

# Counting kW's:

How the Utilities in Texas Quantify the  
Demand Reduction Impacts of Air Conditioning  
Energy Efficiency Programs



*Rebecca Farrell*  
*Frontier Associates*  
*Austin Texas*

# Overview

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- Background
- Methodology
  - Available data
  - Compilation of performance data
- Peak Demand and Annual Energy Consumption – Development of Deemed Savings
- Results



# Background

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- January of 2006 federal minimum standards for air conditioners and heat pumps less than 65,000 BTU/hr is raised to 13 SEER
- Texas uses deemed savings to account for reduction in demand and reduction in annual cooling energy consumption – new baseline requires new savings values



# Method – available data

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- Best method would apply manufacturer unit performance data to develop performance curves for each of the following SEER ranges:
  - 13-13.9
  - 14-14.9
  - 15-15.9
  - 16-16.9
  - 17-17.9
  - 18 and above



# Method – available data cont'd

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- Performance data was requested from the 4 largest AC/HP manufacturers:
  - Carrier
  - Goodman/Amana
  - Lennox
  - American Standard/Trane
- Jointly these 4 manufacturers account for 71% of the national market share



# Compilation of Performance Data

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- All four manufacturers provided their performance data which allowed Frontier to compile 42 possible performance curves per manufacturer
  - 6 SEER ranges for 7 standard tonnage sizes: 1.5, 2, 2.5, 3, 3.5, 4, and 5 tons



# Compilation of Performance Data Cont'd

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- In selecting the appropriate condenser/coil combination, Frontier generally used the following criteria:
  1. SEER value at or near low end of the SEER range, e.g., 14.00 instead of 14.5 for example.
  2. All units 14 SEER and above had to meet Energy Star standard
  3. The specific condenser/coil combination that was tested by the manufacturer
  4. Highest sales volume combination



# Construction of Unit Database

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This table was constructed per SEER range (13-13.9, etc)  
and per tonnage size (1.5-5)

		Comp. Model #	Coil Model #	CFM	SEER
manufacturer	Lennox				
	Carrier				
	Trane				
	Goodman/Amana				





# Construction of Unit Database

## Cont'd

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Indicates Low Speed

65°F outdoor ambient			75°F outdoor ambient			85°F outdoor ambient			95°F outdoor ambient			105°F outdoor ambient			115°F outdoor ambient		
MBtu	kW	EER	MBtu	kW	EER	MBtu	kW	EER	MBtu	kW	EER	MBtu	kW	EER	MBtu	kW	EER



# Construction of Unit Database

## Cont'd

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- After the data was compiled one average unit per SEER range and per tonnage size was calculated, using manufacture market share to weight the performance values.
- For the baseline an adjustment was made to reflect the effect of condenser-only change-outs – a 10% reduction to EER for an estimated 30% of condenser-only change-outs



# Peak Demand and Annual Cooling Energy Consumption

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- The load, the capacity and the EER with cycling losses of the units was calculated at each temperature point between 65 and 115 degrees ambient
  - An oversize factor of 115% was applied
  - A cyclic degradation factor of .25 was applied
- Developed a model to estimate kW and kWh for single and multiple speed units



# Peak Demand and Annual Cooling Energy Consumption Cont'd

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- Calculated peak demand at the 99% design temperature for each Texas weather zone
  - Amarillo
  - Corpus Christi
  - Dallas
  - Houston



# Peak Demand and Annual Cooling Energy Consumption Cont'd

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- For annual cooling energy consumption hourly weather data was applied
  - determined the performance at each bin midpoint
  - produced the weather-specific performance based on unit capacities input kW and total load at each temperature bin



# Peak Demand and Annual Cooling Energy Consumption Cont'd

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- Comparison with the performance of the baseline unit in each size range provided estimated peak demand reduction and annual cooling energy savings



# Results

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- AC Demand (kW) Deemed savings for Amarillo

	SEER Range				
Size (tons)	14	15	16	17	18+
1.5	0.13	0.18	0.23	0.30	0.31
2.0	0.17	0.24	0.31	0.41	0.42
2.5	0.21	0.30	0.39	0.51	0.52
3.0	0.25	0.36	0.46	0.61	0.63
3.5	0.30	0.42	0.54	0.71	0.73
4.0	0.34	0.48	0.62	0.81	0.83
5.0	0.42	0.60	0.77	1.01	1.04



# Results Continued

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- AC Energy (kWh) Deemed Savings for Amarillo

	SEER Range				
Size (tons)	14	15	16	17	18+
1.5	219	384	457	615	657
2.0	292	512	609	821	876
2.5	365	640	761	1,026	1,095
3.0	438	769	914	1,231	1,314
3.5	511	897	1,066	1,436	1,533
4.0	584	1,025	1,218	1,641	1,752
5.0	730	1,281	1,523	2,051	2,191





# Results Continued

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- HP Demand (kW) Savings for Amarillo

	SEER Range				
Size (tons)	14	15	16	17	18+
1.5	0.12	0.20	0.20	0.23	0.31
2.0	0.17	0.26	0.27	0.30	0.41
2.5	0.21	0.33	0.34	0.38	0.52
3.0	0.25	0.39	0.40	0.45	0.62
3.5	0.29	0.46	0.47	0.53	0.72
4.0	0.33	0.53	0.54	0.60	0.83
5.0	0.41	0.66	0.67	0.76	1.04



# Results Continued

- HP Energy (kWh) Deemed Savings for Amarillo

	SEER Range				
Size (tons)	14	15	16	17	18+
1.5	400	753	1,032	1,100	1,300
2.0	533	1,003	1,376	1,466	1,733
2.5	667	1,254	1,720	1,833	2,166
3.0	800	1,505	2,064	2,199	2,599
3.5	933	1,756	2,408	2,566	3,032
4.0	1,067	2,007	2,752	2,932	3,465
5.0	1,333	2,508	3,440	3,666	4,332



**\*HP cooling energy savings only\***

# Results Cont'd

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- Factors making these savings more accurate than previous deemed savings:
  - Real unit performance data
  - Application of hourly weather data for each region
  - Accounting for cyclic degradation
  - Accounting for condenser-only change-outs for baseline units



# Questions?

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# Contact Information

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Rebecca Farrell

Frontier Associates

Austin Texas

[www.frontierassoc.com](http://www.frontierassoc.com)

[rfarrell@frontierassoc.com](mailto:rfarrell@frontierassoc.com)

