification by approved agency.** Verification of compliance with Section R406 shall be completed by an *approved* third party.

2021 IECC Code Change Proposal

**R105.4 Approved third-party inspection agencies.** The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the *building* design or construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the *building* components and systems that they are inspecting.

Add new text as follows:

**R105.4.1 Authorization of approved third-party inspection agency.** When the code official authorizes the use of a third-party inspection agency for all or some aspects of Code compliance inspections, the agency shall be authorized as a third-party extension of the authority having jurisdiction to verify compliance.

**R105.4.2 Approved third-party inspections agreement.** The third-party inspection agency and the authority having jurisdiction shall agree upon which compliance verification measures will be incorporated within each of their inspection processes. These measures shall include mandatory or other provisions required by the specific path of compliance chosen from R401.2.

**R105.4.3 Approved third-party inspections reporting.** The approved agency shall submit inspection reports to the authority having jurisdiction and to the owner’s representative in accordance with *International Building Code* Section 1704.2.4.
What are a Rater’s Responsibilities?

- Different types of ratings, different responsibilities
- HERS® minimum rated features vs. Code mandatory
- HERS Index and HERC vs. ERI and ERI Report
  - Cost compliance report, UA compliance report
- Testing/inspection for code vs. for a HERS rating
  - Insulation / air barrier
  - Blower door
  - Duct leakage

What is a Rating?

- Methodology for evaluating a house
  - Provides
    - Alignment
    - Uniformity
    - Consistency
  - May
    - Assess performance
    - Demonstrate compliance
    - Offer certification
- Index score
- Energy
- Code
- ENERGY STAR®
- LEED®
- Other program
- Warranty
- Audit
Asset Rating

RESNET HERS Rating

- Minimum rated features
- Not a Pass / Fail evaluation

Minimum rated features of a home include:
- Building envelope features
- Water heating
- Space heating and cooling systems
- Passive solar
- Solar domestic water heating
- Appliances
- One-site power production

RESNET Insulation Grading

Modeling guidance for derating the R-value of insulation:
- When it is possible to inspect insulation as installed (i.e., new construction), inspectors shall rate the installation as “Grade I, II, or III” according to the following guidelines

Grade 1

Grade 2

Grade 3
Insulation Grading and the Code?

What Grade is this?

What Grade is this?

Air Sealing and Insulation

N1101.13 (R303.2)

- Materials, systems and equipment shall be installed in accordance with the manufacturer’s instructions and the International Building Code or the International Residential Code, as applicable.

- For insulation only Grade 1 installation meets the intent of the IECC.
Program Rating

Certification/Labeling Rating
- Minimum rated features
- Pass / Fail evaluation

ENERGY STAR® v3
- HERS Index target
- Thermal enclosure checklist
- Rater HVAC checklist
- HVAC design report
- HVAC commissioning report
- Builder water management checklist
- Footnote requirements

R403.3.3 Duct testing (Mandatory).

Leakage testing required when any portion of ductwork is in unconditioned space.

- Attic
- Unconditioned crawl space
- Isolated mechanical room with natural draft appliance
- Floor over garage?
- Exterior wall?
ENERGY STAR Requires Duct Testing Regardless of the Location of the Duct

Total Duct Leakage

Duct Leakage to Outside

Must be tested when using the performance path of code

Code Rating

- Compliance Rating
  - Minimum rated features
  - Pass / Fail evaluation

Mandatory Requirements

- Compliance modeling
  - UA Compliance
  - Cost Compliance
  - EIR Compliance

- Insulation installation
- Air barriers
- Air leakage 3/5ACH
- Duct leakage 4%
- High efficacy lighting
Items Listed in this Table are Mandatory-Sometimes Not Clear

Energy Code Inspection
R105 Inspections - New in the 2015 IECC

• Construction or work for which a permit is required shall be subject to inspection

• The code official or his/her agent shall inspect:
  • Footing and foundation
  • Framing and rough-in inspection
  • Plumbing rough-in inspection
  • Mechanical rough-in inspection
  • Final inspection
  • Re-inspection

Required Inspections

R105.2.2 Framing and rough-in inspection

• Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with the code as to types of insulation and corresponding R-values and their correct location and proper installation; fenestration properties (U-factor and SHGC) and proper installation; and air leakage controls as required by the code and approved plans and specifications.

R105.2.4 Mechanical rough-in inspection

• Inspections at mechanical rough-in shall verify compliance as required by the code and approved plans and specifications as to installed HVAC equipment type and size, required controls, system insulation and corresponding R-value, system air leakage control, programmable thermostats, dampers, whole-house ventilation, and minimum fan efficiency.
Focus on House Performance

Building Science Built into the Code

PERFORMANCE PATH OPTIONS PROVIDE FLEXIBILITY

- High-Efficiency Appliances
- Attic Insulation
- Energy-Efficient Windows
- Energy-Efficient Water Heaters
- Proper Ventilation System
- Insulated Foundation Walls
- High-Efficiency Lighting
- HVAC Systems
Fundamental Questions

Is It There?  Does It Work?

[Images of a bathroom and a ceiling with insulation]

Fundamental Questions

Is It There?  Does It Work?

[Images of a wall and a ceiling with insulation]
Fundamental Questions

Is It There?  Does It Work?

Fundamental Questions

Is It There?  Does It Work?
Raters Are Uniquely Qualified

- Energy specialist and building generalist
- Systems thinking and applied building science background
- Leveraging the Rating process
- Leveraging commonalities between programs and codes
- Modeling skills
- Educator
- Enhances the business model

Expectation
Integrated within Chapter 4

- Systems Thinking
- Applied Building Science

- Air Flow
- Thermal Flow
- Moisture Flow
What / Where is the Thermal Envelope?  
IECC Chapter 4

Can a House Be Too Tight?

NO!

- Wrong question
- Control air flow
- In order to control the air

Real question ...
- Can a house be under-ventilated?

YES!

Build Tight and Ventilate Right
Business Model

- Bottom line security in a volatile industry
Which is More Sustainable?

Residential Energy Inspector/Plans Examiner

Your RESNET HERS Rater Certification Qualifies You for the ICC/RESNET Member Value Package

The International Code Council (ICC), in cooperation with RESNET, is offering certified RESNET HERS Raters the opportunity to build their professional qualifications and enjoy the valuable benefits offered exclusively to ICC Members at a savings of more than $50.

Through the ICC/RESNET Member Value Package, you will receive:

- 1-year ICC Building Safety Professional Membership
- An electronic download of the 2015 or 2018 International Energy Conservation Code® (IECC®)
- A voucher good for one ICC Certification Examination® that can be redeemed at any of hundreds of exam locations throughout the country

*Satisfactory completion of the ICC certification exams results in a 3-year ICC certification.

Code Officials looking to outsource Inspections often look for HERS Raters that have ICC credentials—so now is a great time to get yours!

The ICC/RESNET Member Value Package also includes:

- One year of free code opinions by ICC’s expert technical staff—a ICC Member benefit
- Special ICC Member pricing on many publications and digital products, training and other products and services.

Don’t miss out on this opportunity that is only available to certified RESNET HERS Raters! Simply submit the application and begin to enjoy all the benefits of being an ICC Member.

https://www.iccsafe.org/content/resnet-member-value-package/
R103.1 General

- Construction documents, technical reports and other supporting data shall be submitted in one or more sets with each application for a permit. The construction documents and technical reports shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the code official is authorized to require necessary construction documents to be prepared by a registered design professional.

2021 Proposed definition

- Compliance Reports. Documents created to demonstrate compliance with the intent of the code for the purpose of obtaining the building permit and/or acquiring the certificate of occupancy.

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Code Development

**Local Level**

- Home rule state or state wide codes?
- How you can impact adoption?
  - Local proposals and code hearings
- Networking with jurisdictions
  - Education and presentation
- Demonstrating your expertise
  - Be the expert

**National Level**

- National ICC hearings
- Opportunity to shape the codes
  - Committee
  - Public comment
Conclusion

• Lots of opportunity
  • Baby boomers are retiring

• Raters are uniquely qualified
  • But ERI path may not be the pathway of choice

• Must understand the code and your role!
  • What is your scope of work?
  • What is the code official’s responsibility / what are your responsibilities?

• Building science and the code
  • Many jurisdictions don’t want to learn or change, so take advantage
  • Do you want to do more than blower door and duct leakage testing or generation of an ERI score?

• Sustainable business opportunity

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