



Residential Energy Code Field Study Kick Off Meeting : Utah

September 2019

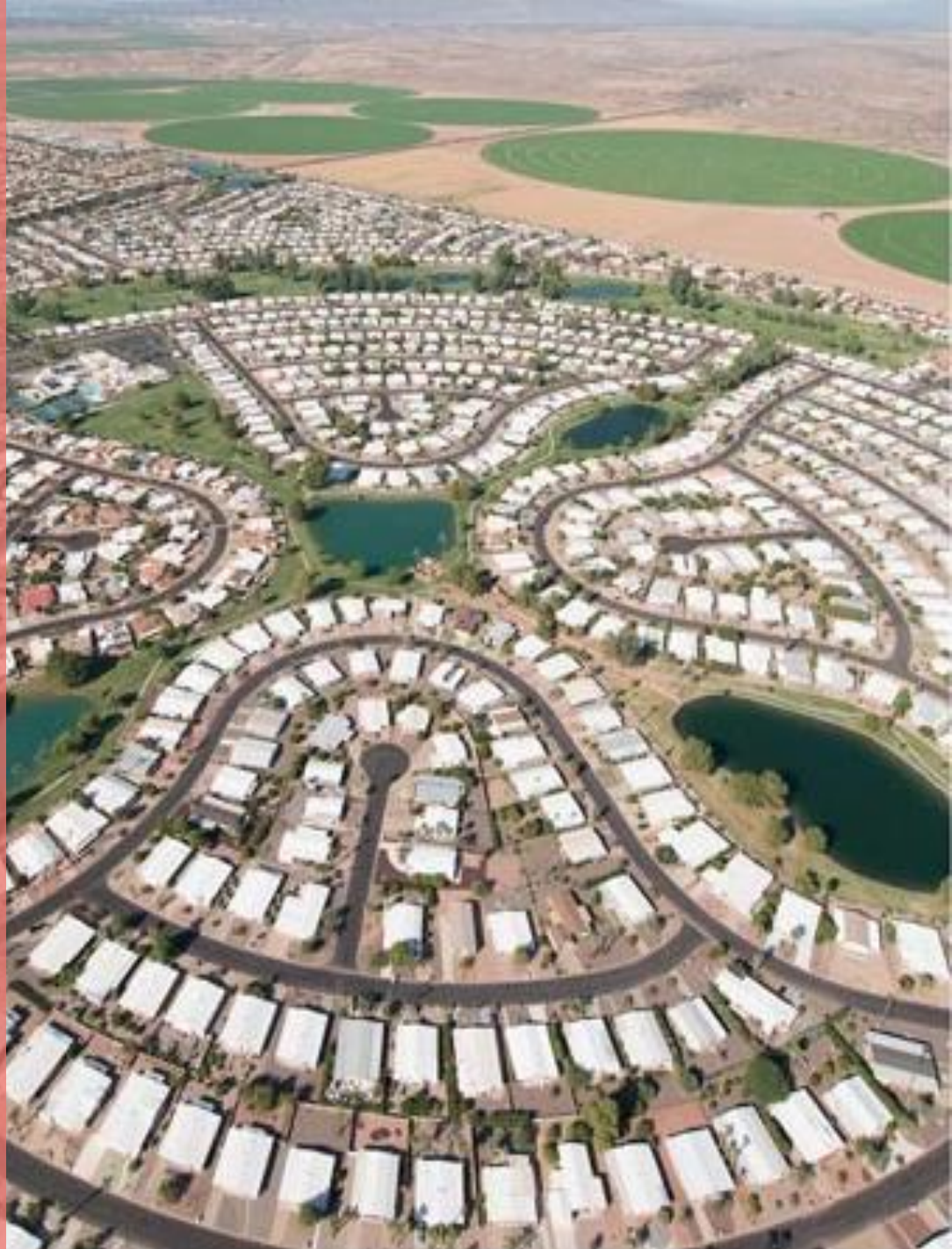
Agenda



1. Team Members + Roles
2. Objectives
3. Tasks + Timelines
4. Methodology + Data Collection
5. Sampling Plan Review
7. Initial ETO Ideas + Feedback
8. QA on Project

Project Partners

US Department of Energy
Pacific Northwest National Lab
Institute for Market Transformation
SWEEP
Utah Clean Energy
Nexant
WC3
Governor's Office of Energy Dev.
Dominion Energy
Rocky Mountain Power



Institute for Market Transformation

Role

- Overall project management
- Stakeholder engagement
- Education coordination and oversight

Contact Info

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Utah Clean Energy

Role

- Coordination assistance in state
- Stakeholder engagement
- Education and outreach

Point Person

Kevin Emerson

Southwest Energy Efficiency Project

Role

- Stakeholder engagement
- REEO Partner

Point Person

Jim Meyers

Nexant

Role

- Baseline Assessment Data Collection

Point Person

Matt Meyer

West Coast Code Consultants

Role

- Training Needs Assessment
- Curriculum Development
- Training Development
- Conduct Statewide Training

Point Person

Brent Ursenbach

Additional Partners/Support From

Governor's Office of Energy Development

Dominion Energy

Rocky Mountain Power

US Department of Energy

Pacific Northwest National Labs

Energy Code Stakeholder Group

Role

- Feedback on Sampling Plan
- Guide Curriculum Development
- Feedback on Education Implementation

Point Person

(Look to your left and right)

Goals of the Field Study



Collect field data to generate baseline compliance rate across two states (Arizona and Utah)



Develop targeted education programs to address key measures that will result in the largest savings



Pilot jurisdictional administrative enforcement mechanisms that may increase compliance without education

Why Federal (DOE) Interest?

DOE's
interest is
energy—
study seeks
data to
assess use

States and
localities
voiced need
for additional
support

Seeking a
consistent
approach

Testing a
methodology
that any
interested
state can
implement

How projects
selected—
submissions,
competitive
process,
review board

Why Utah?
Dry Climate
Zone

Establish
empirical
data set
showing the
amount of
savings
available

State and
industry
investments

Data Confidentiality



- No information that identifies people or individual homes will be submitted to DOE/PNNL
- Findings reported only on a statewide or climate zone basis
- Code officials will provide only addresses of qualifying homes—they will not be present for onsite data collection
- No owner-occupied homes will be included
- Blower door and duct testing results will be shared with builders upon request
- Each house visited only one time—not enough information to determine ‘compliance’ for an individual home or jurisdiction

Study Benefits



Consumers/Homebuyers: Lower energy bills—assurance that code-intended savings are realized



Builders & Code Officials: Level playing field, better market data (e.g. relative to existing homes), protected competitive advantage, free training, reduced burden/risk

Study Benefits



Utilities: Cost & savings data to enable future investments, increased accuracy in forecasting, better connection to code implementation infrastructure



State & Local Governments: Federal tax dollars gives direct benefits to local businesses, enhanced ability to provide training & education programs, and may complement existing policies and energy goals

Overview of Tasks + Milestones



Convene Energy Stakeholder Group

- Identify stakeholders
- Convene introductory meeting
- Review results of baseline assessment

Anticipated Timeline:

- May 2019 (complete)
- We're Here!
- May 2020 (target)

Overview of Tasks + Milestones

Baseline Field Study

- Draft Sampling Plan
- Sampling Plan accepted by Stakeholder Group
- Data Collection begins
- Data Collection 50% complete
- Data Collection 100% complete
- All data transmitted to PNNL

Anticipated Timeline:

- May 2019 (complete)
- We're Here!
- September 2019
- December 2019
- March 2020
- March 2020

Overview of Tasks + Milestones

Develop Education and Training Program

- Develop E&T approach
 - Types, attendance targets, distribution across state
 - Optional administrative enforcement program
- Develop E&T materials
 - Review existing materials
 - Identify need for new materials
- Convene Stakeholder Group for review of E&T approach + materials

Anticipated Timeline:

- Oct 2019 – March 2020 (first pass)
- Oct 2019 – March 2020 (first pass)
- Summer 2020 (target)



Overview of Tasks + Milestones



Implement Education and Training Program

- Develop evaluation forms
- Complete 25% training
- Complete 50% training
- Stakeholder Group review
- Complete 100% training
- Final Convening held in UT

Anticipated Timeline:

- April 2020
- December 2020
- May 2021
- May 2021
- May 2022
- May 2022



QUESTIONS?

Field Study Background

U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

Residential Building Energy Code Field Study

Data Collection & Analysis Methodology

Original FOA

- DOE funded 8 states
- Methodology was tested and refined
- Studies were see-do-see – testing if education could close compliance gaps

Current studies (UT/AZ and CO/NV)

- Expansion into dry climate zones and home rule states
- See-do only – no repeat assessment at the end

Methodology Highlights



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

Methodology Activities

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

Identified **Key Measures**

1. Envelope tightness (ACH50)
2. Window SHGC
3. Window U-factor
4. Exterior wall insulation
5. Ceiling insulation
6. High-efficiency lighting
7. Foundation insulation
8. Duct leakage

QUESTION:

Are there other measures we want to add for Utah?

ID	Code Section	Description	Meets Requirement	Does Not Meet Requirement	Not Applicable	Not Observable	Field Observation	REScheck or HERS Value*	Format	Units	Comments
Envelope Wall All Walls (Does not include knee walls)											
Wall1	NA	Are the walls predominantly frame walls or mass walls?							Text		
IN4	303.2	Wall insulation is installed per manufacturer's instructions							Check Box		
Envelope Wall Frame (Does not include knee walls)											
IN3a	402.1.1, 402.2.5	Frame Wall insulation R-value (cavity insulation)							Number	R-value	
IN3b	402.1.1, 402.2.5	Frame Wall insulation R-value (continuous insulation)							Number	R-value	
M2	NA	What is the wall framing material wood or steel?							Text		
Wall2	NA	What is the predominant wall framing depth? (2 inch, 4 inch, 6 inch, 8 inch, etc.)							Number	Inches of framing depth	
IQ3	NA	What is the frame wall insulation quality? (I,II,III) - see INFO - Insulation Grading tab									
Envelope Wall Mass (Does not include knee walls)											
FR10a	402.1.1	Mass wall insulation R-value							Number		

State-Specific Data Collection Form

Combination of

- REScheck checklists (essentially all of the applicable code requirements),
- Any items added or subtracted for state-specific codes, and
- Additional items needed for energy simulation (including key items)

Details of the Data Collection Form



Project team will perform blower door tests



Project team will perform duct leakage tests



Observation of frame cavity insulation installation grade will be done

2009 IECC Residential Data Collection Form - Envelope					
Code			Does Not	Not	Not
Section	Description	Complies	Comply	Applicable	Unusable
01	Roofing				
02	Exterior Walls				
03	Floors				
04	Basement				
05	Attic				
06	Windows				
07	Doors				
08	Garage				
09	Unfinished Basement				
10	Unfinished Attic				
11	Unfinished Porch				
12	Unfinished Deck				
13	Unfinished Staircase				
14	Unfinished Balcony				
15	Unfinished Terrace				
16	Unfinished Walkway				
17	Unfinished Driveway				
18	Unfinished Parking				
19	Unfinished Pool				
20	Unfinished Spa				
21	Unfinished Hot Tub				
22	Unfinished Sauna				
23	Unfinished Hammock				
24	Unfinished Swing Set				
25	Unfinished Trampoline				
26	Unfinished Playground				
27	Unfinished Garden				
28	Unfinished Lawn				
29	Unfinished Yard				
30	Unfinished Driveway				
31	Unfinished Parking				
32	Unfinished Pool				
33	Unfinished Spa				
34	Unfinished Hot Tub				
35	Unfinished Sauna				
36	Unfinished Hammock				
37	Unfinished Swing Set				
38	Unfinished Trampoline				
39	Unfinished Playground				
40	Unfinished Garden				
41	Unfinished Lawn				
42	Unfinished Yard				
43	Unfinished Driveway				
44	Unfinished Parking				
45	Unfinished Pool				
46	Unfinished Spa				
47	Unfinished Hot Tub				
48	Unfinished Sauna				
49	Unfinished Hammock				
50	Unfinished Swing Set				
51	Unfinished Trampoline				
52	Unfinished Playground				
53	Unfinished Garden				
54	Unfinished Lawn				
55	Unfinished Yard				
56	Unfinished Driveway				
57	Unfinished Parking				
58	Unfinished Pool				
59	Unfinished Spa				
60	Unfinished Hot Tub				
61	Unfinished Sauna				
62	Unfinished Hammock				
63	Unfinished Swing Set				
64	Unfinished Trampoline				
65	Unfinished Playground				
66	Unfinished Garden				
67	Unfinished Lawn				
68	Unfinished Yard				
69	Unfinished Driveway				
70	Unfinished Parking				
71	Unfinished Pool				
72	Unfinished Spa				
73	Unfinished Hot Tub				
74	Unfinished Sauna				
75	Unfinished Hammock				
76	Unfinished Swing Set				
77	Unfinished Trampoline				
78	Unfinished Playground				
79	Unfinished Garden				
80	Unfinished Lawn				
81	Unfinished Yard				
82	Unfinished Driveway				
83	Unfinished Parking				
84	Unfinished Pool				
85	Unfinished Spa				
86	Unfinished Hot Tub				
87	Unfinished Sauna				
88	Unfinished Hammock				
89	Unfinished Swing Set				
90	Unfinished Trampoline				
91	Unfinished Playground				
92	Unfinished Garden				
93	Unfinished Lawn				
94	Unfinished Yard				
95	Unfinished Driveway				
96	Unfinished Parking				
97	Unfinished Pool				
98	Unfinished Spa				
99	Unfinished Hot Tub				
100	Unfinished Sauna				

KEY ITEM

IN3a	402.1.1, 402.2.5	Frame Wall insulation R-value (cavity insulation)
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	Code	Description	Does Not Apply	Not Applicable	Observed	Field Note
01	Section 1	Coverage Wall All Walls (does not include knee walls)				
02	Subsection 1	Walls - does the wall predominantly frame walls or knee walls?				
03	Subsection 2	Wall insulation is installed per manufacturer's instructions.				
04	Section 2	Coverage Wall Frame (does not include knee walls)				
05	Subsection 1	Frame Wall Insulation R value				

IN4	303.2	Wall insulation is installed per manufacturer's instructions
-----	-------	--

2009 IECC Residential Data Collection Form - Envelope					Overall	
Code	Section	Description	Complies	Complies	Applicable	Observable
01	01.0	Roofing				
02	02.0	Windows				
03	03.0	Doors				
04	04.0	Walls				
05	05.0	Floors				
06	06.0	Basement				
07	07.0	Attic				
08	08.0	Garage				
09	09.0	Other				
10	10.0	Other				
11	11.0	Other				
12	12.0	Other				
13	13.0	Other				
14	14.0	Other				
15	15.0	Other				
16	16.0	Other				
17	17.0	Other				
18	18.0	Other				
19	19.0	Other				
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21	21.0	Other				
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44	44.0	Other				
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90	90.0	Other				
91	91.0	Other				
92	92.0	Other				
93	93.0	Other				
94	94.0	Other				
95	95.0	Other				
96	96.0	Other				
97	97.0	Other				
98	98.0	Other				
99	99.0	Other				
100	100.0	Other				

Simulation Input

Wall1	NA	Are the walls predominantly frame walls or mass walls?
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Simulation Input

Wall1	NA	Are the walls predominantly frame walls or mass walls?
-------	----	--

PNNL National **Prototype**



Observations are used to model full homes and calculate compliance rates by key measures and overall across the state

PNNL National Prototype

Table 2.1. Single-Family Prototype Characteristics

Parameter	Assumption	Notes
Conditioned floor area	2,400 ft ² (plus 1,200 ft ² of conditioned basement, where applicable)	Characteristics of New Housing, U.S. Census Bureau
Footprint and height	30-ft-by-40 ft, two-story, 8.5-ft-high ceilings	
Area above unconditioned space	1,200 ft ²	Over a vented crawlspace or unconditioned basement
Area below roof/ceilings	1,200 ft ² , 70% with attic, 30% cathedral	
Perimeter length	140 ft	
Gross exterior wall area	2,380 ft ²	
Window area (relative to gross wall area)	Fifteen percent equally distributed to the four cardinal directions (or as required to evaluate glazing-specific code changes)	
Door area	42 ft ²	
Internal gains	91,436 Btu/day	2006 IECC, Section 404
Heating system	Natural gas furnace, heat pump, electric furnace, or oil-fired furnace	Efficiencies will be based on prevailing federal minimum manufacturing standards.
Cooling system	Central electric air conditioning	Efficiency will be based on prevailing federal minimum manufacturing standards.
Water heating	Natural gas, or as required to evaluate domestic hot water-specific code changes	

Btu = British thermal units.

IECC = International Energy Conservation Code.

Construction Methods



Are there construction practices that are different in the west/southwest that we didn't see in the first set of studies that are important/prevalent enough to drive focus on?



STANDARD:

Wood frame cavity insulation construction.



QUESTIONS?

Study Area : Utah



Sampling Plan	
Stage	# Required
Insulation	63
Final	63
Total	126
“Full Homes”	63

Sample Size Bottom Line

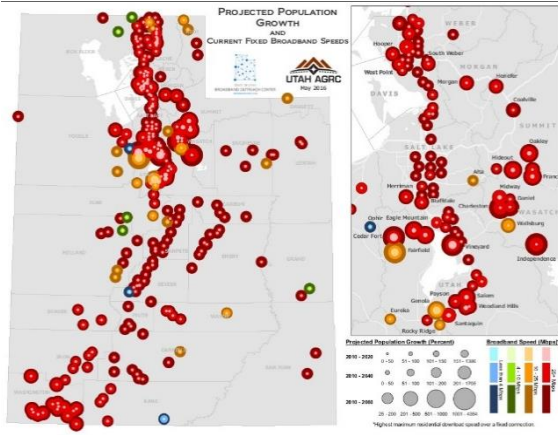
63

observations of each key
item in each state

**Think # of observations
rather than # of homes**



State-Specific Sampling Plan



Initial sampling plan
based on Census
Bureau permit database
using latest 3 years of
permit data by place
within the state

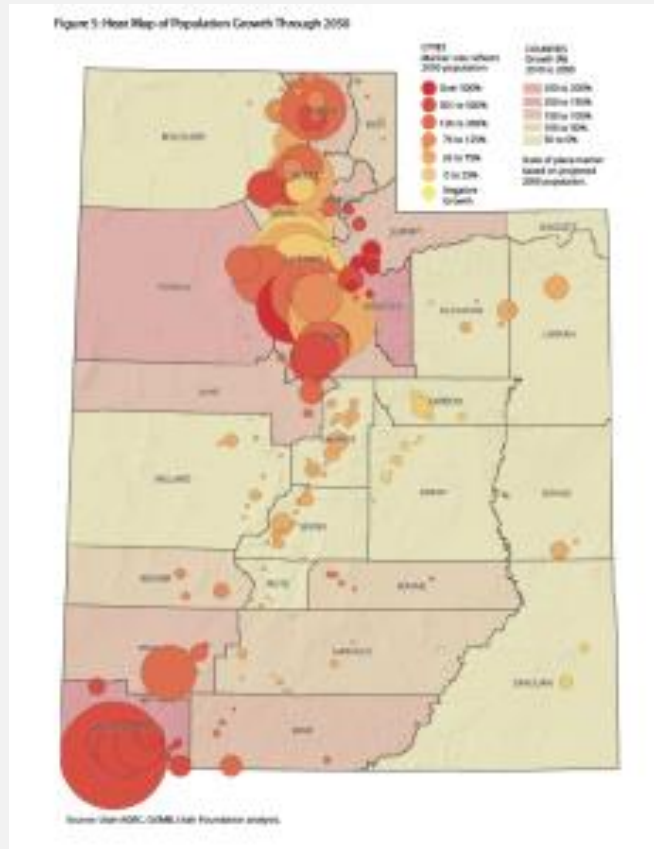


Final sampling plan developed after Project Team and Stakeholder meetings in case any changes or additions to the sampling plan are needed



63 observations will require visiting more than 63 homes per state due to practical limitations of being able to observe all key items in a single site visit

State-Specific Sampling Plan (cont'd)

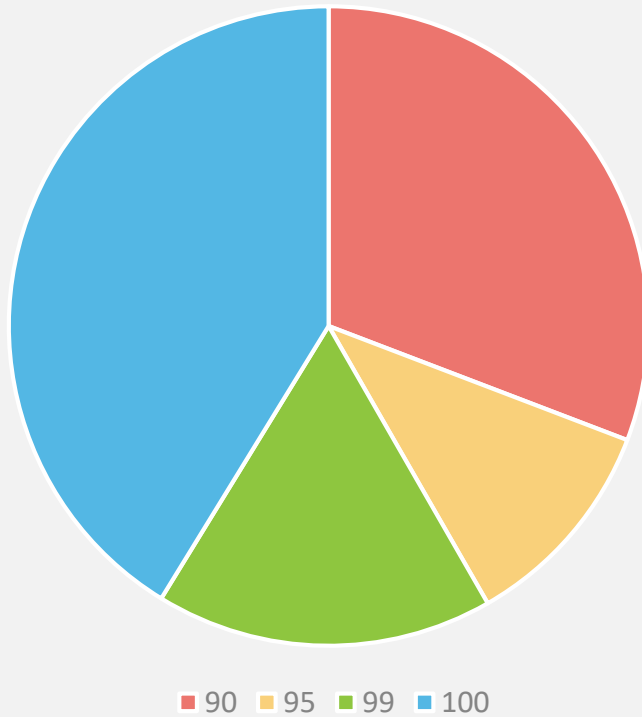


Proportional random sample

Substitutions that do not introduce bias into the sample are allowed

Distribution of Places

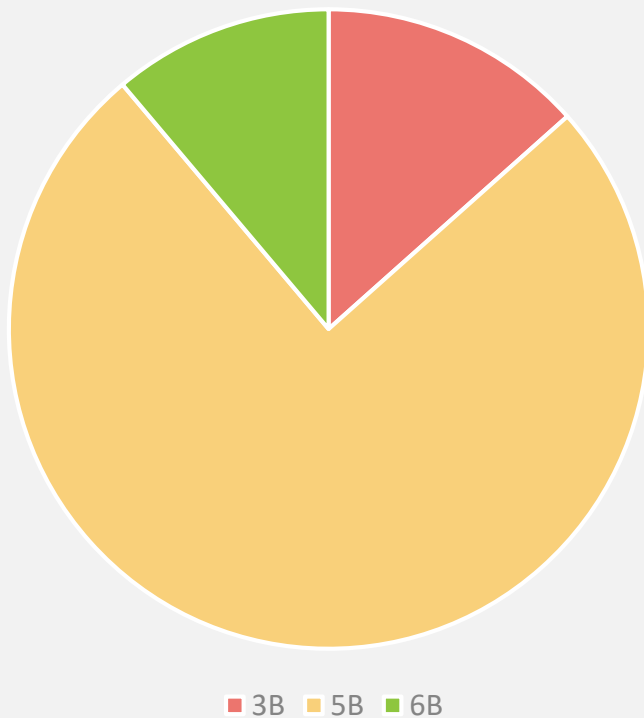
Places Included



Cut Off	Places	% Places
90%	65	31%
95%	88	42%
99%	124	58%
100%	212	100%

Distribution of Climate Zones

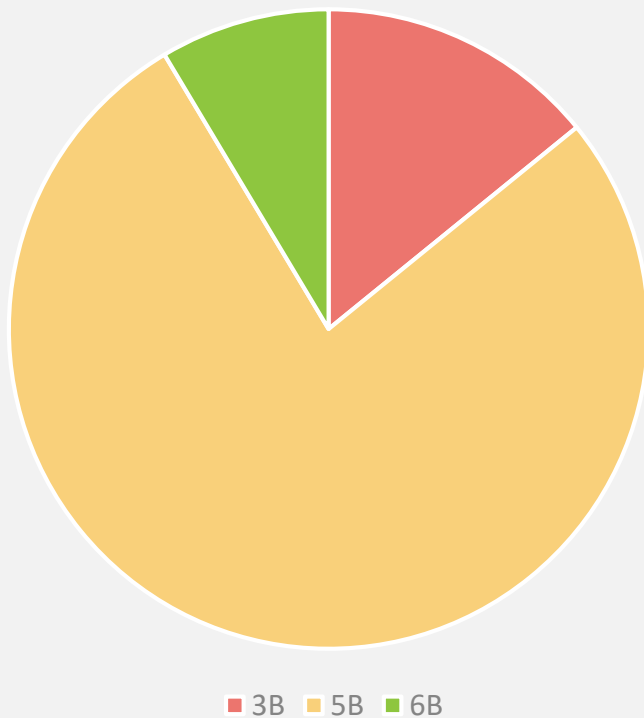
Distribution of Climate Zones



CZ	Permits	% Permits
3B	2315	13%
5B	13,009	75%
6B	1923	11%

CZs at 90% Cut Off

Distribution of Climate Zones @ 90%



CZ	Permits	% Permits
3B	2195	14%
5B	11,998	77%
6B	1332	9%



Sampling Plan Questions

Are we covering enough of the state under a 90% cut off?

Do we think the distribution accurately reflects the climate zones?

Anything else we should consider?

Does data appear accurate?

Did we miss any places?

Are we comfortable with distribution?

Selecting the Sample Plan



Why might you like one plan over another?

- Compactness / Expansiveness
- Density of permits
- Include or exclude a specific place
- Geographic distribution

Proposed Sample **

Location	Count		
Herriman, Salt Lake County	4	Riverton, Salt Lake County	1
Lehi, Utah County	4	Santaquin, Utah County	2
St. George, Washington County	4	Cedar City, Iron County	3
South Jordan, Salt Lake County	6	Mapleton, Utah County	1
Eagle Mountain, Utah County	4	Farmington, Davis County	1
Saratoga Springs, Utah County	3	Ivins, Washington County	3
		Weber County Unincorporated Area, Weber County	2
Vineyard town, Utah County	3	Plain City, Weber County	1
Washington, Washington County	1	Millcreek, Salt Lake County	1
Bluffdale, Salt Lake County	2	Washington County Unincorporated Area, Washington County	1
West Jordan, Salt Lake County	2		
Cache County Unincorporated Area, Cache County	3	Midway, Wasatch County	1
Syracuse, Davis County	3	Santa Clara, Washington County	1
Wasatch County Unincorporated Area, Wasatch County	2	Park City, Summit County	1
West Haven, Weber County	2	Cottonwood Heights, Salt Lake County	1
		Total	63

**This sample was discussed and changes proposed at the stakeholder meeting.
A final sampling plan will be posted on acceptance by DOE and PNNL



QUESTIONS?

Utah Adjustments



Specific items to look at :

Additional field data collection?

Additional analysis questions?

Construction Methods



Are there construction practices that are different in the west/southwest that we didn't see in the first set of studies that are important/prevalent enough to drive focus on?




STANDARD:

Wood frame cavity insulation construction.

HVAC Sizing



Do we have enough information on dry and hot climates enforcement and right sizing of equipment? All previous states were moist climates (A)

Right-J Worksheet					<<	<	prev zone			
1				Room name	Entire House					
2				Exposed wall	240.0 ft					
3				Ceiling height	8.0					
4				Room dimensions						
5				Room area	1750.0 ft²					
	Ty	Construction number <small>Select any cell then click here</small> ...	U-value	Or ...	HTM (Btuh/ft²)		Area (ft²) or perimeter (ft)		Load (Btuh)	
					Heat	Cool	Gross	N/P/S	Heat	Cool
6	W	15B-10sfc-2	0.083	n	0.305	1.129	560	492	189	397
	•	1D-e2ow	0.570	n	2.850	19.32	40	0	114	773
	•	11D0	0.390	n	1.950	11.19	28	28	55	313
11	W	15B-10sfc-2	0.083	e	0.305	1.129	400	368	142	303
	•	1D-e2ow	0.570	e	2.850	21.39	32	0	91	1965
	W	15B-10sfc-2	0.083	s	0.305	1.129	560	484	185	388
	•	1D-e2ow	0.570	s	2.850	21.64	48	0	137	1039

STANDARD:

Manual J Calculation

Anything Else?



Education + Outreach



Previous study included:

Energy Code 101 trainings

Specialist trainings (focused on code officials, mechanical trades, etc)

Fact Sheets

Residential Provisions of the 2012
International Energy Conservation
Code

July 2011

Utah Initial Ideas

In person and online access to all training modules

Online FAQ for questions

Spanish language translation

Jurisdictional admin/enforcement PILOT



Jurisdictional Admin **PILOT**



Big Idea: People know what's required to comply with the code (education is not needed) and will respond to increased enforcement

Potential policies:

1. Fines
2. Plan Review Stringency/Checklists
3. Inspections Stringency/Checklists
4. Withhold CO

The background of the slide is a photograph of a building's interior during construction. It shows a complex network of wooden beams, joists, and studs. The floor is made of large wooden panels. In the background, there are windows and more structural elements, suggesting a multi-story building. The lighting is warm and natural, coming from the windows.

Final Thoughts

1. Are the right people in the room?
2. Is there anything else about UT we don't know that we should?
3. What else do you need from us?



Contact Us

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