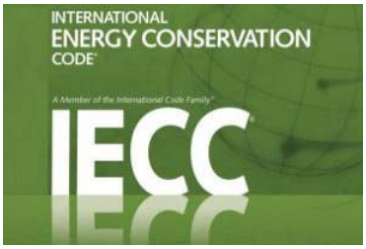
ERI vs. Performance Path: Which is better for the builder?

energyLogic

Presented By Robby Schwarz

Conclusion



- ANSI 301 Named the Energy Rating Index
  - RESNET HERS ERI
  - 2015 IECC ERI
  - 2018 IECC ERI
  - More to come
- The Code ERI is not a marketing tool/Not the Same at the HERS Index
- Code ERI will become a matrix of compliance just like:
  - Area weighted U-factors for the U-factor trade off/RESCheck path
  - Cost Compliance for the Simulated performance path
- Section R405 Simulated performance path is the path for Builders
  - Most cost affective compliance
  - HERS Index/ERI is a byproduct of the path way for marketing

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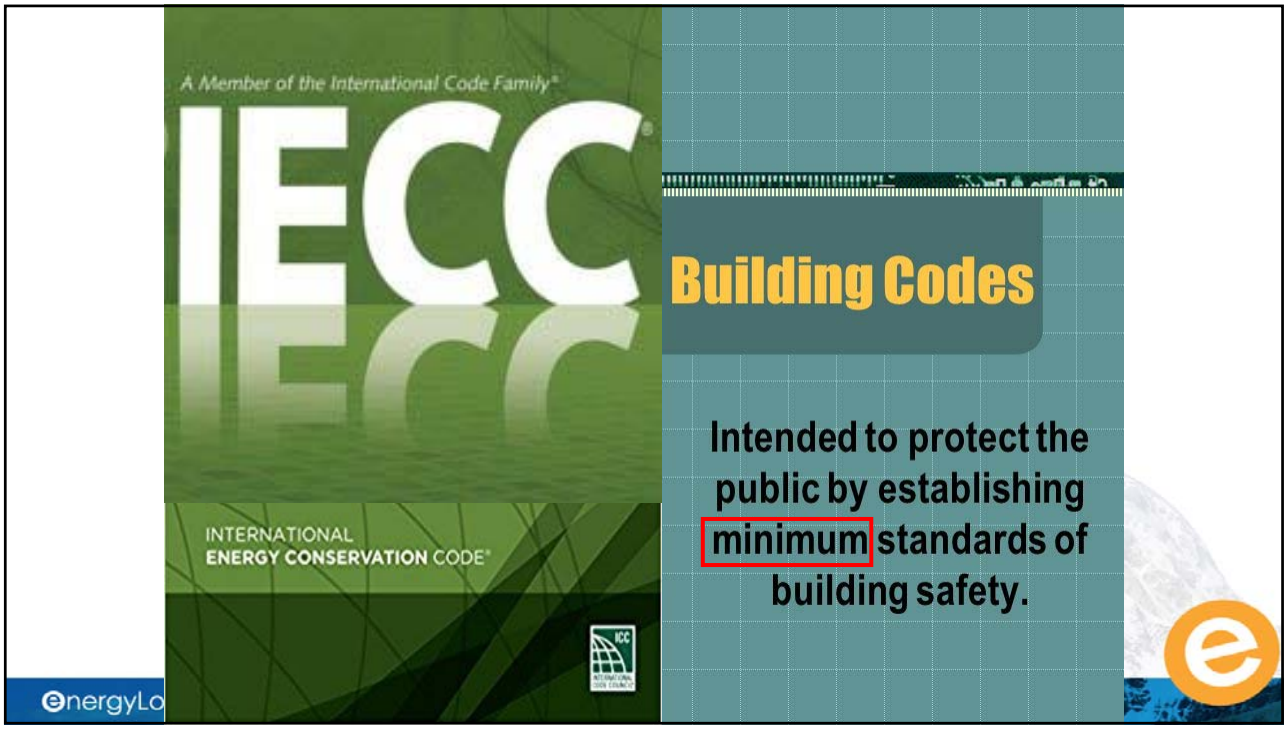
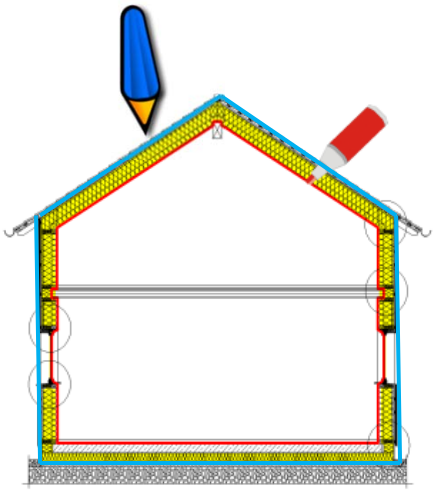


New in the 2015

- 103.2.1 Building Thermal Envelope depiction:
  - The buildings thermal envelope shall be represented on the construction documents
    - Blue – Exterior air barrier
    - Yellow Thermal Barrier
    - Red Interior air barrier



2009 IECC vs. 2015/18 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

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;

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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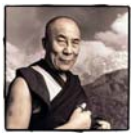
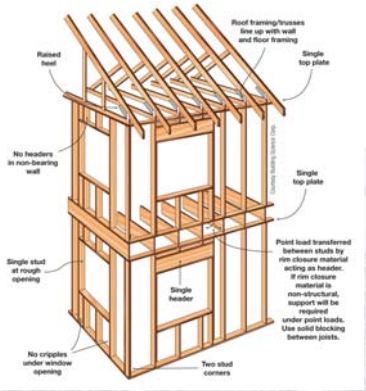
2018 IECC – Intent

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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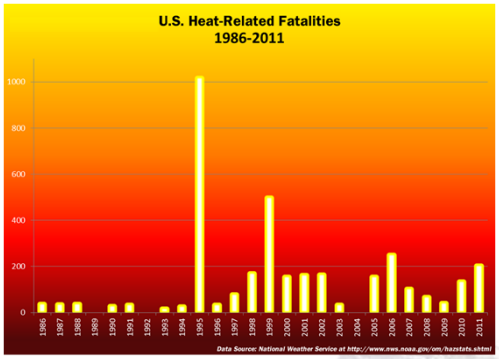
2018 IECC – Intent

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



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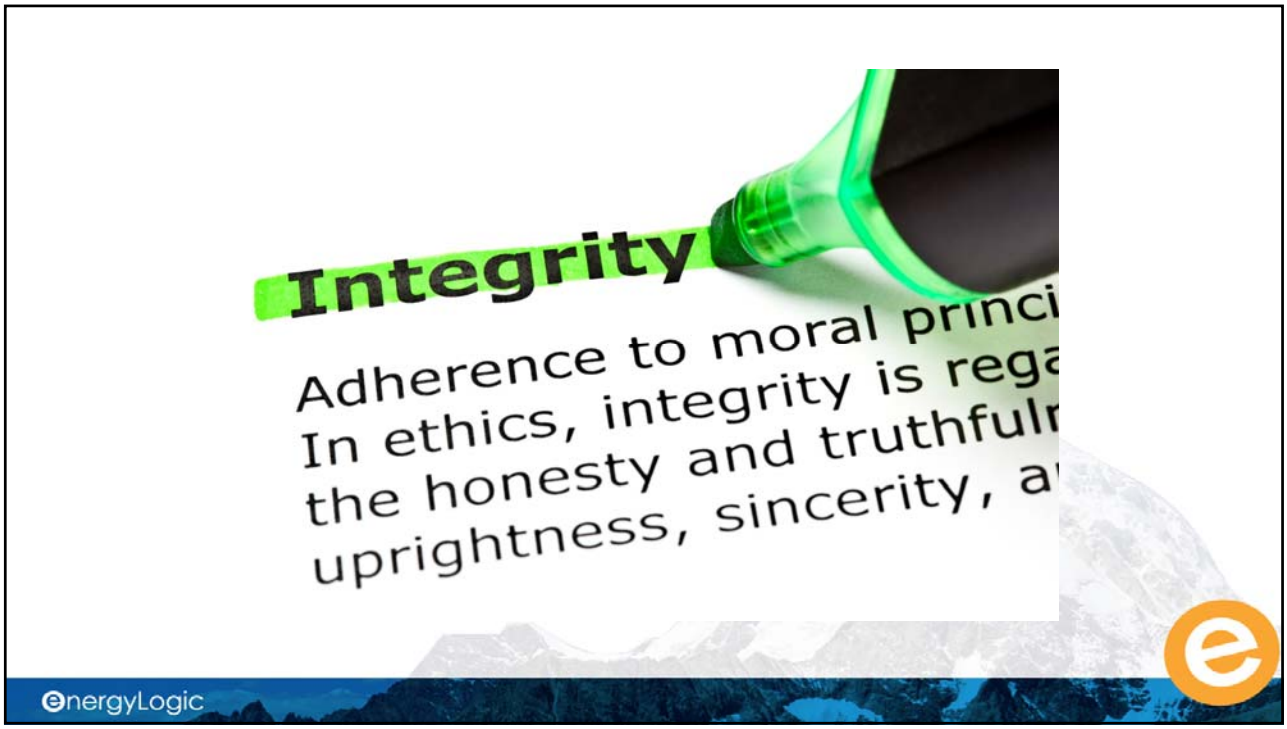
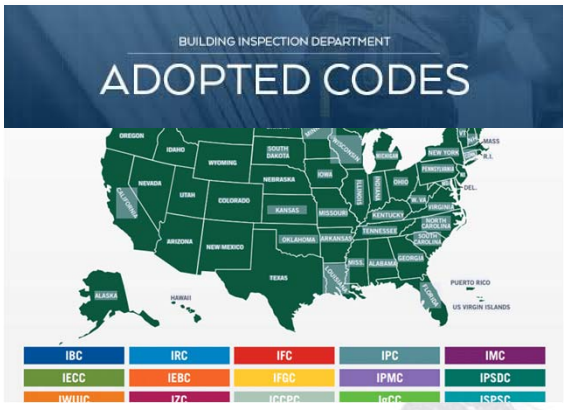


The key factor of code development

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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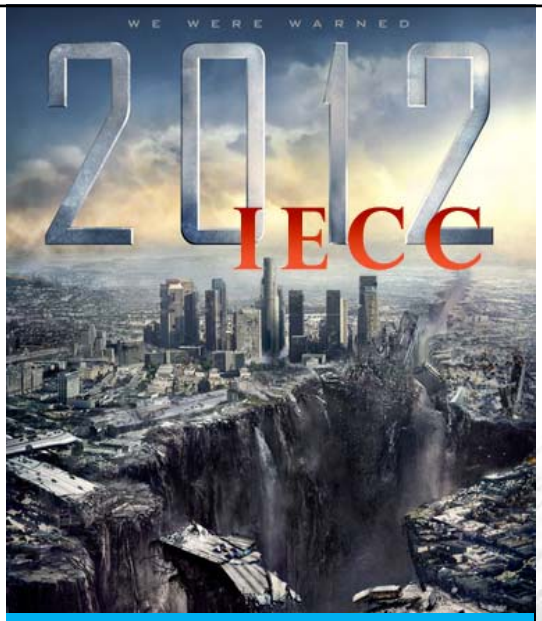

The Apocalypse is Coming

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Energy Code

Its not your Daddy's code?

- No longer building the minimum _ _ _ house allowable!

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Focus on House Performance

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Fundamental Questions

Is It There?	*Does It Work?*

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Fundamental Questions

Is It There?	Does It Work?

EnergyLogic

Fundamental Questions

Is It There?	Does It Work?

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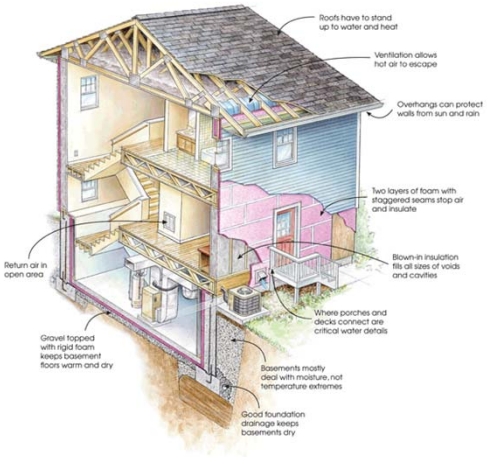
Chapter 4: Residential Energy Efficiency

Specific and technical requirements for:

- Building Thermal Envelope
- Mechanical Systems
- Service Hot Water Systems
- Electrical Power and Lighting Systems



Pathways = Flexibility/Options

IECC

Cost Effective

Value?

- Builder Perspective
  - 1st Costs/cost of construction
  - Flexibility in specification selection
  - Build the house you want to
  - Builder Risk
- Consumer Perspective
  - Cost of ownership
  - Payback
    - o Simple payback
    - o Investment paid for in a loan
  - Opportunity cost

Code Compliance Paths


Prescriptive Path


UA Compliance Path


Simulated Performance Path


Energy Rating Index Path

Regardless of the Pathway

International Energy Conservation Code

Mandatory Requirements

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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

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Prescriptive/Mandatory Requirements

Installation issues required by code


Eve Baffles


Attic Insulation


Crawl Vapor Retarders


Floor Insulation

EnergyLogic

Prescriptive Path

- Most restrictive path
  - Only option is to do better
- 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.

EnergyLogic

SECTION R402 BUILDING THERMAL ENVELOPE
Prescriptive path ways through code (3 choices)

- **R402.1 General (Prescriptive).**
  - The building thermal envelope shall meet the requirements of Sections R402.1.1 through R402.1.4.
- Sections R402.1.3
  - R-value table specification
- Section R402.1.4
  - U-Value table specification
- Section R402.1.5
  - Total UA Alternative Approach

- R402.1.3 R-value computation Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value
- The manufacturer's settled R-value shall be used for blown insulation (Attics)
- **Computed R-values shall not include an R-value for other building materials or air films**

EnergyLogic

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

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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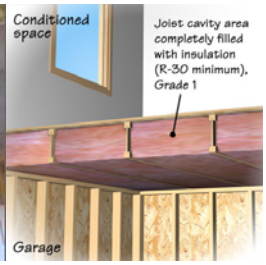
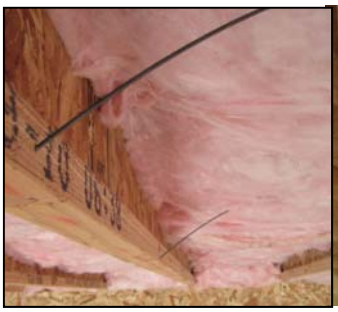
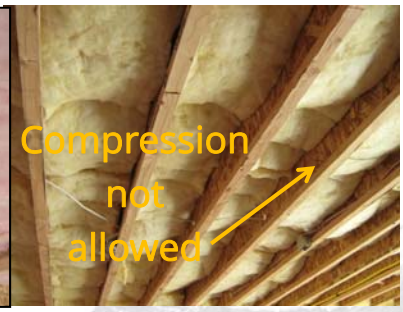


Floor Systems

- Best Practices
  - Insulation must be in contact with the surface it is intended to insulate
  - Insulation completely fills the cavity





2012 IECC

- **R402.2.7 Floors.**
- Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking
- **R-30 climate zone 5**

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Ducts in Garage Ceiling

Code requirements

- Insulation in complete contact with subfloor
- Insulation encapsulates duct
- IECC Table 402.1.2 footnote G
- **Minimum R-19 below duct**

EnergyLogic

R402.1.4 U-factor Alternative

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U- FACTOR	MASS WALL U-FACTORb	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U- FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091c	0.136
4 except Marine	0.32	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

- An assembly with a U-factor equal to or less than that specified in Table R402.1.4 shall be permitted as an alternative to the R-value in Table R402.1.2
- Example: Climate zone 5 framed wall
  - U- .060 = R-16.67
  - R-value table requires cavity insulation at R20 or 13+5
  - 1/20 = U.05 Plus sheathing, air film, etc. = U.06

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All other paths use a software

Software allows tradeoffs

UA Compliance Path

Simulated Performance Path

Energy Rating Index Path

EnergyLogic

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 uses to show compliance with the UA Trade Off (ResCheck) and the Simulated Performance Path

The Actual built homes performance will be less than or equal to the performance of the code standard reference design

The Standard reference design for code is the prescriptive path of compliance built in Table 405.5.2 (1)

EnergyLogic

Twin Houses

2018 IECC reference design house vs. ***Builder's desired house***

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

- 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

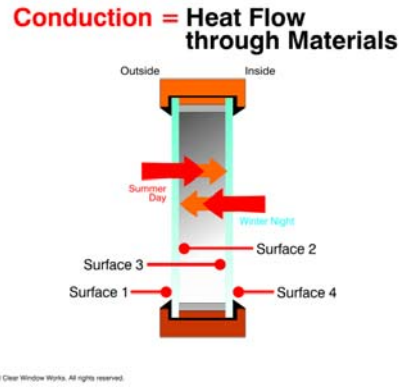
EnergyLogic

R402.1.5 Total UA alternative

prescriptive

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



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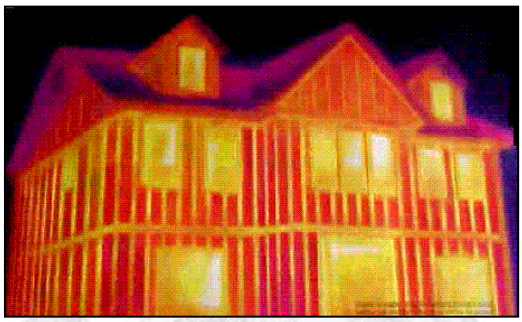
R402.1.5 Total UA alternative

prescriptive

- If the total building thermal envelope UA (sum of U-factor times assembly area) is less than or equal to the total UA resulting from using the U-factors in Table R402.1.4 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table R402.1.1.
- The UA calculation shall include the thermal bridging effects of framing materials.



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Example

IECC 2018 Building UA Compliance

energyLogic

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

Builder
Best Builder In America Homes

Inspection Status
Results are projected

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: Robby Schwarz
Digitally signed: 10/10/18 at 10:29 AM

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Code Compliance Paths

Prescriptive Path

UA Compliance Path

Simulated Performance Path

Energy Rating Index Path

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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

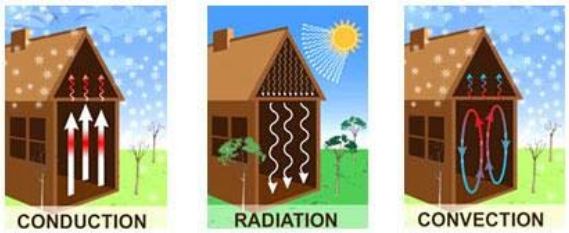
Mechanical equipment tradeoff removed

EnergyLogic

R405 Performance-based compliance

- Energy Analysis
  - A method for performing whole house performance energy trade offs
    - **Conduction** - Trading off R-values and U-values
    - Convection – Energy moving with air infiltration and exfiltration
    - **Radiation** – Trade offs created by energy moving form areas of high concentrations to low concentration through open space.

Energy moves from warm to cold



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

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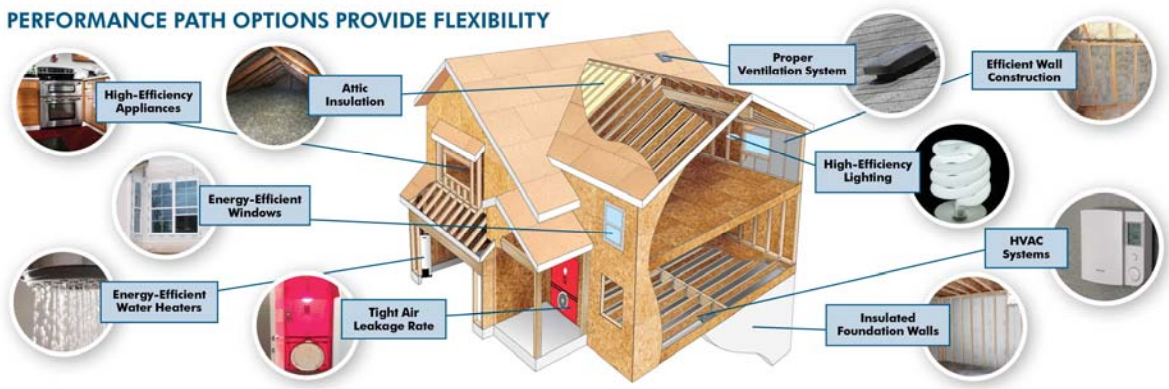
Building Science built into the code



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The Reference Home/Twin Home Concept

Used by modeling software for Code

2015 reference design house Built from table 405.5.2(1)

VS.

Rated Home: Builders desired house

- The reference home is the <u>geometric twin</u> of the rated home *configured to a standard set of thermal performance characteristics*.
  - I.e. The 2015 IECC Prescriptive path

- The home you are building and evaluating, compared to the "Reference" home in order to quantify performance and demonstrate compliance with the Energy code.

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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.

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IECC 2018 Performance Compliance

energyLogic

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

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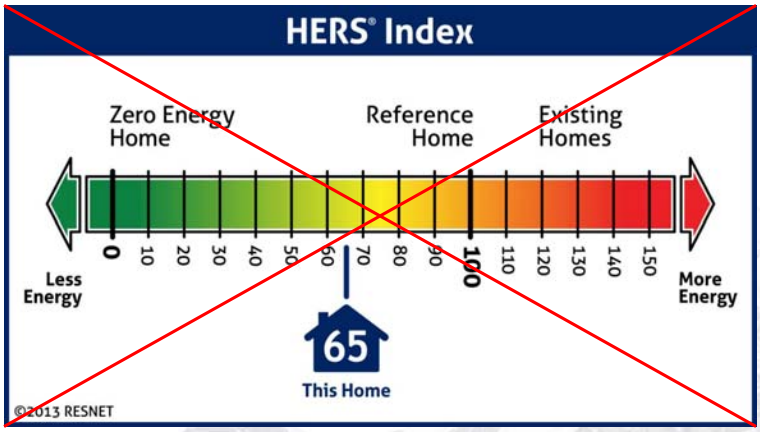
By Product
Not a code compliance document



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Code Compliance Paths


Prescriptive Path


UA Compliance Path


Simulated Performance Path


Energy Rating Index Path

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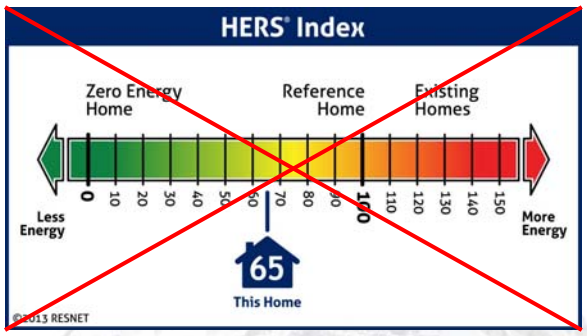
Section R406 of the 2015 and 2018 IECC
Energy Rating Index Compliance Alternative

- What is an Energy Rating Index

Section R406 of the 2015/2018 IECC
Energy Rating Index Compliance Alternative

ERI Index Score ≠ HERS Index Score any more



2015 IECC misprint and the Errata

er·ra·tum

iˈrätəm,-ˈrā-,-ˈrat-/ *noun*

plural noun: **errata**

An error in printing or writing.

A list of corrected errors appended to a book or published in a subsequent issue of a journal.

R406.2 Mandatory requirements. Compliance with this section requires that the ~~mandatory~~ provisions identified in Sections ~~R401.2~~ R401 through R404 labeled 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 Coefficient in Table 402.1.2 or 402.1.4 of the 2009 *International Energy Conservation Code*.

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Mandatory sections of the 2015/18 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 there is no solar** on the home then the builders **must** also meet the minimum prescriptive envelope efficiency measures in the **2009 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**

EnergyLogic

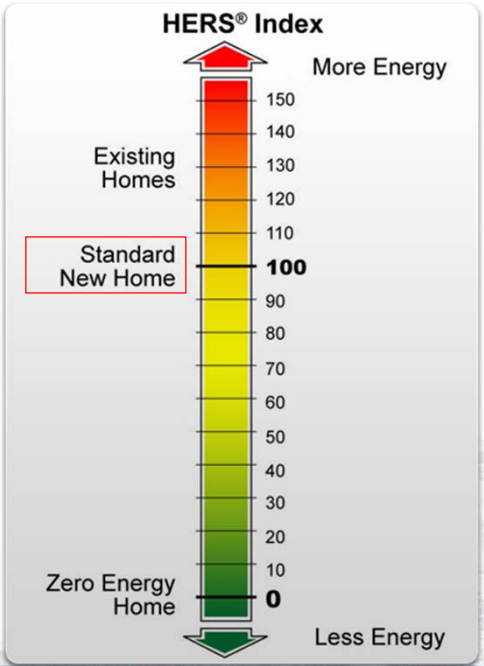
2009 IECC vs. 2015 IECC Prescriptive Table

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

EnergyLogic

Why create a backstop

- 100 meets the minimum requirements of the 2006 International Energy Conservation Code prescriptive requirements



EnergyLogic

Why create a backstop?

2006 IECC compliant

- 2 story
- 2800 Square Feet
- Single Family Detached
- Conditioned basement

- HERS Index
  - HERS 100
  - 6.5K PV system = HERS ERI **55**

House Specs

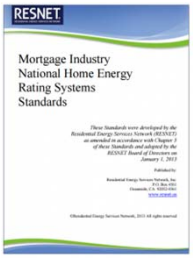
- Foundation R-10
- Slab R-0
- Floor over garage R-30 **Grade 3**
- Rim R-19 **Grade 3**
- Walls blown R-19 / Knee wall R-13 **Grade 3**
- Windows U-.35/SHGC -.35
- Doors R-5/ R-2.2
- Attic R-38 flat R-30 edge
- Furnace 80 AFUE w/ 4% CFM LTO & 5% supply & return in attic R-6
- Water Heater .56 EF
- AC 12 Seer
- 8 ACH50 & Exhaust Ventilation
- Default appliances 0% CFL

EnergyLogic

R406.3.1 ERI reference design

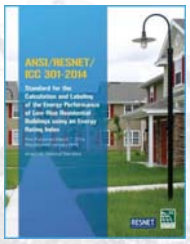
2015 IECC

- The *ERI **reference design*** shall be configured such that is it meets the minimum requirements of the 2006 *International Energy Conservation Code* prescriptive requirement



2018 IECC

- The Energy Rating Index will be develop in accordance with ANSI/RESNET/ICC 301-2014



- The proposed residential building shall be shown to have an annual total normalized Modified Loads that are less than or equal to the annual total Loads of the *ERI reference design*

EnergyLogic

Twin Houses

ERI reference design house

- Geometric Twin
- 2006 IECC prescriptive requirements

VS.

Builder's desired house

- Geometric Twin
- Mandatory 2009 IECC Envelope R-Values
- 2015 IECC Mandatory Requirements

The Builder's house must have the Energy Rating Index Required by code, or lower, to meet the intent of code

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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*

EnergyLogic

Summary of ERI Path

- Mandatory Insulation levels (Backstop)
  - 2015 ERI 2009 IECC Insulation Table
  - 2018 ERI 2009 IECC Insulation Table or 2015 IECC Insulation Table
  - Hot water pipe insulation
- Specific ERI score per climate zone
  - 2015 ERI created per code defined RESNET process
  - 2018 ERI score created per ANSI/RESNET/ICC standard 301
- Other Normal Code compliance Mandatory/Prescriptive requirements

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Features that can Impact the ERI score
(Lower the score)

- Mechanical equipment
  - High efficiency furnace
  - High efficiency AC
  - High efficiency water heater
- More R-value than required by the 2009 IECC
- House orientation with the ERI
- House tightness below 3 ACH50
- Duct leakage to the outside
- Duct location
- Whole house fan
- CFL or LED Lighting above 75%
- High efficiency appliances
- Solar

EnergyLogic

RESNET
RESIDENTIAL ENERGY SERVICES NETWORK

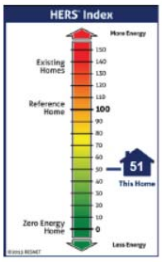
2015 IECC R-406 Projected Energy Rating Index Report

Property
Builder:Best Builder In America Homes
Address:
8925 Place to live, Denver, CO 80238

Organization
Company:EnergyLogic
Phone:720-838-0677
Rater:Robby Schwarz

Energy Rating Index Information
Projected Rating
Rating No:
Rater ID (RTIN):9124083
Date Rated:2016-09-29

HERS Index



Estimated Annual Energy Consumption*

	Rated Home Calculated Energy Use (MBtu)	Rated Home Cost ($/yr)
Heating	48.7	$467
Cooling	1.8	$65
Water Heating	10.2	$96
Lights & Appliances	22.1	$705
Photovoltaics	0.0	$0
Total	82.8	$1,333

*Based on standard operating conditions

ERI with PV:51
ERI without PV:51

Annual Estimates

Electric (kWh):6,219.3	CO2 Emissions (Tons):9.6
Natural Gas (Therms):615.4	Energy Savings ($)**:N/A

**Based on the 2015 IECC R-406 Reference design home

Maximum Energy Rating Index:55 | This Home's Energy Rating Index:51 | PASS

This home MEETS the Energy Rating Index Score requirement of 2015 IECC R-406 for Climate Zone 5. It MEETS all of the requirements verified by Ekotrope. Mandatory requirements are summarized on the 2nd page of this report, some of which are not verified by Ekotrope.

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

Rating Provider Data and Seal

Company:EnergyLogic
Address:PO Box N Berthoud, CO 80513
Phone #:(970) 556-0839
Fax #:

To determine if a provider is properly accredited go to: **www.resnet.us/professional/programs/search_directory**

2018 IECC R-406 Projected Energy Rating Index Report

Property
Builder:Best Builder In America Homes
Address:
8925 Place to live, Denver, CO 80238

Organization
Company:EnergyLogic
Phone:720-838-0677
Rater:Robby Schwarz

Energy Rating Index Information
Projected Rating
Rating No:
Rater ID (RTIN):9124083
Date Rated:2016-09-29

Estimated Annual Energy Consumption*

	Rated Home Calculated Energy Use (MBtu)	Rated Home Cost ($/yr)
Heating	48.7	$467
Cooling	1.8	$65
Water Heating	10.2	$96
Lights & Appliances	22.1	$705
Photovoltaics	0.0	$0
Total	82.8	$1,333

*Based on standard operating conditions

ERI with PV:61
ERI without PV:61

Annual Estimates

Electric (kWh):6,219.3	CO2 Emissions (Tons):9.6
Natural Gas (Therms):615.4	

Maximum Energy Rating Index:61 | This Home's Energy Rating Index:61 | PASS

This home MEETS the Energy Rating Index Score requirement of 2018 IECC R-406 for Climate Zone 5. It MEETS all of the requirements verified by Ekotrope. Mandatory requirements are summarized on the 2nd page of this report, some of which are not verified by Ekotrope.

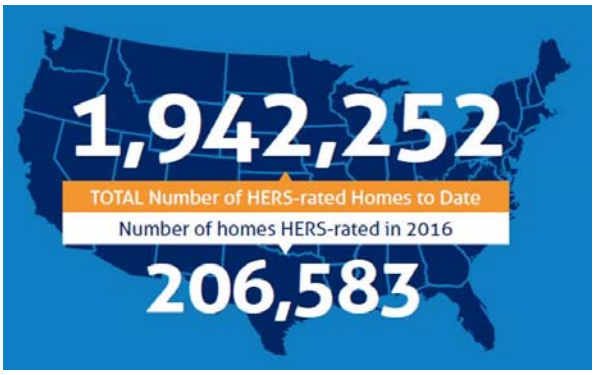
Name: Robby Schwarz
Signature:
Organization: EnergyLogic
Digitally signed: 10/10/18 at 10:29 AM

Rating Provider Data and Seal

Company:EnergyLogic
Address:PO Box N Berthoud, CO 80513
Phone #:(970) 556-0839
Fax #:

To determine if a provider is properly accredited go to: **www.resnet.us/professional/programs/search_directory**

Will the ERI path be used?



- In 2015
  - 190,180 homes were HERS Rated
  - Average HERS Index 62
- In 2016
  - 206,583 homes were HERS Rated
  - Average HERS Index 61
- In 2017
  - 227,840 homes were HERS Rated
  - Average HERS Index 62
- HERS ≠ERI

EnergyLogic

Code Compliance Paths


Prescriptive Path


UA Compliance Path


Simulated Performance Path


Energy Rating Index Path

EnergyLogic

Code Compliance Paths

Prescriptive Path

UA Compliance Path

Simulated Performance Path

Energy Rating Index Path

energyLogic

2015 ERI = 51
2018 ERI = 61

Home Energy Rating Certificate
Projected Report

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

energyLogic

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

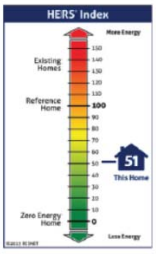
Annual Savings $1,669
*Relative to an average U.S. home

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**	**$1,333**



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
House Tightness:	2.5 ACH50
Ventilation:	58.0 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

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

Rating Completed by:

Energy Rater: Robby Schwarz
RESNET ID:9124083

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:3.1.0.2024
The Home Energy Rating Standard Disclosure for this house is available from the rating provider.
This report does not constitute any warranty or guarantee.

energyLogic

IECC Compliance Reality

Base House
- 2 story
- 2800 Square Feet
- Single Family Detached
- Conditioned basement

Compliance Comparison	
2018 UA Trade OFF	Pass By 4.1%
2015 UA Trade OFF	Pass by 6.2%
2018 Simulated Performance	Pass by 1.1%
2015 Simulated Performance	Pass by 0.5%
HERS ERI	76
2015 ERI	76 (required ERI 55 CZ 5)
2018 ERI	89 (required ERI 61 CZ 5)

EnergyLogic

Why the Code ERI is diverging from the HERS ERI

Codified calculation methodology vs. continual maintenance ANSI Standard

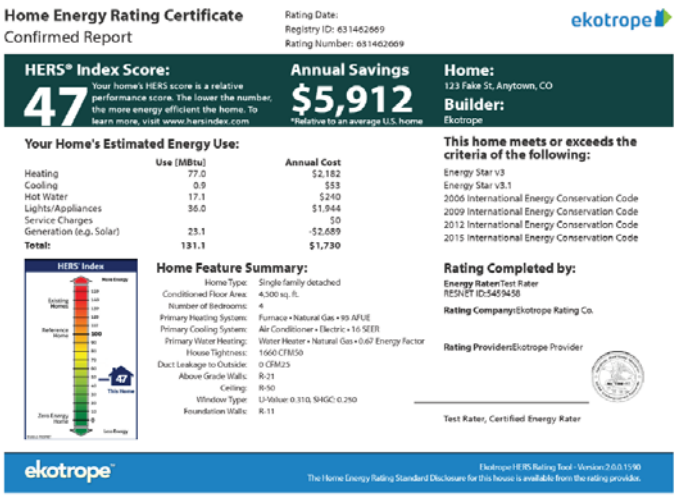
- HERS ERI
  - Ventilation Rate based on ASHRAE 62.2-2013
  - Size adjustment factor and LED Lighting modeling example of continual maintenance
- 2015
  - In alignment with HERS ERI at the time of codification
- 2018
  - Ventilation Rate based on ASHRAE 62.2-2010

2015 IECC

RESNET HERS INDEX

EnergyLogic

Which Pathway to use?



Home Energy Rating Certificate
Confirmed Report

Rating Date:
Registry ID: 631462669
Rating Number: 631462669

ekotrope

HERS® Index Score: 47
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 $5,912
*Relative to an average U.S. home

Home:
123 Fake St, Anytown, CO
Builder:
Ekotrope

Your Home's Estimated Energy Use:

	Use (MBtu)	Annual Cost
Heating	77.0	$2,182
Cooling	0.9	$53
Hot Water	17.1	$240
Lights/Appliances	36.0	$1,944
Service Charges		$0
Generation (e.g. Solar)	23.1	-$2,689
Total:	**131.1**	**$1,730**

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

HERS Index

Home Feature Summary:

Home Type:	Single-family detached
Conditioned Floor Area:	4,500 sq. ft.
Number of Bedrooms:	4
Primary Heating System:	Furnace • Natural Gas • 95 AFUE
Primary Cooling System:	Air Conditioner • Electric • 16 SEER
Primary Water Heating:	Water Heater • Natural Gas • 0.67 Energy Factor
House Tightness:	1660 CFM50
Duct Leakage to Outside:	0 CFM25
Above Grade Walls:	R-21
Ceiling:	R-50
Window Type:	U-Value: 0.310, SHGC: 0.250
Foundation Walls:	R-11

Rating Completed by:
Energy Rater: Test Rater
RESNET ID: 5459458
Rating Company: Ekotrope Rating Co.
Rating Provider: Ekotrope Provider

Test Rater, Certified Energy Rater

ekotrope
Ekotrope HERS Rating Tool - Version: 2.0.0.1590
The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

Section R405 Simulated Performance Path HERS Index is a by product

EnergyLogic

Four Steps of IECC Performance Compliance using the Simulated Performance Path or the Energy Rating Index

Step 1

From Plan Analysis:

- Demonstrates that the proposed design will comply with the IECC.
- Determine the most cost effective way to comply with the IECC.
- Develop required permitting submittal documents.
- Assistance with other required documents such as air sealing details.

Step 2

Rough Inspection:

- Perform IECC required rough inspections for compliance, quality assurance, and builder risk.
- Inspections allow 3rd Party to generate final documentation that is needed to obtain the certificate of occupancy.
- Insulation, air barrier, windows, HVAC, Duct leakage, ventilation and more will be inspected.
- Action item reporting after each inspection.

EnergyLogic

Four Steps of IECC Performance Compliance Simulated Performance Path or Energy Rating Index

Step 3

Final Inspection:

- Diagnostics - Blower door air tightness and duct leakage to outside.
- Attic and foundation insulation.
- Controlled whole house mechanical ventilation / Spot Ventilation.
- Action item reporting after each inspection.

Step 4

Modeling and Certification

- Making the from plans analysis address and lot/site specific including the details of what has been inspected at rough and final.
- Generate required code compliance certificates and reports for C.O.
- Homes using the Simulated Performance Path receive a cost compliance report, and other required reports.
- **The HERS Index is a byproduct on code compliance using the SPP.**

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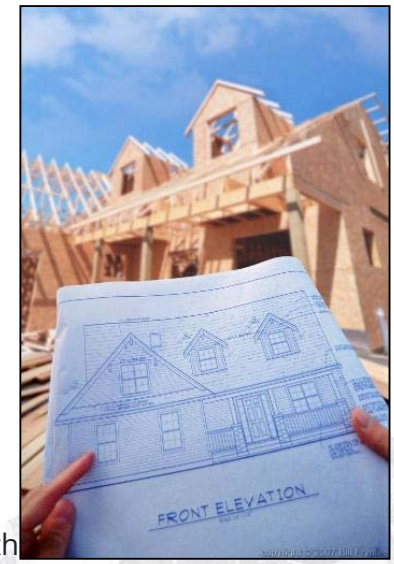
Agenda

- Intro
- Prescriptive Path
- UA Trade off Path
- Simulated Performance Path
- Energy Rating Index
- Process
- Builders Will Use the Simulated Performance Path



Change is Hard … Change is Good… Change can be Made Easier

EnergyLogic

Robby Schwarz

EnergyLogic

Principal/Director of Builder Relations

robby@nrglogic.com 720-838-0677 www.nrglogic.com

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