

2014 Building America Webinar Series



# Standardized Retrofit Packages – What Works to Meet Consistent Levels of Performance:

## *Midwest Energy Efficiency Alliance*

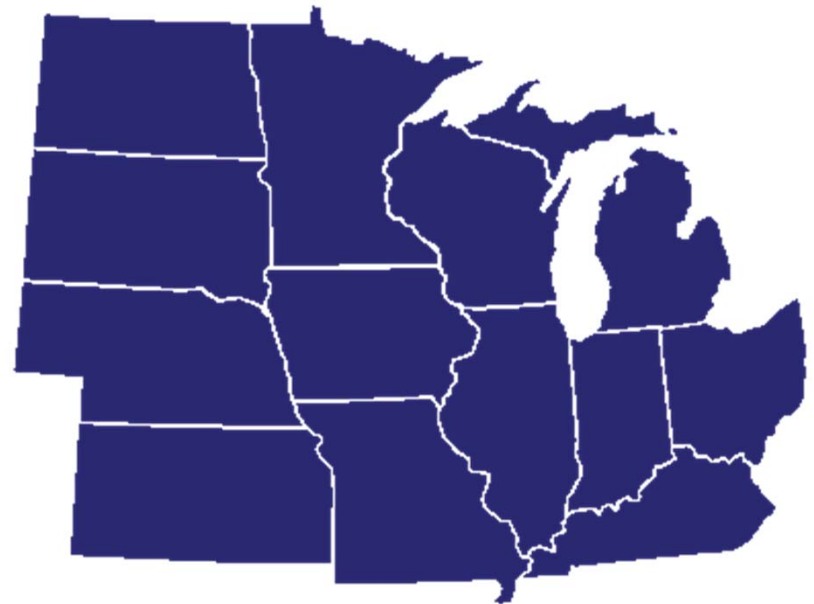
Scott Yee  
March 19<sup>th</sup>, 2014



# Midwest Energy Efficiency Alliance (MEEA)

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MEEA is a collaborative network whose purpose is to advance energy efficiency to support sustainable economic development and environmental preservation.



# Partnership for Advanced Residential Retrofit (PARR)

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The Partnership for Advanced Residential Retrofit (PARR) team applies strong experience in design, development, integration, and testing of advanced building energy equipment, components and systems in laboratory and test house settings to improve performance, quality and market acceptance of whole house residential energy efficiency retrofits in cold climates.



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*Evaluation of Missed Energy Saving Opportunity Based on  
Illinois Home Performance (IHP) Program Field Data:  
Homeowner Selected Upgrades vs. Cost-Optimized  
Solutions*

# Context

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- The five-county Chicagoland region contains over 3.3 million homes, many of which are aging, energy intensive, and costly for homeowners to maintain.
- Substantial energy savings potential exists, but scalability of residential energy efficiency programs remains a problem.
- Goal: Use robust programmatic retrofit data to evaluate the energy savings potential of standardized retrofit archetypes and measure packages

# Illinois Home Performance Basics

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- Illinois' version of national Home Performance with ENERGY STAR® program
- Statewide platform for whole home retrofit programs
- Existing, 1-4 unit homes throughout Illinois with no income eligibility criteria
- Provide support for current whole home work
- Results in Illinois Home Performance with ENERGY STAR Silver and Gold certifications
- IL DCEO grant with ratepayer funding




# Research Questions


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- How do modeled optimal energy savings for each housing type compare to the energy savings derived from typically installed measure packages for that housing type?
- What are the characteristics of retrofits currently occurring under the IHP program platform in Northern Illinois?
- How do large data sets help explain homeowner decision making behavior and energy savings objectives?
- What housing types should existing programs focus on to provide maximum cost effective energy savings?


# Technical Approach

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- Identify data from the first 800 Illinois Home Performance homes
  - Collect pre and post retrofit data for all 800 homes

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- Assign each home to one of fifteen archetypes derived from Chicagoland Characterization Study (Spanier et al., 2012)
  - Aggregate the measure level data by frequency and housing archetype

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- Model energy savings of three scenarios:
    - *Baseline (no measures) energy consumption*
    - *Illinois Home Performance common measures*
    - *BEopt cost optimized recommended measures*

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- Evaluate the energy savings of common archetype-level measure packages
  - Compare Illinois Home Performance measure packages with cost optimal measure packages



# Technical Approach

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- Technical approach limitations and areas not fully resolved:
  - International Energy Conservation Code was not considered in cost optimized measure package recommendations
  - Specific measure recommendations are only applicable to single family homes in the Chicagoland area.

# Technical Approach

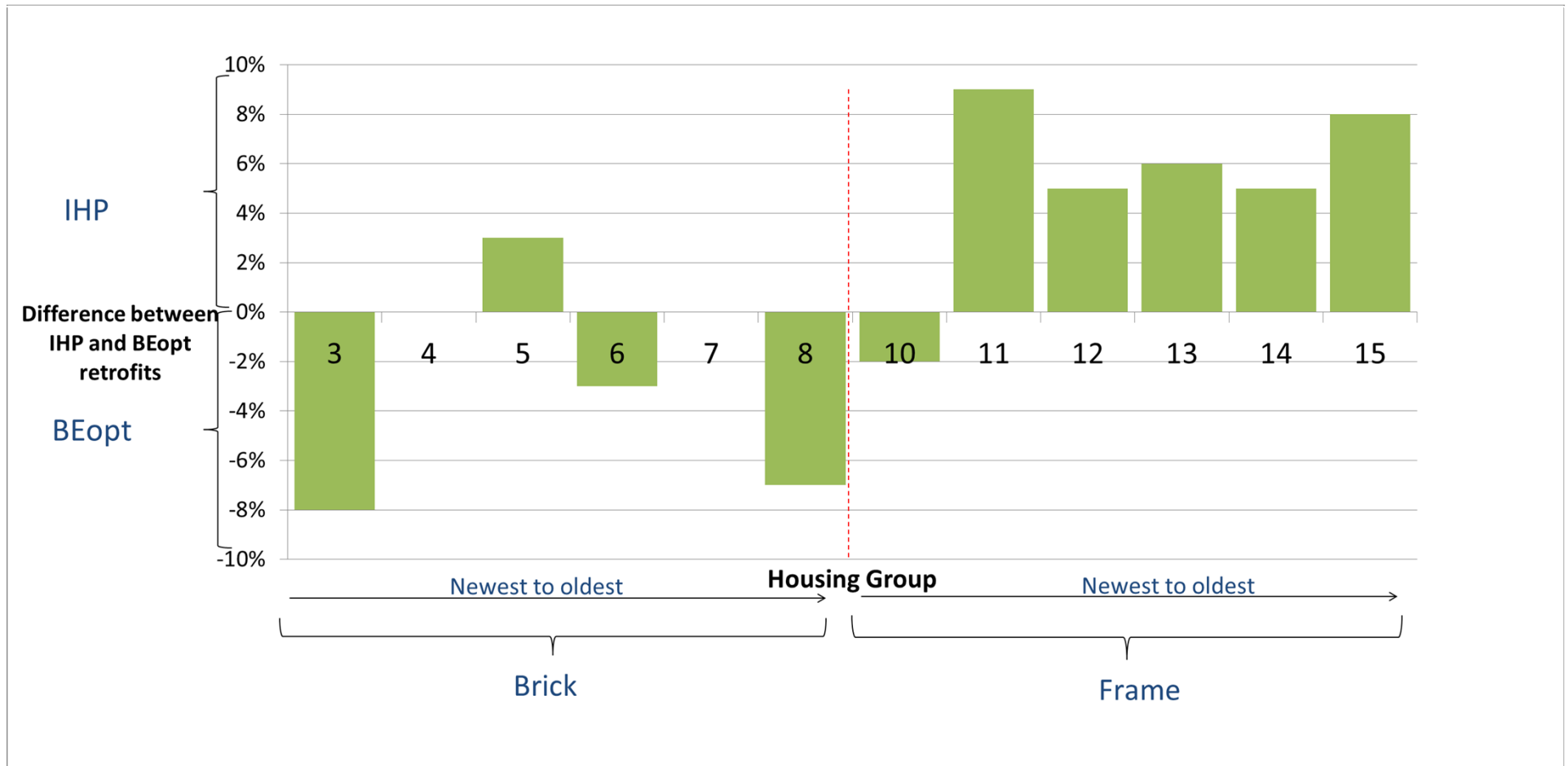
## *Illinois Home Performance measure packages*

Measures	Housing Group												Total
	3	4	5	6	7	8	10	11	12	13	14	15	
Air sealing	x	x	x	x	x	x	x	x	x	x	x	x	12
Attic insulation	x	x	x	x	x	x	x	x	x	x	x	x	12
Exterior wall insulation									x	x	x	x	4
"Crawlspace insulation"					x		x	x		x	x		5
Exhaust fans vented to exterior		x			x					x	x	x	5
Programmable thermostat installed					x								1
Furnace replacement					x								1
Ducts sealed					x								1
<b>Total</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>7</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>5</b>	<b>4</b>	

## *BEopt cost optimal measure packages*

Measures	Housing Group												Total
	3	4	5	6	7	8	10	11	12	13	14	15	
Air sealing	x	x	x		x	x	x	x	x	x	x	x	11
Attic insulation			x	x		x	x		x	x	x	x	8
Furnace replacement	x		x	x	x	x	x			x	x	x	9
Water heater		x		x	x	x	x	x			x	x	8
<b>Total</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>4</b>	

# Results



# Technical Approach

*Air Sealing*



*Attic Insulation*



*Efficient Heating  
(Furnace/Boiler)*



*Efficient Water Heater*



**Housing  
Group 7**

**98%** of IHP projects completed this measure

*Not recommended by  
BEopt*

**3%** of IHP projects completed this measure

**0%** of IHP projects completed this measure

**Housing  
Group 12**

**100%** of IHP projects completed this measure

**93%** of IHP projects completed this measure

*Not recommended by  
BEopt*

*Not recommended by  
BEopt*

**Housing  
Group 14**

**100%** of IHP projects completed this measure

**91%** of IHP projects completed this measure

**5%** of IHP projects completed this measure

**0%** of IHP projects completed this measure

# Recommended Guidance

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- Assigning common retrofit measure packages to housing archetypes is possible.
- Energy savings associated with common IHP retrofit measure packages can and often do exceed cost-optimized measure packages.
- Basing IHP retrofit measure packages on pre-assigned archetypes may generate equivalent or greater energy savings than cost-optimized measure packages.

# Value

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1. Development of regional housing archetypes is possible using home vintage and construction type.
2. Installed retrofit measure packages, based on home energy audits, are often very similar for each archetype.
3. Large sets of home performance data can help identify effective patterns and best practices in retrofit measure selection.
4. Correlating exact retrofit measure packages based on housing archetypes may help reduce audit and administration time.

# Market Readiness

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- The procedure for developing common retrofit packages and matching the packages to archetypes is market ready, but largely dependent on utility program planners.
- The methodology and framework used to develop housing archetypes is available from the DOE solution center.
  - *Spanier, J. Scheu, R., Brand, L., & Yang, J. “Chicagoland Single Family Housing Characterization.” U.S. Department of Energy: Energy Efficiency & Renewable Energy. DOE/GO-102012-3604. June 2012.*
- Technical report documenting the methodology used to evaluate common IHP retrofit measure packages is currently in peer review and expected to be released late Spring 2014.
  - *Yee, S., Milby, M., & Baker, W. “DRAFT Technical Report: Evaluation of Missed Energy Saving Opportunity Based on Illinois Home Performance (IHP) Program Field Data: Homeowner Selected Upgrades vs. Cost-Optimized Solutions” Expected availability – Spring 2014*

# Pros and Cons

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- Pros
  - Reduce or potentially eliminate the pre-retrofit audit time
  - Improve the total volume of high performance retrofits
  - Improve total energy savings associated with existing home retrofits programs
  - Retrofit measure package standardization may allow participating contractors to develop unique skill sets related to certain building types
- Cons
  - Lack of retrofit customization and specificity
  - Largely dependent on regional retrofit demographics and Research methodology



# References

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