

IMPACT OF THE IMPLEMENTATION OF THE 2000/2001 IECC ON RESIDENTIAL ENERGY USE IN TEXAS: PRELIMINARY VERIFICATION OF RESIDENTIAL ENERGY SAVINGS

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INTRODUCTION

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METHODOLOGY

SLIDING PRISM

CONCLUSIONS

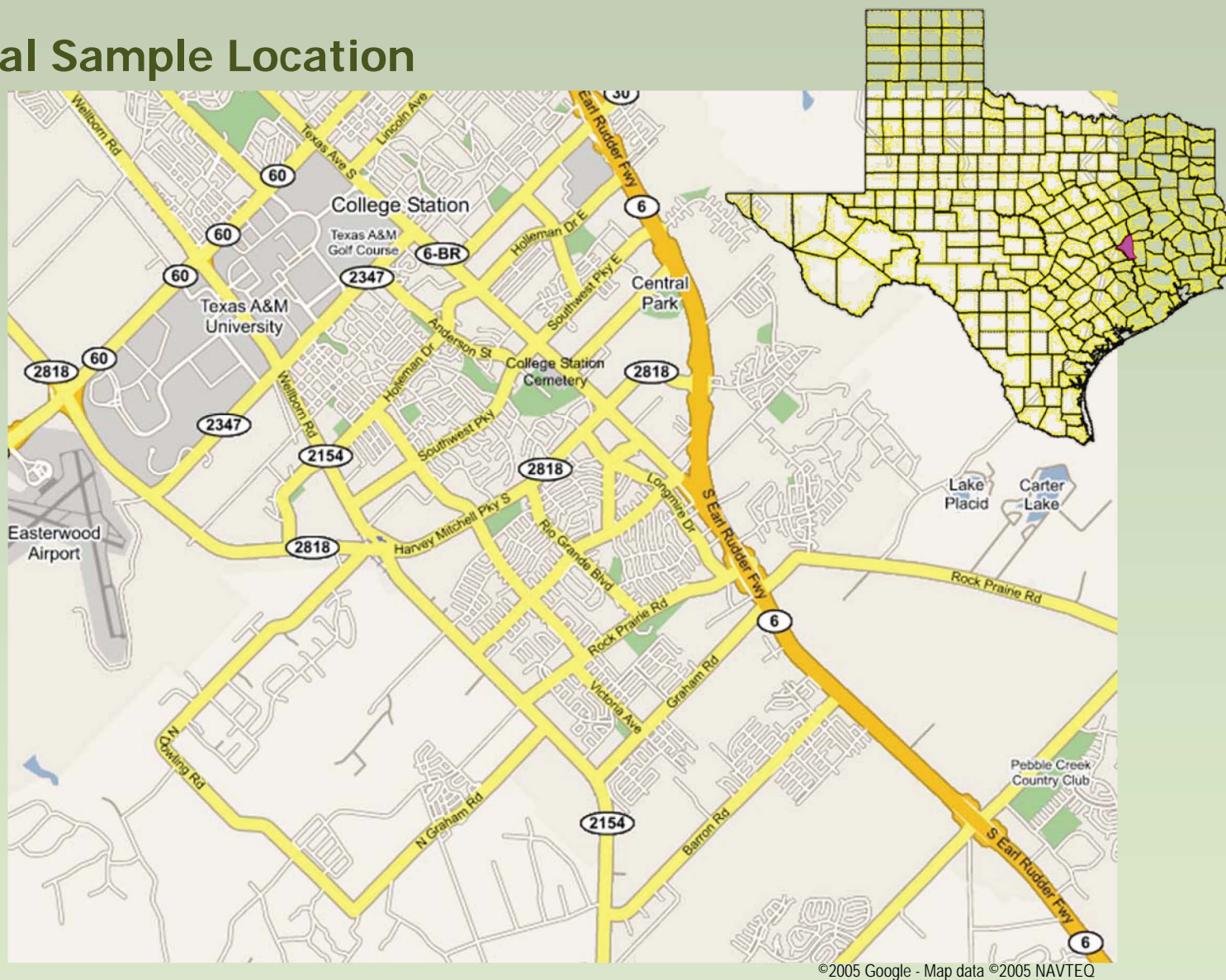
- ✓ **In September 2001, Texas state adopted the 2000/2001 international residential Code**
- ✓ **Texas Legislature has required that the energy savings and emissions reductions from the implementation of the Texas Building Energy Performance Standards (TBEPS) be tracked annually and reported to the Texas Commission on Environmental Quality (TCEQ).**
- ✓ **Verify the code application by utility billing analysis**

IECC: This code addresses the design of energy efficient building envelopes and installation of energy-efficient mechanical, lighting and power systems emphasizing performance

The selection of the houses utilized in this work was based on the following factors:

- a) Two local groups of houses from the same city where the social and economic status is similar**
- b) Both groups of houses built by the same builder**

Residential Sample Location



Residential Area - Aerial View



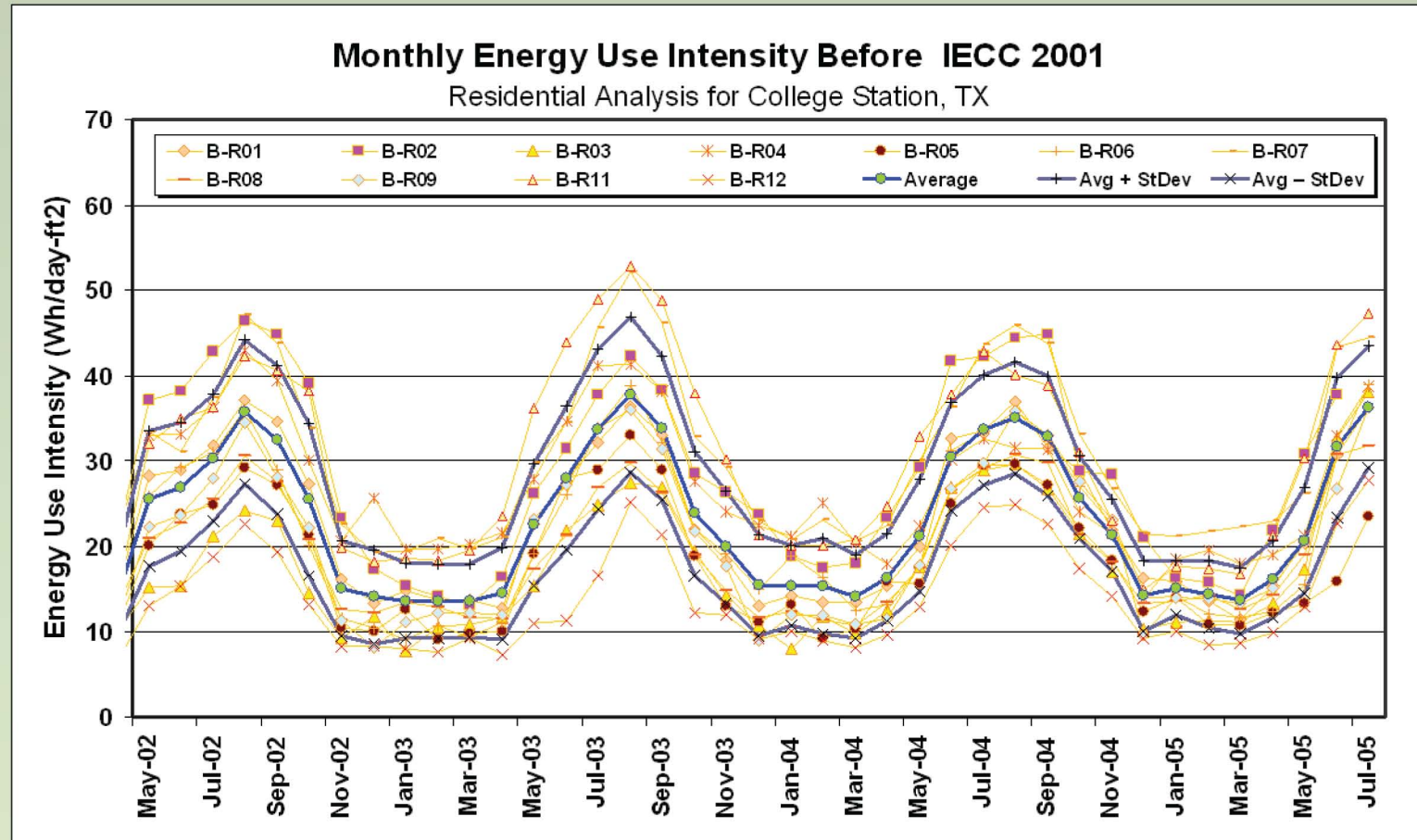
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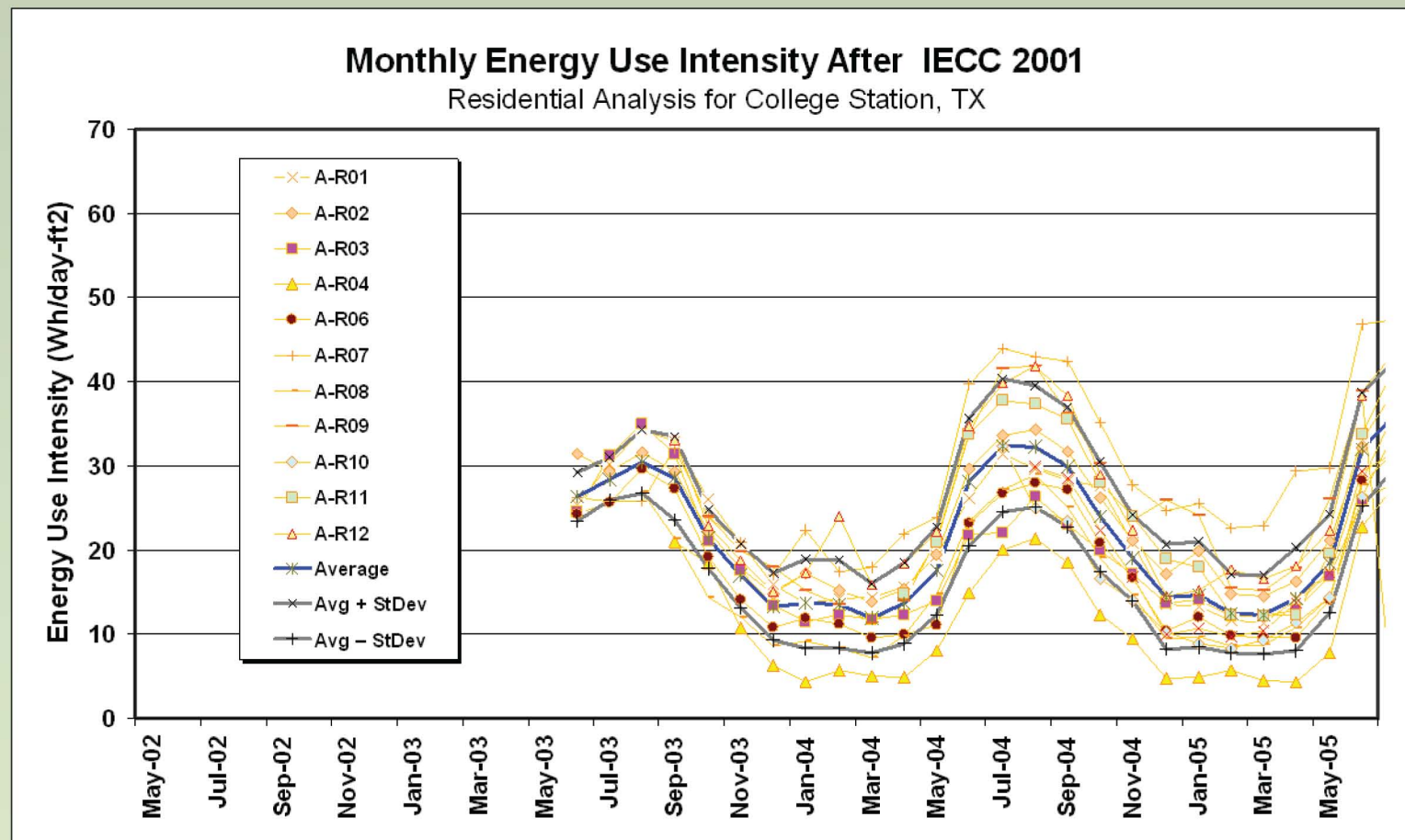
Residential Style



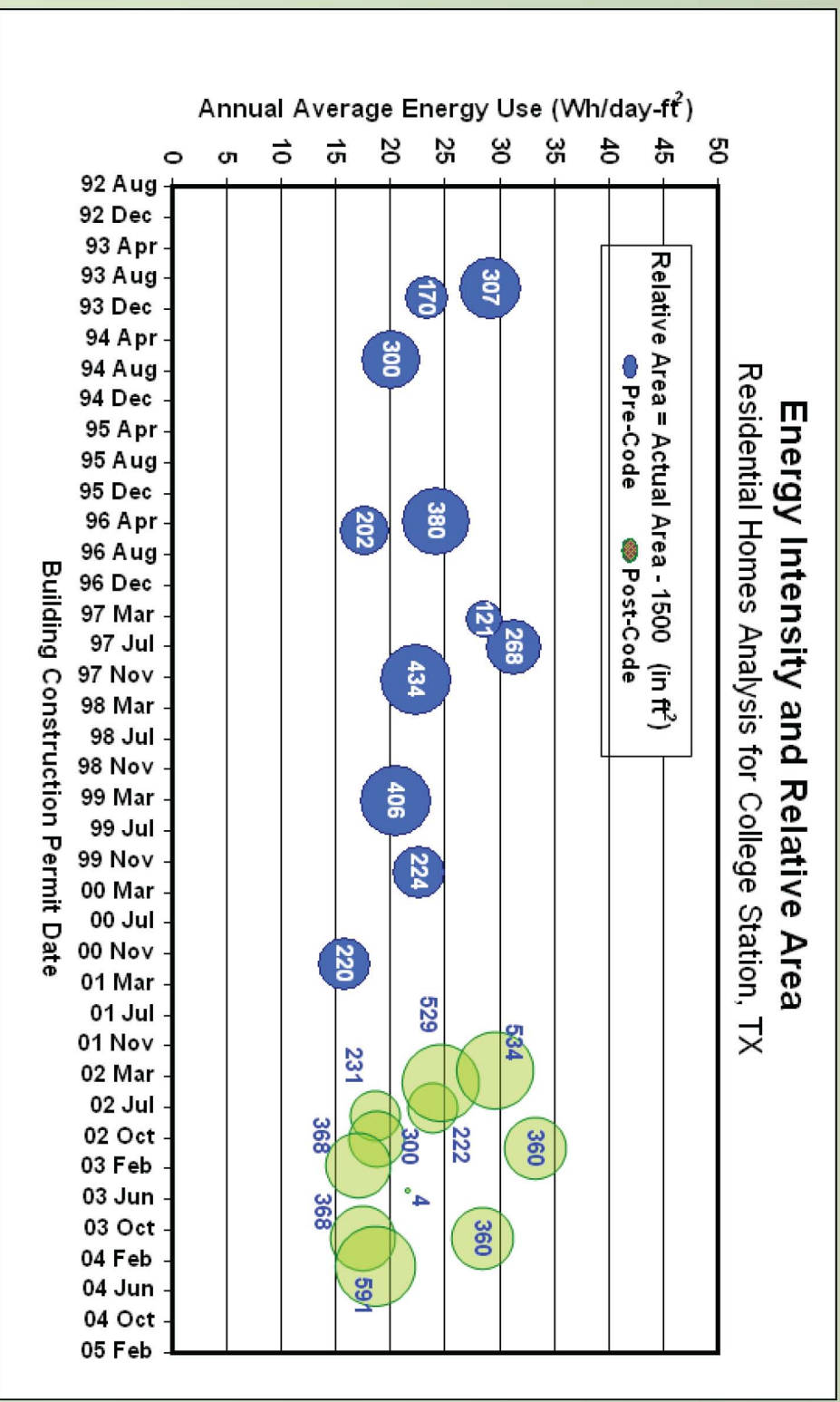
Energy-use intensity patterns for the group of houses constructed BEFORE the implementation of the IECC 2000/2001.



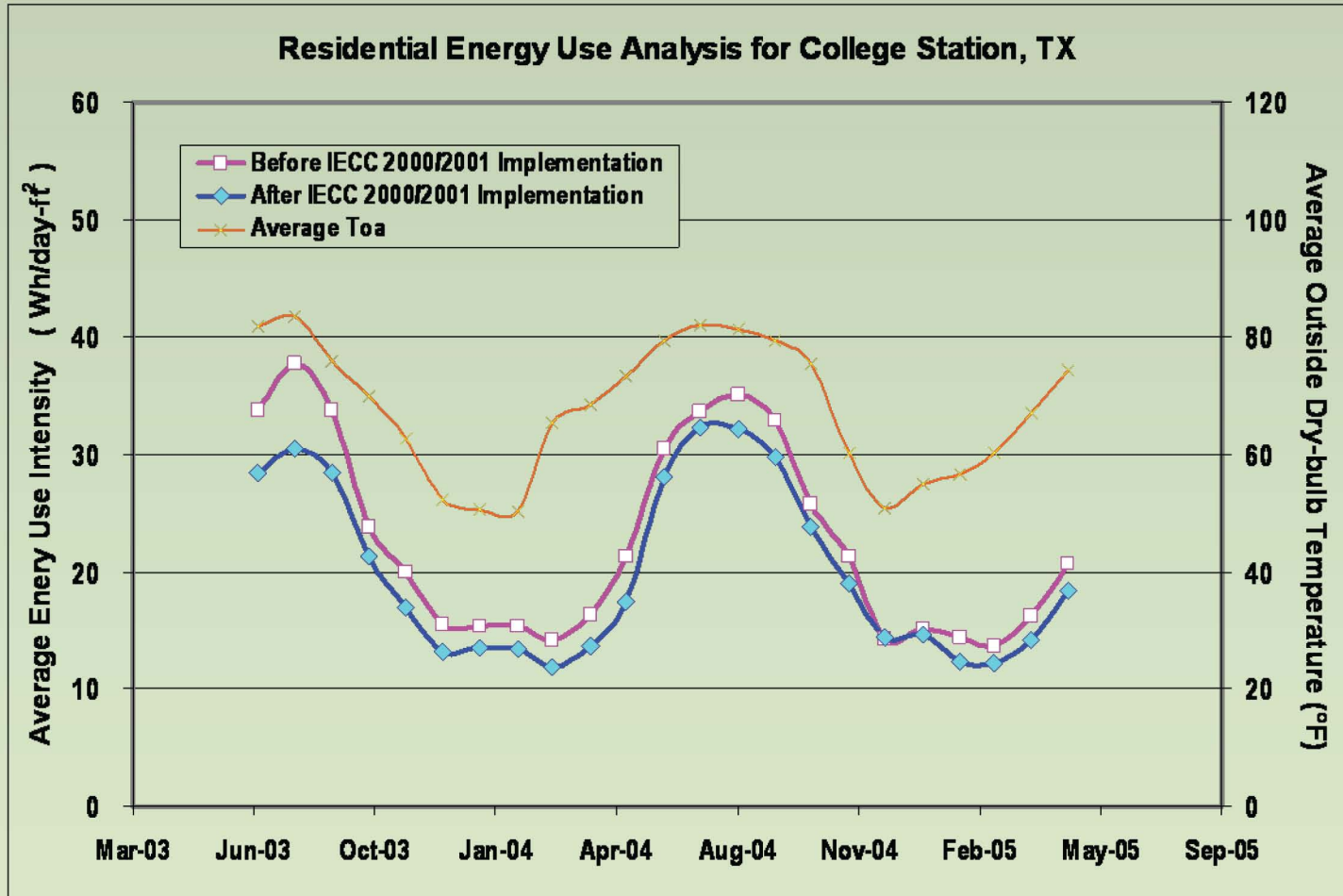
Energy-use intensity patterns for the group of houses constructed AFTER the implementation of the IECC 2000/2001.



Energy Use Intensity



Analysis of the Energy Use Patterns

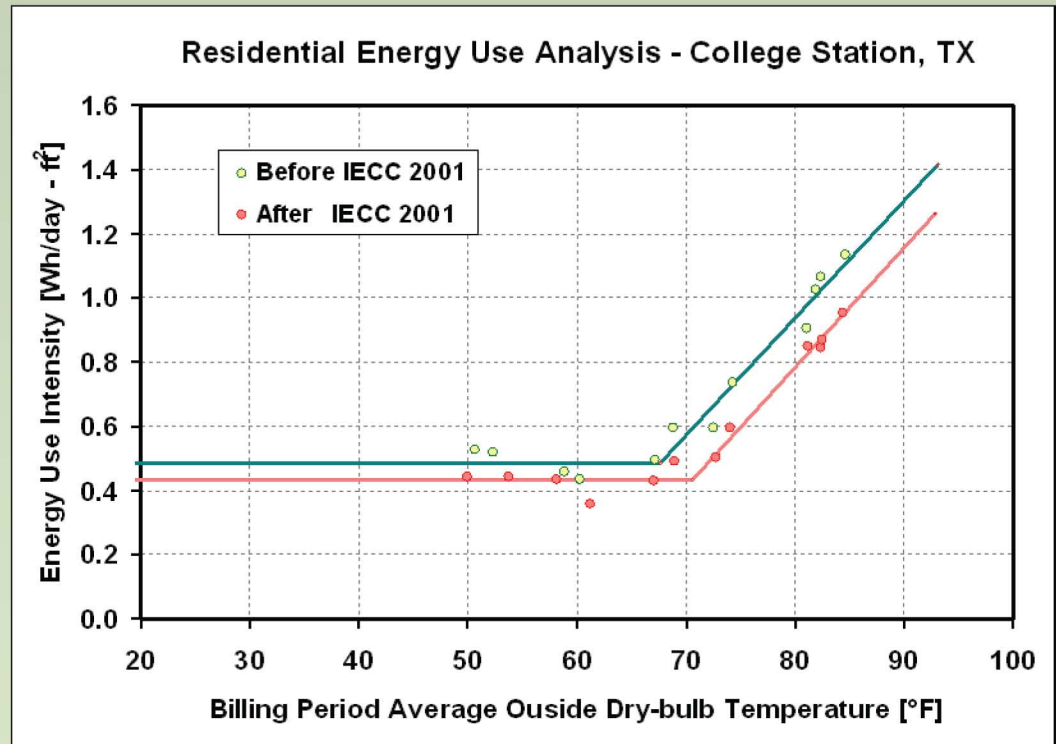


Analysis of the Energy Use Patterns (Change Point Regression)

$$E = a + b(T_{oa} - T_{cp})^+$$

Change Point statistical parameters

	<i>Before</i>	<i>After</i>
<i>a</i>	0.4876	0.4347
<i>b</i>	0.0364	0.0372
<i>T_{cp}</i>	67.6461	70.6201
<i>R²</i>	0.9682	0.9771
<i>AdjR²</i>	0.9650	0.9748
<i>RMSE</i>	0.0480	0.0341
<i>CV-RMSE</i>	6.8%	5.7%



Analysis of the Energy Use Patterns (PRISM)

$$F_i = \alpha + \beta H_i(\tau) + \varepsilon_i$$

$$NAC = 365\alpha + \beta H_o(\tau) + \varepsilon_i$$

$$\text{Energy Savings} = NAC_{\text{before}} - NAC_{\text{after}}$$

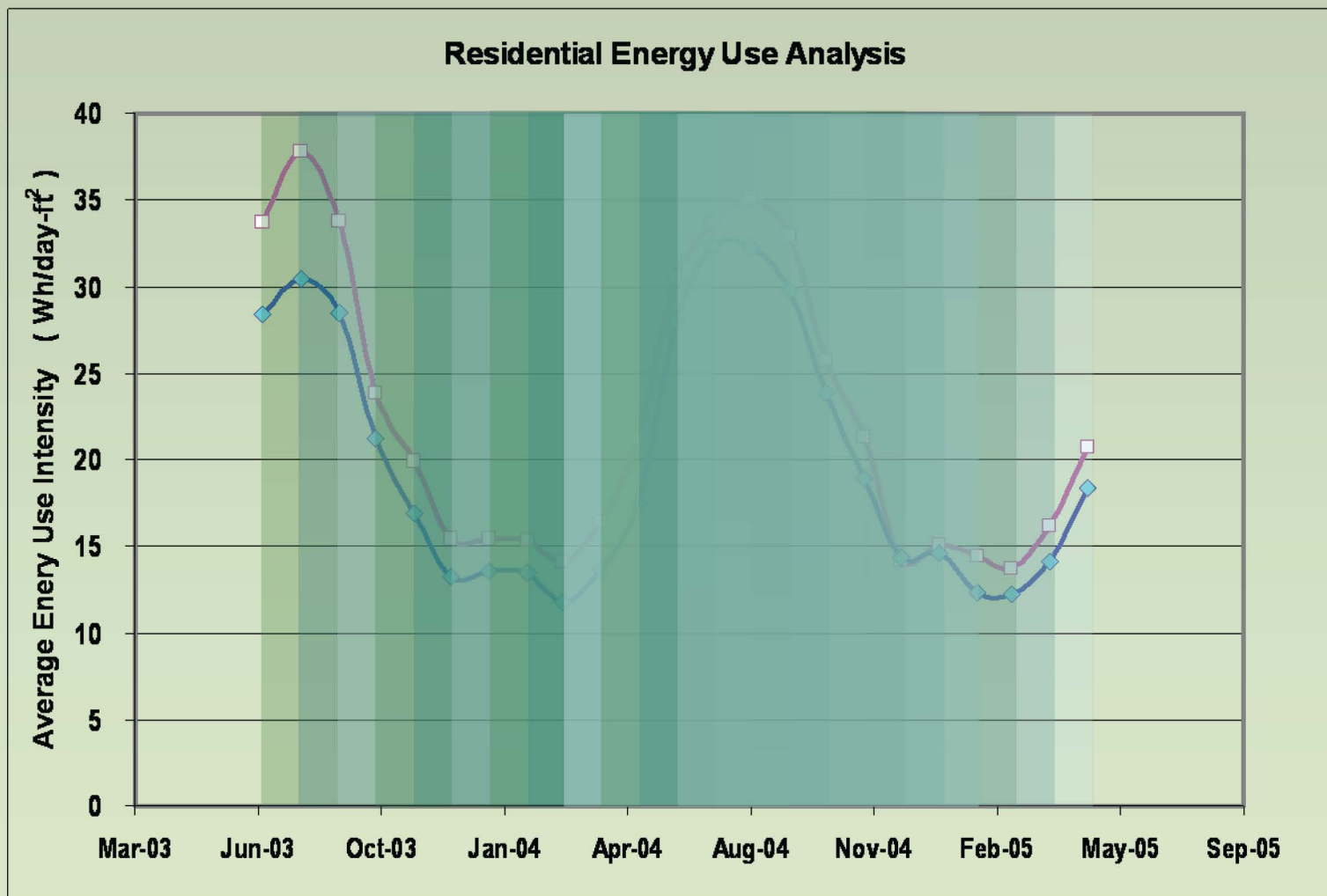
Before the IECC 2000/2001

	Estimates	Std Errs	CV%
Ref. Temperature (τ)	68.000	1.3600	---
Cooling Slope (β)	0.0013	0.0001	8.80%
Base Level (α)	0.0149	0.0007	4.70%
NAC	8.5494	0.1382	1.60%
R-Square	0.9816		
Cooling Part of NAC	3.1234	0.1909	6.10%
Number of Obs.	12		

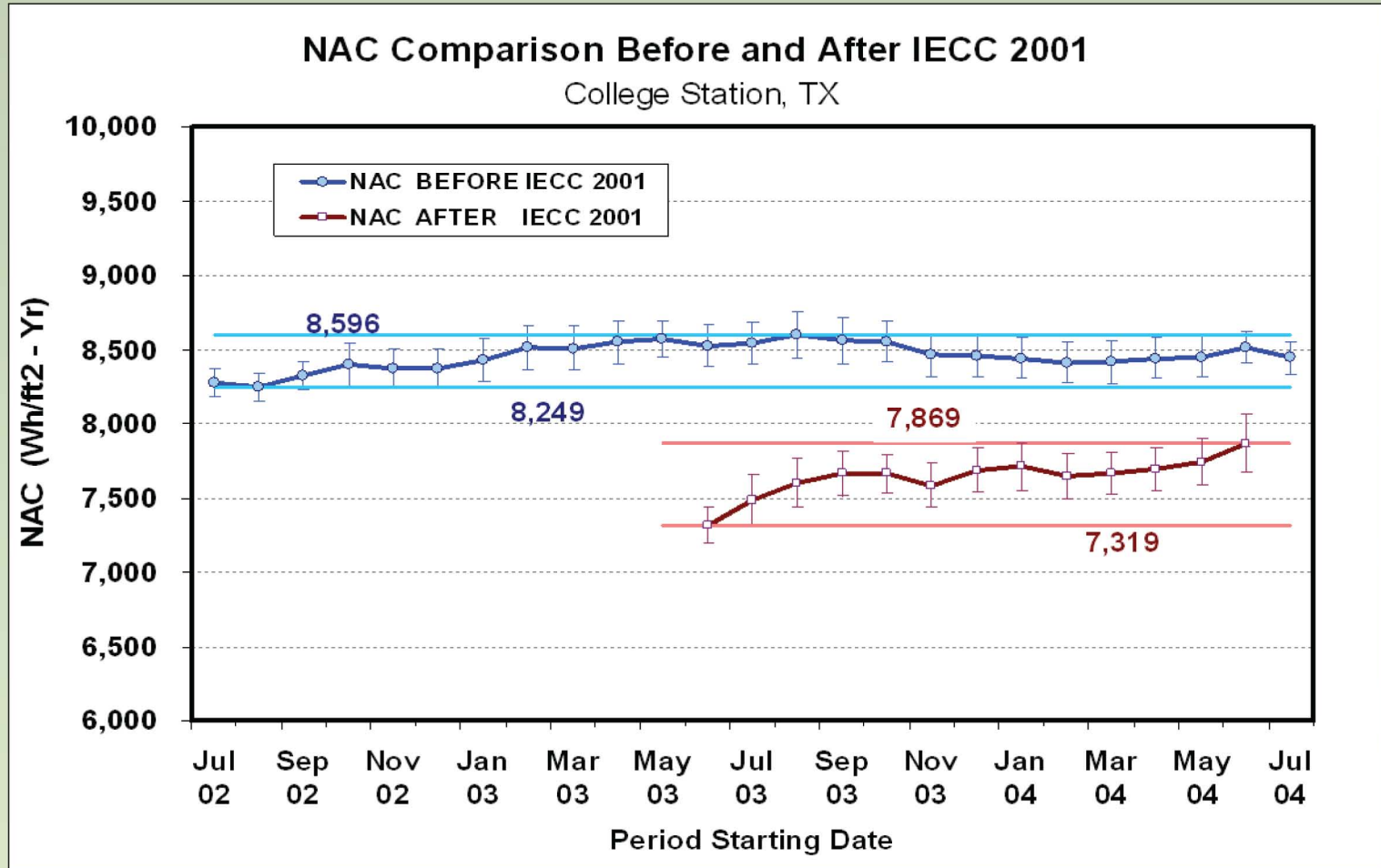
After the IECC 2000/2001

	Estimates	Std Errs	CV%
Ref. Temperature (τ)	67.24	1.47	---
Cooling Slope (β)	0.0011	0.0001	9.00%
Base Level (α)	0.0122	0.0006	5.10%
NAC	7.3137	0.1228	1.70%
R-Square	0.9817		
Cooling Part of NAC	2.4836	0.1710	6.00%
Number of Obs.	12		

Sliding PRISM Energy Savings



Sliding PRISM Energy Savings





Sliding PRISM Energy Savings

NAC_{Before}
SE(NAC_{bef})

8,452

± 23

NAC_{After}
SE(NAC_{aft})

7,667

± 26

Savings
SE (Sav)

785

± 35

9.3%

Wh/(ft²-Yr)

Wh/(ft²-Yr)





The measured savings ranged from 16.2% using a three-parameter change-point model to 14.3% using PRISM. Both results are similar to the anticipated savings from simulations of the code-compliant houses (13.7%).

Results from the application of sliding PRISM to the average data from both groups showed substantial increases in energy use (4.2-7.5%) during the first twelve months the houses were occupied, which can negatively impact the evaluation of code-compliant savings.





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Questions!



Sliding PRISM Energy Savings

