Case Study: Texas Residential New Construction Baseline Study Findings and Impacts 2016 RESNET Conference

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Agenda

- Background
- Objective
- Approach
- Key Findings & Results
- Recommendations
- Next Steps

Background

- Utilities are challenged to improve program performance
- Codes in place for several years
- Increased stringency of baseline codes and federal standards
- Reduced avoided costs
- Concerns for free-ridership with market transformation program
- Requirements for more savings to be claimed and better program cost-effectiveness

Objective

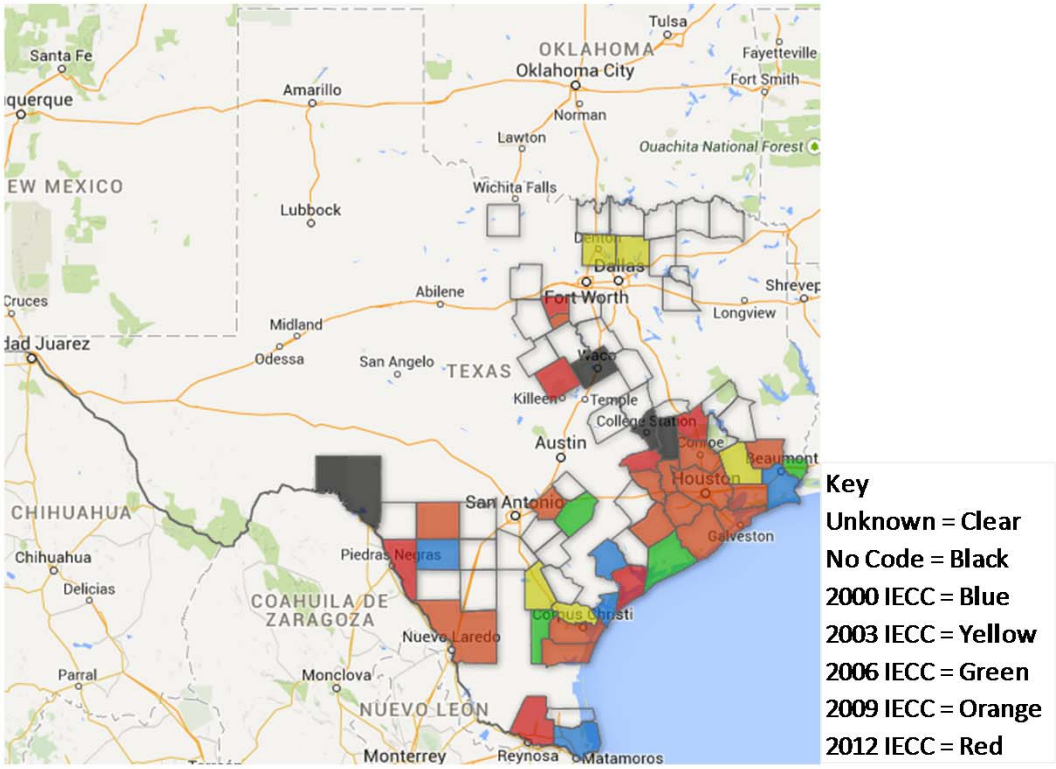
- Characterize the construction characteristics of in-territory nonparticipating homebuilders
- Establish current baseline practices
- Comparison against current baseline practices
- Inform and improve program planning, design, and implementation

Determining the Sample Size

Determine Sample Size

- Determine new home construction starts per county.
- Define target population by segmenting in-territory new construction homebuilders by program participants and non-participants.
- Determine sample population size to achieve 90% confidence interval based on available resources.
- Determine optimal number of home inspections by county by proportionally allocating home inspections based on number of nonparticipating new home builds.
- Research code adoption in each utility service territory

Distribution of Adopted Codes



One of the biggest challenges facing above code utility programs is the lack of code enforcement and current code adoption.

Data Collection Methods

Plan and Design Data Collection Methods

- Source associations and contacts for homebuilders list and develop online survey distribution lists for non-participants.
- Develop home inspection selection criteria.
- Develop survey data collection instruments and accompanying documents for online survey and field verification and testing.
- Develop processes and protocols for documentation
- Develop home access coordination and logistics

Deploy Survey/Field Verification

Deploy Survey and Field Verification

- Deploy online survey to nonparticipating homebuilders.
- Perform field verification and diagnostic testing of nonparticipating homebuilders.

Collect Data

Collect Survey Feedback and Field Data

- Develop database to receive online survey and field inspection data.
- Review, track, and perform quality assurance on data.
- Use data to inform data collection process.
- Collect and compile participating homebuilder REM/Rate files and QA/QC data with survey and field inspection data.

Analyze Survey Results and Field Data

Review and Analyze Survey Results and Field Data

- Segregate data by utility and weight home characteristics by new home construction starts.
- Statistically analyze data to determine weighted average mean building characteristics at 90% confidence intervals.

Report and Implement Results

Report and Implement Analysis Results

- Examine data to identify trends in homebuilder construction practices and code compliance.
- Develop recommended baseline characteristic home construction values and develop corresponding energy models.
- Perform energy savings calculations.
- Use results to improve cost effectiveness and implementation of program design

Nonparticipant Construction Volume Energy Code

Code Unverifiable	No Code	IECC 2000	IECC 2003	IECC 2006	IECC 2009	IECC 2012	Total
5	166	160	14	579	7,700	86	8,710

Non-Participant Construction Volume by Utility

Utility Statistics	AEP	CNP	Entergy	TNMP	Total
Homes Represented	632	5,865	1,542	671	8,710
% of Homes Surveyed	7%	67%	18%	8%	
Builders Represented	22	29	22	11	69
% of Builders Surveyed	32%	42%	32%	16%	
Avg. Homes per Builder	29	202	70	61	126

Baseline Study Summary

- The *Number of Responses*, *Number of Homes Sampled*, and *Number of Homes Represented* are defined as the number of responses received in the study, the number of homes included in the study sample, and the total number of homes represented by the study, respectively. The variability of the numbers of homes or homebuilders in these categories is a result of partially incomplete survey responses. That is, when a building characteristic was not provided by the homebuilder or HERS Rater and its value could not be reconciled, it was omitted from the survey.
- The *Mean* is defined as the weighted average of all survey respondents, weighted by the number of new home construction starts represented by the sampled homebuilder. Equivalently, you can get the same weighted mean by weighting each surveyed home by the number of new home constructions starts represented by that home. It is influenced by the range of characteristic values and the number of homes that represent that value.
- *Margin of Error as a % of Mean* is a relative measurement of the 90% Confidence Interval's width and is a function of the variability in the survey data.

Baseline Study Summary; All Utilities (90% Confidence Interval)

Construction Characteristic	Classification	Number of Responses	Number of Homes Sampled	Number of Homes Represented	Mean	Margin of Error as a % of Mean
Attic Ins (R)	All	11,243	19,766	46,634	31.1379	3%
	Non-Participants	76	8,599	35,467	30.4871	3%
	Participants	11,167	11,167	11,167	33.2049	0%
Cathedral Ceiling Ins (R)	All	10,130	17,249	42,479	20.9777	4%
	Non-Participants	45	7,164	32,394	21.1923	6%
	Participants	10,085	10,085	10,085	20.2883	0%
Cooling Efficiency (SEER)	All	12,409	20,932	47,800	14.4049	1%
	Non-Participants	76	8,599	35,467	14.0093	1%
	Participants	12,333	12,333	12,333	15.5426	0%

Baseline Study Summary; All Utilities (90% Confidence Interval)

Construction Characteristic	Classification	Number of Responses	Number of Homes Sampled	Number of Homes Represented	Mean	Margin of Error as a % of Mean
Duct Leakage (CFM25/100CFA)	All	12,355	19,859	47,401	4.4494	17%
	Non-Participants	59	7,563	35,105	5.0378	21%
	Participants	12,296	12,296	12,296	2.7696	0%
Duct (R)	All	12,405	20,720	47,743	6.3251	3%
	Non-Participants	72	8,387	35,410	6.3277	4%
	Participants	12,333	12,333	12,333	6.3175	0%
Gas Furnace Eff (AFUE)	All	34	6,691	26,768	79.8475	0%
	Non-Participants	34	6,691	26,768	79.8475	0%
Heat Pump Eff (HSPF)	All	810	1,023	17,220	8.0120	0%
	Non-Participants	5	218	16,415	7.9857	1%
	Participants	805	805	805	8.5475	0%
Infiltration (ACH50)	All	12,391	19,574	47,800	4.9646	9%
	Non-Participants	58	7,241	35,467	5.2029	12%
	Participants	12,333	12,333	12,333	4.2793	0%

Baseline Study Summary; All Utilities (90% Confidence Interval)

Construction Characteristic	Classification	Number of Responses	Number of Homes Sampled	Number of Homes Represented	Mean	Margin of Error as a % of Mean
Percent Fluorescent Fixtures (%)	All	12,407	20,905	47,800	36.5091	25%
	Non-Participants	74	8,572	35,467	22.4646	46%
	Participants	12,333	12,333	12,333	76.8980	0%
Thermostat Man (%)	All	12,408	20,909	47,800	0.1392	57%
	Non-Participants	75	8,576	35,467	0.1858	60%
	Participants	12,333	12,333	12,333	0.0054	0%
Thermostat Prog (%)	All	12,408	20,909	47,800	0.8608	9%
	Non-Participants	75	8,576	35,467	0.8142	14%
	Participants	12,333	12,333	12,333	0.9946	0%
Wall Insulation (R)	All	12,395	20,832	47,105	13.6149	2%
	Non-Participants	62	8,499	34,772	13.5081	3%
	Participants	12,333	12,333	12,333	13.9159	0%
Window (SHGC)	All	12,401	20,367	46,700	0.2358	4%
	Non-Participants	68	8,034	34,367	0.2375	5%
	Participants	12,333	12,333	12,333	0.2310	0%
Window (U-Value)	All	12,401	20,367	46,700	0.3827	7%
	Non-Participants	68	8,034	34,367	0.3914	10%
	Participants	12,333	12,333	12,333	0.3587	0%

Key Findings

- Construction Practices
  - Variance of homebuilder construction characteristics and specifications
  - On average, nonparticipating homebuilders are constructing at or above IECC 2009
- Spillover
  - New Home utility programs have a spillover effect to nonparticipating homebuilders
- Building Codes
  - 40% of counties covered by the study have adopted codes as stringent or more stringent that IECC 2009; 10% less efficient; 50% no code or unverifiable code
  - Statewide – more than 20% of cities still have adopted codes lower than the 2009 IECC/IRC
  - Approximately 38% of cities have adopted the 2009 IECC/IRC

Results – Weighted Average Baseline (Nonparticipant Data)

Utility	IECC Baseline	Weighted Average Baseline Savings				
		kWh	kWh %	Therms	kW	kW %
AEP	2009	-1,089	-6.8%	0.3	-0.79	-19.8%
CNP	2009	-892	-7.1%	-91.9	-0.86	-20.9%
CNP	2012	974	9.1%	-27.9	-0.26	-7.4%
Entergy	2009	-1,501	-11.9%	-60.2	-0.67	-16.6%
TNMP	2009	-1,389	-11.2%	-55.6	-0.87	-23.0%
TX Utilities	2009	-1,984	-14.4%	-54.2	-0.93	-22.9%

Recommendations – Below Code

- Attic Insulation
  - Reduce requirement from R30 to R28 (AEP)
  - Reduce requirement from R38 to R31 (CNP homes following IECC 2012)
- Cathedral Ceiling
  - Recommend keeping TRM requirement of R19
- Percent of Fluorescent Fixtures
  - Reduce requirement from 50% to 20% (AEP, CNP, TX)
  - Reduce requirement from 50% to 40% (Entergy, TNMP)

Recommendations – Above Code

- Window U
  - Raise requirement from 0.65 to 0.4 (AEP, CNP, Entergy, TX)
  - Raise requirement from 0.65 to 0.35 (TNMP)
- Window SHGC
  - Raise requirement from 0.30 to 0.28 (AEP)
  - Raise requirement from 0.30 to 0.24 (Entergy, TX)
  - Raise requirement from 0.30 to 0.22 (CNP)
  - Raise requirement from 0.30 to 0.21 (TNMP)

  * Note: The Final TRM set the window values at a maximum U Value of .40 and Maximum SHGC at .30

Savings Impact –2015 TRM + Recommended Changes

Utility	IECC Baseline	Difference in Baselines				
		kWh	kWh %	Therms	kW	kW %
AEP	2009	-397	-2.5%	-0.7	-0.59	-14.8%
CNP	2009	-273	-2.2%	-43.4	-0.44	-10.6%
CNP	2012	1,350	12.6%	-11.9	0.01	0.3%
Entergy	2009	-888	-7.0%	-39.3	-0.50	-12.4%
TNMP	2009	-864	-7.0%	-23.5	-0.47	-12.5%
TX Utilities	2009	-375	-2.7%	-30.4	-0.40	-9.9%

Next Steps and Adjusting for the Impacts

- The results were submitted to the EM&V Evaluator for review and approval.
- The new baseline and measures details were reflected in the Texas TRM for Program year 2016.
- Program designs were then “optimized” using a ICF’s Beacon Optimizer tool to help bridge the gap in the reduced savings impacts
- The New Homes Programs were optimized to deliver greater kW based on the cost effectiveness of the measure
  - Incentive structure was developed to pay for the homes performance based on kWh savings over the new Texas Baseline and bonus incentive tiers based on prescriptive measures designed to drive greater kW savings

Questions?

Thank you for attending!