EPA ENERGY STAR Connected Thermostats

Stakeholder working meeting
Connected Thermostat Field Savings Metric
11/20/2015

Agenda

- Introduction – anyone new joining the call?
- Software module update
- Next data call

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Attendees

- Abigail Daken, EPA
- Doug Frazee, ICF International on behalf of EPA
- Alan Meier, Lawrence Berkeley National Laboratories
- Ethan Goldman, VEIC
- Nick Lange, VEIC
- Michael Blasnik, Nest Labs
- Dave Cassano, Nest Labs
- Raj Shah, Carrier
- Phil Ngo, Impact Labs
- Brent Huchuck, Ecobee
- Michael Siemann, Weatherbug Home
- Wendell Miyaji, Comverge
- Alex Bosenberg, NEMA

- Matt Golden, Open EE
- Ed Pike, Energy Solutions on behalf CA IOUs
- Ford Garberson, Ecofactor
- Ram Soma, Ecofactor
- Jennifer Kulp, ICF International on behalf of EPA
- Chris Smith, IRCO (Trane)
- Kurt Mease, Lux Products

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Software modules (recent release)

- v0.2.6-alpha

- https://github.com/impactlab/thermostat/ (source, issues)

- http://thermostat.readthedocs.org/en/latest/ (documentation)

  - refresh to make sure you're not seeing an old cached version

- Install using "pip install thermostat"

- Note changes in input file format.

Next - statistics on many thermostats

- Currently implemented

- Next up and anticipated schedule

- Support

IMPACT LAB

Currently implemented

- Batching

  - Submit a metadata file that lists all thermostats (up to 10k)

  - Module will split into the number of batches you request

  - Aids parallel processing

- Zip code grouping ("all" only at the moment)

- Means, std error of the mean and decile grouping for integer and real outputs from individual thermostat module

Next up, anticipated schedule

- Bumping version to 2.7 or 2.8 in the coming week

- Zip code grouping input file, grouping by weather station

- Testing will continue

- Release ready for data call end of November

Support

- Impact lab will provide debugging and usage support

    - phil@theimpactlab.co or

    - by phone (email me and I will be happy to send my number)

Data call

- Software ready end of November

- Draft data call to go out next week

- Discussion/modification of data request on this call December 5

- Ask for data by end of the year/first week of January

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Data request contents

- Edited version of software module output – essentially eliminating rows by individual zip codes, eliminating some columns.

- Mean metric scores and standard error of the mean for the following fields (using each of the three methods)
    - # days with insufficient data
    - # days in season
    - # days with both heating and cooling
    - Parameters of the fits as applicable for each method
        - For method 1 (linear fit method): Slope, intercept
        - For methods 2 and 3 (HDD/CDD): Alpha, Delta T base
    - Mean squared errors (This is the mean of means)
    - Baseline daily runtime
    - Baseline seasonal runtime
    - Baseline comfort temperature
    - Actual daily runtime
    - Actual seasonal runtime
    - Seasonal avoided runtime
    - Seasonal savings
    - All 12 RHU bins (independent of the modeling method)

- Deciles for **savings metric scores only** (note: this includes the median - 50th percentile)
    - 10th percentile
    - 20th percentile
    - 30th percentile
    - …
    - 90th percentile

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Discussion of data call elements

- How many devices are we talking about?
  - Meet precision requirement – by region or nationally?
  - We don't really know what we need until we see this data
  - Increase sample size at least until standard deviation until it is not being effected
  - But increase over that to get standard errors small
  - Easier if we have a guess of the standard deviation of the population
    - One vendor got within 1% (out of 15%) with sample of 700
  - We don't actually know the shape of the distribution at this point – assuming vaguely Guassian and using standard statistical techniques
- EPA urges folks to dig in a little more deeply, be ready to provide feedback by Dec. 5 call

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Data request – ask for regional data?

- Why would we do this?
  - Potential to discover strong regionality of savings which is consistent across products
  - Would imply to national product score may depend more on distribution of customers than on properties of the product
  - If this is the case, we can modify the metric calculation to more fairly reflect product features (e.g. same weighting of regions for all products)
  - If no strong regionality detected, proceed as we are
  - More likely to detect regionality with smaller regions
- Will be simple to implement with zip code grouping summary feature
- Three options for regions
  - Impact Labs implementing groupings by weather stations (~1700): too many
  - Currently have zip code mapping for 6ish Building America regions: too few?
  - EPA/ICF can provide zip code mapping for 15-20 IECC regions in time for data call

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Discussion of data call regions

- Is the purpose of the regions to reflect climatic differences?
  - For now, we are looking more at climate than at other factors
  - One vendor thinks that for this purpose, the BA climate zones may work fairly well
  - Smaller climate zones may be able to better distinguish the signal, but
  - If we go with smaller climate zones and we need 1k – 2k per zone, data sets get huge
  - 100 units per 20 climate zones is 2k units nationally – fairly manageable
- Objections to asking for data by BA climate zones, looking for 250 units per zone? None from vendors on call – 2 or 3 plan to submit data, 2 do not
- Objections to asking for data by IECC climate zones, asking for > 100 units per zone? No objections either
- Anyone else have opinions about whether BA zones are likely to give enough information to see climate dependent signal? No – EPA hopes for more opinions by Dec. 5 call.

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Other issues

- In heating, scores will be biased low, b/c we are using set points not indoor temp for baselining, but are using the indoor temps for modeling
  - Avg heating season indoor temp may be higher than comfort set point b/c of variations in indoor heating gains (cooking , lights, appliances, showers, etc.) and solar gain; not even considering specific secondary heating sources
  - Second vendor agrees, particularly in milder climates
  - Usually don't see the same in cooling – no spontaneous heating sinks!
  - 1 degree off on baseline may result in 4-5 percent off on the savings
  - Potential solution – change to using indoor temp to establish baseline?
  - Had tried to solve this by using only core heating season data where indoor temp and set temp are more closely related, but at least one vendor is seeing a difference
  - Using indoor temp for baselining may also not reflect true preferences, for reasons discussed previously

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Other issues

- Threshold of heating and cooling seasons (currently using one hour of run time), which will affect the result as well
  - On the other hand, a wider threshold in the linear fit will start to include points which are not on the line with the same slope
  - This problem does not occur with the ratio estimator technique – though does it affect the delta T base?
- Is there a way to easily include some sensitivity analysis in software?
  - It is open source for this purpose
- Also keep in mind that we know that the scores are not realistic anyway b/c the baseline is not realistic
- Optics problem?
  - Maybe, but EPA claims not because we will not base messaging on metric scores
- What inputs are parametrized in the current software implementation?
  - Not sure, can check - easy to parametrize anything that isn't currently
  - Quantities that are parametrized are easier to do sensitivity analysis on

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Contact Information

Web site for these notes and all public discussion/comments:

http://www.energystar.gov/products/spec/connected_thermostats_specification_v1_0_pd

Abigail Daken

EPA ENERGY STAR Program

202-343-9375

daken.abigail@epa.gov

Doug Frazee

ICF International

443-333-9267

dfrazee@icfi.com