



EPA ENERGY STAR Climate Controls

Stakeholder working meeting
RCCS Field Savings Metric
3/27/2015

Agenda

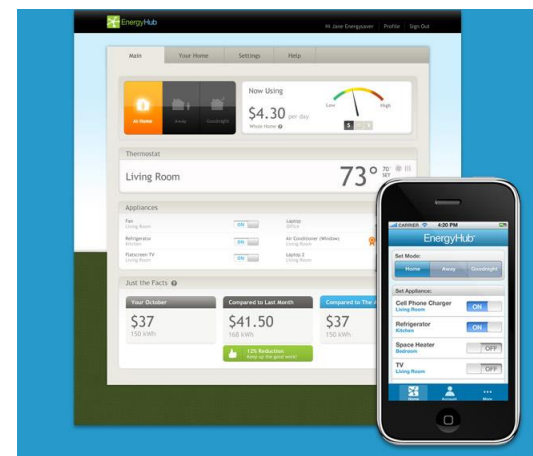
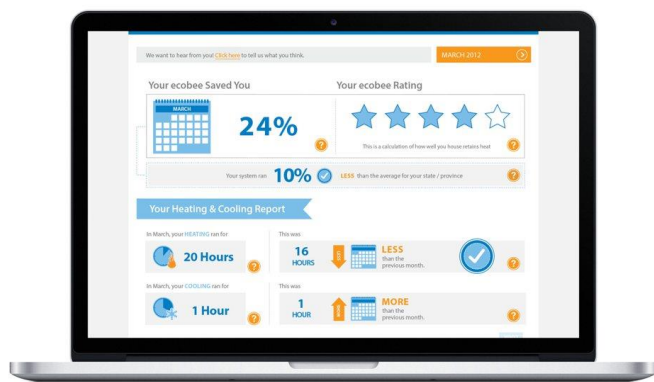


- Reminder of what EPA is aiming for, purpose of the series of meetings (skip if no new participants)
- Any administrative issues?
- Old business
 - Data call odds and ends
 - Update on EPA provided code: inputs and outputs
- New business
 - Your questions and concerns

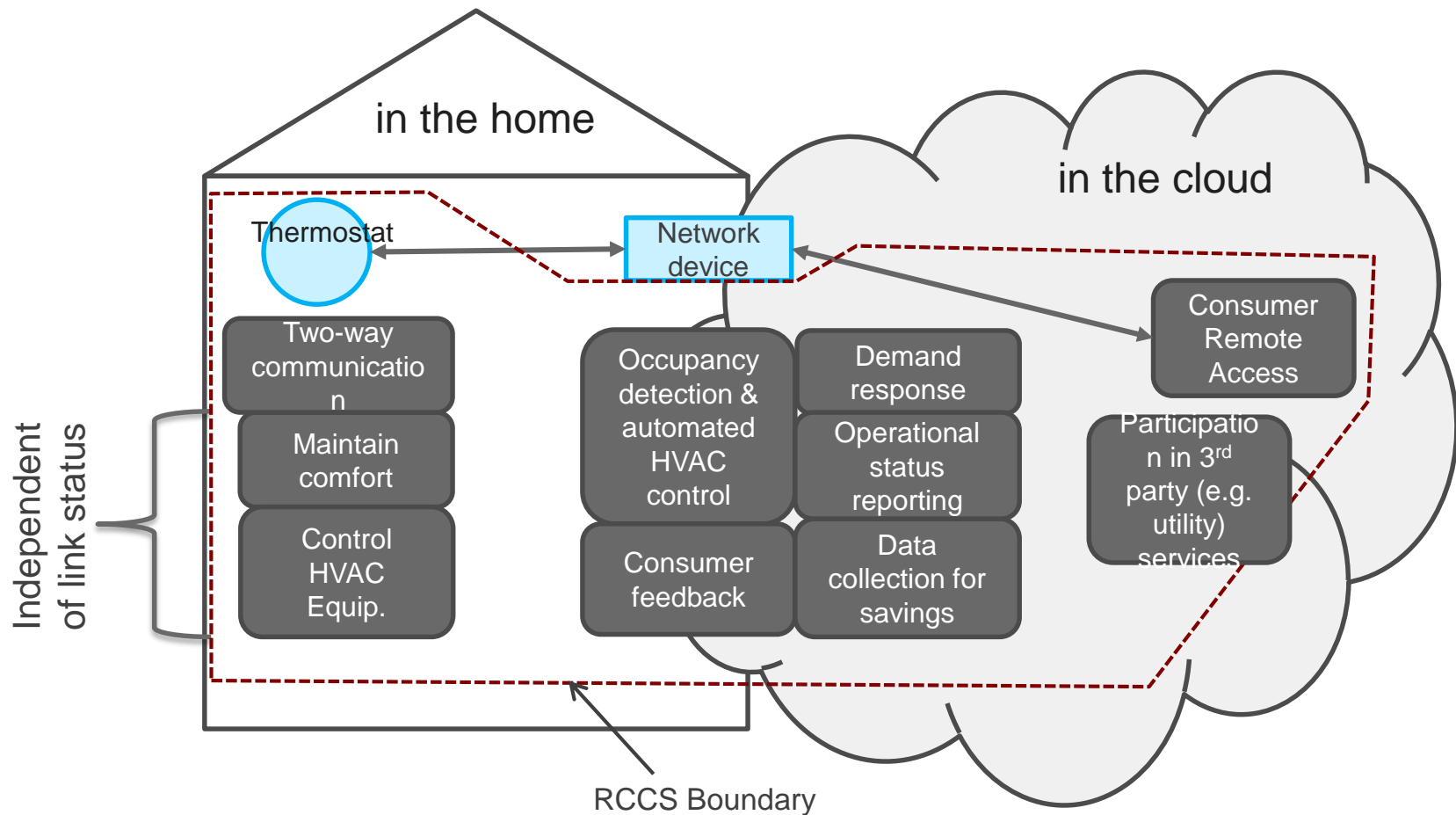
Introduction – A New Approach



- Large potential savings
- New product types & business models emerge
- Measuring RCCS savings being done today, but...
 - no standard methodology
 - savings claims vary widely



Blend of local hardware and cloud services provides RCCS capabilities



Program Outline



- Recognition for RCCSs that save energy in the field
- To earn the ENERGY STAR:
 - RCCS criteria that enables savings
 - Periodic reporting of savings
- Product includes service component
- ENERGY STAR Partner is service provider
- Periodic field data
 - Calculate program emissions reductions
 - Serve as energy savings data for QPL

Step 1: Metric



- Ranks RCCSs based on field savings
- Uses data from RCCS or publically available
- Preserves consumer privacy
- Protects proprietary information
- Practical to calculate
- Activities to date
 - Framework 11/5/14; San Francisco meeting 11/19/14
 - Algorithmic framework 1/12/15; Stakeholder call 1/16/15
 - Stakeholder call and next algorithmic framework, 1/30/15

Administrative concerns?

- Anything we need to deal with?

Data call



- Data call reminders:
 - Please **send data to ICF** (Doug Frazee)
 - Data anonymity: if we get 5 data points, will share with group. Otherwise, will discuss with those who provide data before we release
 - EPA standard practice in other specs: release anonymous data as long as we have at least 3 data points
 - Typo: page 2 still refers to 2 options for the regions, please ignore
- EPA will provide reporting template next week
- Issues raised by stakeholders so far:
 - Standard deviation of the mean values or standard errors of the reported sample mean values (for all items)?
 - Definition of heating and cooling days are different for different data items, can we make them consistent?

Data call (continued)

- Proposal (HRT = heating run time, CRT = cooling run time)
 - Core heating days >1 hour HRT, no CRT
 - Shoulder heating days $0 < \text{HRT} < 1$ hour, no CRT
 - Core cooling days >1 CRT, no HRT
 - Shoulder cooling days $0 < \text{CRT} < 1$ hour, no HRT
 - All other days – report only how many days heating and cooling both operate
- Possible issues with this proposal:
 - Outdoor temps aren't monthly averages
 - Set point reporting doesn't include days in heating/cooling mode, but no run time. OK because people are ignoring HVAC systems on those days?

Data call - discussion



- Alternate proposal based on outdoor temp – heating days are days that heat mode is on, and that the outdoor temps is lower than 60 F or something
- Core heating season, $HRT > 1$ hr, no cooling
- Shoulder heating season, ($0 < HRT < 1$ hr, no cooling) or (outdoor temperature < 60 F, no cooling)
- Nest shared that 90-98% of run time occurs in core seasons rather than shoulders (as defined by less than an hour of run time).
- We need something simple to do now. Can refine as we go, but lets use the above proposal for now.
- Add total number of days in each defined “seasons”

Software Modules – status update



- SOW created but needs refinement
- Stakeholder input needed for suitability
 - Planned inputs
 - Planned outputs
 - csv input & output file formats

Software Modules – overview



- Purpose – open-source software modules will standardize calculation of three savings metric variants:
 - HDD/CDD – run time regression, option 1
 - HDD/CDD – run time regression, option 2
 - ΔT – run time regression
- Initial usage – modules will be used by stakeholders for a forthcoming call for data
 - This data call will target refinement and potential finalization of savings methodology & software modules
- Final software module(s) will be used for periodic reporting of field savings

Software Modules – inputs



- Inputs and outputs are for one home – modules not planned to perform calculations across sample of homes
- HVAC type (enter one of the following numerals):
 - 1. Single zone, single stage HP w/ resistance emerg/aux
 - 2. Single zone, single stage HP w/o emerg/aux heat
 - 3. Single zone, single stage oil/gas w/ single zone, single stage CAC
 - 4. Single zone, single stage oil/gas heat w/o CAC
 - 5. Single zone, single stage CAC w/o central heating
 - 6. Other (e.g. multi-zone multi-stage, modulating – module outputs a message indicating the tool is not designed for these HVAC systems)

Software Modules – inputs



- CT data (date range must cover at least one full heating or cooling season):
 - T_{in} – hourly avg. conditioned space temps (°F, min. res. 0.5°F)
 - T_{set} – hourly avg. set points (°F, min. res. 0.5°F)
 - T_{out} – hourly outdoor temps (°F, min. res. 0.5°F)
 - RT_{heat} – hourly HVAC primary heating run time (seconds)
 - RT_{aux} – hourly HVAC elec. aux heat run time (seconds)
 - RT_{emg} – hourly HVAC elec. emerg. heat run time (seconds)
 - RT_{cool} – hourly HVAC cooling run time (seconds)

Software Modules – outputs



- Module will parse data as heating or cooling using the following (draft) rules:
 - Heating season = all days with no cooling, heating run time ≥ 1 hour
 - Cooling season = all days with no heating, cooling run time ≥ 1 hour
- Outputs (per home)
 - Heating & Cooling comfort baseline temps. (e.g. 90th percentile of heating set point history, 10th percentile of cooling set point history)
 - Regression models, slope, Y-intercept, goodness of fit:
 - HDD/CDD – run time regression, option 1
 - HDD/CDD – run time regression, option 2
 - ΔT – run time regression

Software Modules – outputs



- Baseline seasonal run times for each regression model (Hours, Minutes, Seconds)
- Actual seasonal run times (Hours, Minutes, Seconds)
- Seasonal savings for each regression model (% heating or % cooling run time reduction)
- Avoided seasonal run times for each regression model (Hours, Minutes, Seconds)
- Resistance Heat Utilization in twelve 5°F outside temp bins from 0 to 60°F (HP w/ elec res aux/emerg heat):

$$RU = (\text{total heating season } R_{\text{aux}} + R_{\text{emg}}) / (\text{total heating season } R_{\text{heat}} + R_{\text{emg}})$$

Software Modules – discussion



- Initial data call will be for single-zone single-stage HVAC:
 - Are service providers able to reliably distinguish single-zone vs multi-zone installations? How?
 - Would a 2-zone home, with one CT and one legacy thermostat be detectable?
 - Will the goodness-of-fit statistic will help with this?
 - Might it also detect homes that, for example, use wood stoves?

Software Modules – discussion



- RU metric – Intent is to calculate the ratio of resistance heating run time (aux + emergency) to total heating time (heat pump + emergency), in twelve 5°F outside temperature bins from 0 to 60°F (0 – 5°F, 5 – 10°F, 10 – 15°F...)
 - Is this the right metric to efficient use of aux/emerg. heat?
- Python code base, open source, etc?
 - Process for collaboration – some of the questions we’ve been discussing could be informed by stakeholders playing with the code themselves
 - Include in SOW for contractor to publish as open source and/or manage edits and additions from other parties.
- OpenEEmeter.org – project to create open source weather normalizing energy usage data (largely from utilities)
- Arm called “impact lab” can be hired for python coding

Software Modules – discussion



- Inverse modeling toolkit may not work well for what we need – focuses on the problems that we used to use
 - The whole idea is about whole facility billing data
- Several voices for stand alone code base all in python so that its less black box. Use existing python libraries.
- Impact lab did some very fast work for VEIC that was similar
- EPA/ICF will take this under advisement

Running parking lot

- Verification and gaming the system?
- Does the customer base bias the metric results, aside from the qualities of the products?
- Add on today's parking lot items...

Contact Information



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