Ameren Missouri Energy Codes Compliance Collaborative

Ian Blanding
Program Manager
Residential Energy Code Support Program

Safety 101: The Do's and Don'ts of Elevator Safety

Do:

- Watch your step when getting in or out to avoid tripping.
- Stay calm if you find yourself stuck in an elevator. Use the alarm button or emergency contact button to get help.
- Stay in a stuck elevator – don't attempt to pry open the doors. Stay quiet and wait for safety instructions.

Don't:

- *Use an elevator in the event of a fire. Take the stairs instead.*
- *Get on an overly crowded elevator*
- *Rest on or push against door*

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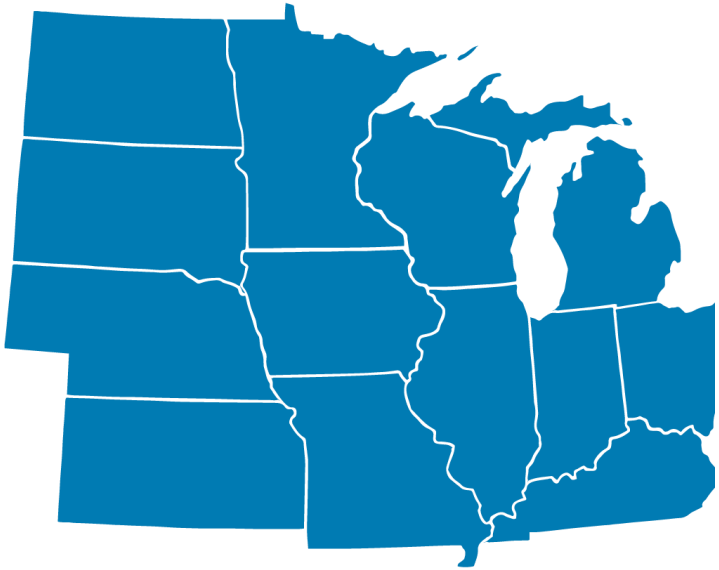
Agenda

- Introductions
- About the Ameren Residential Energy Code Support Program
- Findings from MO Baseline Study
- Discussion | Goals of the Collaborative
- Discussion | Compliance Challenges
- Next Steps
- Lunch and Networking

About MEEA

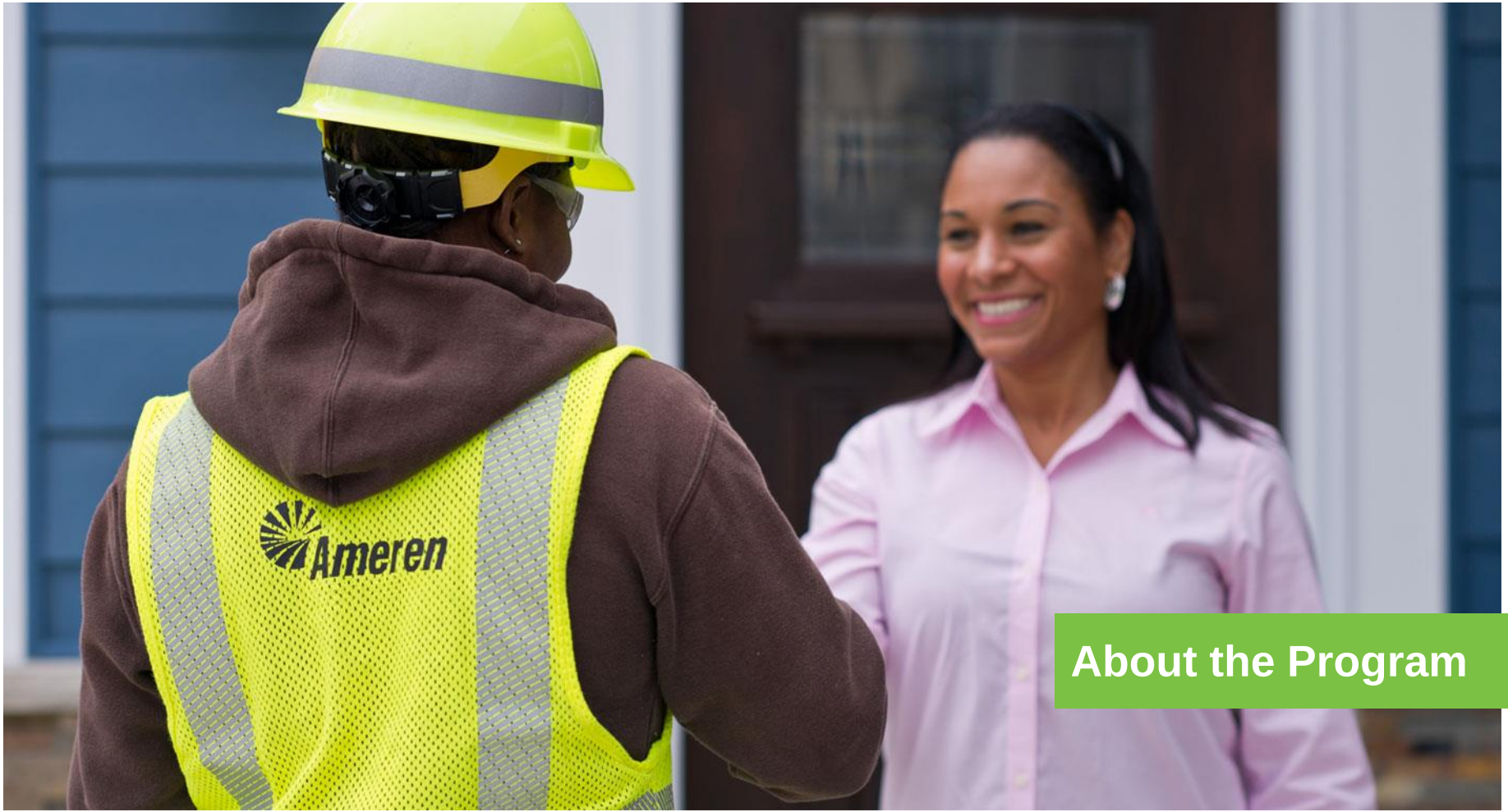
- We are a nonprofit membership organization with 160+ members including:
  - Utilities
  - Research Institutions and advocacy organizations
  - State and local governments
  - Energy efficiency-related businesses

- 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



Introductions

- First, let’s get to know each other!
  - Name
  - Job Title and Employer
  - Location of Workplace
  - How do you interact with your local energy code?



About the Program

Ameren Residential Energy Code Support Program

- What?
  - A 3-year comprehensive program funded by Ameren Missouri to improve understanding and support compliance with local residential energy codes.
- Why?
  - Currently resources and training on local residential energy codes are limited. Better understanding of codes = improved compliance = more efficient construction = greater customer satisfaction
- How?
  - Collaborative Discussion, Proactive Engagement, In-Person Training, Useful Resources

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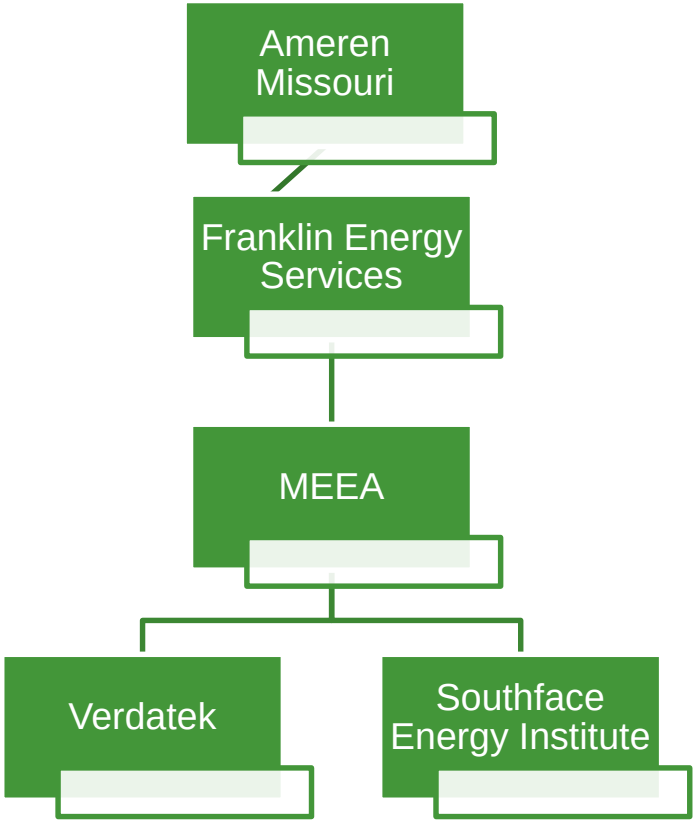
Background

- MEEA managed a statewide residential energy code baseline study funded by Missouri Division of Energy
- Baseline study surveyed residential construction practices (2016) relative to the energy code
- Five key opportunities for improved compliance were identified
- Ameren Missouri included a code support program in their 3 year filing
- MEEA developed the program and hired a team

The Team


Ameren Missouri
Franklin Energy Services
MEEA
Verdatek
Southface Energy Institute

Overview of Program

- Code Compliance Collaborative
  - Opportunity for residential construction professionals to discuss opportunities and barriers to energy code compliance
- In-Field Code Consultant
  - Proactively engages building industry to educate, investigate and improve energy code understanding in a small group or 1-on-1 setting
- In-Person Classroom Training
  - Full day training focused on the what, why and how of the residential energy code

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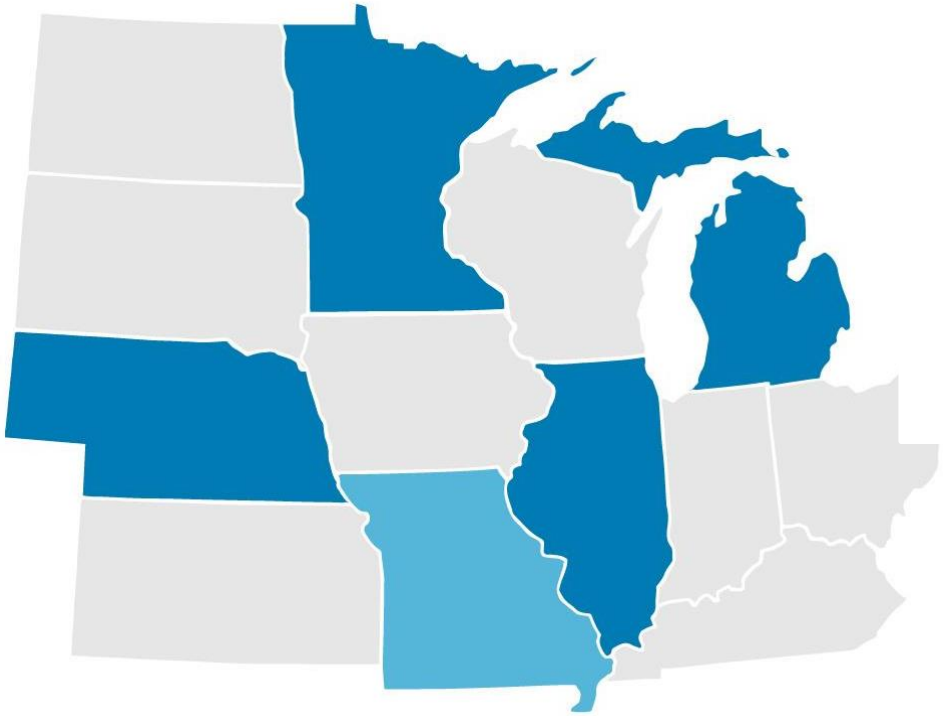
Collaborative

- Who
  - A group of stakeholders that come together on a regular basis to explore common interests and address obstacles related to energy code compliance.
  - Open to everyone involved in any aspect of residential construction
- Why
  - To establish a neutral, cooperative forum for identifying and tackling obstacles to improving energy code compliance.

Collaborative Outcomes

- Improved ease and rates of compliance
- Identification and coordination of support activities and incentives
- Increased education/training opportunities
- Opportunity to learn from shared experiences
- Collective understanding of code interpretations and verification
- Awareness of common practices, compliance rates and opportunities for improvement

Collaborative Examples



Active collaborative

In development

Circuit Rider/Energy Code Consultant

- Qualified expert on energy codes travels to all parts of Ameren Missouri territory on a regular basis
- Proactively engages building industry to provide individualized, targeted training and assistance
- Engages all residential building industry stakeholders (builders, code officials, raters, architects, supply houses, realtors, appraisers)
- Provides information about available trainings, online resources and energy code guidance

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Matt Belcher – Energy Code Consultant

- Owner Verdatek Solutions, LLC
- Nationally recognized builder/developer/consultant
- Three decades of building experience
- Current builder and former code official
- Member of NAHB, ICC, GBI

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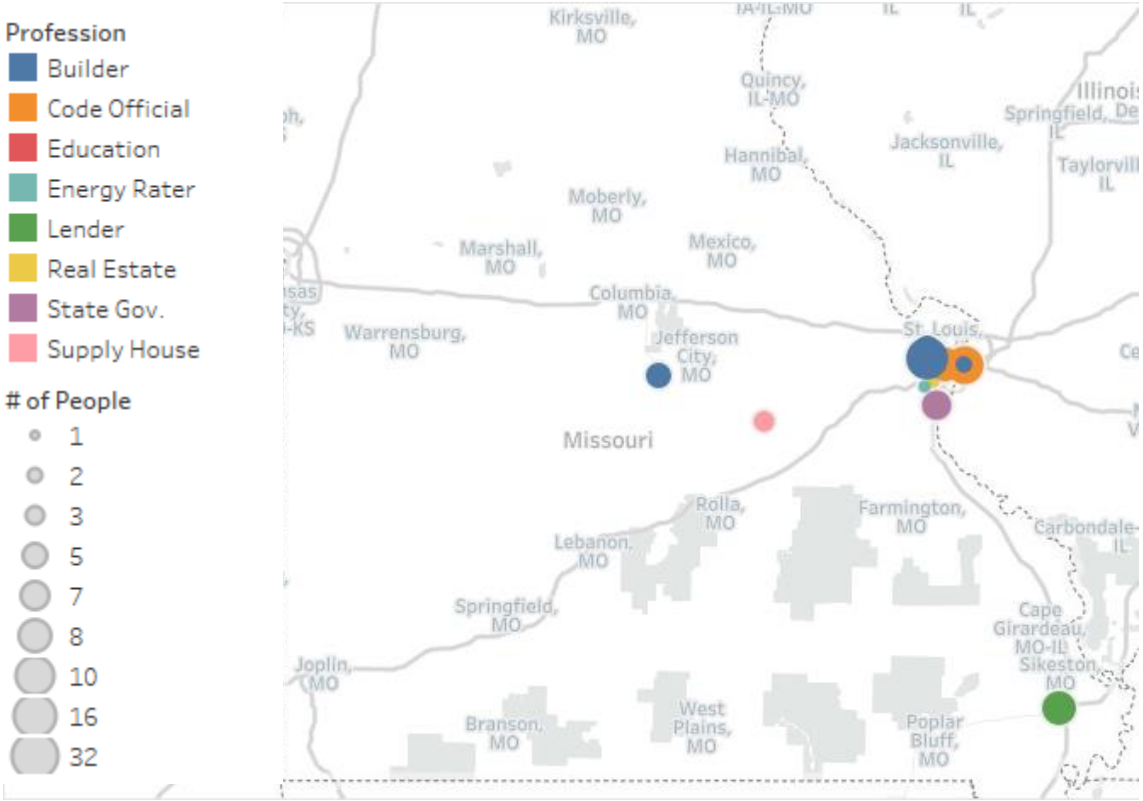
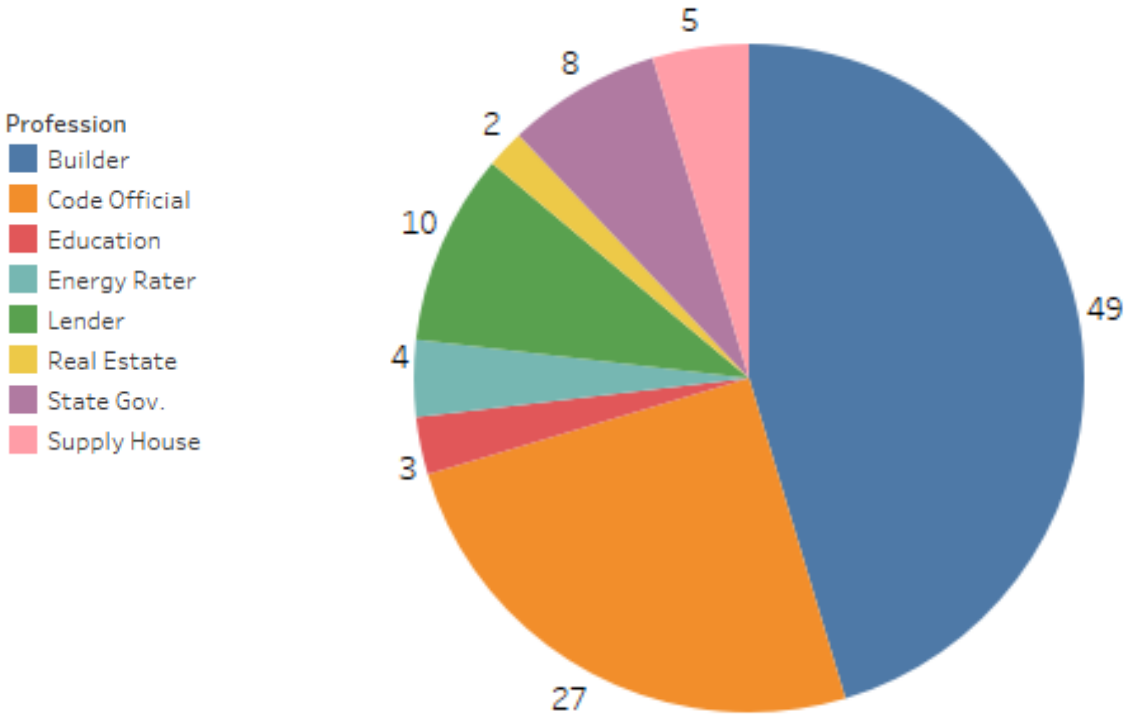
Energy Code Consultant - Report



Energy Code Consultant - Report



Matt's Contact Information

Matt Belcher
Energy Code Consultant
(314) 749-4189
matt@moenergycodesupport.org

In-person Training

- Statewide baseline study identified five key areas of compliance improvement opportunities
- Curriculum is being developed and will be refined throughout the program in response to attendee feedback and energy code developments
- In addition to explaining energy code requirements, trainings will also describe building science concepts related to the energy code
- It’s critical to not only focus on what is required, but the rationale (building science) behind the requirements

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Expert Trainers - Southface Energy Institute

- Over 40 years of experience promoting sustainable homes, communities, and workplaces through education, research, advocacy and technical assistance
- The Southface Education and Training team develops in-person, online, and hands-on training and skill development opportunities for the next generation of the regenerative economy workforce.
- Currently developing customized curriculum for 4 in-person trainings in PY 1, and 8 trainings in each subsequent program year

In-Person Training – Schedule

May Trainings

- May 21, 9:00am – 3:00pm
  Earthways Center
  St. Louis, MO

- May 22, 9:00am – 3:00pm
  HBA of Central Missouri
  Jefferson City, MO

August Trainings

- August 20, 9:00am – 3:00pm
  HBA of St. Louis & Eastern Missouri
  St. Louis, MO

- August 21, 9:00am – 3:00pm
  TBD
  Sikeston, MO

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Resources

- Key educational resources and handouts will be developed to supplement training and engagement
- Handouts currently available include:
  - *About the Program*
  - *Training Flyer*
  - *Collaborative Flyer*
  - *Builder Guide – Tips for Energy Code Compliance*
  - *Guide to proper Insulation Installation*

Resources

- Handouts in progress:
  - *Code Compliance Checklist*
  - *Air Sealing, Moisture, Ventilation – House as a system*
  - *Guide to Efficient Lighting*
  - *Guide to HVAC Sizing*
  - *Guide to Basement Insulation*
  - *Guide to Duct Sealing*

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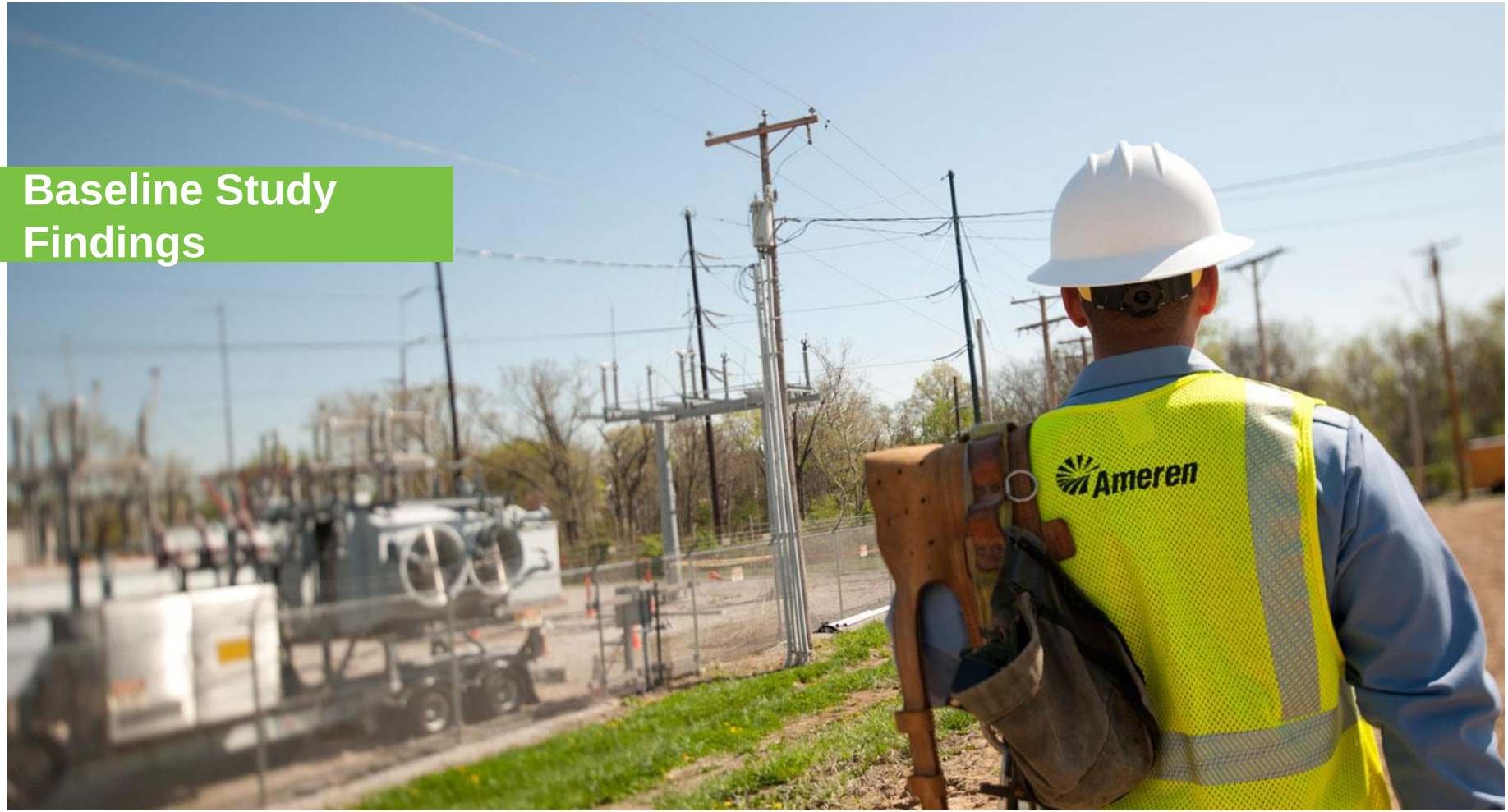
Baseline Study Findings



Goals and Rationale of Study

- Comply with American Recovery and Reinvestment Act (ARRA) requirements
- Establish residential energy code compliance baseline
- Determine potential energy savings from improved compliance
- 1-year, statewide study focused on new, never occupied single family homes
- Study was funded by Division of Energy and led by MEEA
- Data collection was conducted March - June 2016

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Goals and Rationale of Study

Sampling Plan

- First step was to create a randomized sampling plan
- Sampling distribution determined by random drawing of all single family permits from across the state (US census data)
- Survey focused on high-impact energy measures
- Minimum # of required observations calculated by PNNL to ensure statistical significance of results
- Used in-state project manager (Matt Belcher) to facilitate outreach and building recruitment
- In-field data collection was performed by The Cadmus Group

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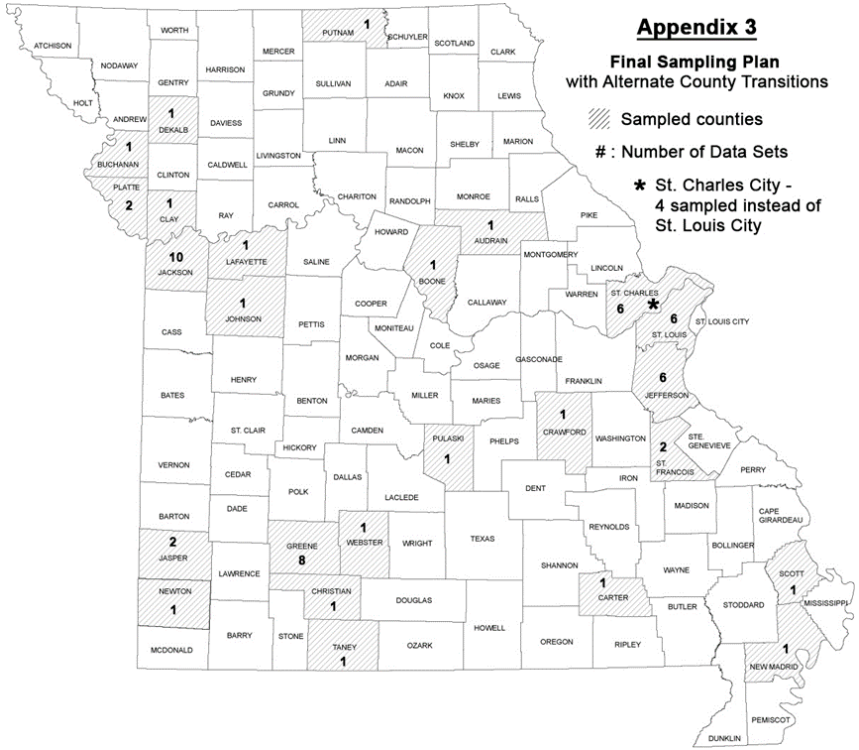
Goals and Rationale of Study

Sampling Plan



Goals and Rationale of Study

Data Collection Methodology

- Each site visited only once (Either at insulation stage or at final)
- Observations were focused on key individual measures – not whole house
- 63 observations of each of 8 key measure (data sets)
- Locations for data collection were randomly selected and binned by county. (based on all permits issued statewide)
- Collected data from each site visit then inputted into Department of Energy designed database
- Pacific Northwest National Laboratory (PNNL) analyzed the inputs and determined potential energy savings from improved compliance

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Goals and Rationale of Study
Data Collection Key Items

Measures Typically Collected at Insulation Stage

- Exterior wall insulation R-value and *quality*
- Foundation wall insulation R-value and *quality*
- Floor insulation R-value and *quality*
- Air sealing. Sealing on all penetrations in the building envelope including around windows, plumbing penetrations, utility penetrations, etc.
- Duct insulation R-value
- Window efficiency (U-factor)
- Window Solar Heat Gain Coefficient (SHGC)
- Air handler system information (e.g. furnace or heat pump)

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Goals and Rationale of Study

Data Collection Key Items

Measures Typically Collected at Final Stage

- Ceiling insulation R-value and *quality*
- High efficacy lighting
- Envelope tightness – Air Changes per Hour at 50 Pascals (ACH50), aka Blower Door Test
- Duct Leakage – Cubic Feet per Minute at 25 Pascals (CFM25), aka Duct Blaster Test
- Additional information on the air handler and cooling system sizes

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Key Item Analysis

Methodology

- Methodology was designed to determine the energy impact of non-compliance to a statistical significance
- Methodology provides a projection of savings associated with improved compliance
- Focused on components with largest direct impact on energy consumption (*key items*)
- Limited to new, never occupied, single family homes
- Actual observations must be made – no assumed default values
- Ultimately 127 homes were visited to create the 63 data sets

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Key Item Analysis
Methodology

- Key items with more than 15% non-compliant observations were selected for the savings analysis
- The six measures selected for savings analysis were, in order of greatest potential savings:
  - Basement Wall Insulation
  - Duct Leakage
  - High Efficacy Lighting
  - Above Grade Wall Insulation
  - Window U-Factor
  - Ceiling Insulation

Key Item Analysis

Methodology

- Energy simulations were conducted using EnergyPlus software
- Each non-compliant measure was analyzed separately
- Each non-compliant value was modeled individually
- All other components were maintained at the corresponding prescriptive code value, allowing for the savings potential associated with a key item to be evaluated in isolation
- All values on the following charts to the left of the vertical line are non-compliant values

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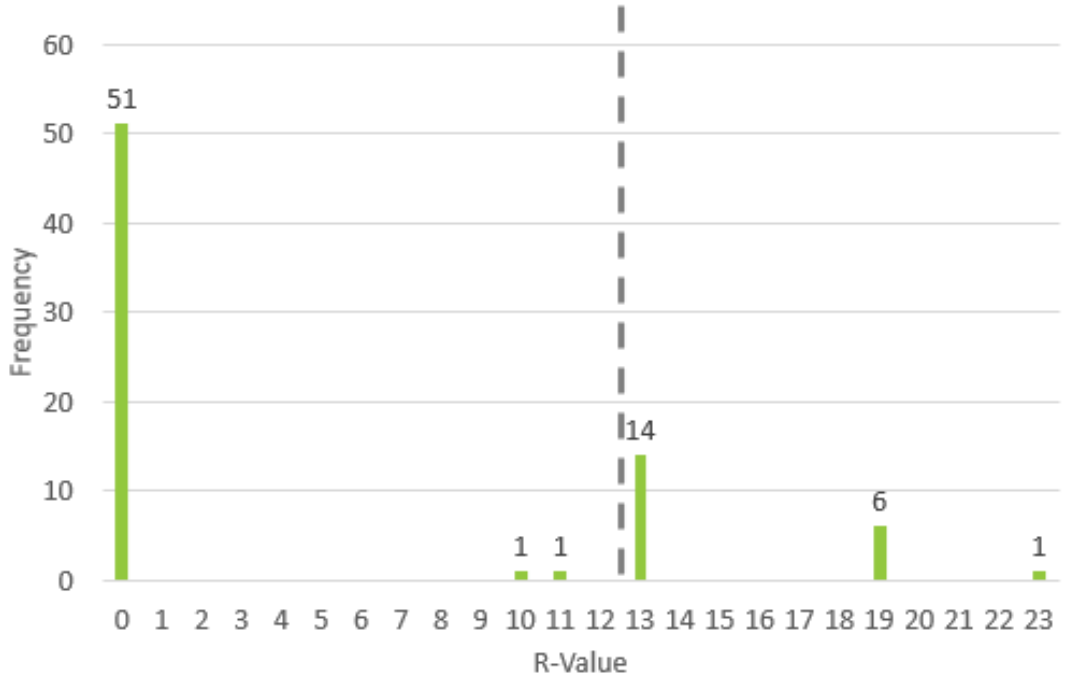
Basement Wall Insulation

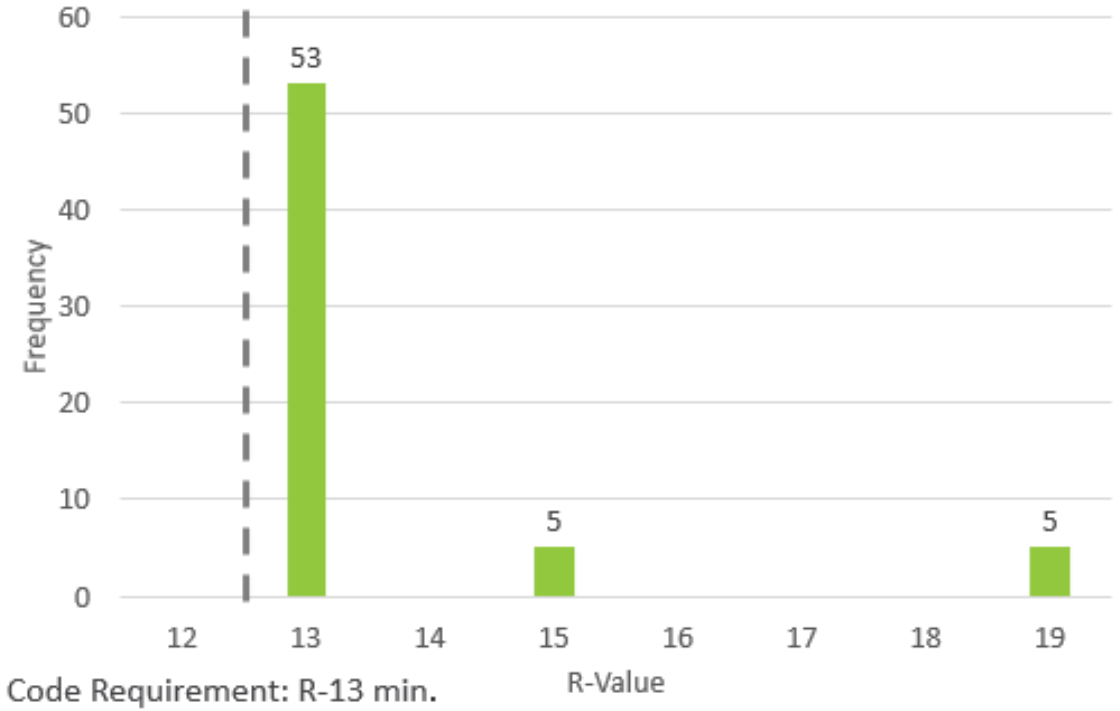
R-Value



Code Requirement: R-13 min.

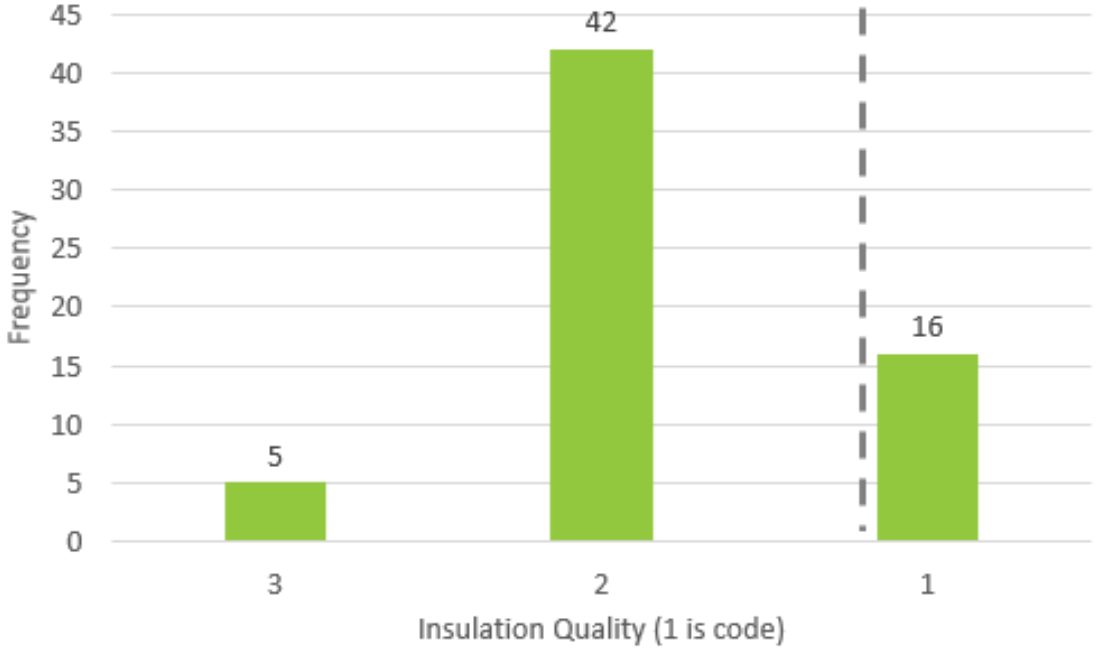
Exterior Wall Insulation

R-Value



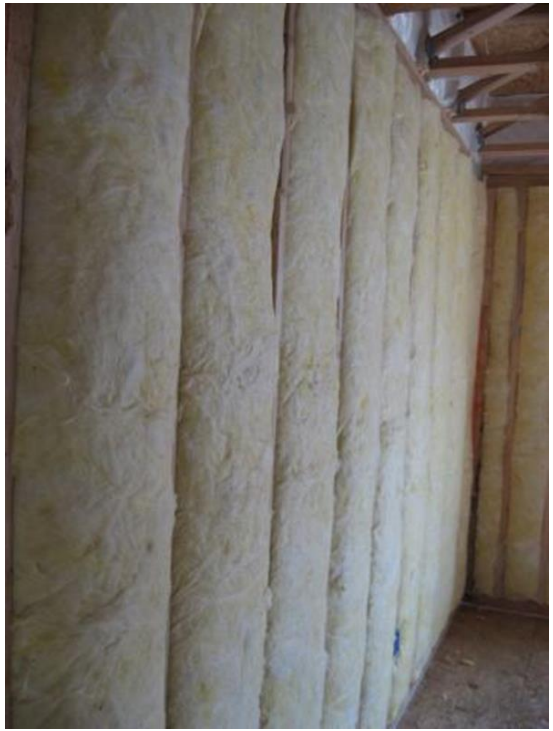
Exterior Wall Insulation

Insulation Quality



Insulation Quality

Level 1 = Code

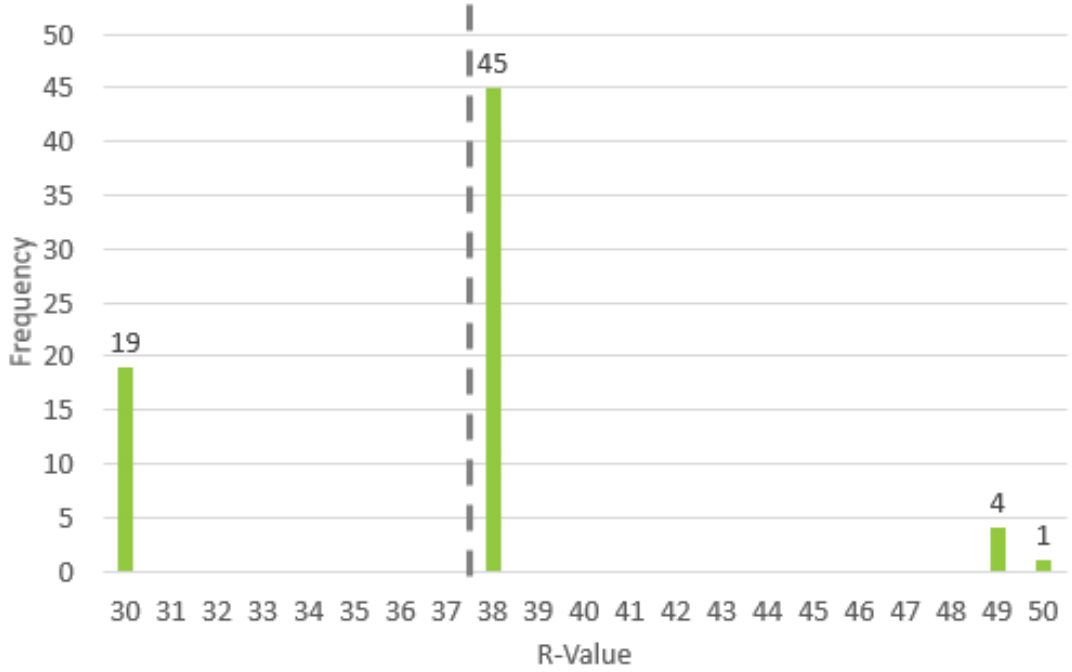


Insulation Quality

Level 3 = Not Code

Ceiling Insulation

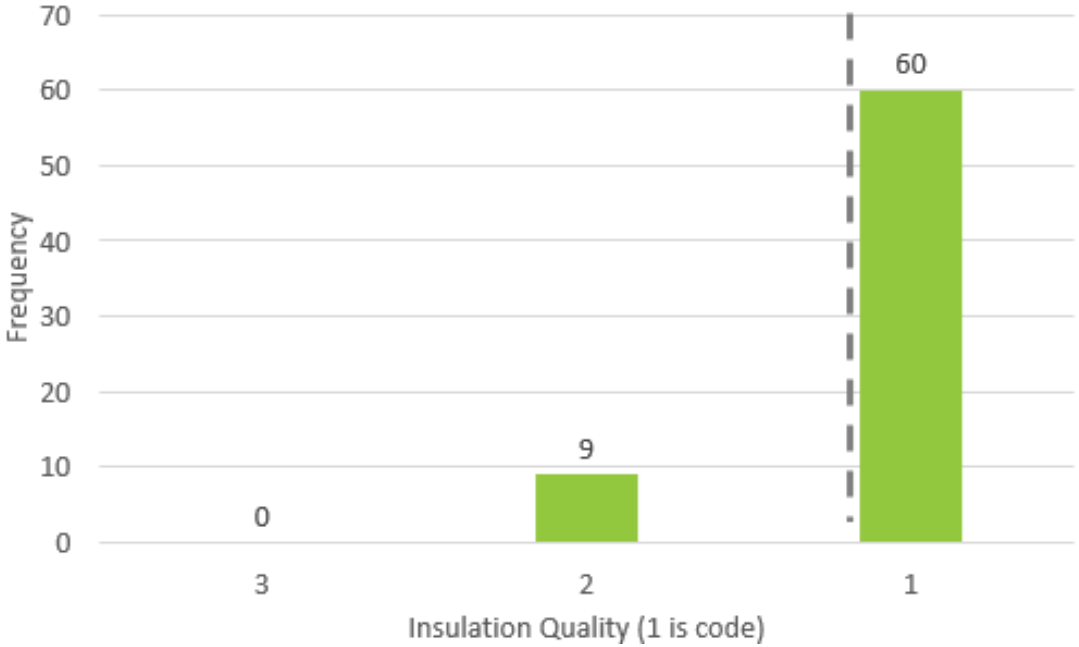
R-Value



Code Requirement: R-38 min.

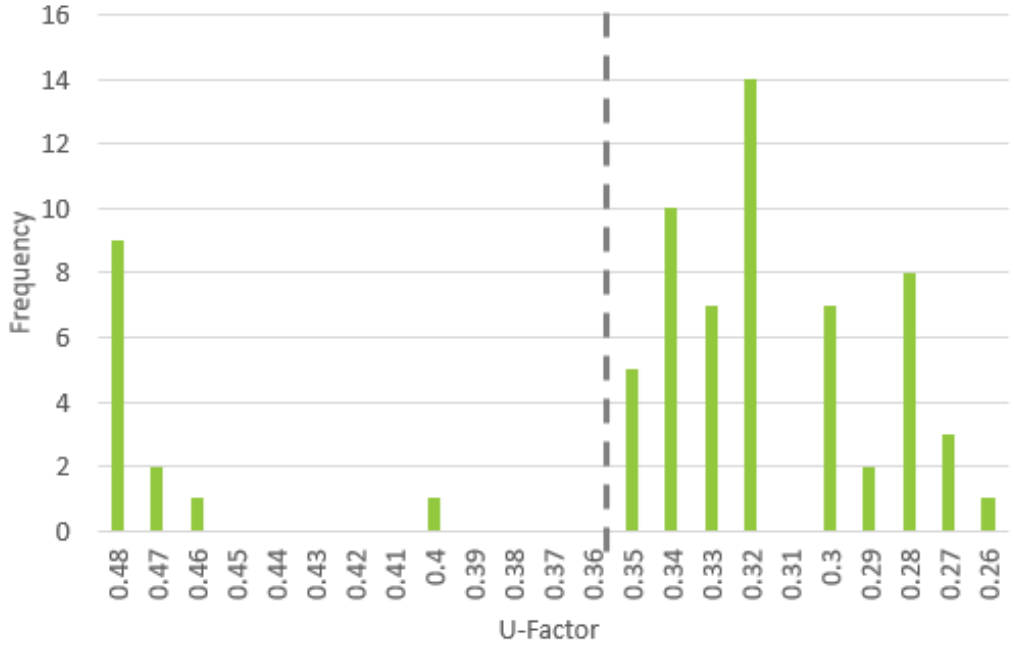
Ceiling Insulation

Insulation Quality



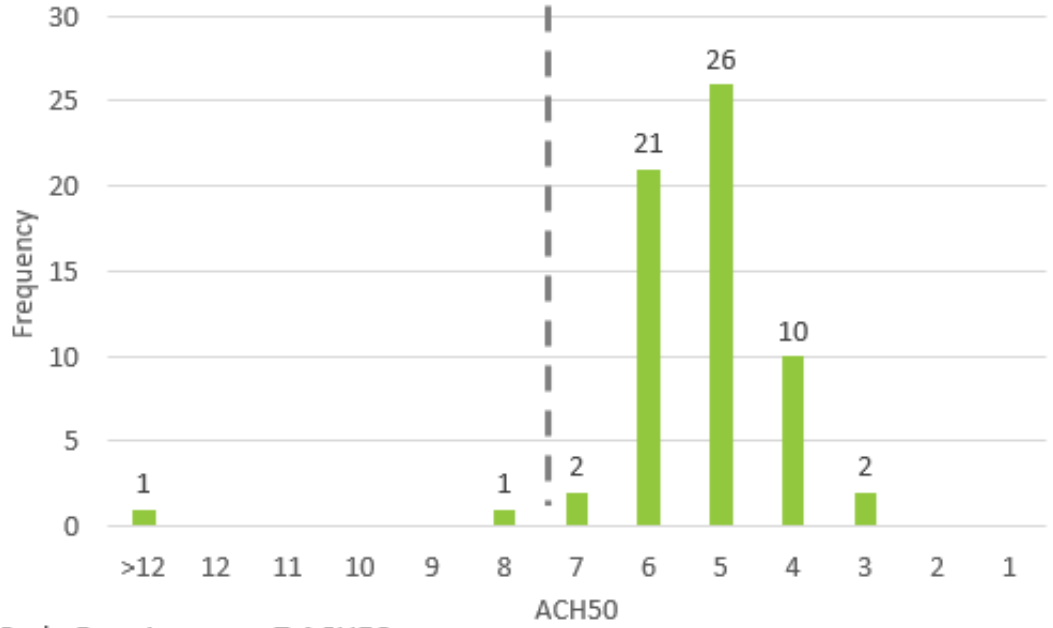
Window Efficiency

U-Factor



Code Requirement: U=.35 max.

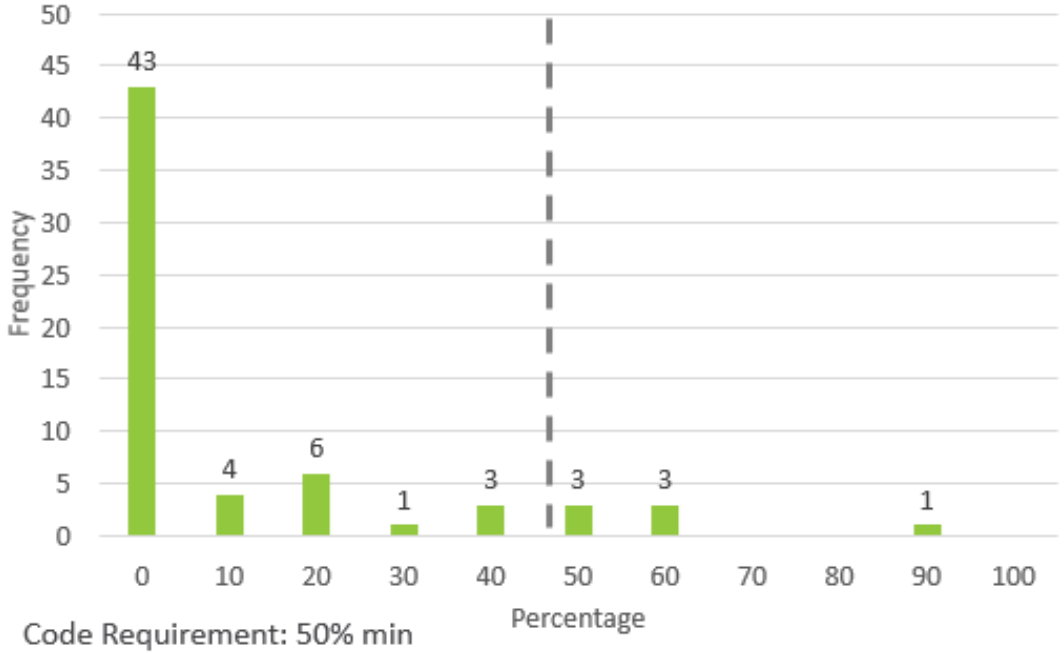
Air Sealing
Leakage Rate (ACH50)



Code Requirement: 7 ACH50 max

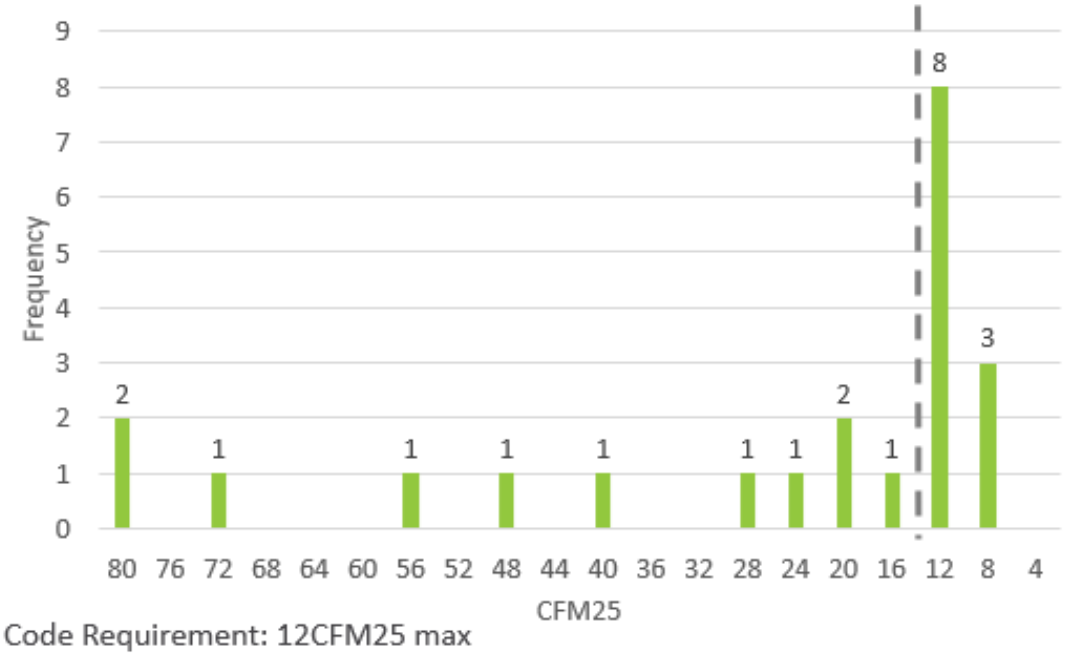
Lighting Efficacy

High Efficacy Lighting (%)



Duct Leakage – Unconditioned Space

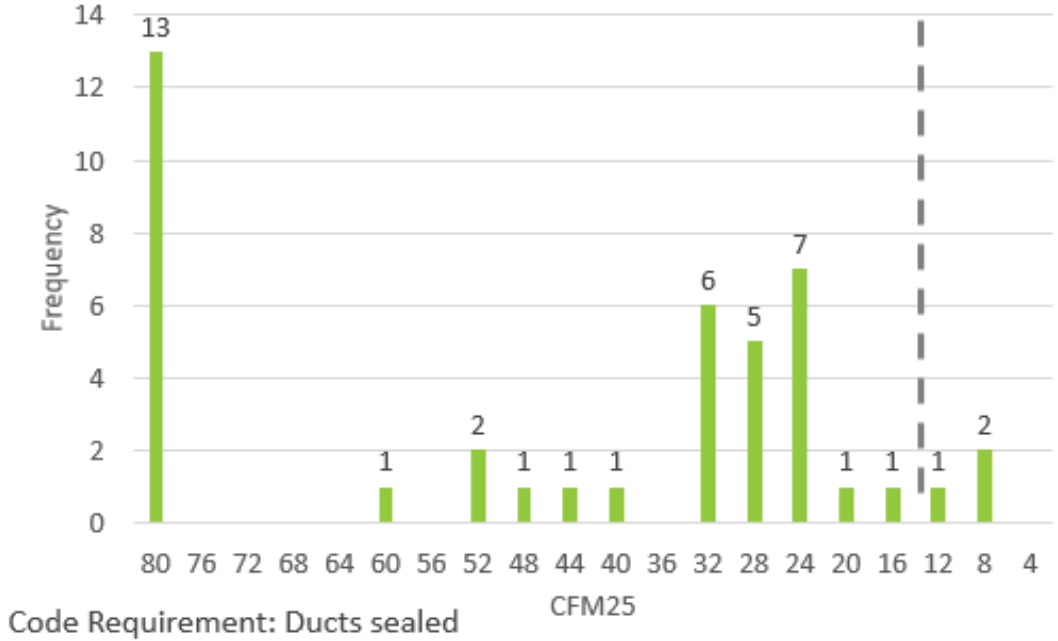
Duct Leakage (CFM25/100 sq. ft.)



Code Requirement: 12CFM25 max

Duct Leakage – Conditioned Space

Duct Leakage (CFM25/100 sq. ft.)



Potential Energy Savings (Annual)

Measure Level Savings

Measure	Electricity Savings (kWh at meter)	Natural Gas Savings (therms)	Energy Savings (MMBtu)	Electricity Savings	Natural Gas Savings (dollars)	Energy Cost Savings (dollars)
Basement Wall Insulation	732,822	847,765	87,277	$89,990	$971,746	$1,061,737
Duct Leakage	3,706,493	400,964	52,743	$455,157	$459,603	$914,760
Lighting Efficacy	4,830,095	-64,040	10,076	$593,136	$-73,405	$519,731
Wall Insulation	1,624,312	203,688	25,911	$199,466	$233,476	$432,942

Fuel Prices		
Electricity	0.12	$/kWh
Natural Gas	1.15	$/therm

# Homes	
CZ4	10,061
CZ5	278

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Potential Energy Savings (Annual)

Measure Level Savings

Measure	Electricity Savings (kWh at meter)	Natural Gas Savings (therms)	Energy Savings (MMBtu)	Electricity Savings	Natural Gas Savings (dollars)	Energy Cost Savings (dollars)
Window U-Factor	329,806	75,268	8,652	$40,500	$86,276	$126,776
Ceiling Insulation	222,191	21,867	2,945	$27,285	$25,065	$52,351
TOTAL	11,445,719	1,485,512	187,604	$1,405,534	1,702,761	$3,108,297

Fuel Prices		
Electricity	0.12	$/kWh
Natural Gas	1.15	$/therm

# Homes	
CZ4	10,061
CZ5	278

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HVAC Analysis
Methodology

- Methodology* was designed to determine if the AC system was appropriately sized (ACCA Manual J) for the home as constructed**
- Each home was individually modeled, the building load calculated, and the maximum design size for the unit calculated
- The design size was then compared to the size of the unit actually installed and right-sizing potential demand savings calculated
- PNNL also calculated the demand savings associated with the non-compliant key items

* This is an exploratory analysis. It does not carry the statistical significance of the key item analysis

** See http://www.mwalliance.org/sites/default/files/media/More-Bang-for-the-Buck-Final.pdf

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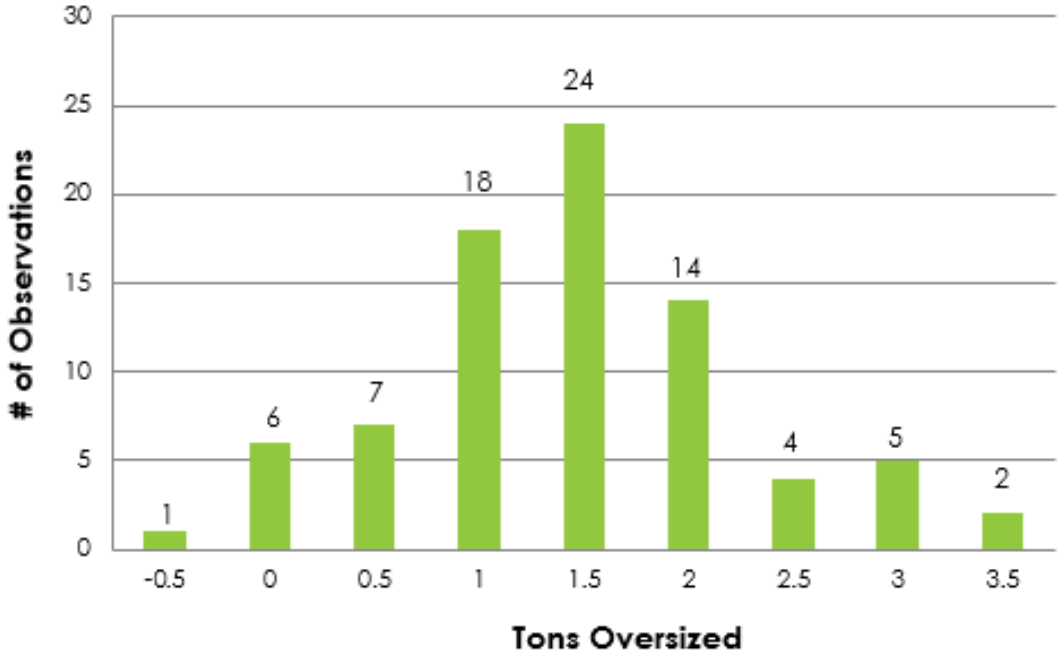
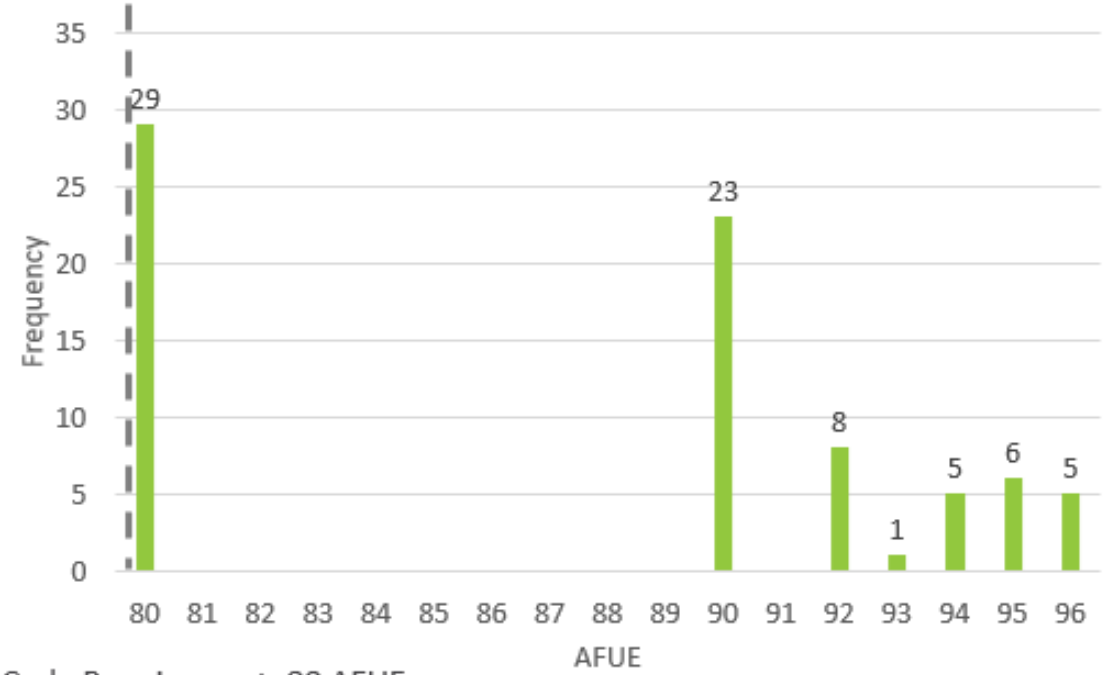
Installed AC Units

Tons Oversized



Furnace Efficiency

AFUE



Code Requirement: 80 AFUE

Potential Electric Demand Reduction

Annual kW Potential Savings

Measure	Potential Electric Demand Reduction (kW)
AC Right Sizing	2,497
Lighting Efficacy	1,390
Exterior Wall Insulation	1,250
Basement Insulation	690
Window U-Factor	310
Duct Leakage	210
Ceiling Insulation	170

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Range of kW Savings

Interactive Effect

- Impact of kW interactive effects is not known (PNNL internal study found little key item interactive effect for kWh and therms)
- Annual savings
  - Low Range: ~ 3,500 kW
  - Mid Range: ~ 4,500 kW
  - High Range: ~ 6,500 kW


15 Minute Break

Discussion | Goals of the Collaborative

Possible Questions

- What is the focus?
- Any Annual Goals?
- Should we develop subcommittees?
- Who else should be involved/who is missing?
- How do we coordinate with other groups?
- How can we inform and support the program?

Discussion | Compliance Challenges

Possible Questions

- What challenges are you experiencing with compliance in the field?
- What is one thing you feel would help to improve compliance?

Next Steps/Homework

- Identify opportunities for the collaborative
- Attend next meetings
- What should we cover at the next meeting?
- Register for and/or advertise the in-person trainings
- Encourage participation / promote the program
- Anything else?


Lunch & Networking

Contact Information

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