



ENERGY STAR Connected Thermostats

Stakeholder Working Meeting Field Savings Metric

August 19, 2016



Attendees

Abigail Daken, EPA

Doug Frazee, ICF International, for EPA

Dan Baldewicz, ICF International, for EPA

Alan Meier, Lawrence Berkeley National
Laboratories

Ethan Goldman, VEIC

Nick Lange, VEIC

Michael Blasnik, Nest Labs

Dave Cassano, Nest Labs

Adam Brouwer, Carrier

Paul Kinningham, Carrier

Matt Golden, Open EE

Phil Ngo, Impact Labs

McGee Young, Impact Labs

Brent Huchuck, Ecobee

Wade Ferkey, AprilAire

Jack Callahan, BPA (retired)

Michael Siemann, Weatherbug Home

Wendell Miyaji, Comverge

Laurie Sobczak, Comverge

Alex Bosenberg, NEMA

Ed Pike, Energy Solutions, for CA IOUs

Ford Garberson, Ecofactor

Ulysses Grundler, Ecofactor

Ram Soma, Ecofactor

Chris Smith, IRCO (Trane)

Roy Crawford, IRCO (Trane)

Kurt Mease, Lux Products

John Sartain, Emerson

Charles Kim, SoCalEdison

Henry Liu, PG&E

Michael Lubliner – Washington State University

Dave Piecuch – UL

Paul Jackson – UL

Essie Snell, eSource

Theresa Weston, DuPont



Agenda

- Status updates
 - Data filtering
 - Baseline discussion
 - Next software release
- Planned milestones
- Post program launch – EPA plans to continue to work with CT stakeholders to refine savings methodology



Status Update: Data Filtering

- Two participating stakeholders have provided output files and participated in discussions
- Recommended filtering out CT instances where:
 1. $\tau < 0^{\circ}\text{F}$ or $>25^{\circ}\text{F}$, and/or
 2. $\text{CV}(\text{RSME}) > 0.6$
- Overview of filtering at these levels as reported by one stakeholder:
 - Additional filtering of CTs with very high or very low savings was found to be unnecessary
 - 32% filtering rate for heating, 15% for cooling
 - Filtering rates varied by climate zone, to a worst case of 73% for heating in the Hot-Dry zone



Discussion: Filtering

- Clarification
- Climate zones with high filtering percentage have relatively small amount of use of that HVAC (e.g. heating in very hot climates, cooling in very cold climates)
- Cooling season less filtering?
 - 28% heating cases drop out from tau constraint <0 ; less than 1% in cooling
 - Note that any condition that causes use of less heating when it's very cold outside (e.g. auxiliary heating when very cold) or more heating when it's less cold, will tend to move tau negative
 - Higher range of outdoor temps – more possibility of temp outliers
 - More supplemental heat sources?
 - Outdoor temps more tightly clustered for cooling
- Should requirement for 250 t'stats/CZ be applied after filtering? What's the impact?
- Is there are target for how little we are filtering?
 - No, nothing specific
 - Begs the question of whether there are systematic differences, causing us to miss something



Status Update: comfort temp baselining

- We are considering the merits of a shift to using T_{indoor} history for assessment of comfort temps for heating and cooling (currently T_{setpoint} is used).
- Pros
 - more technically correct, will result in T_{indoor} being used for both baselining and thermal/HVAC load modeling
 - T_{indoor} is arguably a truer indication of comfort preferences
- Cons??
- Discussion



Discussion: T_{indoor} vs. T_{set} for baseline

- Will this have a different impact for a central heat pump that sometimes runs electric resistance?
 - None we can think of
- Potential downside – homes with secondary heating (wood stove) used a lot, you might have 90th percentile be very high. But may be screened out anyway. Screen for such homes ($T_{\text{in}} \gg T_{\text{set}}$)? Remove those days? Could increase # with good fit.
- Anything similar on cooling? Night flushing during cool evenings. Also, 2 zones (up/down) or supplemental window or ductless units. Do get about 20% more savings estimated using T_{in} for baseline; 40% more savings for heating, by comparison. Significant variation by Climate Zone.
- This matters if it will change the ranking of product strategies. Any thought about that? Or about which is more true to the intention of the metric?
 - Big difference by climate zone
 - Takes float into account?
- During setback – large differential, but drifting toward set point.



Discussion: T_{indoor} vs. T_{set} for baseline

- Polled participants about their opinion on this change
 - Good with T_{in} : 6
 - Against: 0
 - Need more info/think more: 1
 - Good with T_{in} , as long as we deal with homes that have wildly different T_{in} and T_{set} (e.g. external heating some days): 2



Status Update: Planned Beta 1.x software release

- Hard coded data filtering rules
- Additional outputs
 - Software version
 - Per EIA Climate Zone
 - Savings relative to regional comfort temperatures (in addition to 10/90 per-home baseline temps)
 - Mean Indoor ΔT
$$= (\text{baseline } T_{\text{indoor}} - \text{mean } T_{\text{indoor}})$$
 - Mean % Run Time reduction per degree T_{indoor} change
- To be used for a data call to
 1. Inform level setting
 2. Inform selection of a single method



Planned Milestones

- August 2016
 - Draft 2 ENERGY STAR Method to Demonstrate CT Field Savings
 - Discussion Document detailing candidate methods for demonstrating CT field savings & software implementation
- August/early September 2016 – Beta software release
- Early September 2016 – Data request using new software, to inform selection of methodology and minimum % savings
- Late September/October 2016 – results of data request
- October 2016
 - Draft 3 ENERGY STAR CT Specification
 - Final Draft ENERGY STAR Method to Demonstrate CT Field Savings



Planned Milestones (cont.)

- October 2016 – V1.x ENERGY STAR CT Field Savings software
- November 2016
 - Final Draft ENERGY STAR CT Specification
 - Final ENERGY STAR CT Method to Demonstrate Savings
- December 2016 – Final V1.0 ENERGY STAR CT specification
effective upon release



Discussion

- How quickly will there be a QPL?
 - Likely get to take about a month to get the infrastructure in place.



Projected Activities Post Program Launch

- EPA plans to continue to work with CT stakeholders to refine savings methodology
- This effort may include
 - Investigation into alternate baselines, e.g. regional
 - Investigation into alternate methods to assess field savings
 - Opportunities to assess savings from multi-stage & modulating systems
 - Slightly altered metric using temperature choices in homes would allow these to be included easily, could also be used in homes with external heating/cooling sources
 - Validate savings by comparison to pre-post meter data



ACEEE Summer Study

- Following ACEEE Summer Study sessions may be of interest:
 - Mon 8-22, 2 – 4pm (Informal Sessions)
 - Intelligent Efficiency Protocols Project
Ethan Rogers, ACEEE
 - Getting There from Here: A Roadmap for the “Emerging”
uses for Connected Thermostats
Rebecca Foster, Vermont Energy Investment Corporation
 - EIA Building Data (RECS & CBECS) and Forecast
Analysis (AEO) Update
Joelle Michaels, U.S. Energy Information Administration



ACEEE Summer Study

- ACEEE Summer Study sessions (cont):
 - Tues 8-23, 10:30am - noon - Things are Heating Up (or Cooling Down) with Smart Thermostats
 - National Study of Potential of Smart Thermostats for Energy Efficiency and Demand Response
Jennifer Robinson, EPRI
 - Thriller in Asilomar: Battle of the Smart Thermostats
Noah Lieb, Apex Analytics LLC
 - Do Connected Thermostats Save Energy?
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ACEEE Summer Study

- Weds 8-24, 10:30am - noon - Improving and Applying Energy Modeling
 - Exactly What is a Full Load Cooling Hour and Does Size Really Matter?
David Korn, Cadmus
 - A Method to Test Model Calibration Techniques
Ron Judkoff, National Renewable Energy Laboratory
 - Costs and Primary Energy Use of Energy Supply Options to Buildings of Different Energy Efficiency Levels
Nguyen Le Truong, Department of Built Environment and Energy Technology



ACEEE Summer Study

- Thurs 8-25, 8:30 - 10:00am - Performance of Emerging Heat Pump Technologies
 - Field Assessment of Cold-Climate Air Source Heat Pumps
Nicole Kessler, Center for Energy and Environment
 - Performance Testing of Ducted Variable Capacity Heat Pumps
Robert Davis, Ecotope
 - Evaluation of Mini-Split Heat Pumps as Supplemental and Full System Retrofits in a HotHumid Climate
Karen Sutherland, Florida Solar Energy Center



ACEEE Summer Study

- Fri 8-26, 10:30 am – noon - Smart Residential Systems
 - Smart Technologies and Connected Products: Early Adopter Toys or Gateways to Energy Savings?
William Goetzler, Navigant Consulting, Inc. S
 - A Look Inside the Eye on the Wall: Sub-metering Data Analysis of the Nest Thermostat
Phillip Kelsven, Bonneville Power Administration



Contact Information

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