Energy Star Residential Climate Control Systems (RCCS) Data Request

Objective of this Data Request
EPA is requesting certain data to inform development of a metric that fairly represents the relative energy-savings of different RCCSs. This data, along with stakeholder discussions, will help EPA determine the most appropriate baseline conditions from which savings will be modeled. This effort will help EPA establish an RCCS ENERGY STAR program that leads to cost-effective energy savings and emissions reductions.

Broader questions associated with this data request include:
- Should regional heating and cooling baseline temperatures for conditioned spaces be established?
- Do outdoor temperatures in a given region reported by different service providers reasonably align with each other?
- Are there systematic differences between service providers in reported indoor temperatures in the same regions?
- Are there systematic differences between service providers in reported set temperatures in the same regions?
- Are there significant differences in run time between service providers in the same region?

Regional Data
EPA seeks data from specific climate regions in order to better understand the ways in which temperature and runtime behavior changes with climates.
Hypothesis: Climate regions influence occupants' choice of temperatures and settings.

Approach: Calculate aggregate temperature set points and indoor temperatures from several different regions and compare them. Relatively extreme climates were selected to provide the clearest climate signal. EPA asks that participants supply data for the following DOE Building America climate zones:
- Cold;
- Hot-Humid

The "BA-ClimateZone-Zip_code_database_2015.02.23," provided separately, maps U.S. zip codes to Building America Climate Zones.

The comparison period is from January 1 to December 31, 2014.

Filters and Data Cleaning
The general goal is to compare the performance of homes during the 2014 calendar year. Homes should be removed from the analysis if:
- the home's RCCS connection date is subsequent to January 1, 2014
- the home's RCCS disconnect date is prior to December 31, 2014
- more than 5% of any home's RCCS data stream is missing

If service providers exclude other data from their sample; please provide the rationale and percentage of excluded data for each set of excluded data. Providers should also indicate the total percentage of homes removed from analyses through these filters. The sample of data will be large enough that the uncertainty of the mean for each quantity is less than 0.2 °F.

Temperature Data
Three types of temperature data will be compiled:
- outside temperatures;
- RCCS set points;
- inside temperatures (reported by the RCCS).

Participants should first calculate temperatures for each home. Participants should report the average temperatures (to the nearest 0.5°F) and standard deviation across homes for the installed RCCS base in each DOE climate zone (option 1) or group of states (option 2).

Outside Temperature Data			
Data	**Interval**	**Days included**	**Hypotheses being tested**
Average Outside Temperatures	Monthly	All days	• Each provider's customer population faces similar distributions of outside temperatures. • Service providers use similar sources of outside temperature data.
Setpoint History			
90th percentile of setpoint history	Heating season	Days where heating run time ≥ 1 hr/day, mode is "heat" or "auto"	• Comfort temperatures vary between vendors. • Lower heating comfort temperatures are used in colder climates.
90th percentile of setpoint history	Shoulder seasons	Days where 0 ≤ HVAC run time (heating and/or cooling) < 1 hr/day, mode is not "off"	• Occupants manage set points differently during shoulder seasons
10th percentile of setpoint history	Cooling season	Cooling run time ≥ 1 hr/day, mode is "cool" or "auto"	• Comfort temperatures vary between vendors. • Higher cooling comfort temperatures are used in warmer climates.
10th percentile of setpoint history	Shoulder seasons	Days where 0 ≤ HVAC run time (heating and/or cooling) < 1 hr/day, mode is not "off"	• Occupants manage set points differently during shoulder seasons
Average setpoint	Heating season	Heating run time ≥ 1 hr/day, mode is "heat" or "auto"	• Set points vary regionally and between vendors.
Average setpoint	Cooling season	Cooling run time ≥ 1 hr/day, mode is "cool" or "auto"	• Set points vary regionally and between vendors.
Daily standard deviation	Whole year	All days	• There are differences in set up/set back behavior between regions and between vendors.

Conditioned Space Temperature History			
90th percentile of inside temperature history	Heating season	Days where heating run time ≥ 1 hr/day, mode is "heat" or "auto"	• During heating season, indoor temperature will be similar to set points.
90th percentile of inside temperature history	Shoulder seasons	Days where 0 ≤ HVAC run time (heating and/or cooling) < 1 hr/day, mode is not "off"	• During shoulder seasons, indoor temperatures will not be similar to set points.
10th percentile of inside temperature history	Cooling season	Cooling run time ≥ 1 hr/day, mode is "cool" or "auto"	• During cooling season, inside temperatures will be similar to set points.
10th percentile of inside temperature history	Shoulder seasons	Days where 0 ≤ HVAC run time (heating and/or cooling) < 1 hr/day, mode is not "off"	• During shoulder seasons, indoor temperatures will not be similar to set points.
Average inside temperature	Heating season	Heating run time ≥ 1 hr/day, mode is "heat" or "auto"	• The annual average inside temperature will deviate from the average set point
Average inside temperature	Cooling season	Cooling run time ≥ 1 hr/day, mode is "cool" or "auto"	• The annual average inside temperature will deviate from the average set point
Daily standard deviation	Whole year	All days	• Standard deviation will be lower for inside temperatures versus for set points.

Run time Data
Participants should separately calculate heating and cooling run time data for each home (min/year). Separately report average run times (to the nearest minute) and standard deviation of run times for the installed RCCS base in each DOE climate zone (option 1) or group of states (option 2).

Runtime Data			
Data	**Interval**	**Days included**	**Hypothesis being tested**
Heating Run time (min/year)	Whole year	All days	• Run time is similar in all regions, regardless of climate. • Run time varies between vendors.
Heating Run time (min)	Shoulder seasons	Days where 0 ≤ HVAC run time (heating and/or cooling) < 1 hr/day, mode is not "off"	• Shoulder seasons represent less than 10% of total energy use
Cooling Run time (min/year)	Whole year	All days	• Runtime is similar in all regions, regardless of climate. • Run time varies between vendors.
Cooling Run time (min)	Shoulder seasons	Days where 0 ≤ HVAC run time (heating and/or cooling) < 1 hr/day, mode is not "off"	• Shoulder seasons represent less than 10% of total energy use
Fan Run time (min/year)	Whole year	Fan operating without heating or cooling	• Fan-only operation occurs less than 1% of the year

Data Confidentiality
EPA respects confidentiality of submitted data. For the purposes of discussion, all data will be displayed but with the submitter's identity removed. Participants may divide their data into two (or more) groups and submit them separately so as to further preserve anonymity, as long as they report how they chose which homes were in which group. If service providers have additional concerns about data confidentiality, please contact EPA or ICF to discuss.