



ENERGY SYSTEMS LABORATORY

TEXAS A&M ENGINEERING EXPERIMENT STATION

Shirley Ellis

Energy Codes Specialist

Texas A&M Engineering Experiment Station

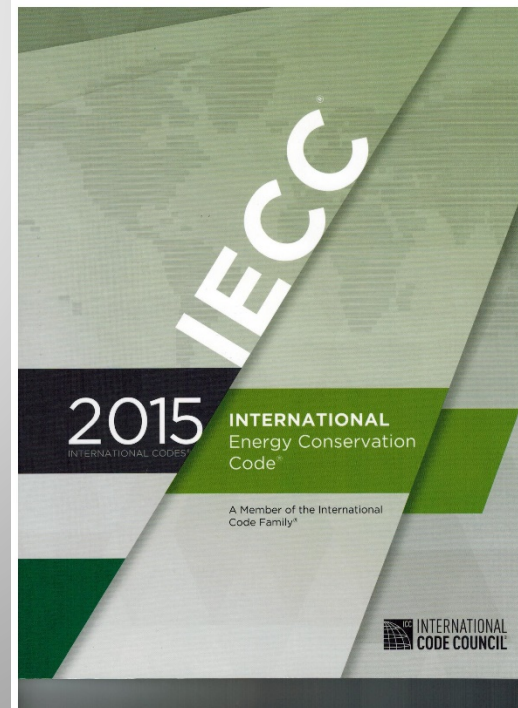
shirleyellis@tamu.edu



ENERGY SYSTEMS LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION

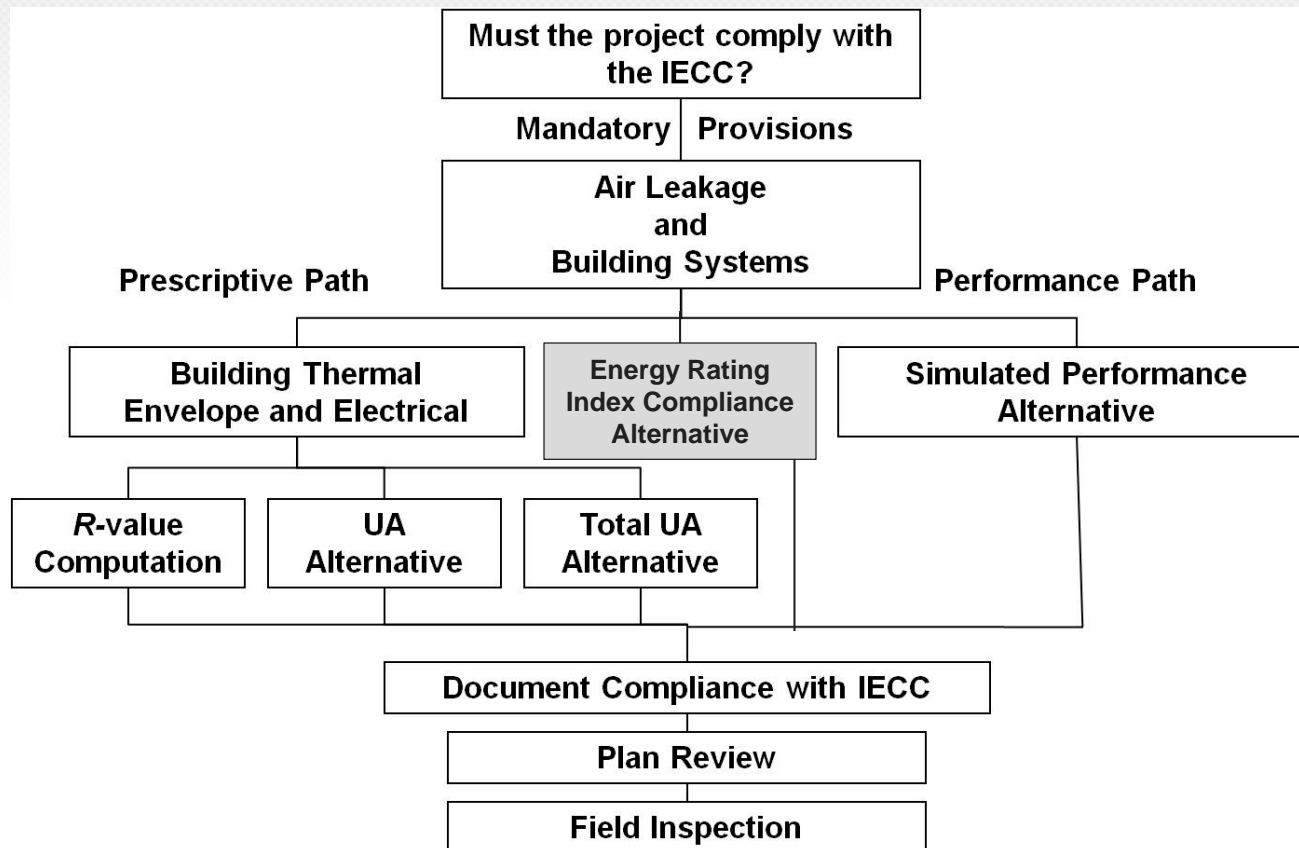
Overview of the ERI Compliance Alternative

The 2015 IECC requirements for compliance using the Energy Rating Index (ERI)





IECC Residential Compliance Process





Section R406 ERI Compliance

- Additional option for IECC compliance
- Target ERI score is met through a wide range of performance options
- Requires builders to achieve the mandatory code requirements of the 2015 IECC and comply with minimum insulation and window envelope performance requirements of the 2009 IECC



R406.2 Mandatory Requirements

- 2015 IECC requirements
 - Mandatory requirements in R401.2
 - Section R402.4 Air Leakage
 - Section R403 Systems
 - Section R404 Electrical Power and Lighting Systems
 - Prescriptive requirements in R403.5.3
 - Hot water pipe insulation
- 2009 IECC Building Envelope requirements

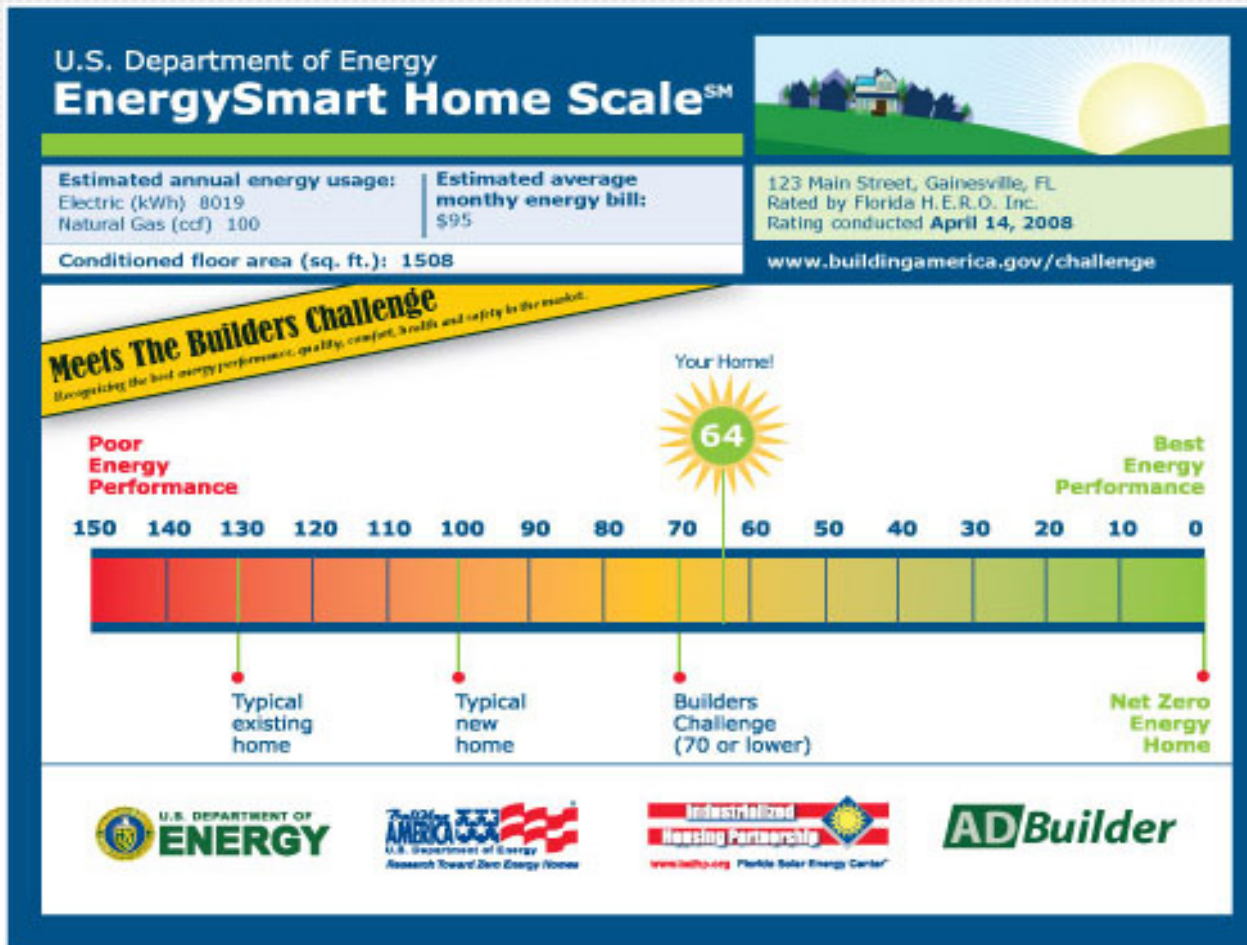


R406.3 Energy Rating Index

The ERI value is defined as a numerical score where 100 is equivalent to the 2006 IECC and 0 is equivalent to a net-zero home. Each integer value on the scale represents a one percent change in the total energy use of the ***rated design*** relative to the total energy use of the ***ERI reference design***.



Energy Rating Index



The scale is based on a 100 – 0 index

ERI score of 100 is equivalent to a home based on the 2006 IECC

ERI score of 0 is equivalent to a net zero home



2015 IECC Target ERI Scores

R406.4 ERI Based Compliance

Definition:

ERI Reference Design -

A version of the rated design that meets the minimum requirements of the 2009 IECC.

Table R406.4

MAXIMUM ENERGY RATING INDEX

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



R406.5 Verification by approved agency

Verification of compliance with the ERI compliance shall be completed by an *approved* third party.



R406.6 Documentation

- Documentation of the software used to determine the ERI and the parameters for the residential building in accordance with Sections R406.6.1 through R406.6.3
 - Compliance software tools
 - Compliance report
 - Additional Documentation



R406.6.1 Compliance software tools

- Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions and provided to the code official.
- Must look at Sections R406.7 – R406.7.3
 - Calculation software tools
 - Minimum capabilities
 - Specific approval
 - Input values



R406.6.2 Compliance report

- Compliance software tools must generate a report that documents the ERI of *rated design complies*.
- Documentation shall include the following:
 - Address or other identification of the residence
 - Inspection checklist documenting the building component characteristics of the *rated design*
 - Show the results for both the *ERI reference design* and *rated design*, and
 - Document all inputs entered by the user necessary to reproduce the results
 - Name of individual completing the compliance report
 - Compliance software tool name and version
 - One Exception regarding orientation



R406.6.3 Additional Documentation

- Documentation of the *ERI reference design* building component characteristics
- Certificate signed by the builder providing the *rated design* building component characteristics
- Documentation of the *rated design* actual values used in the calculations

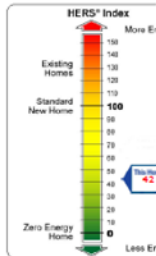


2015 IECC ENERGY RATING INDEX REPORT

Property
I.M. Smith
2342 Maybee Ave.
Denver, CO 80333

Organization
L.A. Raters
303 222 1111
H.I. Scorer

HERS
Based on plans
4/12/95
Rating No: XYZ-22233



TARGET INDEX: 55
This home **MEETS** the RESNET Home Energy Conservation Code based on the 2009 IECC UA Duct Sealing (2012) Mechanical Ventilation Mechanical Ventilation Efficacy

Name: H.I. Scorer
Organization: L.A. Raters

HERS Target:
2009 IECC UA
Duct Sealing (2012)
Mechanical Ventilation
Mechanical Ventilation Efficacy

Emission
Pollution Prevented
Carbon Dioxide (CO₂) - tons/year
Sulfur Dioxide (SO₂) - lbs/year
Nitrogen Oxides (NO_x) - lbs/year

Home Energy Rating Certificate



DOE Challenge bldg
2342 Maybee Ave.
Denver, CO 80333

5 Stars Plus
Confirmed
HERS Index: 42

General Information

Conditioned Area	3000 sq. ft.	House Type	Single-family detached
Conditioned Volume	24000 cubic ft.	Foundation	Enclosed crawl space
Bedrooms	5		

Mechanical Systems Features

Heating:	Fuel-fired air distribution, Natural gas, 92.0 AFUE.
Cooling:	Air conditioner, Electric, 14.0 SEER.
Water Heating:	Instant water heater, Natural gas, 0.80 EF, 0.0 Gal.
Duct Leakage to Outside	68.67 CFM25.
Ventilation System	Balanced: HRV, 75 cfm, 50.0 watts.
Programmable Thermostat	Heat=Yes; Cool=Yes

Building Shell Features

Ceiling Flat	R-50.0	Slab	None
Sealed Attic	NA	Exposed Floor	R-19.0
Vaulted Ceiling	NA	Window Type	U-Value: 0.270, SHGC: 0.390
Above Grade Walls	R-18.0	Infiltration Rate	Htg: 0.05 Clg: 0.05 ACHnat
Foundation Walls	R-19.0	Method	Blower door test

Lights and Appliance Features

Percent Interior Lighting	80.00	Range/Oven Fuel	Electric
Percent Garage Lighting	0.00	Clothes Dryer Fuel	Electric
Refrigerator (kWh/yr)	700.00	Clothes Dryer EF	2.67
Dishwasher Energy Factor	0.50	Ceiling Fan (cfm/Watt)	70.40

ENERGY STAR v3.1 Home Report

Property
I.M. Smith
2342 Maybee Ave.
Denver, CO 80333

Organization
L.A. Raters
303 222 1111
H.I. Scorer

HERS
Confirmed
4/12/95
Rating No: XYZ-22233
Rater ID: 303 333 2222



Registry ID: 111111111
Rating Number: XYZ-22233
Certified Energy Rater: H.I. Scorer
Rating Date: 4/12/95
Rating Ordered For: I.M. Smith

Estimated Annual Energy Cost

Use	MMBtu	Cost	Percent
Heating	12.5	\$62	7%
Cooling	3.4	\$80	9%
Hot Water	9.7	\$48	5%
Lights/Appliances	31.9	\$747	80%
Photovoltaics	-5.3	-\$124	-13%
Service Charges		\$120	13%
Total	52.2	\$934	100%

Criteria

This home meets or exceeds the minimum criteria for the following:
EPA ENERGY STAR Version 3.1 Home
2012 International Energy Conservation Code

L.A. Raters
2540 Frontier Ave, Suite 100
Boulder, CO 80301
H.I. Scorer
(303) 444-4149
rsm-support@noresico.com



Certified Energy Rater: _____

MMBtu/yr)

As Designed	7.2
	9.7
	4.6
	31.9
	53.5

48 HERS Index w/o PV
42 HERS Index

Comments

0 requirements.
Zone 4 and above.
Insulated sheathing.

Requirements

Requirements satisfied Home.
x = HERS Index Target to comply.

Savings

	\$/yr
	226
	111
	73
	115
	525

Complies with the ENERGY STAR Version 3.1 procedure for National Program Requirements, with RESNET Mortgage Industry National Rules, window shading and the existence of

Software v15.0
cost or savings.

REM/Rate - Residential Energy Analysis and Rating Software v15.0

This information does not constitute any warranty of energy cost or savings. © 1985-2014 Noreasco, Boulder, Colorado.
The Home Energy Rating Standard Disclosure for this home is available from the rating provider.



Home Energy Rating Procedures

- Determining the Energy Rating Index
- Energy Rating Reference Home and Rated Home Configuration
- Operating Condition Assumptions
- Minimum Rated Features
- Existing Home Retrofit Savings
 - *Not relevant to code compliance*
- Economic Cost Effectiveness



Certification and Labeling

- Rating Requirements
- Innovative Design Requests
- Labeling
 - Real property physical address
 - Energy Rating Index score
 - Projected annual site energy use by fuel type
 - Projected annual energy cost
 - Name and address of the Approved Rating Provider
 - Date of the home energy rating



ERI Calculation includes

- Above-grade walls
- Conditioned basement walls
- Floors over unconditioned spaces or outdoor environment
- Ceilings/Roofs/Attics
- Foundations/Crawlspaces
- Doors
- Glazing/Skylights
- Thermally isolated sunrooms
- Air exchange rate
- Whole-House Mechanical ventilation

Note: These variables are not specifically defined in the code.



ERI Calculation includes

- Internal gains
- Internal mass
- Structural mass
- Heating and cooling systems
 - Equipment efficiencies and sizing
 - Air- and ground-source heat pumps
 - Solid fuel combustion
- Service water heating systems
- Thermal distribution systems
- Thermostat
- Lighting, appliance and miscellaneous loads

Note: These variables are not specifically defined in the code.



Additional Considerations

- Tables for Energy Rating Reference Home
 - Component heat transfer characteristics
 - Internal gains
- Tables for Default values
 - Solar absorptance for various roofing surfaces
 - Framing for fractions of enclosure elements
- Insulation assessment



The ERI compliance path, implemented through the rating process, provides independent, third-party analysis and review of the energy using features of a house.

- The process includes:
 - Initial analysis and energy rating of the proposed home
 - Review for compliance with the energy code
 - The inspection and testing of energy using features in the home to ensure that they perform as proposed
 - Completing a final energy rating of the home once completed



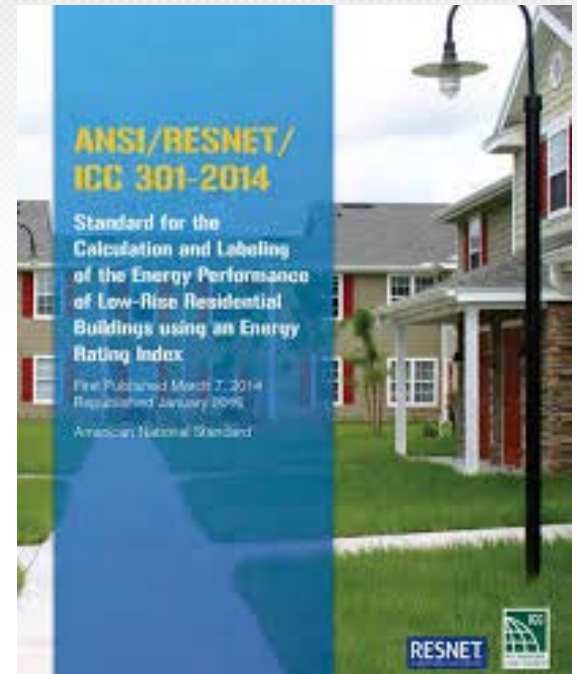
R406.7 Calculation Software Tools

- Software tools capable of calculating the ERI per Section R406.3
- No tools are referenced in 2015 IECC for compliance
- AHJ has final authority



Software Guidelines

- ANSI/RESNET/ICC 301-2014
Standard for the Calculation and Labeling of the Energy Performance of Low-Rise Residential Buildings using an Energy Rating Index
- Addendum A-2015





Software Guidelines

- The Rating Software that is defined in ANSI/RESNET 301-201 is the standard to create rating software programs
 - Software programs will generate reports and must have the following information:
 - Property location, including city, state, zip code, street address or community/subdivision name and lot number and Plan Name for the rated home
 - Name and contact information (phone number and email address) of the Certified Rater conducting the rating



Software Guidelines

- Name, mailing address and telephone number of the Approved Rating Quality Assurance (Q/A) Provider under whose auspices the Rater is certified
- Date the Rating was conducted
- Name of the Approved Software Rating Tool (including version number) used to determine the Rating
- In addition, the rating report must have the following statement in no less than 10 point font:
 - *“The Home Energy Rating Standard Disclosure for this home is available from the Rating Provider.”*



Who Might Be Approved as ERI Raters?

- Currently RESNET will certify raters
 - Home Energy Rater Certification
 - Rating Field Inspector Certification
 - Not certified to provide an ERI Rating
- ERI Raters must be experienced and educated in conducting, supervising, and evaluating an ERI rating.



ICC and RESNET undertake education effort to code officials on the Energy Rating Index option and its benefits

Provide documentation that building envelope meets the minimum insulation and glazing requirements as defined in the 2009 IECC

Provide documentation that 2015 IECC requirements have been met:

- ✓ HVAC
- ✓ Water Heating
- ✓ Lighting



Six informational fact sheets are available from RESNET

- Overview of the ERI Performance Path in the 2015 IECC
- Benefits of the Energy Rating Index Score
- Frequently Asked Questions
- Cost Effectiveness of Using the ERI to Comply with the 2015 IECC
- Implementation Guidelines for the ERI Performance Path
- ERI Performance Path Score Alternatives
- Case Studies: Incorporating the HERS Index into an Energy Code



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Energy Rating Index

Fact Sheets

RESNET
RESNET 155-2013

Energy Rating Index Performance Path

Implementation Guidelines for the ERI Performance Path

The Energy Rating Index (ERI) performance path gives builders an another option for complying with the International Energy Conservation Code (IECC). In addition to the prescriptive and performance paths of previous versions of the IECC, builders now have the option of meeting a target ERI score through a wide range of performance options to demonstrate compliance. The ERI performance path also requires builders to meet the mandatory code requirements of the IECC, including piping provisions for water heating, as well as comply with the minimum insulation and window envelope prescriptive requirements of the 2009 IECC.

The ERI performance path allows a state or jurisdiction adopting the IECC to specify which qualifying Energy Rating Index method will use. The Residential Energy Services Network (RESNET) Home Energy Rating System (HERS) Index, based on ANSI/RESNET Standard 155-2013, is the existing compliant ERI method and is a nationally recognized for engineering and calculating a home's energy performance. To date, over 1.3 million homes have been rated in the U.S. under the RESNET standards, and in 2013, half of all new homes were rated and issued a HERS Index Score.

The ERI compliance path, implemented through the IECC rating process, provides independent, third party analysis and review of the energy using features of a home that includes:

- An initial energy and performance energy rating of the proposed home prior to permit submittal
- Review for compliance with the energy code
- On-site inspection of energy features on the home
- A final energy rating of the home once construction is completed

A home complying with the ERI performance path demonstrates compliance with the IECC. The requirements of the IECC using provisions reduce the need for the jurisdiction to conduct plan review and specific inspections focused on compliance with the energy code. Jurisdictions are encouraged to participate in the rating process as an observer to better understand how the ERI approach, as implemented through a HERS rating, demonstrates compliance with the energy code.

The Implementation Guidelines for the ERI Performance Path are provided for the successful implementation of the ERI approach within a jurisdiction. A RESNET HERS rater that provides a energy code plan review and inspection verification to a jurisdiction falls under the category of a Special Inspector as defined in Chapter 17, Special Inspectors and Tests, of the IECC International Building Code (IBC). The recommended guidelines follow specific provisions within Chapter 17 that are applicable to the ERI and HERS rating process to ensure compliance with the IECC.

HERS RATING DOCUMENTATION

Documentation should be requested from the HERS rater to show that they are following requirements are met.

Independence. The HERS rater should be objective and competent for the work performed. The HERS rater should also declare possible conflicts of interest so that objectivity can be confirmed. RESNET HERS raters follow the Rating and Home Energy Service Code of Ethics that stresses the obligation of home energy professionals to present accurate and unbiased information on energy performance in a professional manner and disclose any potential conflicts of interest.

Professionalism. The HERS Rater should provide certifications to demonstrate that they are experienced and educated in conducting, inspecting and evaluating a HERS rating. The following RESNET HERS certifications demonstrate competency in the field:

- Home Energy Star Certification
- Rating Field Inspector Certification (can provide the initial testing and inspection but are not certified to provide an ERI)

Qualifications for each certification level are found in the Mortgage Industry National Home Energy Rating System Standards¹.

The IECC user should also demonstrate their knowledge of the residential provisions of the IECC. This is accomplished by holding the IECC National Energy Inspector/Plan Examiner certification. In addition, the HERS rater must have knowledge of any state or local jurisdiction requirements for the IECC.

RESNET

RESNET
RESNET 155-2013

Energy Rating Index Performance Path

Benefits of the Energy Rating Index Score Option

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RESNET

RESNET
RESNET 155-2013

Energy Rating Index Performance Path

ERI Performance Path Score Alternatives

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RESNET

2009 IECC ERI SCORES

According to the U.S. Department of Energy, a home built to the 2009 IECC is expected to save 15 to 20 percent in energy costs a year following the 2009 IECC. In other words, a home built to comply with the minimum prescriptive requirements of the 2009 IECC would achieve the following ERI Index Scores:

Climate	2009 IECC ERI Index Score
Zone 1-2	73
Zone 3	75
Zone 4-5	82
Zone 6	84
Zone 7	86
Zone 8	86
U.S. Average	80

2012 IECC ERI SCORES

The 2012 IECC is expected to decrease energy consumption in homes by 20 percent when compared to the 2009 IECC. As a result, a home built to comply with the minimum prescriptive requirements of the 2012 IECC would achieve the following ERI Index Scores:

Climate	2012 IECC ERI Index Score
Zone 1	74
Zone 2	73
Zone 3	81
Zone 4	74
Zone 5	86
Zone 6	79
Zone 7	78
Zone 8	74
U.S. Average	74

In viewing the relation of the IECC and ERI Scores, it is important for states and jurisdictions to remember that lower ERI Scores equate to less energy consumption and greater energy savings.



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Access guides directly from checklists for Zero Energy Ready Home, ENERGY STAR Certified Home, and Indoor airPLUS.



Building Components

Access guides for new and existing homes based on building components of interest.



Sales Tool

Translate building science technical terms into a new language of vs. vs.



Climate Packages

Review new home energy efficiency specifications and case studies that exceed 2009 IECC by 30%.



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Scope

Description

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Scope

Reduced Thermal Bridging

Continuous rigid insulation, insulated siding, or combination of the two; \geq R-3 in [Climate Zones 1 to 4](#), \geq R-5 in [Climate Zones 5 to 8](#)

- If utilizing insulated siding that is not water-resistant barrier, install a water-resistant barrier before installing siding.
- If using steel studs, install continuous rigid insulation of \geq R-3 in Climate Zones 1 to 4 or \geq R-5 in Climate Zones 5 to 8.
- Tape and seal all seams of continuous rigid insulation if it is being utilized as a water-resistant barrier.



ENERGY STAR Certified Homes Notes:

[Note: Guidance for ENERGY STAR Certified Homes Version 3.0, Revision 08 is coming soon.]

Building Energy Codes Program

www.energycodes.gov

- ▶ Compliance software
- ▶ Technical support
- ▶ Code notes
- ▶ Publications
- ▶ Resource guides
- ▶ Training materials

REScheck-Web - 2015 IECC - Internet Explorer

Project title: 2015 IECC

Email Address Password Log In

Register | Forgotten Password?

New Project PROJECT ENVELOPE MECHANICAL REQUIREMENTS Reports

Code/Location

Code: 2015 IECC What's my code?

State: Alabama

City: Abbeville

County: Autauga

If your location is not included here, choose a nearby location with similar weather conditions.

Project Type

New Construction

Addition

Alteration

Compliance Method

UA Trade-Off

Performance Alternative

Building Characteristics

1- and 2-Family, Detached

Multifamily

Conditioned Floor Area: 0 ft²

All ducts and air handlers are located within conditioned spaces

[Explanation of duct testing requirements](#)

Project includes a thermally isolated sunroom

Project includes a pool or inground spa

Project includes an interior wood-burning fireplace

Project Details (optional)

This information will appear on the compliance report. [Edit Project Details...](#)

CHECK COMPLIANCE To display compliance results, click the Check Co



U.S. DEPARTMENT OF ENERGY Energy Efficiency & Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

2012 IECC

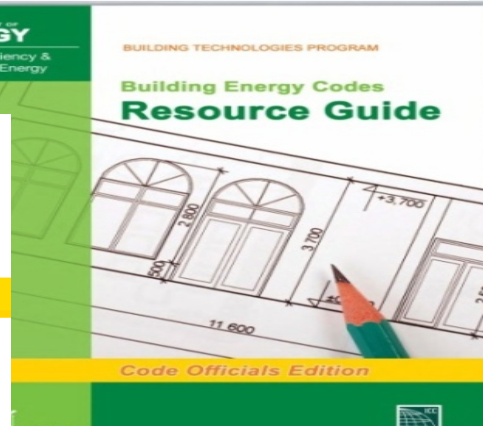
Insulation Requirements in Residential Buildings for Mechanical and Service Hot-Water Piping

The intent of the pipe insulation requirements is to reduce temperature changes while fluids are being transported through piping associated with heating, cooling or service hot water (SHW) systems, thereby saving energy and reducing operating costs.

Uninsulated piping systems that transport fluids can create water temperature irregularities, which ultimately requires additional heating or cooling and associated energy costs to bring the water to operating temperature. Any piping that carries heated or cooled water, including piping systems with external heating (e.g., heat trace or impedance heating), should be thermally insulated to reduce heat loss or gain, allowing the fluid to be delivered at the intended temperature. The addition of insulation can also improve the comfort of the occupants and reduce energy consumption by reducing heat losses (or gains) as the fluid moves throughout the home

protected from exposure to sunlight, moisture, and wind—all of which can damage the insulation materials over time. This protection must shield the insulation from solar radiation. The 2012 IECC prohibits the use of adhesive tapes as shielding.

CODE NOTES





Overview of Resources:

- International Codes Council (ICC)
www.iccsafe.org
- RESNET www.resnet.us
- Building America Solution Center (BASC)
<https://basc.pnnl.gov>
- Building Energy Codes Program (BECF)
www.energycodes.gov



Building Energy Codes Program

www.energycodes.gov

BECP help desk

<https://www.energycodes.gov/HelpDesk>