



HERS and the ERI Path

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Description

- As of October 1, 2018, builders in Pennsylvania have the option of a new energy code compliance path under the PA Uniform Construction Code. The 2015 I-Codes expanded the number of available paths to include the ERI (Energy Rating Index) path. This compliance option allows builders to utilize a HERS (Home Energy Rating System) score to demonstrate compliance with the enforceable energy code. This webinar will dig into the basics of the HERS index as well as its applicability in the ERI path.


Learning Objectives

- Describe the HERS index and the process a builder goes through in order to design and evaluate a home to meet target HERS values.
- Understand the process undertaken by HERS Raters, including performance testing of building systems, in order to better implement high performance residential features.
- Analyze the features of a home that can raise and lower a HERS score and the impact those changes have on cost and performance.
- Explore the 2015 ICC ERI path and the differences between this compliance path and other options such as utilizing RESCheck or the performance path.





Outline

- ERI Compliance Path
- What is the HERS Index?
- Case Study




Pennsylvania's Energy Codes: Oct 1, 2018



2018
Pennsylvania
Alternative
Residential
Energy
Provisions


OR



2015
IRC


Chapter 11 of
IRC 2015

OR



2015
IECC

Residential
Provisions of
IECC 2015



Energy Code Compliance Options

Prescriptive

Sections N1102.1 through N1102.3, N1103.3.1, N1103.3.4, and N1103.5.3

Indicated as (Prescriptive)

Total UA Alternative

Section N1102.1.4

Calculate manually
REScheck
Other software

Simulated Performance Alternative


Section N1105

REScheck
Other software

ERI Path

Section N1106

HERS Index



Section N1106 Energy Rating Index Compliance Alternative

• Section N1106.3 Energy rating index.

- The Energy Rating Index (ERI) shall be a numerical integer value that is based on a **linear scale** constructed such that the ERI **reference design has an Index value of 100 and a residential building that uses no net purchased energy has an Index value of 0**. Each integer value on the scale shall represent a 1 percent change in the total energy use of the rated design relative to the total energy use of the ERI reference design. **The ERI shall consider all energy used in the residential building.**

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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL



Section N1106.3.1 ERI reference design

- The **ERI reference design** shall be configured such that it meets the **minimum requirements of the 2006 International Energy Conservation Code** prescriptive requirements.
- The proposed residential building shall be shown to have an annual total normalized modified load less than or equal to the annual total loads of the ERI reference design.

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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL



Reference Home vs. Rated Home

- | | |
|---|--|
| <ul style="list-style-type: none"> • Minimum requirements established in 2006 IECC and federal efficiency requirements | <ul style="list-style-type: none"> • "As-built" home • Components entered and modeled by the rater |
|---|--|

ERI path is more of a "true" performance path:
If it's installed at final inspection, you can use it to calculate total energy use.

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Section N1106.4 ERI-based compliance

- 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 N1106.4* when compared with the reference design.

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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL



Table N1106.4 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



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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL



2015 IECC Section R406.4 *Amendment*

2015 IRC Section N1106.4

- **PA Amendment:** 2018 IRC Section N1106.4 was adopted (ERI target values were amended and footnote a was added):
 - "a. Where on-site renewable energy is included for compliance using the ERI analysis of Section N1106.4, the building shall meet the mandatory requirements of N1106.2 and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table N1102.1.2 or Table N1102.1.4 of the 2015 IRC."

Climate Zone	2015 IECC	Amended Targets
4	54	62
5	55	61
6	54	61



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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL



Section N1106.2 Mandatory Requirements

- Compliance with this section requires that the **mandatory provisions** identified in Sections N1101.13 through N1104 identified as “mandatory” and Section N1103.5.3 be met.

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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL



Section N1106.2 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**.
 - Exception: Supply and return ducts not completely inside the building thermal envelope shall be insulated to a minimum of R-6.

“Backstop”

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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL



What is Mandatory? (Examples)

- **N1102.4 Air leakage**
 - Testing and leakage rate (as modified in the UCC)
- **N1103 Systems**
 - Duct testing (leakage rate is prescriptive)
- **N1104 Electrical Power and Lighting Systems**
 - 75% high efficacy lamps or fixtures

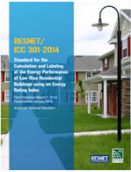
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Which ERI Options are Available?

- **ANSI/RESNET/ICC Standard 301-2014**

- Not referenced directly in 2015 (was not published yet) but is directly referenced in the 2018 codes



**HERS
Index**



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HERS Index

- "The HERS or Home Energy Rating System was developed by RESNET and is the nationally recognized system for inspecting and calculating a home's energy performance. Certified RESNET Home Energy Raters conduct inspections to verify a home's energy performance and determine what improvements can be made to increase it. "

- RESNET



Source: www.hersindex.com



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What is RESNET?

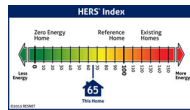
- An independent nonprofit organization, founded in 1996
- A recognized national standards-making body for building energy efficiency rating and certification systems in the United States



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How is a HERS Rating Calculated?

- Certified RESNET HERS Rater conducts an energy rating on a specific home (often using REM/Rate)
- The analysis is compared to a 'reference home'– a designed-model home of the same size and shape as the actual home
 - Reference home designed to meet the 2006 IECC and given a score of 100

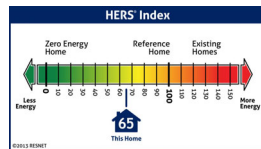


Source: www.hersindex.com



HERS Index Scale

- Existing homes > 100
- Reference home = 100
- Net-zero energy = 0
- 1 point lower = 1% reduction



Source: www.hersindex.com



HERS Index Variables

- All exterior walls (both above and below grade)
- Floors over unconditioned spaces
- Ceilings and roofs
- Attics, foundations and crawlspaces
- Windows and doors, vents and ductwork
- HVAC systems, water heating system, and your thermostat
- Lighting and some appliances
- Air and duct leakage



Section N1106.5 Verification by approved agency

- Verification of compliance with Section N1106 shall be completed by an **approved third party**.

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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hills, IL



Certified HERS Raters

- When doing a comprehensive HERS energy rating, a certified RESNET **HERS Rater** will conduct a series of diagnostic tests using specialized equipment, such as: a blower door test, duct leakage test, and infrared cameras
 - The amount and location of air leaks in the building envelope
 - The amount of leakage from HVAC distribution ducts
 - The effectiveness of insulation inside walls and ceilings

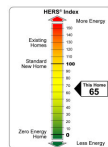
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Source: www.hersindex.com



HERS Rating Process

- Rating process involves analysis of a home's plans and onsite inspections
- A Home Energy Rater uses software to perform an energy analysis of the home's design and determines the projected, pre-construction HERS Index
- The rater also conducts onsite inspections
 - Blower door test
 - Duct blast test
- Final (confirmed) HERS index is calculated



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How Many Inspections?

- **Plan review**
 - Produce projected rating
- **Pre-drywall inspection**
 - Insulation R-values & installation grading
 - Air sealing
 - Windows
 - Installed equipment
- **Final inspection**
 - Envelope & duct tightness testing
 - Produce final confirmed HERS rating



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Section N1106.6 Documentation

- **Compliance report**
 - Address
 - Building component characteristics of rated design
 - Name of individual completing compliance report
 - Name and version of the compliance software tool



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Source: International Code Council (ICC), (2014), 2015 International Residential Code, Country Club Hill, IL

Code Compliance Process

Permitting & Plan Review

- Projected rating should be included with permit application
- Verify HERS Rater is certified with RESNET
- Inspection checklist should be submitted

Inspection

- Approved third party conducts inspection
- Code official requests completed inspection checklist
- Verify mandatory requirements have been met

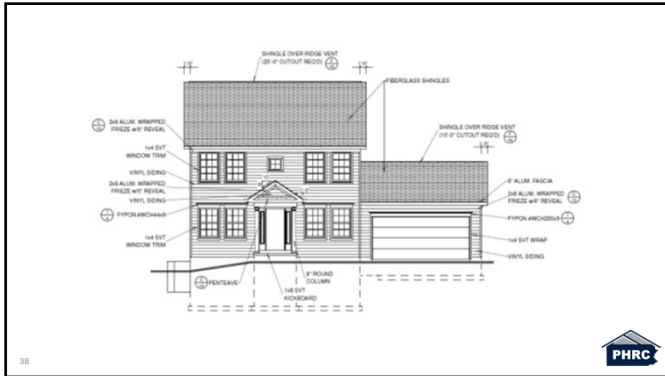
Final

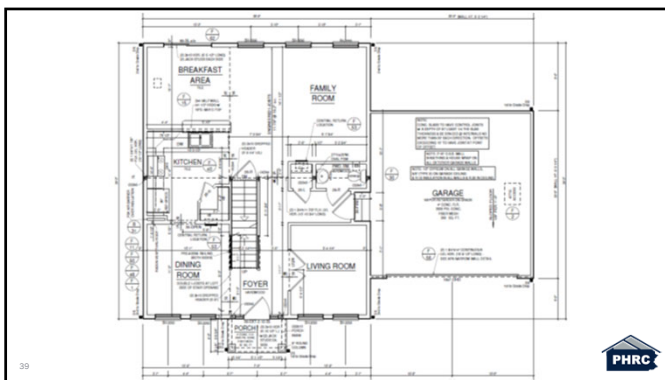
- Request rating certificate
- Request results from duct leakage and blower door tests
- Ensure the rating is "confirmed"



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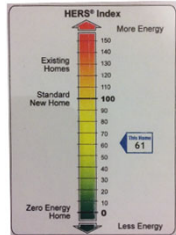
Source: "What Code Officials Need to Know About the Energy Rating Index" Webinar, RESNET







What was the Score?



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Code Minimum

- **This house = 61**
 - Climate zone 5 – 2009 IRC
- **2015 ERI Target = 61**
- *Which aspects of this house are better than the reference home and/or code minimum?*



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Equipment

- **Heating**
 - Natural gas furnace
 - Lennox 93% AFUE
- **Cooling**
 - Lennox 13 SEER
- **Water heating**
 - 50 gallon electric tank
 - 0.91 EF



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Reference Home Equipment

- Natural gas furnace = 78% AFUE
- Electric air conditioner = 13 SEER
- Electric tank water heater = 0.904 EF

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Source: ANSI/RESNET/ICC 301-2014



Glazing

- U-factor = 0.30



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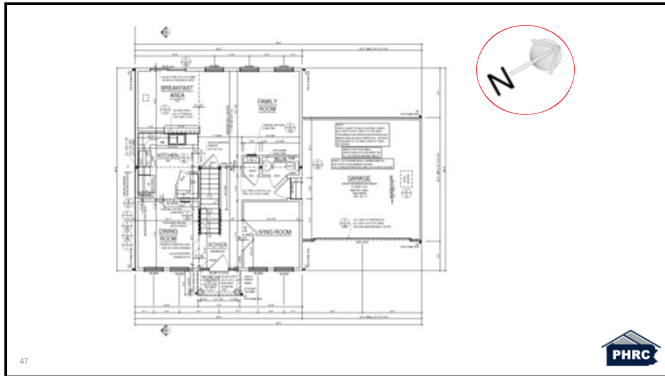
Reference Home Glazing

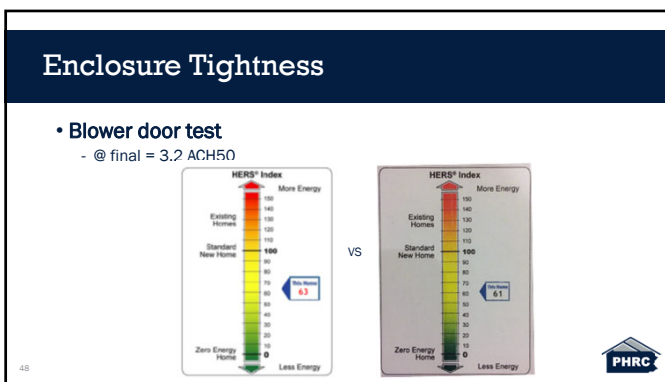
- Fenestration and opaque door U-factor = 0.35
 - Climate zone 5
- Amount of glazing assumes 18% of conditioned floor area
- Orientation
 - Assume all glazing equally distributed to 4 cardinal compass directions

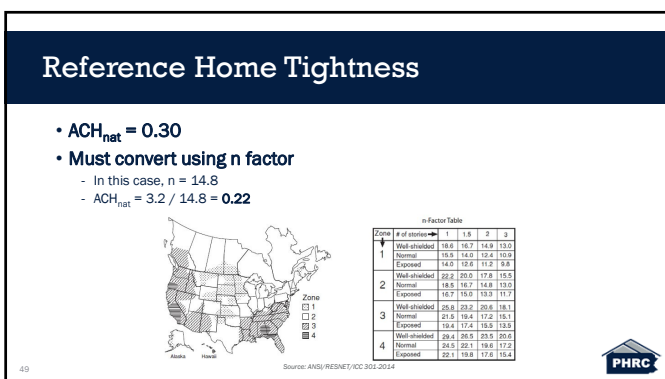
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Source: ANSI/RESNET/ICC 301-2014









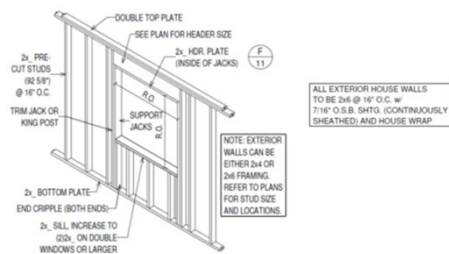
Other Room for Improvement?

- Wall insulation
- Attic insulation
- Equipment efficiency
- What is very difficult to change?
 - Orientation
 - Architecture



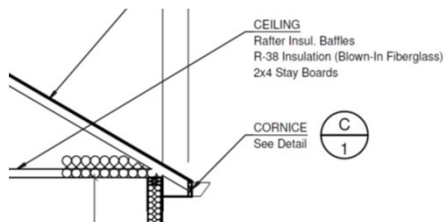
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Example: Advanced Framing



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Example: Attic Insulation



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Could This Home Comply w/2015 IECC?

- **Not without some modifications**
 - Increased wall insulation (currently R-19 batt)
 - 2009 minimum = R-20
 - Mandatory 2015 IECC provisions must be met
 - Mechanical ventilation
- **Could we add PV to lower our HERS score?**

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Solar & ERI

- **HERS allows renewable energy to impact the score**
- **BUT – New backstop:**
 - “a. Where on-site renewable energy is included for compliance using the ERI analysis of Section N1106.4, the building shall meet the mandatory requirements of N1106.2 and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table N1102.1.2 or Table N1102.1.4 of the 2015 IRC.”



Image Source: <https://www.atlanticstuff.com/chain-link-baseball-backstop/>

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How Much Does This Cost?

- **According to RESNET, the national average cost of obtaining a HERS score is \$450**
 - Includes 3 site visits and diagnostic testing
 - Note: diagnostic testing is required (as applicable) regardless of compliance path

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Source: <http://www.resnet.us/energy-rating-faq>



Energy-Efficient New Home Rebate Programs

- House Bill 2200 (Act 129 of 2008) – Signed October 15, 2008 requires Electric Distribution Companies (EDCs) to reduce kWh consumption.
- EDCs have developed a variety of energy efficiency programs to meet mandated targets. New Home Rebates is one of these programs.
- Some gas distribution companies are voluntarily providing new home rebates as well.



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Available Programs

- **The Pennsylvania Energy Efficient New Homes Program (Met-Ed, Penelec, Penn Power, West Penn Power)**
 - <http://energysavepa-newhomes.com/>
- **PPL New Homes Program**
 - <http://pplelectricnewhomes.com/>
- **PECO New Home Rebates**
 - <http://peconewhomes.com/>
- **UGI Save Smart New Home**
 - <https://ugisavesmart.com/newhomes/>
- **PGW EnergySense Efficient Construction Grants**
 - <https://pgwenergysense.com/efficient-construction-grants/>



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How to Find HERS Raters?

- <http://www.resnet.us/directory/search>



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Summary

- The ERI compliance path is a new option for builders who may want to use a “true” performance path option
- The ERI path relies on the HERS Index and the existing infrastructure established by RESNET



Resources

- www.resnet.us
- http://www.resnet.us/professional/main/Hers_index_and_energy_codes
- http://www.resnet.us/blog/wp-content/uploads/2016/01/ANSI-RESNET-ICC_301-2014-Second-Edition-Publish-Version.pdf
- <http://www.resnet.us/directory/search>



Questions?






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The slide features a dark blue header with the title "HERS and the ERI Path" in white. Below the header is a white section with the website URL "www.phrc.psu.edu" in blue. The bottom of the slide contains a row of five logos: PennState College of Engineering, Pennsylvania Housing Research Center, NARI CEU Approved, ICC Preferred Education Provider, and PHRC. The background of the slide is white with a pattern of faint, overlapping rectangular outlines.
