From HERS® Rater to Code Official

EnergyLogic

RESNET 2019 Conference New Orleans, LA • Feb 25-27

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.

RESNET · ENERGY STAR AWARD 2017 PARTNER OF THE YEAR Sustained Excellence · EPX ENERGYPRO EXCHANGE · Built-In Savings Guaranty · QA GenieLife · ICC INTERNATIONAL CODE COUNCIL · LEED HOMES · EPA Indoor airPLUS QUALIFIED HOME · DASH · energyLogic Academy · ePro · ZERO ENERGY READY HOME PARTNER · raterfest!

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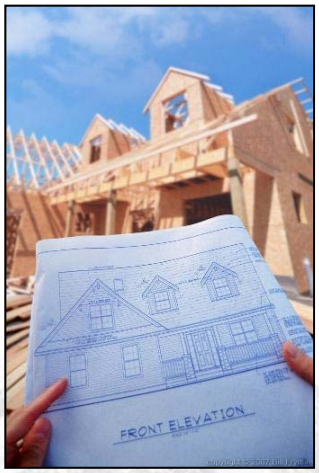
Our Plan

- 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

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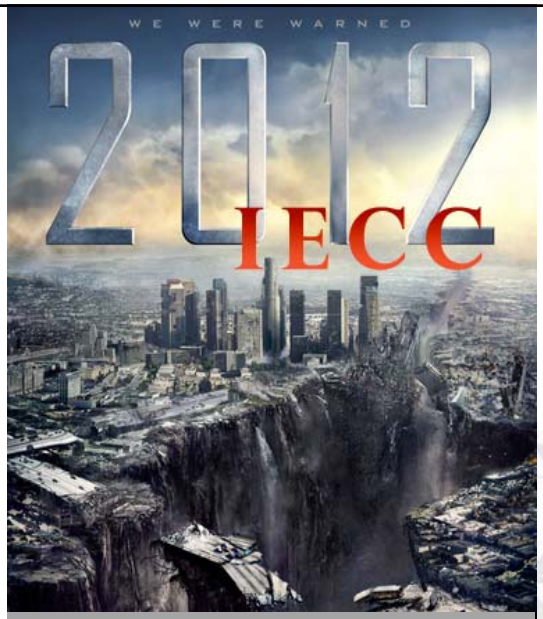

The Apocalypse is Coming

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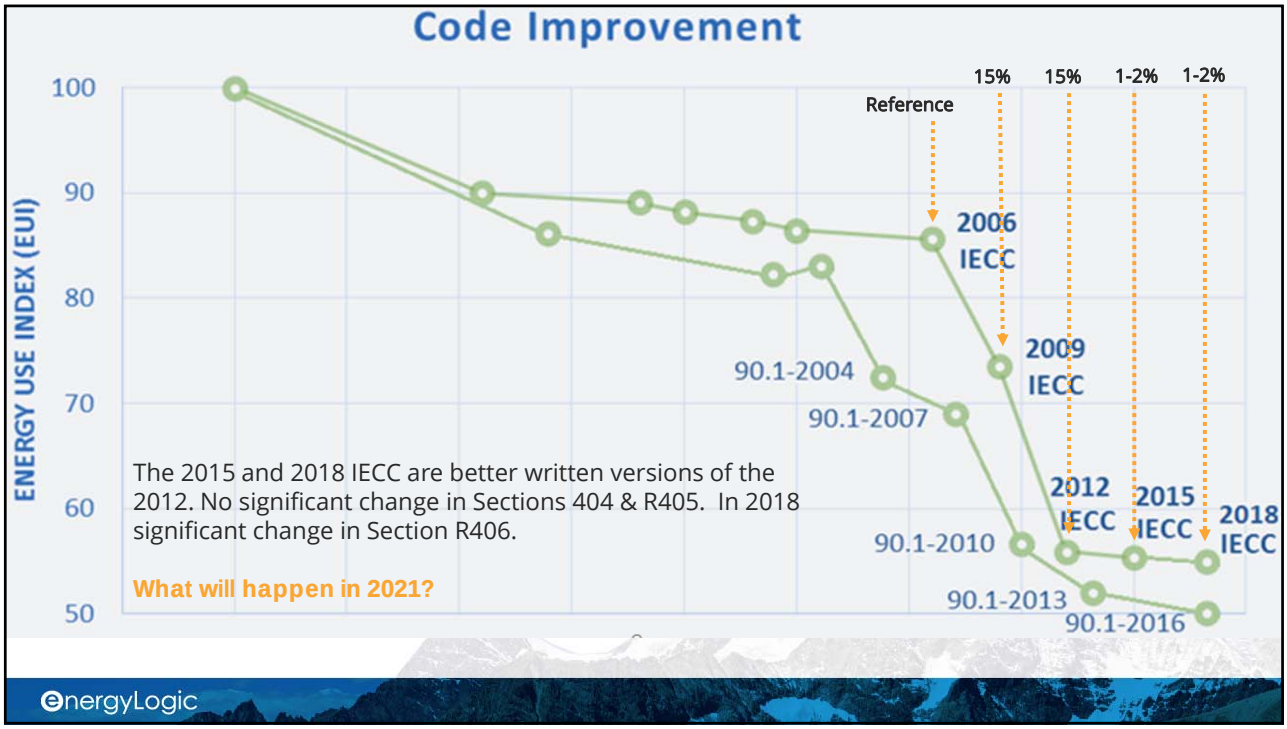
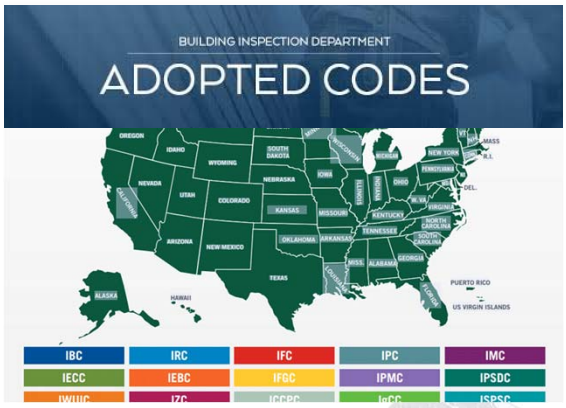


The Key Factor of Code Development

Adoption



Amendment

- a·mend·ment
- əˈmen(d)mənt/
- *noun*
- A minor change in a document
- A change or addition to a legal or statutory document

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INTENT & IMPACT DIFFERENCE

in·tent

/in ˈtent/

noun

1. intention or purpose.
   "with alarm she realized his intent"
   synonyms: aim, intention, purpose, objective, object, goal, target;

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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

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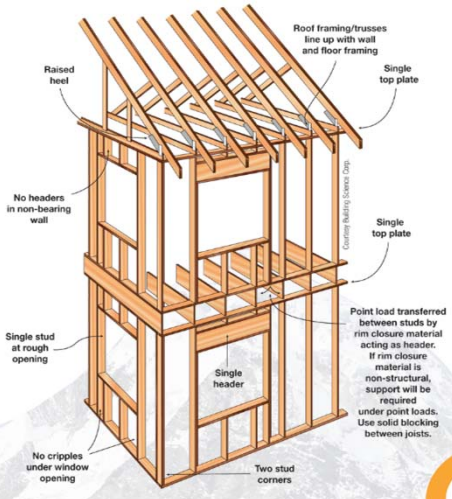
2018 IECC – Intent

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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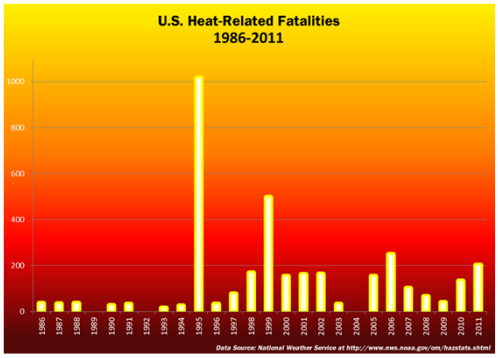
2018 IECC – Intent

The code is <u>not intended</u> to **abridge safety, health or environmental requirements** contained in other applicable codes or ordinances.



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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

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Pathways = Flexibility/Options

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Code Compliance Paths

Prescriptive Path

UA Compliance Path

Simulated Performance Path

Energy Rating Index Path

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Prescriptive Path – R402

- 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.

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2018 Prescriptive R-value Table Compliance Specification

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

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Only looking at cavity or component R-value/U-value

CLIMATE ZONE	[illegible]									CRAWL SPACE[e] WALL *R*-VALUE
1										0
2										0
3	0.32	0.55	0.25	38	20 or 13+5[b]	8/13	19	5/13	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[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[b]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[b] or 13+10[b]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[b] or 13+10[b]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required.

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. 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.
Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" 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. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 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-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass 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

IECC
INTERNATIONAL ENERGY CONSERVATION CODE

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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

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

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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 (RES*check*™), 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

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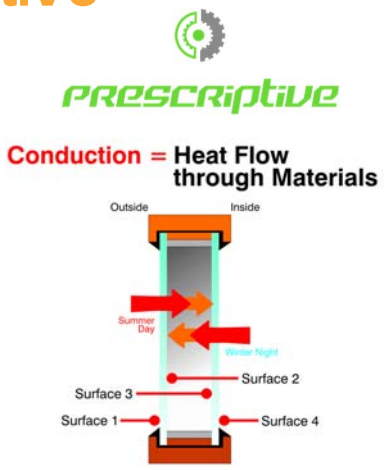
R402.1.5 Total UA Alternative

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)

VS.

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.

UA Compliance Path

IECC 2018 Building UA Compliance

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Property
8925 Place to live
Denver, CO 80238

2018 IECC Compliance - taken to a l
Robby's Test play house

Organization
EnergyLogic
720-838-0677
Robby Schwarz

Inspection Status
Results are projected

Builder
Best Builder In America Homes

Building UA

Elements	IECC Reference	As Designed
Ceilings	26.8	21.0
Above-Grade Walls	144.0	129.7
Windows, Doors and Skylights	137.1	120.5
Slab Floor:	27.3	27.3
Framed Floors	4.4	6.0
Basement Walls	60.8	50.2
Rim Joists	11.5	10.0
Overall UA (Design must be equal or lower):	**411.9**	**364.7**

Mandatory Requirements

402.1.5 Total Ua alternative for insulation and fenestration	402.4.1.2 Air Leakage Testing	402.5 Area-weighted average fenestration SHGC
402.5 Area-weighted average fenestration U-Factor	404 Lighting Equipment Efficiency	Mandatory Checklist
IRC M1505.4.3 Mechanical Ventilation Rate IRC 2018 Chapter 15	403.3.3 Duct Testing	403.5.3 Hot water pipe insulation

Design exceeds requirements for IECC 2018 Prescriptive compliance by 11.5%.

Name: Robby Schwarz
Organization: EnergyLogic
Signature:
Digitally signed: 10/10/18 at 10:29 AM

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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.

Mechanical equipment tradeoff removed

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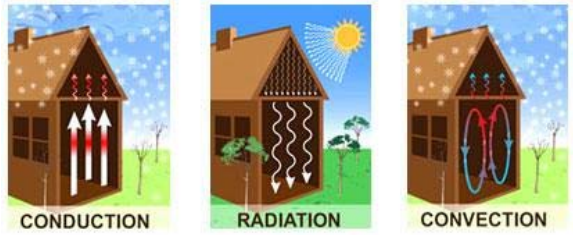
R405 Performance-Based Compliance

- Energy Analysis
  - A method for performing whole house performance energy trade-offs
    - **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



http://www.bpihomeowner.org/blog/technically-speaking-principles-heat-transfer

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

VS.

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.

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IECC 2018 Performance Compliance

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Property
8925 Place to live
Denver, CO 80238

2018 IECC Compliance - taken to a l
Robby's Test play house

Organization
EnergyLogic
720-838-0677
Robby Schwarz

Inspection Status
Results are projected

Builder
Best Builder In America Homes

Annual Energy Cost

Design	IECC 2018 Performance	As Designed
Heating	$521	$472
Cooling	$147	$122
Water Heating	$156	$156
Mechanical Ventilation	$39	$74
SubTotal - Used to determine compliance	$863	$764
Lights & Appliances w/out Ventilation	$609	$609
Onsite generation	$0	$0
Total	$1,472	$1,373

405.3 Performance-based compliance passes by 11.5% ✓
402.4.1.2 Air Leakage Testing ✓
402.5 Area-weighted average fenestration SHGC ✓
402.5 Area-weighted average fenestration U-Factor ✓
404 Lighting Equipment Efficiency ✓
Mandatory Checklist ✓
IRC M1505.4.3 Mechanical Ventilation Rate IRC 2018 Chapter 15 ✓

Design exceeds requirements for IECC 2018 Performance compliance by 11.5%.

As a 3rd party extension of the code jurisdiction utilizing these reports, I certify that this energy code compliance document has been created in accordance with the requirements of Chapter 4 of the adopted International Energy Conservation Code based on Climate Zone 5. If rating is Projected, I certify that the building design described herein is consistent with the building plans, specifications, and other calculations submitted with the permit application. If rating is Confirmed, I certify that the address referenced above has been inspected/tested and that the mandatory provisions of the IECC have been installed to meet or exceed the intent of the IECC or will be verified as such by another party.

Name: Robby Schwarz
Organization: EnergyLogic
Signature: Robby Schwarz
Digitally signed: 10/10/18 at 10:29 AM

Simulated Performance Path

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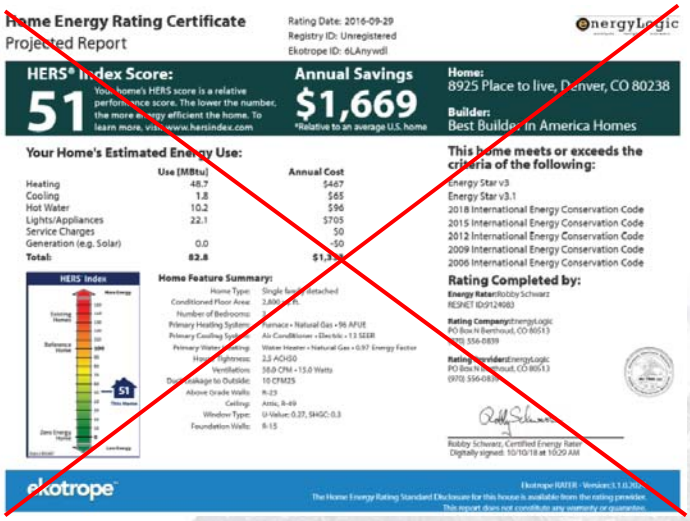
Section R406 of the 2018 IECC

Energy Rating Index Compliance Alternative



Home Energy Rating Certificate
Projected Report

Rating Date: 2016-09-29
Registry ID: Unregistered
Ekotrope ID: 6LAnywdl

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HERS® Index Score: 51
Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings $1,669
*Relative to an average U.S. home

Home:
8925 Place to live, Denver, CO 80238

Builder:
Best Builder in America Homes

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	48.7	$467
Cooling	1.8	$65
Hot Water	10.2	$96
Lights/Appliances	22.1	$705
Service Charges		$0
Generation (e.g. Solar)	0.0	-$0
Total:	82.8	$1,3

This home meets or exceeds the criteria of the following:
Energy Star v3
Energy Star v3.1
2018 International Energy Conservation Code
2015 International Energy Conservation Code
2012 International Energy Conservation Code
2009 International Energy Conservation Code
2006 International Energy Conservation Code

HERS Index

Home Feature Summary:
Home Type: Single family detached
Conditioned Floor Area: 2,800 sq. ft.
Number of Bedrooms: 3
Primary Heating System: Furnace • Natural Gas • 96 AFUE
Primary Cooling System: Air Conditioner • Electric • 13 SEER
Primary Water Heating: Water Heater • Natural Gas • 0.97 Energy Factor
Air Tightness: 2.2 ACH50
Ventilation: 50.0 CFM • 15.0 Watts
Duct Leakage to Outside: 10 CFM25
Above Grade Walls: R-23
Ceiling: Attic, R-49
Window Type: U-Value: 0.27, SHGC: 0.3
Foundation Walls: R-15

Rating Completed by:
Energy Rater: Robby Schwarz
RESNET ID: 9124983
Rating Company: EnergyLogic
PO Box N Berthoud, CO 80513
(970) 556-0839
Rating Provider: EnergyLogic
PO Box N Berthoud, CO 80513
(970) 556-0839

Robby Schwarz, Certified Energy Rater
Digitally signed: 10/10/18 at 10:29 AM

ekotrope

Ekotrope RATER - Version: 3.1.0.2826
The Home Energy Rating Standard Disclosure for this house is available from the rating provider.
This report does not constitute any warranty or guarantee.

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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

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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

Climate Zone	Window U-Factor	Window SHGC	Ceiling R-Value	Wood Framed Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value and Depth	Crawl Space Wall R-Value
1	1.2 NR	0.30 0.25	R-30	R-13	R-3/4	R-13	0	0	0
2	0.65 0.40	0.30 0.25	R- 30 38	R-13	R-4/6	R-13	0	0	0
3	0.35 0.35	0.30 0.25	R-30 38	R-13 R20 or 13+5	R-5/8 8/13	R-19	R-5/13	0	R-5/13
4 except Marine	0.35 0.35	NR 0.40	R-38 49	R-13 R20 or 13+5	R-5/10 8/13	R-19	R-10/13	R-10, 2ft	R-10/13
5 and Marine 4	0.35 0.32	NR	R-38 49	R20 or 13+5	R-13/17	R-30	R-10/13 15/19	R-10, 2ft	R-10/13 15/19
Climate Zone 6	0.35 0.32	NR	R-49	R-20 or 13+5 R20+5 or 13+10	R-15/20	R-30	R-15/19	R-10, 4ft	R-10/13 15/19
Climate Zone 7 & 8	0.35 0.32	NR	R-49	R-21 R20+5 or 13+10	R-19/21	R-38	R-15/19	R-10, 4ft	R-10/13 15/19

Table R406.4 Maximum Energy Rating Index

Climate Zone	2015 IECC Energy Rating Index
1	52
2	52
3	51
4	54
5	55
6	54
7	53
8	53

Climate Zone	2018 IECC Energy Rating Index
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

Compliance based on an ERI analysis requires that the *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 *ERI reference design*

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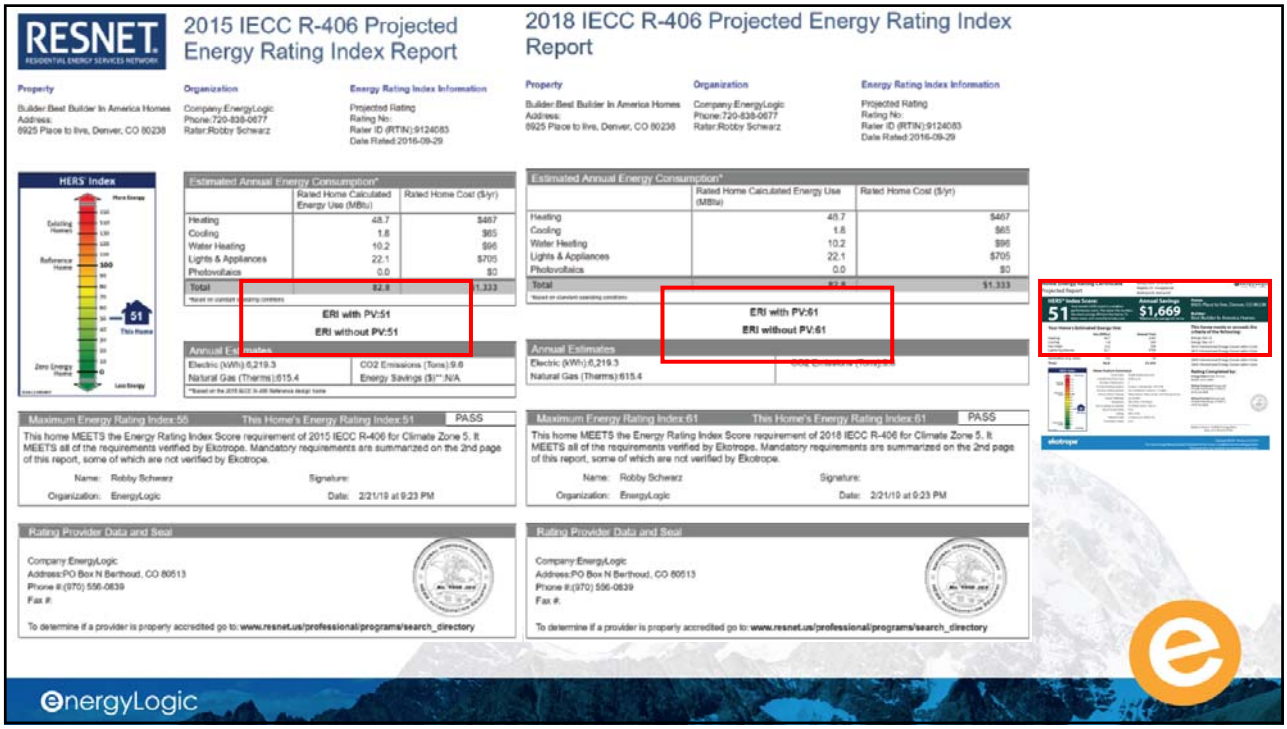

Understanding the Rater's Role in Codes

RESNET®
RESIDENTIAL ENERGY SERVICES NETWORK

Setting the Standard for Quality

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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.

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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.

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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.

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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

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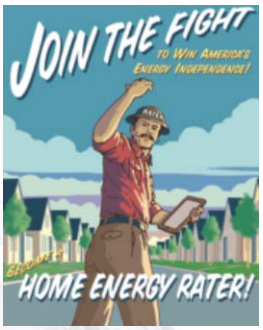
What is a Rating?

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



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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

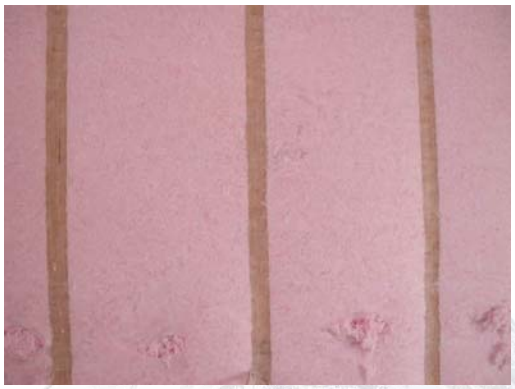
Grade 2

Grade 3

Insulation Grading and the Code?

What Grade is this?

What Grade is this?



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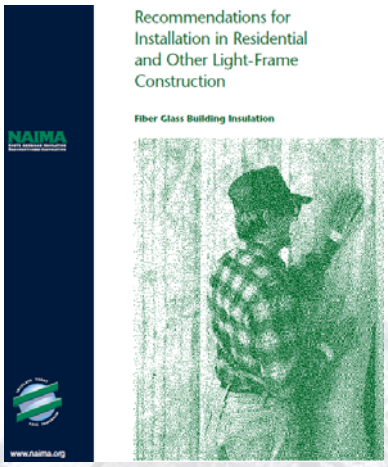
Air Sealing and Insulation

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.



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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

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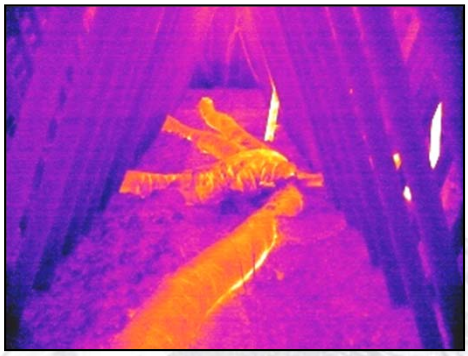
R403.3.3 Duct testing (Mandatory).

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?



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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

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Code Rating

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

IECC
INTERNATIONAL ENERGY CONSERVATION CODE

Mandatory Requirements

- Compliance modeling
  - o UA Compliance
  - o Cost Compliance
  - o EIR Compliance
- Insulation installation
- Air barriers
- Air leakage 3/5ACH
- Duct leakage 4%
- High efficacy lighting

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Items Listed in this Table are Mandatory- Sometimes Not Clear

IECC
INTERNATIONAL ENERGY CONSERVATION CODE

Definitions

Building Thermal Envelope: The basement walls, exterior walls, floor, roof, and any other building element that enclose the conditioned space. This boundary also includes the boundary between conditioned space and any exempt or unconditioned space.

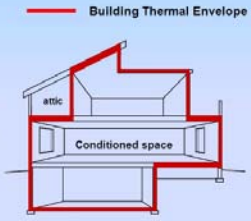

TABLE R402.4.1.1
AIR BARRIER AND INSULATION INSTALLATION

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between window/door jambs and framing, and skylights and framing shall be sealed.	
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors (including above garage and cantilevered floors)	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking, or floor framing cavity insulation shall be permitted to be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing and extends from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Where provided instead of floor insulation, insulation shall be permanently attached to the crawlspace walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	
Narrow cavities		Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the drywall.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring		Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate them from the showers and tubs.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical or communication boxes or air-sealed boxes shall be installed.	
HVAC register boots	HVAC register boots that penetrate building thermal envelope shall be sealed to the subfloor or drywall.	
Concealed sprinklers	When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	

a. In addition, inspection of log walls shall be in accordance with the provisions of ICC-400.

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Energy Code Inspection

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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

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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.

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Focus on House Performance

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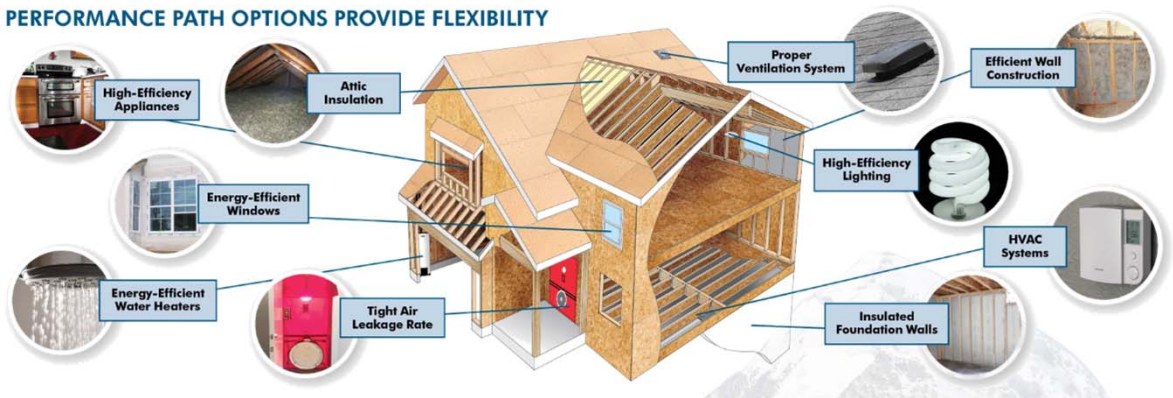
Building Science Built into the Code



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Fundamental Questions

Is It There?	Does It Work?

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Fundamental Questions

Is It There?	Does It Work?

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Fundamental Questions

Is It There?	Does It Work?

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Fundamental Questions

Is It There?	Does It Work?

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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

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Expectation

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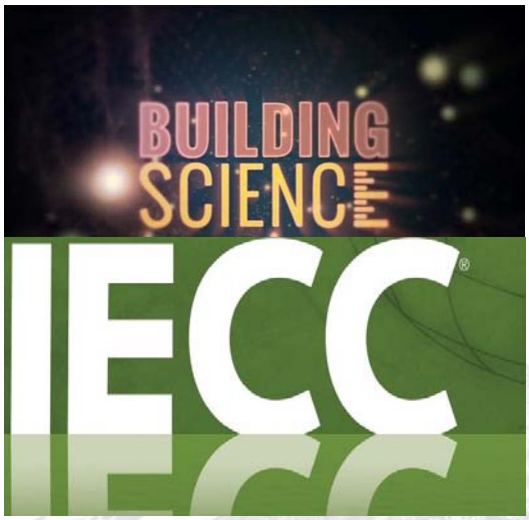
Integrated within Chapter 4

- Systems Thinking
- Applied Building Science

- Air Flow
- Thermal Flow
- Moisture Flow



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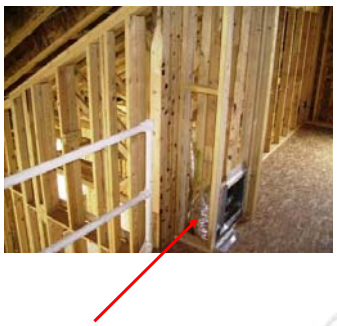
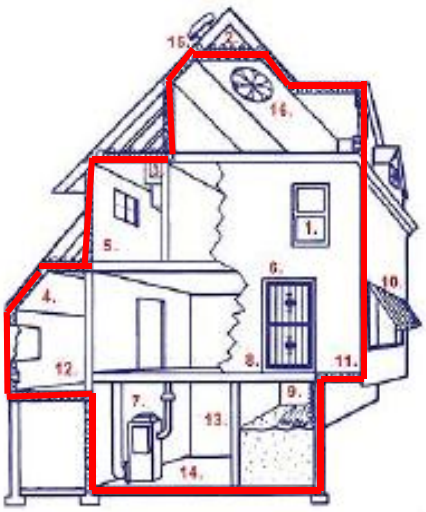
What / Where is the Thermal Envelope? IECC Chapter 4





Can a House Be Too Tight?

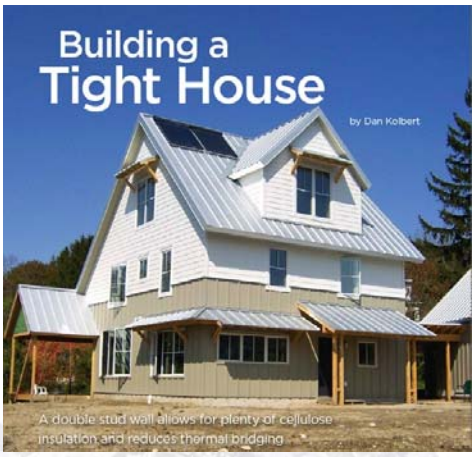
NO!

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

Real question …

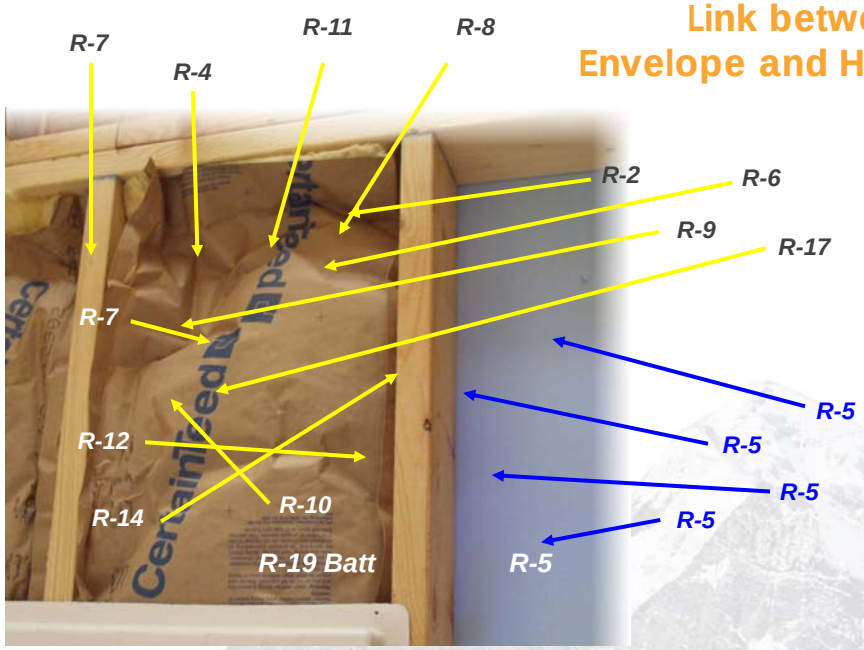
- Can a house be under-ventilated?

YES!



Build Tight and Ventilate Right

Link between Thermal Envelope and HVAC Design



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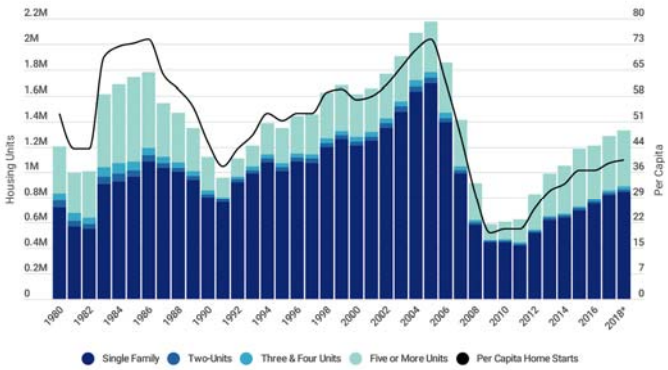
Courtesy of DOW Building Materials

Business Model

- Bottom line security in a volatile industry



Source: U.S. Census Bureau Building Permit Survey; World Bank Population, retrieved from Federal Reserve Bank of St. Louis
* Annual projections for 2018 are based on preliminary data from November 2018

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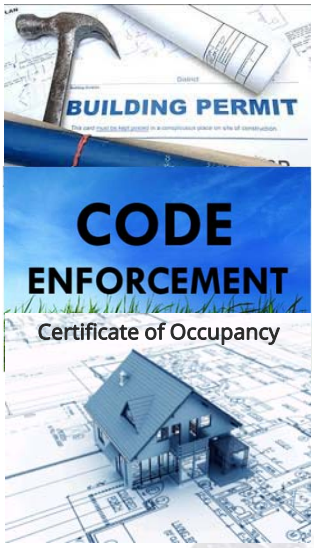
Which is More Sustainable?



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

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R103.1General

- 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.

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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