



Pacific Northwest
NATIONAL LABORATORY

*Proudly Operated by **Battelle** Since 1965*

Residential Field Study

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Highlights

- ▶ Only new, site-built single-family homes
- ▶ Single site visit
- ▶ Focus on review of individual code requirements rather than homes
- ▶ Sample size of 63 observations of key items
- ▶ Energy savings metric

Available: <https://www.energycodes.gov/residential-energy-code-field-study>

Activities



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Step	Activity
1	Develop initial sampling plan
2	Conduct stakeholder meeting
3	Develop final sampling plan
4	Contact jurisdictions and identify homes to sample
5	Collect field data
6	Analyze and report field data
7	Conduct education, training and outreach
8	Re-evaluate

Complete

In Progress

Sampling

- ▶ Determination of statistically valid sample size
- ▶ Development of state-level sampling plan
- ▶ Projects chosen randomly within selected jurisdictions
- ▶ Conducted an energy simulation based sensitivity analysis
 - To identify building components with largest direct impact on energy use

Answer: minimum of 63 observations



Key Items

- ▶ Envelope tightness (ACH50)
- ▶ Window SHGC
- ▶ Window U-factor
- ▶ Exterior wall insulation
- ▶ Ceiling insulation
- ▶ High-efficiency lighting
- ▶ Foundation insulation (floor / basement wall / slab)
- ▶ Duct leakage

Items collected in field to
calculate energy metric



Example Section of Envelope Form

2009 IECC Residential Data Collection Form - Envelope							Key Items marked in bold and italics				
ID	Code Section	Description	Meets Requirement	Does Not Meet Requirement	Not Applicable	Not Observable	Field Observation	REScheck or HERS Value*	Format	Units	Comments
Envelope Ceiling and Attic											
BG15	NA	Is the insulation located in the ceiling or the rafters?							Text		
FI1	402.1.1, 402.2.1, 402.2.2, 402.2.5	<i>Predominant ceiling insulation Total R-value (cavity and continuous insulation)</i>							Number	<i>R-value</i>	
M1	NA	What is the attic framing material - wood or steel?							Text		
IQ1	NA	What is the roof cavity insulation quality? (I,II,III) - see INFO - Insulation Grading tab							Text		
FI3	402.2.3	Attic access hatch and door insulation \geq R-value of the adjacent assembly							Check Box		



Section of Envelope Form

2009 IECC Residential Data Collection Form - Envelope								Key Items marked in bold and italics			
Code	Section	Description	Meets Requirement	Does Not Meet Requirement	Not Applicable	Not Observable	Field Observation	Reference or IECC Value*	Format	Units	Comments
Envelope Ceiling and Attic											
402.1	NA	Is the insulation located in the ceiling or the rafters?							Text		
402.1.1	<i>402.1.1,</i>	<i>Predominant ceiling insulation</i>							Number	R-value	
402.2.1	<i>402.2.1,</i>	<i>Total R-value (cavity and</i>									
402.2.2	<i>402.2.2,</i>	<i>continuous insulation)</i>									
402.2.5	<i>402.2.5</i>										

Key Item

<i>F11</i>	<i>402.1.1,</i>	<i>Predominant ceiling insulation</i>
	<i>402.2.1,</i>	<i>Total R-value (cavity and</i>
	<i>402.2.2,</i>	<i>continuous insulation)</i>
	<i>402.2.5</i>	



Section of Envelope Form

2009 IECC Residential Data Collection Form - Envelope							Key items marked in bold and italic>				
ID	Code Section	Description	Meets Requirement	Does Not Meet Requirement	Not Applicable	Not Observable	Field Observation	Reference or IECC Value*	Format	Units	Comments
Envelope Ceiling and Attic											
0023	NA	Is the insulation located in the ceiling or the attic?							Text		
010	402.2.1, 402.2.2, 402.2.3, 402.2.4	Predominant ceiling material, Total R-value (continuous insulation)							Number	R-value	
011	NA		M1	NA	What is the attic framing material - wood or steel?						
012	NA										
013	402.2.1	Insulation R-value of the adjacent assembly							Size		



Data Confidentiality

- ▶ No personally identifiable information will be reported to DOE/PNNL
- ▶ Data collection form and online tool use an identification code to identify individual homes
 - Format: Two-digit state abbreviation + a unique number assigned by the Project Team
- ▶ DOE/PNNL reporting will be done only on a STATE basis, not at the jurisdictional or home level



Online Data Entry Tool

Browser address bar: <https://energycode.pnl.gov/RCD/compliance/view?id=32&name=ar01> Search []

Residential Compliance Data (RCD)

ar01

[Go Back To Buildings ...](#) [Configure Team](#) | [Change Password](#) | [Logout](#)

Status	ID	Description	Code Section	Complies?	Comments
✓	LOC1	State where home is located	NA		
Entry:		<input type="text" value="AR"/>			
✓	LOC2	Climate zone where home is located	NA		
Entry:		<input type="text" value="3"/>			
!	LOC3	Does the home fall in the Warm-Humid Zone (question applicable only to zone 3)	NA		
Entry:		<input type="text"/>			



Data Analysis

- ▶ Distribution of results at the individual building component level is provided
 - To inform training and outreach activities
- ▶ After the post-study data collection activity, a final analysis determines whether a reduction in the EUI occurred
- ▶ The Energy Metric will be calculated and reported at the State level
- ▶ Based on a pre- and post-training evaluation using PNNL's single-family prototype building model:
 - **Step 1:** Data used to create range of observed key items
 - **Step 2:** Ranges will be randomly sampled to generate building configurations
 - **Step 3:** Each building configuration will be simulated using *EnergyPlus*
 - **Step 4:** Energy use estimates for the entire population of configurations will determine the average energy use for a new home in the state
- ▶ The shift in the mean energy usage, combined with the distributional differences between the pre-and post-training evaluations will be used to draw conclusions about the impact of training programs