



19-Aug-2022

To: EPA ENERGY STAR
From: Michael Blasnik, Google Nest
Re: ENERGY STAR 2.0 for Smart Thermostats

Thank you for the opportunity to provide these comments on the proposed 2.0 update of the ENERGY STAR criteria for Connected/Smart Thermostats. Google Nest is fully supportive of all of the proposed changes to the ENERGY STAR requirements. We do have a few specific comments and questions, mostly related to the new resistance heat utilization metric, and have a proposal to expand the allowable random sampling methods so that the data extraction and prep process can be completed within SQL.

We support all of the key changes including:

- Name change from Connected to Smart better reflects consumer terminology.
- Inclusion of line voltage thermostats since they provide potentially significant energy savings opportunities and can be assessed within the current performance method.
- Exclusion of thermostats designed to control variable speed equipment, including minisplits. This type of equipment may not benefit from temperature setbacks due to variations in equipment efficiency at different speeds and complex, proprietary interactions between equipment software and thermostat set points. The proprietary nature of the controls and efficiency variations render the optimal thermostat strategy unclear and therefore unsuitable for creating an ENERGY STAR specification.
- Inclusion of two stage heating and cooling equipment since the efficiency variations by stage are generally small and setbacks can provide energy savings.
- Increase in sample size to 1000 thermostats per climate region should provide more precise and consistent performance scores.
- Software improvements including more detailed data checks, improved error logging and new output files. We also look forward to any improvements to help keep tau within physically meaningful limits in the data fitting.
- New minimum sample size requirement and reliability criteria passing rate.
- New resistance heat utilization requirements for heat pumps to help ensure energy savings. Although we may be proposing some adjustments to better exclude periods where high aux runtime is due to problems with the heat pump and not the algorithms.

RHU concerns

We have two questions/concerns about the Field Savings document, both related to the new RHU metric:

- 1) Why does the RHU heat pump dataset include heat pumps without aux heat? On p.3 it explicitly includes heat pumps without aux heat and dual fuel heat pumps. Is there some reason to include these systems that have no aux or emergency heat?
- 2) Core heating days are defined (p.8) as having at least 30 minutes of primary heating runtime which excludes heat pump aux and emergency heat runtimes (we realize v1 employed the same definition). The concern is that a thermostat could employ a compressor lockout at a high temperature (e.g., 35F) and then all days colder than 35F would be excluded from core heating days. This scenario becomes especially problematic because the new RHU metric is calculated from only core heating days, so that a very inefficient compressor lockout would have no impact on the RHU metric. Indeed, the RHU metric would get a boost because it would exclude the coldest portion of the 30-45F bin. What is the rationale for excluding aux and emergency heat from core heating days? If there is some sound reason, then perhaps the RHU metric should use a different definition of core heating days that includes aux and emergency heat.

Sampling Proposal

We would like to propose that the random sampling of thermostats allow for standard sampling methods that can be executed in common SQL dialects. This change would greatly simplify data extraction and preparation by no longer requiring a Python step in the middle of the database querying. Specifically, we propose that vendors be allowed to use a hash function in SQL that is salted with the random number seeds provided by EPA (i.e. calculate the hash on the thermostat_id + random number seed as text) in order to select a random sample.

Well known hash functions such as SHA256, MD5, and Farm Fingerprint are widely available in SQL (and Python) and are commonly used for selecting random samples in a transparent and reproducible manner. We propose allowing vendors to employ any of these established approaches to simplify the sampling step. Vendors could be required to document the specific approach used and follow the same approach in future years.

Sincerely,

Michael Blasnik
Google Nest