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## Project Partners

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

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## Institute for Market Transformation

**Role**

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

**Contact Info**

Kimberly Cheslak  
[kimberly.cheslak@imt.org](mailto:kimberly.cheslak@imt.org)  
 (240) 676-1681



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## Utah Clean Energy

**Role**

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

**Point Person**  
Kevin Emerson



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## Southwest Energy Efficiency Project

**Role**

- Stakeholder engagement
- REEO Partner

**Point Person**  
Jim Meyers



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## Nexant

**Role**

- Baseline Assessment Data Collection

**Point Person**  
Matt Meyer



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## West Coast Code Consultants

**Role**

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

**Point Person**  
Brent Ursenbach



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## Additional Partners/Support From

**Governor's Office of Energy Development**

**Dominion Energy**

**Rocky Mountain Power**

**US Department of Energy**

**Pacific Northwest National Labs**



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## Energy Code Stakeholder Group

### **Role**

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

### **Point Person**

(Look to your left and right)



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## 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

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## 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

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## 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

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## 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



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## 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

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## Overview of Tasks + Milestones

**Convene Energy Stakeholder Group**

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

**Anticipated Timeline:**

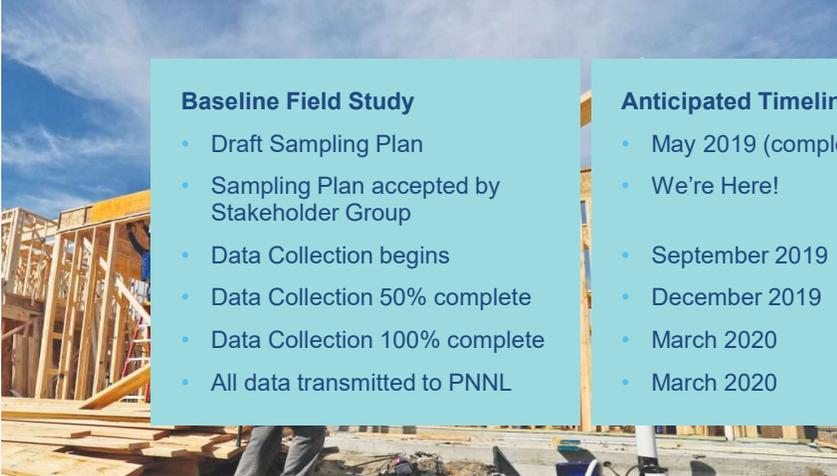
- May 2019 (complete)
- We're Here!
- May 2020 (target)

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## 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

IMT  
INSTITUTE  
FOR MARKET  
TRANSFORMATION

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## 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:**

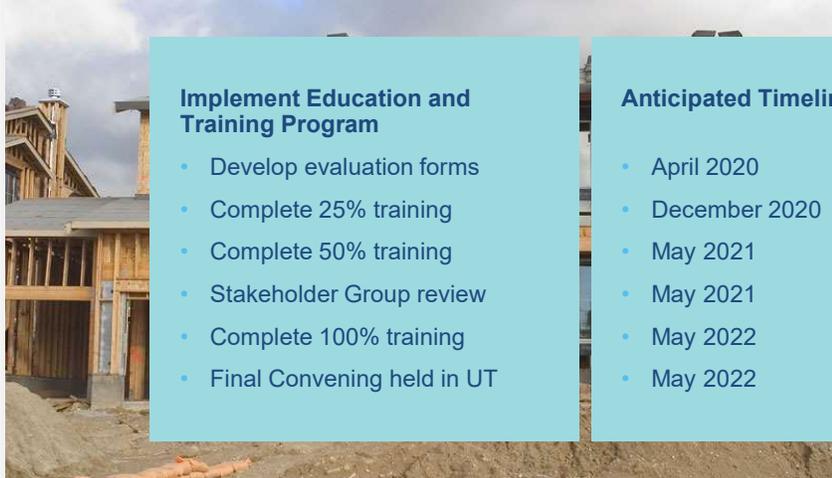
- Oct 2019 – March 2020 (first pass)
- Oct 2019 – March 2020 (first pass)
- Summer 2020 (target)

IMT  
INSTITUTE  
FOR MARKET  
TRANSFORMATION

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## 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

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QUESTIONS?



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## 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

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## 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



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## 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

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## 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?

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D	Code Section	Description	Meets Requirement	Does Not Meet Requirement	Not Applicable	Not Observable	Observation	REScheck or HERS Value*	Format	Units	Comments
<b>Envelope Wall All Walls (Does not include knee walls)</b>											
Wall1	NA	Are the walls predominantly frame walls or mass walls?							Text		
N4	303.2	Wall insulation is installed per manufacturer's instructions							Check Box		
<b>Envelope Wall Frame (Does not include knee walls)</b>											
N3a	402.1.1, 402.2.5	Frame Wall insulation R-value (cavity insulation)							Number	R-value	
N3b	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		
M2	NA	What is the wall framing material wood or steel?							Text		
M2	NA	Framing depth? (2 inch, 4 inch, 6 inch, 8 inch, etc.)							Number	Framing depth	
M2	NA	What is the frame wall insulation quality? (1, 2, 3) - see WFO - insulation drawing tab							Text		
<b>Envelope Wall Mass (Does not include knee walls)</b>											
M3	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)



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## 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



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### 2009 IECC Residential Data Collection Form - Envelope

Code	Section	Description	Complete	Comply	Applicable	Observable
<b>Envelope Wall all walls (Does not include base walls)</b>						
NA	NA	Are the walls predominantly frame walls or mass walls?				
<b>Envelope Wall frame (Does not include base walls)</b>						
NA	NA	What is the frame wall insulation quantity? (R-15, R-20, see 407C) (Insulation trailing off)				

#### Simulation Input

Wall1	NA	Are the walls predominantly frame walls or mass walls?
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### PNNL National **Prototype**



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



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## PNNL National Prototype

**Table 2.1.** Single-Family Prototype Characteristics

Parameter	Assumption	Notes
Conditioned floor area	2,400 ft <sup>2</sup> (plus 1,200 ft <sup>2</sup> 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 <sup>2</sup>	Over a vented crawlspace or unconditioned basement
Area below roof/ceilings	1,200 ft <sup>2</sup> , 70% with attic, 30% cathedral	
Perimeter length	140 ft	
Gross exterior wall area	2,380 ft <sup>2</sup>	
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 <sup>2</sup>	
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.



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## 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?

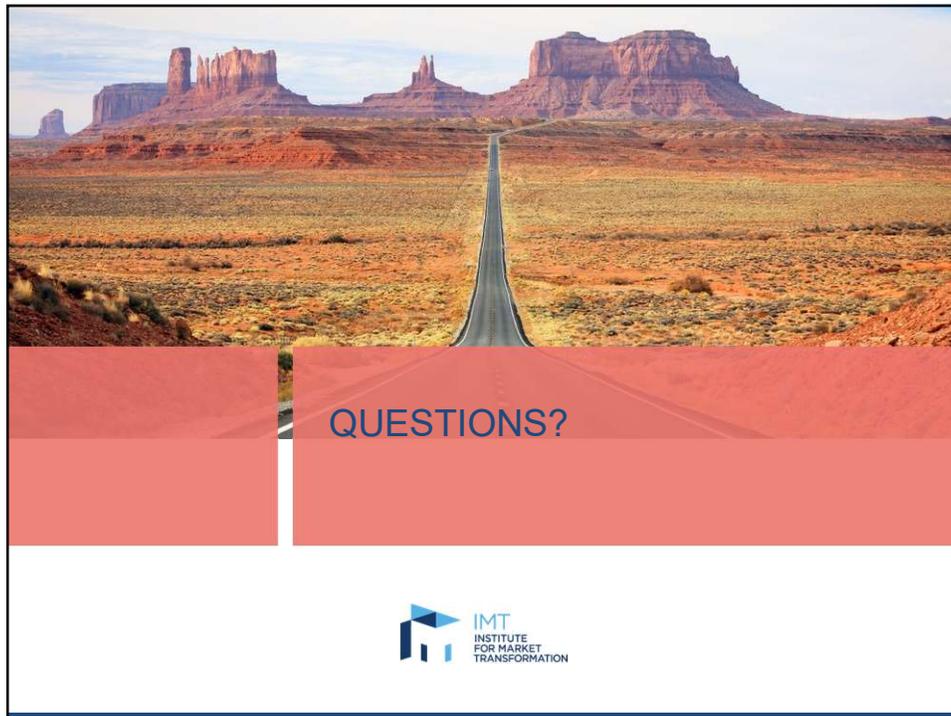


STANDARD:  
Wood frame cavity insulation construction.



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### Study Area : Utah



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



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## Sample Size **Bottom Line**

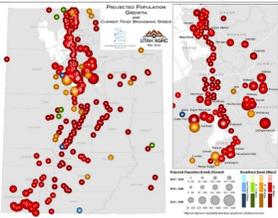
63

observations of each key item in each state

Think # of observations rather than # of homes

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## 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

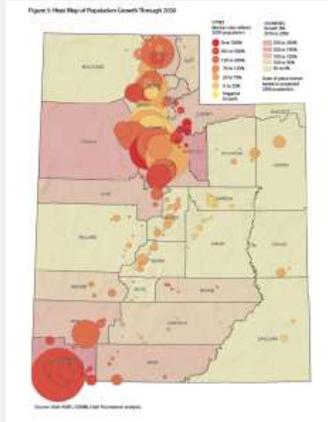


**63** observations will require visiting more than 63 homes per state due to practical limitations of being able to observe all key items in a single site visit



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## State-Specific Sampling Plan (cont'd)

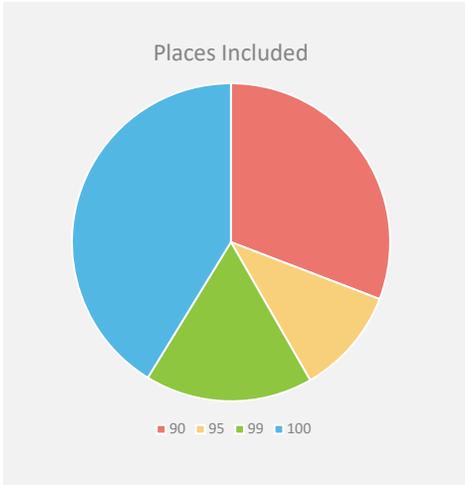


Proportional random sample  
 Substitutions that do not introduce bias into the sample are allowed



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## Distribution of Places

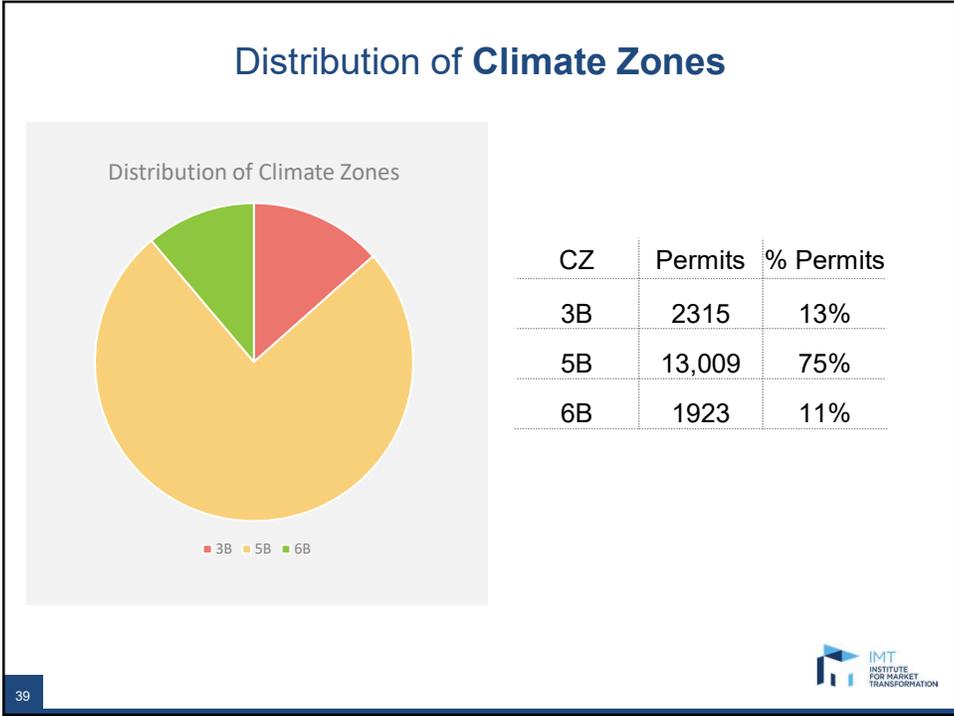


Cut Off	Places	% Places
90%	65	31%
95%	88	42%
99%	124	58%
100%	212	100%



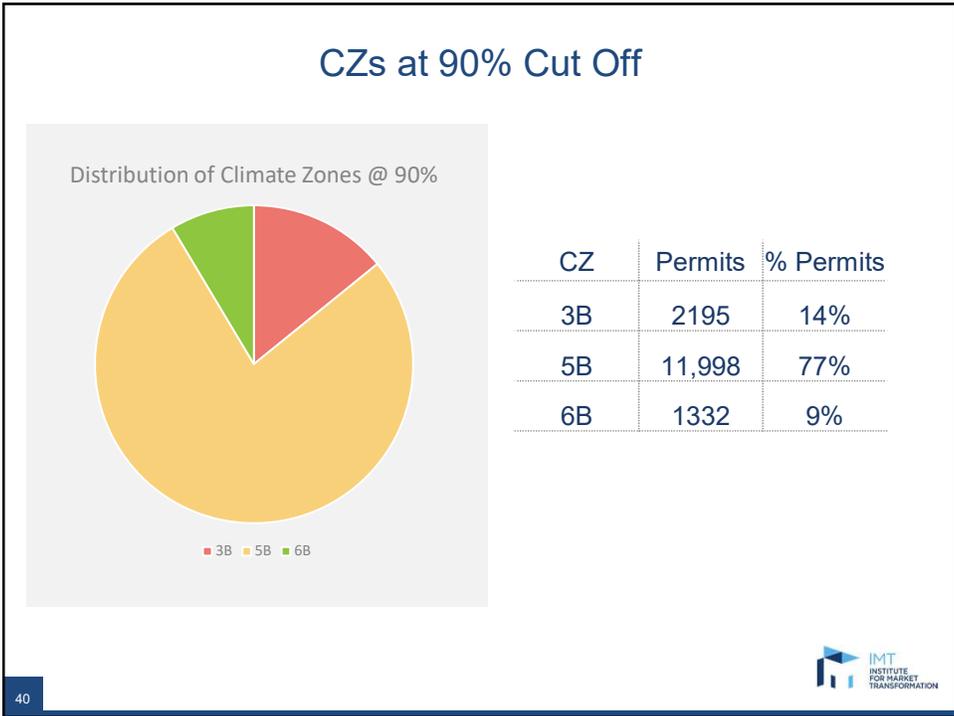
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## Sampling Plan Questions

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

Does data appear accurate?

Do we think the distribution accurately reflects the climate zones?

Did we miss any places?

Anything else we should consider?

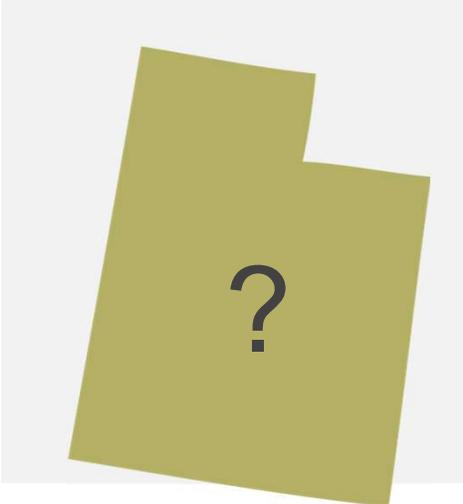
Are we comfortable with distribution?

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## 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

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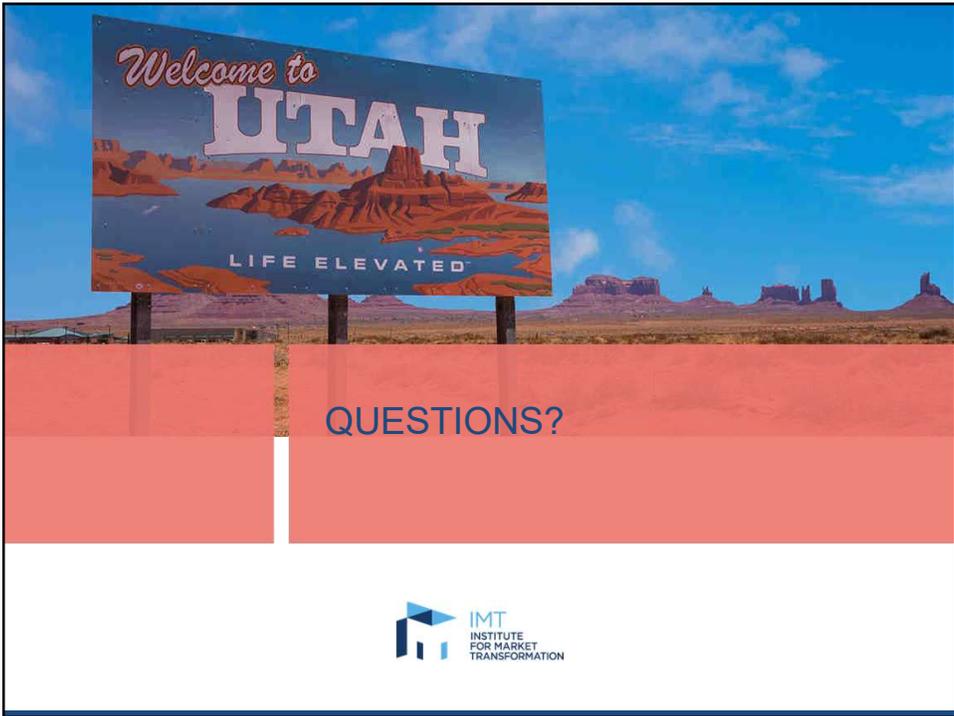
### Proposed Sample \*\*

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
Vineyard town, Utah County	3	Weber County Unincorporated Area, Weber County	2
Washington, Washington County	1	Plain City, Weber County	1
Bluffdale, Salt Lake County	2	Millcreek, Salt Lake County	1
West Jordan, Salt Lake County	2	Washington County Unincorporated Area, Washington County	1
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
		<b>Total</b>	<b>63</b>


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

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## Utah Adjustments



Specific items to look at :

- Additional field data collection?
- Additional analysis questions?



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## 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.



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## 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

1	Room name		Entire House	
2	Exposed wall		240.0 ft	
3	Ceiling height		8.0	
4	Room dimensions			
5	Room area		1750.0 sq ft	

Ty	Construction number <small>Select any cell then click here</small>	U-value	Or	HTM (Btu/ft <sup>2</sup> )		Area (ft <sup>2</sup> ) or perimeter (ft)		Load (Btu/h)	
				Heat	Cool	Gross	N/P/S	Heat	Cool
6	158-10efc-2	0.083	n	0.305	1.129	560	492	189	397
•	10-c2ow	0.570	n	2.850	19.337	40	0	114	773
•	1120	0.390	n	1.950	11.119	28	28	55	313
•	158-10efc-2	0.083	n	0.305	1.129	400	368	142	303
11	10-c2ow	0.570	n	2.850	61.339	32	0	91	1945
•	158-10efc-2	0.083	n	0.305	1.129	560	484	185	388
•	10-c2ow	0.570	n	2.850	21.444	48	0	137	1039

STANDARD:  
Manual J Calculation

## Anything Else?



BUILDING ENERGY CODES UNIVERSITY

## 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

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## Utah Initial Ideas



- In person and online access to all training modules
- Online FAQ for questions
- Spanish language translation
- Jurisdictional admin/enforcement PILOT



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## 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

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## 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?

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