



FLORIDA SOLAR ENERGY CENTER™

Creating Energy Independence

Evaluation of the Space Heating and Cooling Energy Savings of Smart Thermostats in a Hot-Humid Climate

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<http://www.fsec.ucf.edu/en/publications/pdf/fsec-rr-647-16.pdf>



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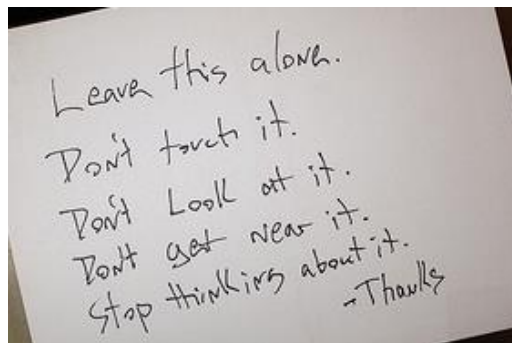
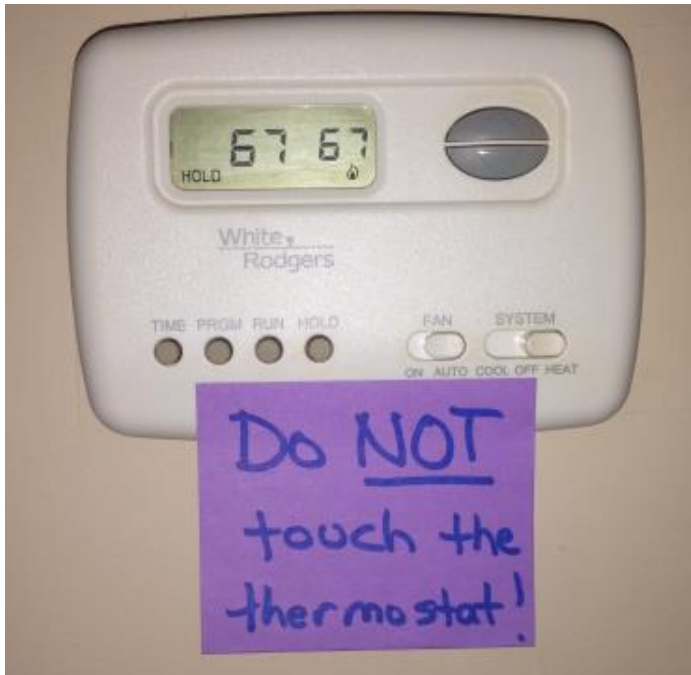


Installation Campaign

- 38 smart thermostats installed overall, but 27 only with no confounding measures
- 22 Nest sites and two Lyric sites in final evaluation
- Detailed characterization of each site; long term data temperature & sub-metered heat pump data (2-3 yrs)



Good Acceptance: Fewer Thermostat Wars

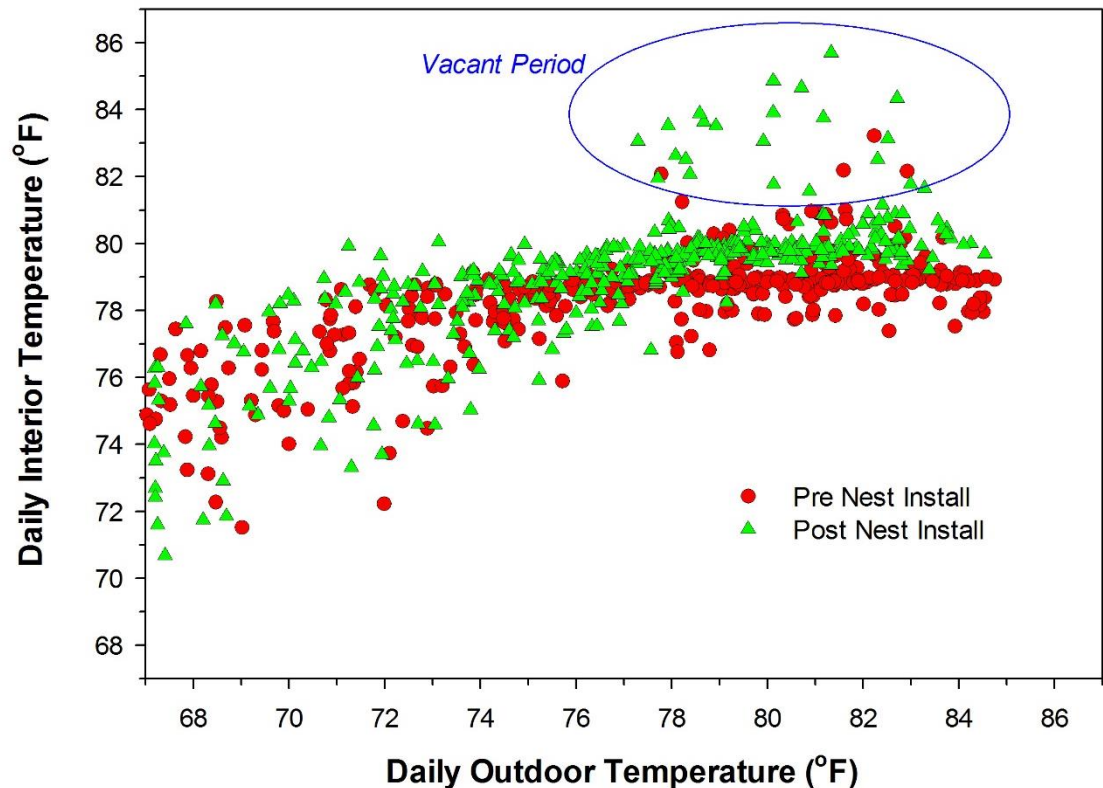


Smart Thermostats

Sometimes Saved a Lot

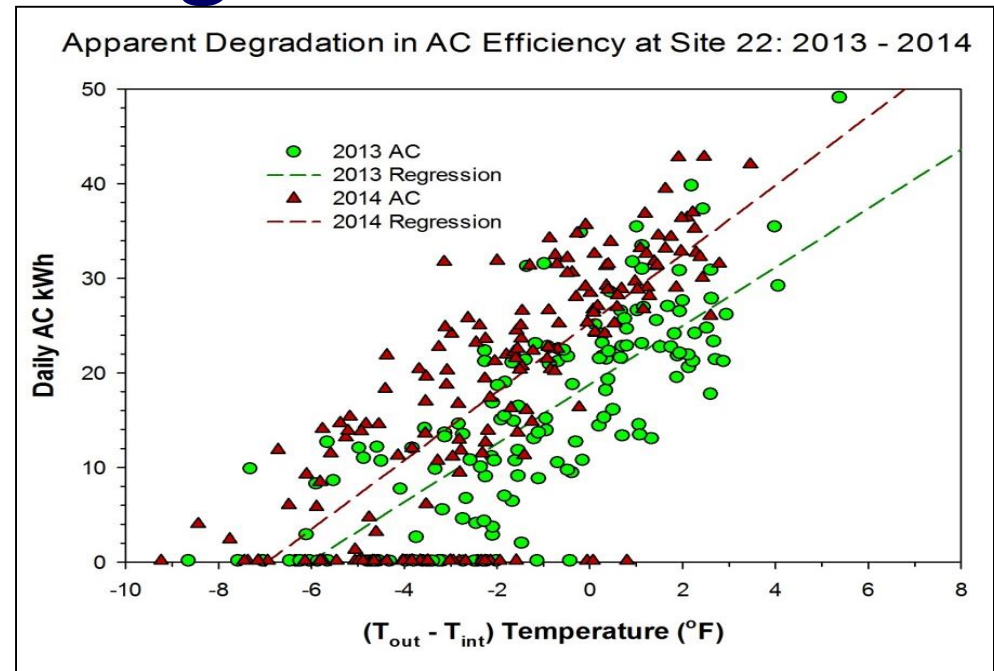
Site 59: Cooling Temperatures Pre and Post

- Occupancy sensing important to savings
- Vacancy periods = large savings
- Defeating AWAY function associated with lower savings



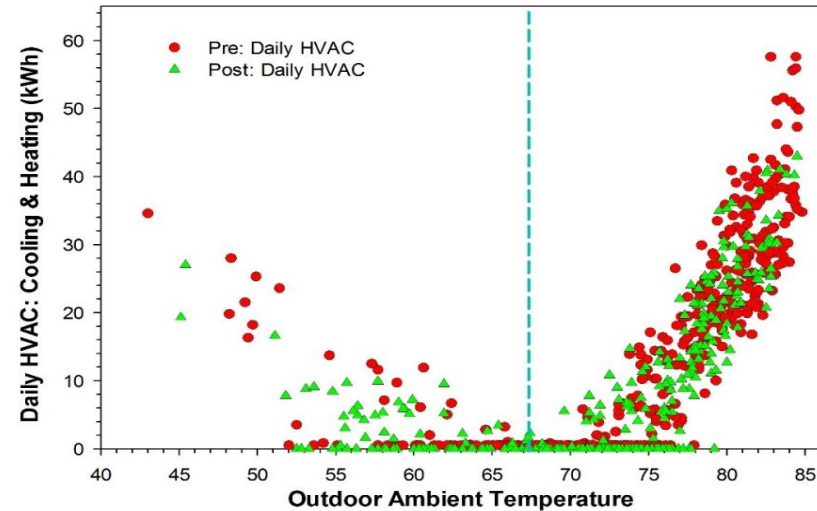
Surprise! Time-Related Degradation in Air Conditioning Performance

- Analysis complicated by changing AC efficiency over time
- Analysis technique allowed us to see how AC performance changed from one year to the next
- Initial plan: 2 years before Nest; 1 year after
- Introduced bias as performance often degraded over 2 year period; typically 1-4% drop in efficiency per year
- Why? Some ideas.....



Conclusions

- Evaluated 22 NEST thermostats with long-term pre and post temperature and sub-metered HVAC data
 - Avg. measured cooling/heating energy savings: 9.6%/9.5%
 - Utility coincident peak savings: 14% summer & 16% winter



- Influences on savings**

- Pre installation thermostat behavior
- Willingness to use AWAY function
- Household occupancy level

Economics very favorable in Florida with high cooling consumption; good retrofit option
 Analytical methods can track falling heat pump performance & may be future opportunity

