



ENERGY STAR® Program Requirements for Connected Thermostat Products

Partner Commitments

Following are the terms of the ENERGY STAR Partnership Agreement as it pertains to the provision and labeling of ENERGY STAR connected thermostat products. The ENERGY STAR Partner must adhere to the following partner commitments:

Providing Qualified Service/Hardware Products

1. Partner must be a connected thermostat service provider.
2. Comply with current ENERGY STAR Connected Thermostat Products Eligibility Criteria, which define performance requirements and test procedures. A list of eligible products and their corresponding Eligibility Criteria can be found at www.energystar.gov/specifications.
3. **Prior to associating the ENERGY STAR name or mark with any product**, obtain written certification of ENERGY STAR qualification from a Certification Body recognized by EPA for Connected Thermostat Products. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform connected thermostat device testing. A list of EPA-recognized laboratories and Certification Bodies can be found at www.energystar.gov/testingandverification.
4. A new product is defined as a connected thermostat with either significantly different hardware or software features relative to an existing product. Products receiving software updates are not considered new products.

Using the ENERGY STAR Name and Marks

5. Comply with current ENERGY STAR Identity Guidelines, which define how the ENERGY STAR name and marks may be used. Partner is responsible for adhering to these guidelines and ensuring that its authorized representatives, such as advertising agencies, dealers, and distributors, are also in compliance. The ENERGY STAR Identity Guidelines are available at www.energystar.gov/logouse.
6. Use the ENERGY STAR name and marks only in association with qualified connected thermostat products, where the CT Service and CT Device have been qualified together. The Partner may not refer to itself as an ENERGY STAR Partner unless at least one product is qualified and offered for sale in the U.S. and/or ENERGY STAR partner countries.
7. Provide clear and consistent labeling of ENERGY STAR CT products.
 - 7.1. Use legible electronic ENERGY STAR certification marks at least 76x78 pixels in cyan, black or white on the home screen of the interface or web portal, the main menu screen, or another place where users would be expected to come across it in routine use.
 - 7.2. The ENERGY STAR mark must be clearly displayed in service provider product literature (i.e., user manuals, spec sheets, etc.) and on the partner's Internet site where information about ENERGY STAR qualified products is displayed.
 - 7.3. The ENERGY STAR mark may not be physically applied to either the CT Device or CT

Device packaging.

7.4. To the extent that there is product literature, web pages, installation manuals, etc. for CT Device, the ENERGY STAR name and mark may only be used in association with the ENERGY STAR CT Product; consisting of a qualified CT Device and qualified CT Service in combination.

8. ENERGY STAR Labeling of CT Products that are associated with a broader product, such as a home security system, shall clearly indicate that only the CT Product is certified. Neither physical nor electronic labels shall be associated with the broader product, and product literature shall state: *"This [insert product type (e.g., security system, home automation system)] includes an ENERGY STAR Certified Connected Thermostat. Only the Connected Thermostat is certified as ENERGY STAR."*

Note: EPA appreciates the feedback we received on the Labeling requirements proposed in Draft 2, both in formal comments and extensive subsequent discussion. In response to the feedback and in light of considerable internal discussion, EPA has restructured and simplified the partner commitments to labeling.

This product category calls for a different approach than that used for most ENERGY STAR categories. This is the case because savings will be driven by the service and EPA will sign partnership agreements only with service providers, not the device manufacturers. As such, EPA is focusing labeling requirements on electronic labeling requirements for mobile device interfaces and web portals, both of which are in the control of the service provider. The Draft 3 proposal reflects an intent to simplify and clarify these requirements. However, EPA recognizes the critical role the ENERGY STAR can play at point of purchase in helping consumers recognize the more efficient choice. EPA regularly relies on physical labeling of products and packaging at retail to educate consumers about efficient choices. However, since connected thermostat devices cannot in and of themselves earn the ENERGY STAR without an associated service, EPA is seeking other ways to educate the consumer at point of purchase that avoid consumer confusion. In the coming months, EPA looks forward to a robust exchange of ideas with our stakeholders about how to best reach consumers at the time and place of their connected thermostat/service purchase.

Providing Information to EPA

9. Provide aggregate savings data and associated statistics to EPA every 6 months in accordance with the ENERGY STAR Method to Demonstrate Connected Thermostat Field Savings. Submitted data shall be representative of savings for the product's U.S. installed base and must demonstrate continued compliance with the requirements of the specification. This data will also be used for program evaluation purposes:
 - 9.1. Every February 1, submit the ENERGY STAR CT Field Savings software tool output file for the previous January 1 through December 31 reporting period.
 - 9.2. Every July 1, submit the ENERGY STAR CT Field Savings software tool output file for the previous June 1 through May 31 reporting period.
10. Participate in verification of thermostat device hardware through a Certification Body recognized by EPA for Connected Thermostats, providing full cooperation and timely responses. EPA may also, at its discretion, conduct tests on products that are referred to as ENERGY STAR certified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government's request.
11. Provide unit shipment data or other market indicators to EPA or an EPA-authorized third party annually to assist with creation of ENERGY STAR market penetration estimates, as follows:
 - 11.1. Partner must submit the total number of units newly subscribing to the service portion of ENERGY STAR qualified Connected Thermostat products within the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner.

- 11.2. Partner must provide subscription data segmented by meaningful product characteristics (e.g., controlled system types, presence of additional functions) as prescribed by EPA.
- 11.3. Partner must submit subscription data for each calendar year to EPA or an EPA-authorized third party, preferably in electronic format, no later than March 1 of the following year.

Submitted unit shipment data will be used by EPA only for program evaluation purposes and will be closely controlled. If requested under the Freedom of Information Act (FOIA), EPA will argue that the data is exempt. Any information used will be masked by EPA so as to protect the confidentiality of the Partner.

Note: EPA proposes simplified semi-annual reporting commitments consisting of submitting the output file from the EPA software tools for the previous 12 month period.

Regarding shipment and subscription data, several commenters requested that partners be able to submit it to a third party, as is allowed for other ENERGY STAR product types. Typically, ICF International collects unit shipment data from partners and shares aggregated data with EPA. In some cases, an industry group agrees to collect data from their members instead, and submits aggregated numbers to ICF. EPA is amenable to this solution. Third parties that have agreed to do this for other ENERGY STAR product categories include the National Electrical Manufacturers Association (NEMA), the Air Conditioning, Heating and Refrigeration Institute (AHRI) and the Consumer Technology Association (CTA). To make this effective in preserving anonymity, at least three partners use any given aggregator. EPA encourages partners interested in such an arrangement to contact the third parties directly.

12. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
13. Notify EPA of a change in the designated responsible party or contacts within 30 days using the My ENERGY STAR Account tool (MESA) available at www.energystar.gov/mesa.

Training and Consumer Education

14. Partner shall train distributors, sales staff and installation contractors on the value of the ENERGY STAR program. This training shall include, at a minimum, identification of ENERGY STAR certified products within the Partner's offerings and on the Partner's web site.
15. All consumer information documents – operating manuals, installation instructions, etc.—must be easily accessible to consumers at a public website.

Performance for Special Distinction

In order to receive additional recognition and/or support from EPA for its efforts within the Partnership, the ENERGY STAR Partner may consider the following voluntary measures, and should keep EPA informed on the progress of these efforts:

- Provide quarterly, written updates to EPA as to the efforts undertaken by Partner to increase availability of ENERGY STAR qualified products, and to promote awareness of ENERGY STAR and its message.
- Consider energy efficiency improvements in company facilities and pursue benchmarking buildings through the ENERGY STAR Buildings program.
- Purchase ENERGY STAR qualified products. Revise the company purchasing or procurement specifications to include ENERGY STAR. Provide procurement officials' contact information to EPA for periodic updates and coordination. Circulate general ENERGY STAR qualified product information to employees for use when purchasing products for their homes.
- Feature the ENERGY STAR mark(s) on Partner website and other promotional materials. If information concerning ENERGY STAR is provided on the Partner website as specified by the

ENERGY STAR Web Linking Policy (available in the Partner Resources section of the ENERGY STAR website), EPA may provide links where appropriate to the Partner website.

- Ensure the power management feature is enabled on all ENERGY STAR qualified displays and computers in use in company facilities, particularly upon installation and after service is performed.
- Provide general information about the ENERGY STAR program to employees whose jobs are relevant to the development, marketing, sales, and service of current ENERGY STAR qualified products.
- Provide a simple plan to EPA outlining specific measures Partner plans to undertake beyond the program requirements listed above. By doing so, EPA may be able to coordinate, and communicate Partner's activities, provide an EPA representative, or include news about the event in the ENERGY STAR newsletter, on the ENERGY STAR website, etc. The plan may be as simple as providing a list of planned activities or milestones of which Partner would like EPA to be aware. For example, activities may include: (1) increasing the availability of ENERGY STAR qualified products by converting the entire product line within two years to meet ENERGY STAR guidelines; (2) demonstrating the economic and environmental benefits of energy efficiency through special in-store displays twice a year; (3) providing information to users (via the website and user's manual) about energy-saving features and operating characteristics of ENERGY STAR qualified products; and (4) building awareness of the ENERGY STAR Partnership and brand identity by collaborating with EPA on one print advertorial and one live press event.
- Join EPA's SmartWay Transport Partnership to improve the environmental performance of the company's shipping operations. The SmartWay Transport Partnership works with freight carriers, shippers, and other stakeholders in the goods movement industry to reduce fuel consumption, greenhouse gases, and air pollution. For more information on SmartWay, visit www.epa.gov/smartway.
- Join EPA's Green Power Partnership. EPA's Green Power Partnership encourages organizations to buy green power as a way to reduce the environmental impacts associated with traditional fossil fuel- based electricity use. The partnership includes a diverse set of organizations including Fortune 500 companies, small and medium businesses, government institutions as well as a growing number of colleges and universities. For more information on Green Power, visit www.epa.gov/greenpower.



ENERGY STAR Program Requirements Product Specification for Connected Thermostat Products

Draft 3 Eligibility Criteria Version 1.0

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8 Following are the eligibility requirements for the Version 1.0 ENERGY STAR Connected Thermostats
9 program. Connected Thermostat Products shall meet all of the identified criteria to earn the ENERGY
10 STAR.

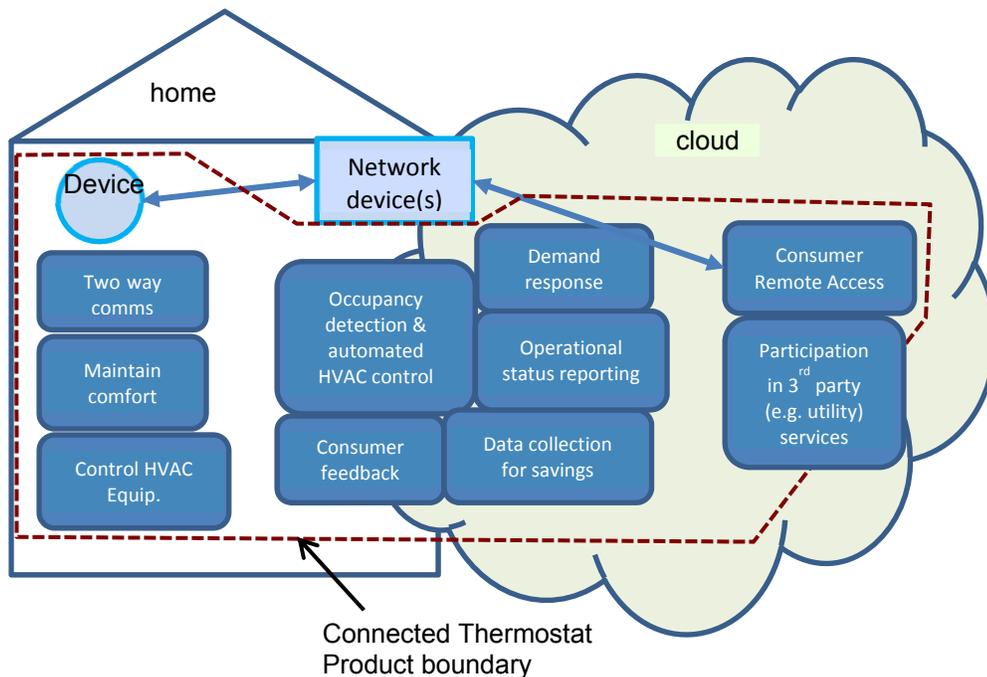
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12 1) Definitions:

13 A. Communication Link: The mechanism for bi-directional data transfers between the CT and one
14 or more external applications, devices or systems.

15 B. Connected Thermostat Device: A product that controls heating, ventilation, and air-conditioning
16 (HVAC) equipment to regulate the temperature of the room or space in which it is installed, and
17 has the ability to communicate with sources external to the HVAC system. For connection, the
18 device may rely on a home area network (e.g. Wi-Fi) and an internet connection that is
19 independent of the Connected Thermostat.

20 C. Connected Thermostat Product: For the purposes of this specification, the connected thermostat
21 product includes the thermostat device in the home with associated firmware, which is assumed
22 to be updated during the time the product is used in the home, as well as a service component
23 supported by hardware and software outside of the home. The service component would
24 typically provide web and smart phone based thermostat control. See below for a pictorial
25 representation of one example. Functions on the left must be in the home, those in the center
26 either require both, or may be enabled by various combinations of cloud services and hardware,
27 and those on the right typically reside in the cloud.



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- 30 D. Connected Thermostat Service Provider: The organization that brands the service component
31 associated with the Connected Thermostat. Associated services typically include smart phone
32 and web control applications, messaging relevant to energy consumption, and APIs that enable
33 consumer-authorized interconnection with utilities and other 3rd parties.
- 34 E. Core Heating Day/Core Cooling Day: A core heating day has more than 30 minutes of heating
35 equipment run time and no cooling equipment run time. Similarly, a core cooling day has more
36 than 30 minutes of cooling equipment run time and no heating equipment run time.
- 37 F. Demand Response (DR): Changes in electric usage by demand-side resources from their
38 normal consumption patterns in response to changes in the price of electricity over time, or to
39 incentive payments designed to induce lower electricity use at times of high wholesale market
40 prices or when system reliability is jeopardized¹.
- 41 G. Demand Response Management System (DRMS): The system operated by a program
42 administrator, such as the utility or third party, which dispatches signals with DR instructions
43 and/or price signals to the ENERGY STAR CTs and receives messages from the CT.
- 44 H. Interface Specification: A document or collection of documents that contains detailed technical
45 information to facilitate access to relevant data and product capabilities over a communications
46 interface
- 47 I. Load Management Entity: DRMS, home energy management system, and the like.
- 48 J. Network Standby: A state with the Connected Thermostat Device is:
- 49 1. installed and interconnected in accordance with provided instructions,
50 2. with no direct or remote user interaction (e.g., smart phone app, web interface, occupancy
51 detection), and
52 3. sufficient time has elapsed to allow the device to enter a low power state, as applicable. For
53 example, the screen has dimmed or turned off automatically.
- 54 K. Open Standards: Communication with entities outside the connected thermostat that use, for all
55 communication layers, standards:
- 56 • Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards,² and/or
57 • Included in the NIST Smart Grid framework Tables 4.1 and 4.2, and/or
58 • Adopted by the American National Standards Institute (ANSI) or another well-established
59 international standards organization such as the International Organization for
60 Standardization (ISO), International Electrotechnical Commission (IEC), International
61 Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE) or
62 Internet Engineering Task Force (IETF).
- 63 L. Product Family: A group of closely related Connected Thermostat Products sharing a primary
64 strategy for delivering savings, and using similar hardware devices. All members of a product
65 family shall share one score on the field savings metrics for heating and cooling. Products using
66 different strategies to produce savings shall be in different product families.
- 67 M. Static temperature accuracy: The deviation in the displayed room temperature from 70°F (21°C);
68 after one hour in a calibrated temperature chamber set to 70°F (21°C).³
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¹ Federal Energy Regulatory Commission, <http://www.ferc.gov/industries/electric/indus-act/demand-response/dem-res-adv-metering.asp>

² http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

³ NEMA DC 3, Annex A-2013

73 **Note:** In response to stakeholder comments, definitions for Open Standards and Interface Specification,
74 consistent with those included in other ENERGY STAR specifications, have been added for clarity. EPA
75 has also added a definition for Product Family in order to support certification of field savings for closely
76 related products through a single submission of metric data. EPA's intention with this definition is to align
77 the program with the way EPA believes the CT will function with Service Providers leveraging a common
78 software and interfaces across hardware platforms and additional services, all of which deliver savings
79 with the Service Provider's savings strategies. Variations of products within a product family may deliver
80 additional savings based on additional capabilities (e.g. pre-cooling in peak periods, or humidity sensing),
81 but the basic minimum savings must be shared by all members of the family that is substantively the
82 same but varies in some ways. This approach makes sense due to the critical role of the Service
83 Provider's software. Definitions of core heating and cooling days were added to help clarify the A/B study
84 option to demonstrate field savings.

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86 **2) Scope:**

- 87 A. Included Products: Only products that meet the definition of a connected thermostat product, as
88 specified herein, are eligible for ENERGY STAR certification. Connected thermostats provided
89 as part of a larger product offering, such as a home security system, may be certified but will be
90 subject to specific labeling requirements.
- 91 B. Excluded Products:
- 92 a. Products that are unable to collect the required data for the energy savings metric (as
93 required by Section 3B4)
- 94 b. Line voltage thermostats, that are powered by and/or switch in excess of 30v

95 **Note:** One stakeholder commented on the need for additional temperature testing for line voltage
96 thermostats (droop, etc.), as well as additional opportunities for savings through pulse width modulation
97 and similar techniques. Lastly, many line voltage thermostats are used in zoned systems, where the
98 applicability of the current metric is unclear. EPA is open to including line voltage thermostats in the
99 future, but due to the need for further development of requirements, proposes to exclude them from this
100 Version 1 specification.

101 **3) Eligibility Criteria:**

102 A. Connected Thermostat Device Requirements:

103 For providers that offer a service that may be used with several devices, all device choices for the
104 service shall fulfill these requirements.

- 105 1. In the absence of connectivity to the CT service provider, retain the ability for residents to
106 locally:
- 107 a. view the room temperature,
108 b. view and adjust the set temperature, and
109 c. switch between off, heating and cooling.
- 110 2. Meet requirements set out in Table 1, below.
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Table 1. Connected Thermostat Device Criteria

Parameter	Performance Requirement	Applicable Products
Static Temperature Accuracy	≤ ± 1.0°F	All
Network Standby average power consumption ¹	≤ 3 W average	
Time to enter network standby after user interaction (on device, remote or occupancy detection)	≤ 5 minutes	

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¹ Includes all equipment necessary to establish connectivity to the CT service provider's cloud, except those that can reasonably be expected to be present in the home, such as Wi-Fi routers and smart phones.

Note: While ENERGY STAR strives to minimize standby and vampire loads, we recognize that stringent criteria in previous Draft CT specifications 1) may serve to preclude qualification of energy saving products, and 2) that energy savings from CT products is typically orders of magnitude greater than CT power consumption. Accordingly, EPA has proposed a higher, 3W network standby limit in Draft 3, but encourages manufacturers to work towards minimization of CT device energy consumption.

EPA notes that several stakeholders encouraged EPA to consider more stringent limits. However, standby mode for CTs may not include an opportunity for as deep a sleep as it does for other product types. In standby, CTs may dim or turn off displays, but must continue to perform other key functions such as, 1) thermal control of HVAC equipment, 2) capability to receive and respond to remote signals, 3) occupancy detection. EPA acknowledges that while a 3W limit does not represent current best practices, it is a sensible starting point for Version 1. In light of ENERGY STAR goals, and consistent with stakeholder feedback, EPA intends to consider more stringent network standby consumption limits in subsequent revisions to the CT specification to more closely align the limit with industry best practices.

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B. Connected Thermostat Product Requirements: The following capabilities may be enabled through hardware, service or any combination of the two. The product shall maintain these capabilities through subsequent firmware and software changes. The Connected Thermostat Service Provider shall maintain documentation that demonstrates compliance to these requirements. Initial certification of these requirements will be based on a review of product literature.

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1. Ability for consumers to set and modify a schedule.

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2. Provision of feedback to occupants about the energy impact of their choice of settings.

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3. Ability for consumer to access information relevant to their HVAC energy consumption, e.g., HVAC run time.

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4. The product shall be capable of collecting the following data, including where noted, to the indicated resolution and accuracy:

142

a. Unique thermostat ID

143

b. ZIP code (installed location)

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c. Controlled HVAC equipment type to the extent it can be determined by the CT Product:

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• Single stage heat pump with aux and/or emergency heat

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• Single stage heat pump without aux and/or emergency heat

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• Single stage non heat pump with single-stage central air conditioning

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• Single stage non heat pump without central air conditioning

- 149 • Single stage central air conditioning without central heating
150 • Other – e.g. multi-zone multi-stage, modulating
151 d. Daily cooling equipment run time (reported to the nearest minute)
152 e. Daily heating equipment run time (reported to the nearest minute)
153 f. Hourly auxiliary heat run time (reported to the nearest minute)
154 g. Hourly emergency heat run time (reported to the nearest minute)
155 h. Hourly average conditioned space temperature (reported to nearest 0.5°F, accurate to
156 ±1.0°F)
157 i. Hourly average heating setpoint temperature (reported to nearest 1.0°F)
158 j. Hourly average cooling setpoint temperature (reported to nearest 1.0°F)
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160 **Note:** EPA received feedback that reporting to the nearest second does not provide benefit beyond
161 reporting to the nearest minute. EPA agrees and has adjusted the requirement accordingly.

162 5. Demand Response

- 163 a. Grid Communications – The product shall include a communication link that facilitates the
164 use of open standards, as defined in this specification, for all communication layers to
165 enable DR functionality.

166 **Note:** Products that enable direct, on-premises, open-standards based interconnection
167 are preferred, but alternative approaches, where open-standards connectivity is enabled
168 only with use of off-premise services, are also acceptable.

- 169 b. Open Access – To enable interconnection with the product over the communication link,
170 an interface specification, application programming interface (API) or similar
171 documentation shall be made available that, at a minimum, enables DR functionality.

172 **Note:** While EPA encourages broad availability of the interface spec or API, CT service
173 providers may elect to limit dissemination of these documents to certified/qualified
174 developers, integration partners and the like.

- 175 c. Consumer Override – Consumers shall be able to override their product’s response to
176 any DR signal.

- 177 d. Capabilities Summary – A ≤250 word summary description of the CT Product’s and/or
178 associated Service Provider’s DR capabilities/services shall be submitted. In this
179 summary, EPA recommends noting the following, as applicable:

- 180 • Capabilities model, e.g. DR aggregator vs. uniquely addressable CT Products.
181 • CT Product DR Types, e.g. load dispatch, ancillary services, price notification, and
182 price response.
183 • Response configurability/flexibility by the consumer and/or Load Management
184 Entity.
185 • Feedback to Load Management Entity, e.g. verification/M&V, override notification.
186 • Measures to limit consumer comfort impacts, if any.

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189 **Note:** EPA acknowledges stakeholder request for more prescriptive DR criteria including 1) the capability
 190 of supporting direct bi-directional communications between the CT Device and utilities, and 2) alignment
 191 of DR criteria for ENERGY STAR CTs with the California Building Energy Efficiency Standards (Part 6 of
 192 Title 24). Title 24 Joint Appendix 5 (JA5). EPA has reviewed JA5 and believes that the proposed DR
 193 criteria enable CT products to comply with both ENERGY STAR and JA5. EPA, however, does not
 194 believe adoption of prescriptive DR criteria to be appropriate in consideration of the broad energy
 195 efficiency goals of the ENERGY STAR program and the diverse business models of CT manufacturers
 196 and service providers. Such criteria may serve to preclude qualification of existing CTs that save
 197 consumers energy and enable DR benefits to accrue. In Draft 3, EPA has made only clarifying changes
 198 to the high-level DR criteria that continue to mandate that CT Products include DR capabilities that use
 199 open standards, facilitate open access, and ensure consumer override-ability.

200 EPA has learned that there are instances where utilities are not using open standards for grid
 201 communications. Accordingly, EPA has proposed revised Grid Communications criteria that change
 202 “uses” to “facilitates the use of” open standards. This subtle change signals that while the CT product
 203 must include the capability of using open standards for grid communications, it does not preclude the CT
 204 product from also using other communication standards. This maximizes consumer access to
 205 participation in load management programs by allowing utilities to structure the programs as makes sense
 206 for them.

207 EPA has added two informative notes intended to 1) encourage CT products that enable direct, open-
 208 standards interconnection in the home and 2) encourage broad availability of an API or interface spec.
 209 While recognizing that limiting dissemination to qualified partners/developers is acceptable.

210 C. Field Savings: Connected thermostat products will demonstrate typical product performance in
 211 the field by one of two methods. To be certified, products must have at least twelve months of
 212 data. These requirements refer to reported performance of the connected thermostat product.

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 214 1. Metric Performance:

215 **Table 2. Connected Thermostat Energy Savings Criteria**

Metric	Statistical measure	Performance Requirement
annual % run time reduction, heating (HS)	Lower 95% confidence limit of weighted national average	≥ 8%
	Weighted national average of 20 th percentiles	≥ 4%
annual % run time reduction, cooling (CS)	Lower 95% confidence limit of weighted national average	≥ 10%
	Weighted national average of 20 th percentiles	≥ 5%
Average resistance heat utilization for heat pump installations (RU)		Reported in 5°F outdoor temperature bins from 0 to 60°F

237 **Note:** One stakeholder commented that EPA should validate the proposed metric performance approach
238 using measured energy data, testing the assumptions EPA makes in the CT metric.

239 EPA believes that the ongoing ENERGY STAR CT specification development has encouraged CT
240 manufacturers to focus on energy savings and is a sound starting point. Once the program launches, both
241 EPA and ENERGY STAR CT partners will continue to focus on improving the modeling of CT product
242 energy performance and will develop improved CT savings metrics/methods.

243 While EPA recognizes that there is no perfect CT metric, the proposed metric leverages building science
244 to construct individual models that define how heating and cooling run times vary with outside and inside
245 temperatures. Since this approach develops a counterfactual baseline run time (what run time would have
246 been under constant comfort settings), and compares CT run times to modeled run time for the same period
247 of time, much of the influence of the aforementioned variables are effectively removed from the assessment
248 of savings.

249 EPA further notes that while data to inform CT savings baselines is limited, EPA intends to continue working
250 with stakeholders to determine if there are opportunities to improve the proposed baselining strategy.

251 Finally, EPA encourages stakeholders that have access to both CT data as well as metered energy data to
252 work with us to determine if and how such data sets might be used to validate or verify efficacy of the field
253 savings metric.

254 2. A/B Study: In lieu of meeting metric performance requirements outlined in Table 2, partner
255 may propose an A/B study which demonstrates the mean reduction of run time (or mean
256 reduction in energy use) for homes using their product as compared to a typical thermostat.
257 To earn the ENERGY STAR, field savings studies shall show that the lower 95% confidence
258 limit of run time reduction for heating is at least 4% and for cooling is at least 5%. In addition,
259 studies shall show that no more than 20% of homes in the study showed savings of zero or
260 lower in heating or in cooling. Partners using this allowance shall also apply the ENERGY
261 STAR Method to Demonstrate Connected Thermostat Field Savings and submit the output at
262 time of certification and periodically as required for all connected thermostat products.

263 a. All studies must be pre-approved and shall meet the following requirements:

264 i. Two groups of consumers shall have products present in their home that they use as
265 the thermostat(s) for their homes during the study period. The test group shall have
266 capabilities available equivalent to the products the study covers. The control group
267 shall have capabilities available to them that represent a typical thermostat and
268 provide a reasonable baseline for comparison.

269 ii. Both groups of consumers shall be large enough, and will use the products for a
270 sufficient length of time, to estimate savings on core heating and cooling days with
271 statistically significant results.

272 iii. Results of the study will be lower 95% confidence limit of the mean % run time
273 reduction or mean % energy savings in the test group compared to the control group,
274 as required by the specification. The confidence limit may be calculated with the
275 simplifying assumption that the relative energy or run time reduction has a Gaussian
276 distribution around the mean.

277 iv. If only a smaller sample of homes is available, a study design using a pre-study
278 matching period in which test and control groups have access to the same capabilities
279 may be proposed. Application of a correction factor derived from the comparison of
280 groups in the pre-test period may be used to account for fluctuations in home
281 properties between groups. In this case, the pre-test and test periods shall be as
282 close together in time as possible, and the uncertainty shall be estimated as half what
283 it would have been without the correction from the pre-test period.

284 v. Results of the study shall be representative of mean savings across the CT Products'
285 U.S. installed base. This will generally require participants throughout the geographic
286 spread of the Partner's customer base.

287 vi. The study shall provide a method for ongoing monitoring of results, equivalent to
288 semi-annual reporting of metric scores. This may involve periodically re-running the
289 study on a smaller set of consumers, for instance.

290 b. Process

291 i. Partner shall submit a proposal for the study to EPA, demonstrating compliance with
292 the study requirements. This is expected to be an iterative process involving
293 conversation between the Partner and EPA.

294 ii. Once the study design is approved, the Partner will execute the study and report the
295 results to EPA. Results shall include at minimum the mean percent HVAC run time or
296 HVAC energy use reduction from the control group to the test group, the associated
297 95% confidence limits of the mean, and the 20th percentile of these quantities across
298 homes.

299 iii. EPA will confirm whether results meet the requirements of the specification and will
300 publish successful studies.

301 D. Significant Digits and Rounding:

302 1. All calculations shall be carried out with directly measured (unrounded) values.

303 2. Unless otherwise specified below, compliance with specification limits shall be evaluated
304 using directly measured or calculated values rounded to the nearest 0.1°F.

305 3. Directly measured or calculated values that are submitted for reporting on the ENERGY
306 STAR website shall be rounded to the nearest significant digit as expressed in the
307 corresponding specification limit.

308 **4) Test Requirements:**

309 A. Product Families: A product family may be established under the following circumstances:

310 1. Each hardware device that is part of a product within the product family is separately
311 tested to ensure it meets the device requirements in section 3)A.

312 2. Each member of the product family meets the capabilities in section 3)B.

313 3. All installations within a product family shall be considered as a single population for
314 determining field savings, and the metric scores achieved through that sampling and
315 analysis shall apply to all members of the product family.

316 B. Software updates: Software updates are expected to either not affect product savings, or to
317 increase savings, and do not require recertification. Software changes that change the principle
318 that savings rest upon, or which are expected to reduce savings, would define a new product
319 and would require a new certification.

320 C. Test Methods:

321 The following methods shall be used to demonstrate ENERGY STAR qualification:

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Table 3: Test Methods for ENERGY STAR Qualification

ENERGY STAR Requirement	Test Method Reference
Functionality in the absence of connectivity	As per section 4.D and 4.E below
Static temperature accuracy	As per section 4.D and 4.F below
Network standby power consumption	IEC 62301, Ed. 2.0, 2011-01, Household electrical appliances – Measurement of standby power, subject to clarifications in section 4.D and 4.G below
Time to standby	
Reduction in average annual % run time, heating (HS)	ENERGY STAR Method to Demonstrate Connected Thermostat Field Savings, V1.0
Reduction in average annual % run time cooling (CS)	
Average resistance heat utilization for heat pump installations (RU)	

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D. Device configuration for testing

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1. Install and configure the device either into a test environment or to control compatible HVAC heating and cooling source equipment. Ensure that the test setup enables observation of the UUT’s HVAC control signals or actions, e.g. monitoring the UUTs wiring terminals for state changes or observing switching of HVAC equipment.

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2. Configure & provision the UUT’s connected functionality, including enrollment of applicable services and updating to latest version of firmware.

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E. Functionality in the absence of connectivity

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1. Disable connectivity, for example by shutting down the WLAN.
2. Verify (pass/fail) the capability for a user to interact with the CT Device to:
 - a. Observe the room temperature,
 - b. Observe and adjust the setpoint, and
 - c. Switch between off, heating and cooling

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F. Static temperature accuracy

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1. Assure that the device is appropriately configured as per section 4.B.
 - a. Install the UUT in a static temperature chamber, set to 70°F (±2°F accuracy), along with a calibrated temperature logger, ±0.5°F accuracy.
 - b. Power the UUT and ensure connectivity is enabled. It is not necessary that the device be enabled into a test environment or to control HVAC source equipment.
2. Test Conduct
 - a. Ensure the UUT and thermometer remain in the 70°F temperature chamber for at least 1 hour.
 - b. Record the room temperature displayed by the UUT and the temperature in the chamber as measured by the calibrated thermometer.
 - c. Verify (pass/fail) that the room temperature displayed by the UUT is within ± 1.0°F of the calibrated temperature logger.

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G. Implementation of IEC 62301 for Connected Thermostat Testing

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Note: This test is not applicable to UUTs powered solely by batteries.

- 353 1. Assure that the device is appropriately configured as per section 4.B.
354 a. This test need not be performed in a temperature chamber.
355 b. Configure the UUT in accordance with the requirements of IEC 62301, Ed. 2.0, 2011-01,
356 "Measurement of Household Appliance Standby Power," Section 4, "General Conditions
357 for Measurements," unless otherwise noted in this document. In the event of conflicting
358 requirements, this ENERGY STAR test method shall take precedence.
- 359 2. Test Conduct – Measure power consumption at the power input to the UUT using the
360 sampling method, section 5.3.2 of IEC 62301, Edition 2.0 2011-01.
- 361 a. Verify ability to control the CT over the communication link, then close all apps & web
362 interfaces.
- 363 b. Increase the setpoint using the CT Device controls.
- 364 c. Wait 5 minutes, while taking appropriate measures to allow the UUT to enter into and
365 remain in network standby mode for the duration of the test, e.g.
- 366 • No additional UUT user interactions
 - 367 • Ensure occupancy sensing UUTs do not detect occupancy,
 - 368 • Ensure apps and/or web remote interfaces remain closed.
 - 369
- 370 d. Separately measure and record average energy consumption over a 5-minute period.
- 371 e. Check measurement stability in accordance with IEC 62301, Edition 2.0 2011-01, and
372 section 5.3.2.
- 373 f. If stability criteria are not satisfied, repeat the test, starting from step 2b, with the test
374 period extended in 5-minute increments (i.e. 10m, 15m, 20m...) as necessary to
375 establish requisite measurement stability.
- 376 g. Once stable, repeat the test over two additional test periods, starting from step 2b.
- 377 h. Record power consumption as the average over the second and third test periods.

378 **Note:** In discussions with stakeholders it became clear that products using the same algorithms, mobile
379 device interfaces, and web portals, but using different hardware devices, would be expected to achieve
380 the same field savings in many cases. There are other product variations (e.g. ability to provide DR
381 services upon enrollment) that offer increased energy and cost savings to consumers but are considered
382 by their providers to be the same consumer product. In recognition of this, and in order to reduce the
383 burden on providers, EPA proposes that providers be able to group products into product families, as long
384 as the basic principle that delivers savings is the same for all members of the product family. The
385 population of installations considered for field savings would then include all members of the product
386 family, and the results would apply to all members. Additional products could be added to an existing
387 product family.

388 The proposed language about software revisions is intended to clearly define when a software update
389 requires recertification. We expect that all products will be updated regularly, as part of an evolutionary
390 growth in product capabilities and savings. Such updates would not require recertification, particularly
391 given that product performance will be monitored on an ongoing basis. However, major software revisions
392 that either change the principle by which the product delivers savings, or that are expected to reduce
393 savings, would be considered a new product and require recertification.

394 EPA welcomes stakeholder feedback on the proposed approach to product families and to recertification.

395 The static temperature accuracy test has been modified slightly to make clear that the temperature
396 chamber shall be static during testing, and that the temperature measurement device shall be a data
397 logger, not just a digital thermometer.

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399 **5) Effective Date:**

400 The ENERGY STAR Connected Thermostat specification shall take effect on TBD. To qualify for
401 ENERGY STAR, a Connected Thermostat Product shall meet the ENERGY STAR specification in effect
402 on the date of connection. The date of connection is specific to each unit and is the date on which a unit
403 is considered to be a Connected Thermostat Product.

404 **Note:** ENERGY STAR specifications for new products generally take effect immediately upon publication
405 of the final requirements, and potential Partners are free to submit products for certification at that time.
406 EPA currently estimates this specification to be finalized at the end of 2016.

407 **6) Future Criteria Revisions:**

408 EPA reserves the right to change the specification should technological and/or market changes affect its
409 usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the
410 specification are arrived at through industry discussions. In the event of a specification revision, please
411 note that the ENERGY STAR qualification is not automatically granted for the life of a product model.