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A presentation slide titled 'Agenda' with a light blue header. The left side of the slide features an aerial photograph of a residential development with several houses and a dirt road. The right side has a white background with a numbered list of seven agenda items. The IMT logo is located in the bottom right corner. A small blue square with the number '2' is positioned at the bottom left of the slide.

Agenda

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

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	<h2>Institute for Market Transformation</h2>
	<p>Role</p> <ul style="list-style-type: none"> • Overall project management • Stakeholder engagement • Education coordination and oversight <p>Contact Info</p> <p>Kimberly Cheslak</p> <p>kimberly.cheslak@imt.org</p> <p>(240) 676-1681</p>
	<p>4</p>

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Southwest Energy Efficiency Project

Role

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

Point Person

Jim Meyers



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Nexant

Role

- Baseline Assessment Data Collection

Point Person

Matt Meyer



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Advanced Energy Efficiency and Environmental Quality

Role

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

Point Person

Kirsten Shaw



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Additional Partners/Support From

Salt River Project

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

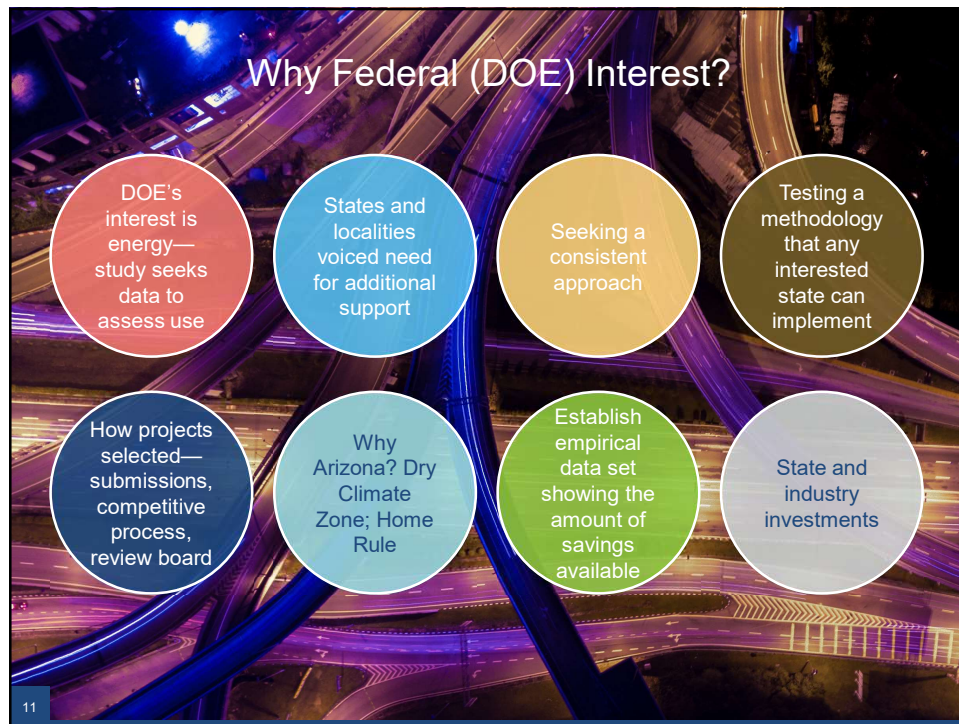


Pilot jurisdictional administrative enforcement mechanisms that may increase compliance without education



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Data Confidentiality

The slide features a photograph of a construction site with wooden framing and stacks of lumber on the left side. The right side contains a list of confidentiality rules.

- 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!
- Summer 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

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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)

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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 AZ

Anticipated Timeline:

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

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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 (Not under this study – but still part of the methodology)	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 Arizona?

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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
Envelope Wall All Walls (Does not include knee walls)											
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		
Envelope Wall Frame (Does not include knee walls)											
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		
M3	NA	What is the predominant wall framing depth? (2 inch, 4 inch, 6 inch, 8 inch, etc.)							Number	framing depth	
N5	NA	What is the frame wall insulation quantity? (1, 2, 3) - see IMT G+ insulation Grading table									
Envelope Wall Mass (Does not include knee walls)											
M2b	1, 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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Code	Section	Description	Does Not Apply	Not Applicable	Not Applicable	Not Applicable
401	Roof	Roof				
402	Walls	Walls				
403	Floors	Floors				
404	Attic	Attic				
405	Basement	Basement				
406	Foundation	Foundation				
407	Windows	Windows				
408	Doors	Doors				
409	Other	Other				
410	Overall	Overall				
411	Energy	Energy				
412	Water	Water				
413	Heating	Heating				
414	Cooling	Cooling				
415	Ventilation	Ventilation				
416	Other	Other				
417	Overall	Overall				
418	Energy	Energy				
419	Water	Water				
420	Heating	Heating				
421	Cooling	Cooling				
422	Ventilation	Ventilation				
423	Other	Other				
424	Overall	Overall				
425	Energy	Energy				
426	Water	Water				
427	Heating	Heating				
428	Cooling	Cooling				
429	Ventilation	Ventilation				
430	Other	Other				
431	Overall	Overall				
432	Energy	Energy				
433	Water	Water				
434	Heating	Heating				
435	Cooling	Cooling				
436	Ventilation	Ventilation				
437	Other	Other				
438	Overall	Overall				
439	Energy	Energy				
440	Water	Water				
441	Heating	Heating				
442	Cooling	Cooling				
443	Ventilation	Ventilation				
444	Other	Other				
445	Overall	Overall				
446	Energy	Energy				
447	Water	Water				
448	Heating	Heating				
449	Cooling	Cooling				
450	Ventilation	Ventilation				
451	Other	Other				
452	Overall	Overall				
453	Energy	Energy				
454	Water	Water				
455	Heating	Heating				
456	Cooling	Cooling				
457	Ventilation	Ventilation				
458	Other	Other				
459	Overall	Overall				
460	Energy	Energy				
461	Water	Water				
462	Heating	Heating				
463	Cooling	Cooling				
464	Ventilation	Ventilation				
465	Other	Other				
466	Overall	Overall				
467	Energy	Energy				
468	Water	Water				
469	Heating	Heating				
470	Cooling	Cooling				
471	Ventilation	Ventilation				
472	Other	Other				
473	Overall	Overall				
474	Energy	Energy				
475	Water	Water				
476	Heating	Heating				
477	Cooling	Cooling				
478	Ventilation	Ventilation				
479	Other	Other				
480	Overall	Overall				
481	Energy	Energy				
482	Water	Water				
483	Heating	Heating				
484	Cooling	Cooling				
485	Ventilation	Ventilation				
486	Other	Other				
487	Overall	Overall				
488	Energy	Energy				
489	Water	Water				
490	Heating	Heating				
491	Cooling	Cooling				
492	Ventilation	Ventilation				
493	Other	Other				
494	Overall	Overall				
495	Energy	Energy				
496	Water	Water				
497	Heating	Heating				
498	Cooling	Cooling				
499	Ventilation	Ventilation				
500	Other	Other				

KEY ITEM

IN3a	402.1.1, 402.2.5	Frame Wall insulation R-value (cavity insulation)
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2009 IECC Residential Data Collection Form - Envelope

Code	Section	Description	Complies	Comply	Applicable	Not Applicable
IN4	303.2	Wall insulation is installed per manufacturer's instructions				

Code Requirement

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2009 IECC Residential Data Collection Form - Envelope

Code	Section	Description	Complies	Comply	Applicable	Not Applicable
Wall1	NA	Are the walls predominantly frame walls or mass walls?				

Simulation Input

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PNNL National Prototype



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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.



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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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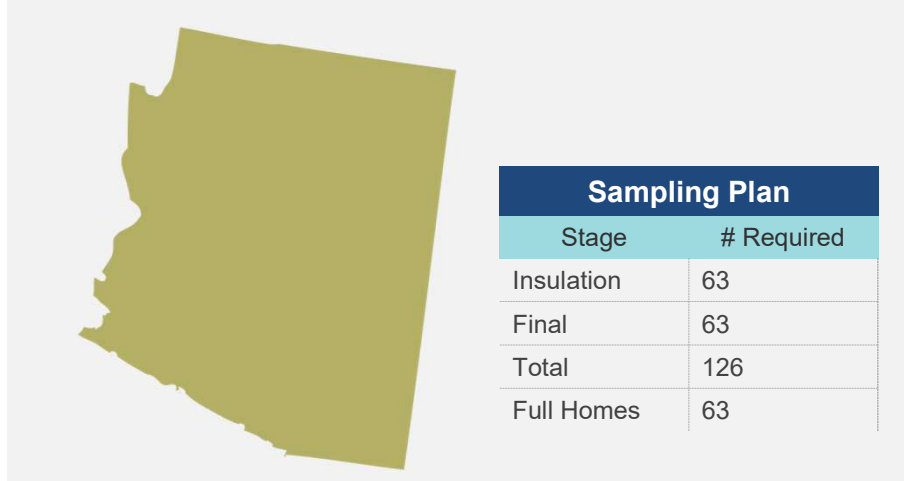


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Study Area : **Arizona**



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Sample Size **Bottom Line**



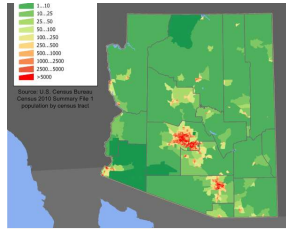
63

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)

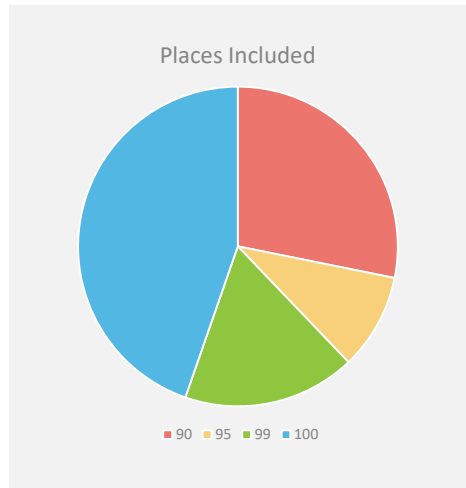


Proportional random sample

Substitutions that do not introduce bias into the sample are allowed

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Distribution of Places

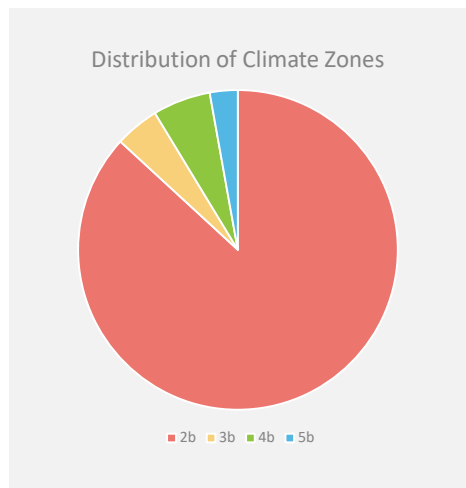


Cut Off	Places	% Places
90%	29	28%
95%	39	38%
99%	57	55%
100%	103	100%

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Distribution of Climate Zones



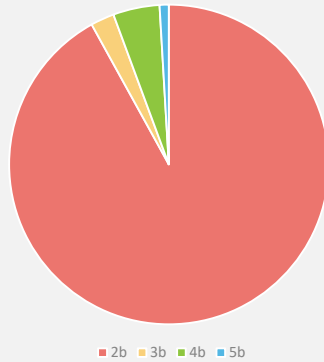
CZ	Permits	% Permits
2B	24374	87%
3B	1260	4%
4B	1645	6%
5B	793	3%

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Czs at 90% Cut Off

Distribution of Climate Zones @ 90%



CZ	Permits	% Permits
2B	23259	92%
3B	603	2%
4B	1193	5%
5B	236	1%

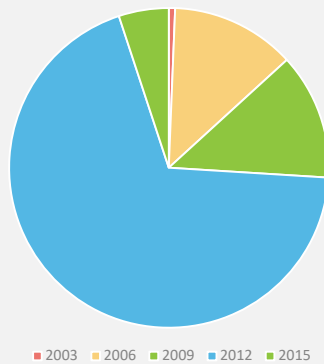
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Distribution of Codes

Distribution of Codes



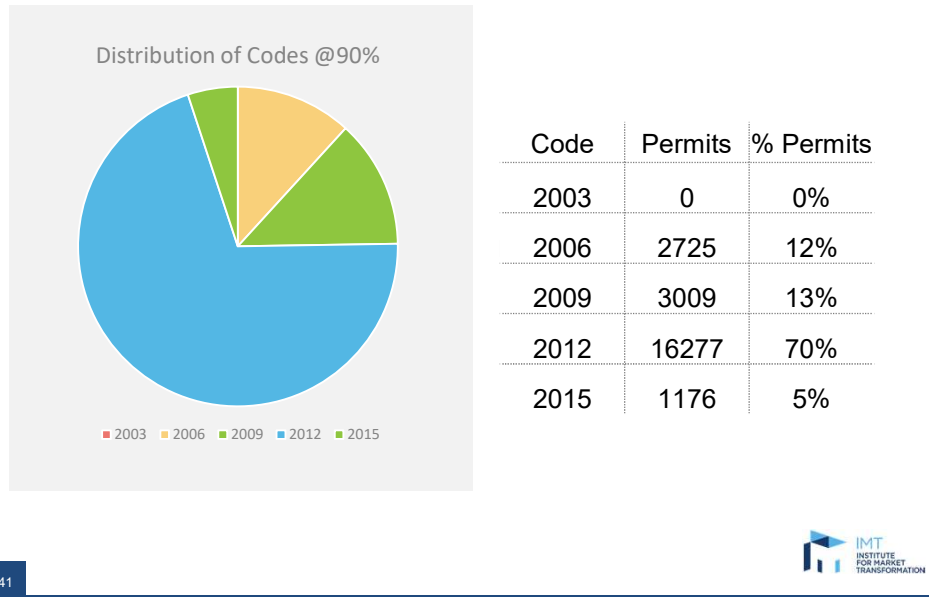
Code	Permits	% Permits
2003	33	0%
2006	3110	13%
2009	3151	13%
2012	17010	69%
2015	1247	5%

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Codes at 90% Cut Off



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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?

Do we think distribution accurately reflects enforced codes?

Does data appear accurate?

Did we miss any places?

Are we comfortable with distribution?

Anything else we should consider?

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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		
Phoenix, Maricopa County	11	Maricopa, Pinal County	1
Mesa, Maricopa County	3	Chandler, Maricopa County	3
Pinal County Unincorporated Area, Pinal County	2	Marana, Pima County	2
Buckeye, Maricopa County	4	Tucson, Pima County	4
Gilbert, Maricopa County	4	Scottsdale, Maricopa County	2
Peoria, Maricopa County	5	Prescott Valley, Yavapai County	2
Maricopa County Unincorporated Area, Maricopa County	5	Prescott, Yavapai County	1
Queen Creek town, Maricopa County	2	Avondale, Maricopa County	1
Goodyear, Maricopa County	2	Flagstaff, Coconino County	2
Surprise, Maricopa County	4	Oro Valley, Pima County	3
		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



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Arizona 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				←		<		prev zone	
1				Room name		Entire House			
2				Exposed wall		240.0 ft			
3				Ceiling height		8.0			
4				Room dimensions		1750.0 ft²			
5				Room area					
	Ty	Construction number <small>Select any unit then click here</small>	U-value	Or	HTM (Btu/ft²)	Area (ft²) 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	169	397
11	1D-e2ew	0.570	n	2.850	19.32	40	0	114	773
	1100	0.390	n	1.950	11.19	28	28	55	313
	158-10efc-2	0.083	n	0.305	1.129	400	368	142	303
	1D-e2ew	0.570	n	2.850	21.33	32	0	91	1945
	158-10efc-2	0.083	n	0.305	1.129	560	484	185	388
	1D-e2ew	0.570	n	2.850	21.44	48	0	137	1039

STANDARD:

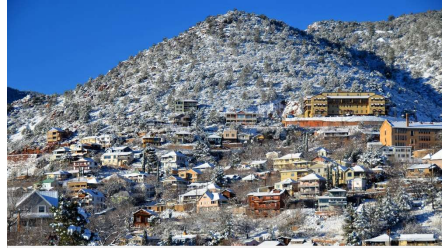
Manual J Calculation

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Anything Else?



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BUILDING ENERGY CODES UNIVERSITY

Education + Outreach



Residential Provisions of the 2012
International Energy Conservation
Code

July 2011

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SA-82108

Previous study included:

Energy Code 101 trainings

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

Fact Sheets



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Arizona Initial Ideas

In person and online access to all training modules


Online FAQ for questions


Spanish language translation

All Handouts

Energy Code 101 Training

Jurisdictional admin/enforcement PILOT



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Jurisdictional Admin **PILOT**



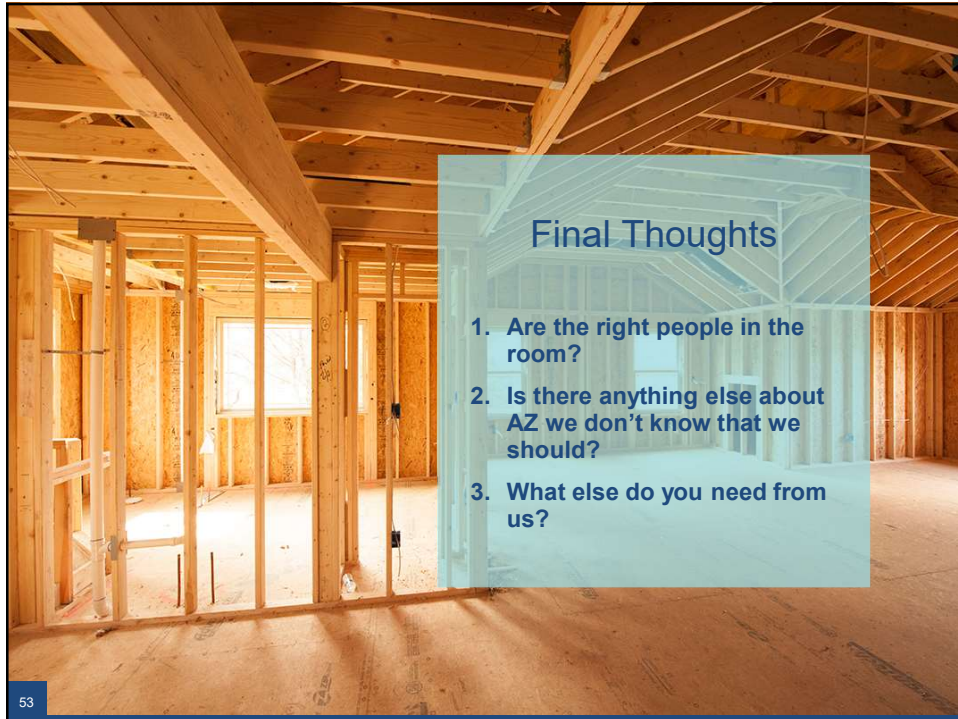
Big Idea: People know what's required to comply with the code (education is not needed) and will respond to increased enforcement

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 AZ we don't know that we should?
3. What else do you need from us?

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Contact Us

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