Midwest Trends: Using Big (HERS) Data to Understand Residential Construction

2019 RESNET Conference
Ian Blanding
About MEEA

The Trusted Source on Energy Efficiency

We are a nonprofit membership organization with 160+ members, including:

- Utilities
- Research institutions and advocacy organizations
- State and local governments
- Energy efficiency-related businesses

As the key resource and champion for energy efficiency in the Midwest, MEEA helps a diverse range of stakeholders understand and implement cost-effective energy efficiency strategies that provide economic and environmental benefits.
Goal

• Analyze HERS data from high level to local level
• Highlight key similarities and differences between locations
• Overlap state, local and utility policy and public datasets to complement the HERS data and gather a more complete understanding of key drivers for HERS homes and the industry
Agenda

- HERS data background
- Midwest Building Policies & Programs
- Midwest HERS Overview
  - Trends by Climate Zone
- Utilizing the data
  - Energy Code Adoption
  - Impact of Energy Codes/Compliance
  - Utility Programs
  - HERS Homes vs Code Homes
- Key Takeaways
- Questions
HERS Dataset

Background
Midwest HERS Data Set

Background

• MEEA received a dataset for all **HERS rated homes in the Midwest** from RESNET which spans **2014 - 2016**

• Dataset includes **HERS scores**, plus most features that impact building efficiency (**minimum rated features**)

• Although dataset includes single, duplex and low-rise multifamily – **the analysis only focuses on new single family**
Midwest HERS Data Set

**Background**

- Single Family
- # of homes analyzed: 78,000
- Confirmed Ratings
- Software: REM/Rate < v.15
- HERS Rated vs. 1-family permits in Midwest
  - 2014: 24%
  - 2015: 25%
  - 2016: 22%
Energy Code Breakdown by HERS Home

- 2006 IECC: 4%
- 2009 IECC: 4%
- 2012 IECC: 9.5%
- 2015 IECC: 26%
- None: 56.5%
Midwest Residential Policies

Codes and Utility Program
Residential Code

Amended Vs. Referenced Code

Code Updates in Progress

Percentage change is based on EUI of adopted code

Key
- No mandatory code
- 2009 IECC
- 2012 IECC
- 2015 IECC
- 2018 IECC
- Less efficient than referenced code
- More efficient than referenced code
- Code update in progress

As of November 2018
Residential Building Energy Codes

Adoption Timeline

2006 2007 2008 2009 2010 2011

2012 2013 2014 2015 2016 2017

Code Level / Equivalence

- No mandatory statewide code
- Pre-2000 Code
- 2000 IECC
- 2003 IECC
- 2006 IECC
- 2009 IECC
- 2012 IECC
- 2015 IECC
Residential Building Energy Code

Energy Use as Code Improves (1975-2016)

Normalized *Site Energy Use Index

Residential Energy Use

Residential Code Update

* Energy Use Index: National average energy use by building type and size.

Source: MEEA based on PNNL Analysis
Code Compliance Studies

Map of US

Field Studies

US DOE
DOE Residential Field Study
Program Design

1. Residential Baseline Study
   ▪ Basis for measuring improvement
   ▪ Identifies specific compliance improvement opportunities

2. Integrated Compliance Support Program
   ▪ Develop a suite of programs targeted at identified compliance improvement opportunities

3. Post Program Study
   ▪ Positive results from Kentucky
Code Compliance Programs

• Utilities have shown interest in funding code compliance programs
• New residential home construction
• Ameren, MO Residential Energy Code Support Program
  – Code Collaborative
  – Circuit Rider
  – In Person Training
# New Construction Program

<table>
<thead>
<tr>
<th>State</th>
<th>Utility</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>Mid Am/Alliant</td>
<td>≤ 57</td>
</tr>
<tr>
<td>IL</td>
<td>ComEd/Nicor</td>
<td>20-30% ^ Code</td>
</tr>
<tr>
<td>IN</td>
<td>Vectren</td>
<td>≤ 63</td>
</tr>
<tr>
<td>MI</td>
<td>Consumers</td>
<td>Energy Star</td>
</tr>
<tr>
<td>MN</td>
<td>Xcel/Centerpoint</td>
<td>10-50% ^ Code</td>
</tr>
<tr>
<td>MO</td>
<td>Ameren/Columbia</td>
<td>≤ 65</td>
</tr>
<tr>
<td>NE</td>
<td>OPPD</td>
<td>≤ 60</td>
</tr>
<tr>
<td>OH</td>
<td>Columbia Gas</td>
<td>≤ 70</td>
</tr>
<tr>
<td>WI</td>
<td>Focus</td>
<td>Energy Star</td>
</tr>
</tbody>
</table>
Energy Star Homes
2017 Market Share

Source: EnergyStar.gov
Percentage of HERS Homes
Based on Census New Construction

Map showing the percentage of HERS homes in different states:
- Minnesota: 38%
- Michigan: 11%
- Ohio: 53%
- West Virginia: 23%
- Other states with varying percentages.
## HERS Comparison
### Policies and Programs

<table>
<thead>
<tr>
<th>State</th>
<th>% of HERS homes</th>
<th>Avg. HERS Score</th>
<th>Primary CZ</th>
<th>State IECC</th>
<th>State IMC</th>
<th>Utility Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>53%</td>
<td>66.0</td>
<td>5</td>
<td>20092012 IMC</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>MN</td>
<td>38%</td>
<td>52.0</td>
<td>6</td>
<td>2012+2012 IMC</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>IA</td>
<td>37%</td>
<td>55.0</td>
<td>5</td>
<td>2012+2015 IMC</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>OH</td>
<td>32%</td>
<td>59.0</td>
<td>5</td>
<td>20092015 IMC</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>KY</td>
<td>23%</td>
<td>65.0</td>
<td>4</td>
<td>20092012 IMC</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>WI</td>
<td>20%</td>
<td>55.0</td>
<td>6</td>
<td>20092015 IMC</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>KS</td>
<td>17%</td>
<td>70.0</td>
<td>4</td>
<td>None None</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>NE</td>
<td>15%</td>
<td>52.5</td>
<td>5</td>
<td>2009 None</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>IL</td>
<td>15%</td>
<td>55.0</td>
<td>5</td>
<td>2012+None</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>MI</td>
<td>11%</td>
<td>55.0</td>
<td>5</td>
<td>20092015 IMC</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>MO</td>
<td>2%</td>
<td>62.5</td>
<td>4</td>
<td>None None</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>SD*</td>
<td>1%</td>
<td>51.5</td>
<td>6</td>
<td>None None</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>ND*</td>
<td>0%</td>
<td>58.5</td>
<td>6</td>
<td>None None</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>
Midwest HERS Homes

High Level Overview
Home Features
Average in Midwest

- HERS Score: 59
- Home Size: 3,500 sq. ft.
- Bedrooms: 3.5
- Foundation:
  - 83% basements/crawl
  - Avg. R- 3+5
- Walls
  - 13% w/ ext. insulation
  - Avg. R – 17 + .5
- Windows
  - U-.30
  - SHGC - .29
- Ceiling
  - R-42
Home Features
Average in Midwest

• ACH50: 2.7
• Duct Leakage: 2% outside
• High Efficacy Lights: 57%
• HVAC Furnace/AC - 88%

• AFUE: 93.5
• SEER: 13.5

• Water Heating – 94%
  Conventional
  • Capacity: 50 Gallons
  • EF: .79
HERS Score by Year

All Midwest

Avg. HERS Score
Midwest: 59
2014: 60.5
2015: 59
2016: 58
HERS Score by Energy Code

All Midwest

Avg. HERS Score
None: 68
2006/2009: 61
2012+: 53.5
Average HERS score

By State

58
52
52
53
55
55
55
70
62
66
59
65
Map of HERS Homes

Number and Score of homes by Zip

Avg. HERS Index (no bin)

40.00
80.00

Count of Number of Homes

United States
AGW Insulation Installation

Average by Zip
Ceiling Insulation (R-Value) Average by Zip
Air Sealing (ACH50)
Average by Zip
Climate Zone

Detailed Analysis
**HERS score**

**Breakdown in Midwest by CZ**

- **Avg. HERS Score**
  - Midwest: 59
  - CZ 4: 65
  - CZ 5: 60
  - CZ 6: 53
  - CZ 7: 56
Number of Homes
Breakdown in Midwest by CZ

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Number of Homes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CZ 4</td>
<td>11,900</td>
</tr>
<tr>
<td>CZ 5</td>
<td>18,800</td>
</tr>
<tr>
<td>CZ 6</td>
<td>47,000</td>
</tr>
<tr>
<td>CZ 7</td>
<td></td>
</tr>
</tbody>
</table>
Above Grade Wall Insulation

Graph: CZ 4

AGW Cavity Insulation (R-Value)

% of Total Sum of Number of Homes

Continuous Insulation:
- 0
- 3
- 6
- 9
- 12
- 15
- 18
- 21
- 27
- 30

10 12 14 16 18 20 22 24 26 28 30
Above Grade Wall Insulation

Graph: CZ 5

AGW Cavity Insulation (R-Value)

% of Total Sum of Number of Homes

Continous Insulation:
- 0
- 3
- 6
- 9
- 12
- 15
- 18
- 24
- 27
- 30
- 45
Above Grade Wall Insulation

Graph: CZ 6+7
Ceiling Insulation

Graph: CZ 4

Ceiling Insulation (R-Value)

% of Total Sum of Number of Homes

0% 5% 10% 15% 20% 25% 30%

22 26 30 34 38 42 46 50 54 58
Window U-Factor

Graph: CZ 4

Window Efficiency (U-Factor)
Window U-Factor

Graph: CZ 5

Window Efficiency (U-Factor)

% of Total Sum of Number of Homes

0.4 0.38 0.36 0.34 0.32 0.3 0.28 0.26 0.24
Window U-Factor

Graph: CZ 6+7
Graph: CZ 6+7

ACH50

% of Total Sum of Number of Homes

- 40%
- 35%
- 30%
- 25%
- 20%
- 15%
- 10%
- 5%
- 0%

ACH50 values for different ranges:
- 7.0: 0%
- 6.0: 0%
- 5.5: 0%
- 5.0: 0%
- 4.5: 0%
- 4.0: 0%
- 3.5: 0%
- 3.0: 0%
- 2.5: 0%
- 2.0: 0%
- 1.5: 35%
- 1.0: 40%
- 0.5: 0%
Duct Leakage (Unconditioned)

Graph: CZ 4

Duct Leakage - Unconditioned Space (%)

% of Total Sum of Number of Homes

0% 5% 10% 15% 20% 25% 30% 35% 40%

16.5 14.0 12.5 11.5 8.5 7.5 6.5 5.5 4.5 3.5 2.5 1.5 0.5
Duct Leakage (Unconditioned)

Graph: CZ 6+7

Duct Leakage - Unconditioned Space (%)
AC Efficiency (SEER)

% of Total Sum of Number of Homes

- 13: 70%
- 14: 10%
- 15: 10%
- 16: 10%
- 17: 10%
- 18: 10%

Graph: CZ 5
AC Efficiency
Graph: CZ 6+7

AC Efficiency (SEER)

% of Total Sum of Number of Homes

<table>
<thead>
<tr>
<th>Year</th>
<th>% of Total Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>90%</td>
</tr>
<tr>
<td>14</td>
<td>10%</td>
</tr>
<tr>
<td>15</td>
<td>2%</td>
</tr>
<tr>
<td>16</td>
<td>1%</td>
</tr>
<tr>
<td>17</td>
<td>0%</td>
</tr>
<tr>
<td>18</td>
<td>0%</td>
</tr>
</tbody>
</table>
Furnace Efficiency

Graph: CZ 4

Furnace Efficiency (AFUE)

% of Total Sum of Number of Homes

- 80
- 92
- 93
- 94
- 95
- 96
- 97
- 98
Furnace Efficiency

Graph: CZ 5

![Bar Graph: Furnace Efficiency (AFUE)]
Graph: CZ 6+7

Furnace Efficiency

Furnace Efficiency (AFUE)

% of Total Sum of Number of Homes

<table>
<thead>
<tr>
<th>Year</th>
<th>0%</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
<th>20%</th>
<th>25%</th>
<th>30%</th>
<th>35%</th>
<th>40%</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>92</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35%</td>
<td>37%</td>
<td></td>
</tr>
<tr>
<td>93</td>
<td></td>
<td></td>
<td>15%</td>
<td>18%</td>
<td>20%</td>
<td>23%</td>
<td>25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>96</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30%</td>
</tr>
<tr>
<td>97</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>98</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0%</td>
</tr>
</tbody>
</table>
Using the Data
Informing Programs & Policy
Using the Data

*Policy and Program Improvements*

- **State**
  - Understand code compliance
  - Inform state energy code update
  - Targeted training or educational campaign

- **Jurisdictions**
  - Understand construction practices
  - Benchmark for building efficiency
  - Inform future policies

- **Utility/Builder**
  - Understand program penetration
  - Determine how builders meet a HERS target
  - Inform future programs
State Energy Code Adoption

Ohio Example
Ohio Residential Energy Code

Adoption Example

- Ohio updated residential energy code from 2009 to amended 2018 IECC
- 32% HERS market penetration
- HERS data played an important role in understanding construction practices and how to meet HERS/ERI scores
- Moved stakeholders from not wanting to update to being open to some improvement
Air Leakage (ACH50)

All Homes in Ohio

Number of Homes that Meet the Mandatory Code Requirement:
- 7 ACH50 or less: 100%
- 3 ACH50 or less: 69%

ACH50

Number of Homes

Meets mandatory code requirement

MEEA

Midwest Energy Efficiency Alliance
Duct Leakage to Outside - Unconditioned

All Homes in Ohio

Meets mandatory code requirement

8% or lower: 99.7%
4% or lower: 95%

Number of Homes

CFM25/100 sq ft

MEEA
Midwest Energy Efficiency Alliance
Ventilation Type
All Homes in Ohio

- Air Cycler: 7%
- Balanced: 23%
- Exhaust Only: 69%
- None: 7%
- Supply Only: 0%
50% or greater: 94%
75% or greater: 89%
90% or greater: 70%
# Example Homes

**HERS 59 - 61**

<table>
<thead>
<tr>
<th>Home</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>2009 IECC</th>
<th>2018 IECC</th>
</tr>
</thead>
<tbody>
<tr>
<td>HERS Score</td>
<td>59</td>
<td>59</td>
<td>60</td>
<td>60</td>
<td>61</td>
<td>61</td>
<td>NA</td>
<td>61</td>
</tr>
<tr>
<td>Cond. Area (sq. ft.)</td>
<td>3141</td>
<td>4808</td>
<td>3860</td>
<td>4494</td>
<td>3770</td>
<td>5234</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BSMT: Cont.</td>
<td>11</td>
<td>5.5</td>
<td>7</td>
<td>10</td>
<td>8</td>
<td>7</td>
<td>10 or</td>
<td>15 or</td>
</tr>
<tr>
<td>BSMT: Batt</td>
<td>4</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>AGW: Cont.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>13+5 or</td>
<td>13+5 or</td>
</tr>
<tr>
<td>AGW: Batt</td>
<td>19</td>
<td>13</td>
<td>19</td>
<td>15</td>
<td>11</td>
<td>16</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Ceiling: Blown</td>
<td>38</td>
<td>39</td>
<td>41</td>
<td>27</td>
<td>39</td>
<td>39</td>
<td>38</td>
<td>49</td>
</tr>
<tr>
<td>Window: U-Factor</td>
<td>.33</td>
<td>.35</td>
<td>.33</td>
<td>.36</td>
<td>.34</td>
<td>.34</td>
<td>.35</td>
<td>.30</td>
</tr>
<tr>
<td>HEL: %</td>
<td>75</td>
<td>0</td>
<td>75</td>
<td>95</td>
<td>80</td>
<td>100</td>
<td>50</td>
<td>90</td>
</tr>
<tr>
<td>Air Leakage</td>
<td>2.5</td>
<td>2.7</td>
<td>4.9</td>
<td>2.2</td>
<td>2.9</td>
<td>2.3</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Duct Leakage</td>
<td>1.5</td>
<td>1.5</td>
<td>Cond.</td>
<td>Cond.</td>
<td>3.2</td>
<td>2.2</td>
<td>8 or Cond.</td>
<td>4 or Cond.</td>
</tr>
<tr>
<td>AC (SEER)</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Furnace (AFUE)</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>92</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>
## Average Home Features

**HERS 59-61; 42-45**

### HERS 59-61 – 2634 Homes

**Building Envelope**
- AGW – R-15 or 15+3
- Ceiling – R-37
- Windows – U-.33
- Air Leakage – 2.8 ACH50

**Lighting/Equipment**
- Duct Leakage – 1.4%*
- Lighting – 83%
- AC Eff. – 13.5 SEER
- Furnace Eff. – 94 AFUE

**Conditioned Area** – 3700 Sq. Ft.

* Or in conditioned space

### HERS 45-47 – 226 Homes

**Building Envelope**
- AGW – R-19 or 17+5
- Ceiling – R-42
- Windows – U-.31
- Air Leakage – 2.2 ACH50

**Lighting/Equipment**
- Duct Leakage – 1.3%*
- Lighting – 83%
- AC Eff. – 14 SEER**
- Furnace Eff. – 95.5 AFUE**

**Conditioned Area** – 4880 Sq. Ft.

** Or GSHP

[Logo: MEEA Midwest Energy Efficiency Alliance]
Ohio Code Outcome

Proposed Changes

• Updated
  – Mandatory Testing and Ventilation
  – Air Leakage from 7 to 5 ACH50
  – Duct Leakage from 12 to 6% leakage to the outside
  – Efficient Lighting from 50 to 90%
  – Adopted ERI as written

• Did not update
  – Insulation levels from 2009 IECC
  – Kept multiple compliance options
Change in Energy Code

Minnesota Example
Minnesota Code Update

• Minnesota updated its energy code in 2015 from the 2006 to 2012 IECC
• Significant update - 27% efficiency improvement in baseline
• Would expect to see changes in construction practices, particularly with respect to mandatory energy code changes and utility programs
• Comparison between 2014 to 2016
Minnesota

Code Update – Key Changes

• Mandatory
  – Blower Door
    • 7 ACH50 – 3 ACH50
  – Duct Blaster
    • 8% to outside to 4% total leakage
  – Efficient Lighting
    • 0% to 75%

• Prescriptive
  – Wall insulation: R-19 to R-20
  – Window U-Factor: .35 to .32
• Strong Utility and Green Programs
  – Xcel Energy’s High Efficiency New Homes Program – Since 2012
  – Centerpoint Energy High Efficiency Homes Program – Since 2013
    • Above code – 10 – 50% above code
  – BATC MN Green Path – Since 2011
    • 1st Tier – HERS Rating
    • 2nd Tier – HERS < 55 + 25 additional points
    • 3rd Tier – HERS < 50 + 50 additional points
Increase in HERS Homes


- Nearly 2,000 more HERS homes in 2016 than 2014
Change in HERS Index


2014 Avg: 56
2016 Avg: 50
AGW Efficiency
MN: 2014

AGW Cavity Insulation (R-Value)

Meets prescriptive code requirement

2014 Avg: 19
AGW Efficiency

MN: 2016

AGW Cavity Insulation (R-Value)

% of Total Sum of Number of Homes

2016 Avg: 20

Meets prescriptive code requirement
Ceiling Efficiency

MN: 2014

2016 Avg: 41

Meets prescriptive code requirement
Ceiling Efficiency

MN: 2016

2016 Avg: 49

Meets prescriptive code requirement

Ceiling Insulation (R-Value)

% of Total Sum of Number of Homes

50%
40%
30%
20%
10%
0%

28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60
Efficient Lighting

MN: 2016

High Efficacy Lights (%)

2016 Avg: 82

Meets mandatory code requirement
Window U-Factor

MN: 2014

Window Efficiency (U-Factor)

2014 Avg: 0.30

Meets prescriptive code requirement

% of Total Sum of Number of Homes

0% 5% 10% 15% 20% 25%

0.37 0.36 0.35 0.34 0.33 0.32 0.31 0.3 0.29 0.28 0.27 0.26 0.25 0.23
Window U-Factor

MN: 2016

Window Efficiency (U-Factor)

Meets prescriptive code requirement

2016 Avg: .295
Furnace Efficiency

MN: 2014

2014 Avg: 93
Furnace Efficiency

2016 Avg: 93.5
Other Measures

Little to no change

<table>
<thead>
<tr>
<th>Measure</th>
<th>2014 (Avg)</th>
<th>2016 (Avg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sq. Ft.</td>
<td>4,000</td>
<td>3,700</td>
</tr>
<tr>
<td>Bedrooms</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Window U-Factor</td>
<td>U-.30</td>
<td>U-.295</td>
</tr>
<tr>
<td>ACH50</td>
<td>1.5</td>
<td>1.6</td>
</tr>
<tr>
<td>Duct Leakage</td>
<td>1.2</td>
<td>1.1</td>
</tr>
<tr>
<td>AC Efficiency</td>
<td>13.1</td>
<td>13.2</td>
</tr>
<tr>
<td>Furnace Efficiency</td>
<td>93</td>
<td>93.5</td>
</tr>
<tr>
<td>Energy Star</td>
<td>75%</td>
<td>72%</td>
</tr>
</tbody>
</table>
Utility Programs

Iowa
Iowa Utility Programs
New Home Construction 14-16

• Alliant New Home Program
  – Builder Option Package
    • Reqs. Heating ≥ 94 AFUE; Cooling ≥ 15 SEER; SAVE
  – Advanced Performance
    • HERS 57 or lower; SAVE
  – High-Performance
    • HERS 52 or lower; SAVE
  – HERS Score Bonus
    • HERS 47, 42 or less

• Mid American New Home Program
  – Energy Star Certified
  – Advanced Building Option
    • HERS 57 or lower; 70 HVAC Save score
HERS Homes IA
Average Score by Zip
HERS Index Iowa
Score by Year

HERS ≤ 57: 65%
60% Homes:
≥ 94 AFUE;
≥ 15 SEER
Other Research

Comparing HERS to DOE study homes
Comparing Field Tested Homes

HERS vs Baseline Study

• **Goal of Study:** Conduct an energy code component analysis of “typical” and HERS rated homes in Kentucky to determine:
  – Key similarities and differences
  – Level of efficiency by component
  – Comparison to the 2009 IECC (state code) prescriptive and mandatory measures
KY - DOE Residential Field Study

- Single Family Homes
- Data collection started in 2015
- Multi-phase Compliance Study:
  - Phase I - Data Collection/Analysis
  - Phase II - Compliance Intervention
  - Phase III - Data Collection/Analysis
- Data collected by field technicians
- 8 key items+ – highest energy impact
- Visited 140 homes
  - Collected 63 complete datasets
- All used prescriptive path to comply
Background

KY - Home Energy Rating System Data

• RESNET provided consistent HERS data from 2014-2016 (used 2015 data)
• Single-Family
• Dataset includes home components that significantly affect energy use
• Data collected by certified raters
• Includes 8 key items +
• 1,616 HERS Homes ~ 24% of permitted homes in 2015
## Home Characteristics
### Averages: Baseline vs HERS

<table>
<thead>
<tr>
<th>General Characteristic</th>
<th>Specific Characteristic</th>
<th>Baseline Homes</th>
<th>HERS Homes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conditioned Size</strong></td>
<td>Square Feet</td>
<td>2,433</td>
<td>2,881</td>
</tr>
<tr>
<td><strong>Foundation Insulation</strong></td>
<td>Cont. (R-Value)</td>
<td>3.9</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>Cavity (R-Value)</td>
<td>8.5</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Wall Insulation</strong></td>
<td>Cont. (R-Value)</td>
<td>0.5</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>Cavity (R-Value)</td>
<td>13.9</td>
<td>15.1</td>
</tr>
<tr>
<td></td>
<td>Quality (1-3)</td>
<td>1.8</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Ceiling Insulation</strong></td>
<td>Cont. (R-Value)</td>
<td>37.7</td>
<td>37.2</td>
</tr>
<tr>
<td></td>
<td>Quality (1-3)</td>
<td>1.6</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Window</strong></td>
<td>Efficiency (U-Factor)</td>
<td>0.32</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>Glazing (SHGC)</td>
<td>0.26</td>
<td>0.27</td>
</tr>
<tr>
<td><strong>Air Leakage</strong></td>
<td>Leakage Rate (ACH50)</td>
<td>5.6</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>Duct Location</strong></td>
<td>Conditioned (%)</td>
<td>27.3</td>
<td>51.4</td>
</tr>
<tr>
<td><strong>Efficient Lights</strong></td>
<td>HEL (%)</td>
<td>33</td>
<td>49</td>
</tr>
<tr>
<td><strong>Equipment Efficiency</strong></td>
<td>AC (SEER)</td>
<td>13.6</td>
<td>13.9</td>
</tr>
<tr>
<td></td>
<td>Furnace (AFUE)</td>
<td>89.4</td>
<td>93.0</td>
</tr>
</tbody>
</table>
HERS compare to code homes?

Kentucky

• On average, HERS homes have more efficient components than Baseline homes
  – Insulation Grade, Air Sealing, Duct Location, and Furnace Efficiency demonstrate biggest distinctions

• HERS homes were larger on average
  – Using more resources/energy

• Ventilation is an area of concern in both homes
Conclusions
Key Takeaways

- States with highest HERS market penetration have utility program and state energy code
- Energy Codes, utility programs, local policies all impact HERS homes
- Data can be very useful to understand and inform these programs and policies
• Continue to collect and analyze data each year
• Use it to understand impacts from new energy codes and changes in programs
  – What will happen with changes in Iowa?
  – What about Pay for Performance programs?
• Dig deeper into what influences and grows the HERS industry and ratings
Questions?
Thank you!

Ian Blanding
Building Policy Manager
Midwest Energy Efficiency Alliance
iblanding@mwalliance.org