

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460



OFFICE OF  
AIR AND RADIATION

July 29, 2019

Dear ENERGY STAR® CAC/ASHP Brand Owner or Other Interested Party,

As part of the specification revision process for ENERGY STAR CAC/ASHP, the U.S. Environmental Protection Agency (EPA) is seeking stakeholder input on a proposal for optional connected criteria. This proposal follows the release of the Draft 1 Version 6.0 specification in April, as EPA was awaiting market factors, including the finalization of AHRI 1380 standard, prior to its development. Feedback received in response to this letter, along with feedback provided on the Draft 1 proposal, will inform the development of a Draft 2 Version 6.0 specification this fall. Stakeholders may provide comments on these proposed connected criteria to EPA no later than **August 29, 2019**.

#### **Proposed Optional Connected Criteria**

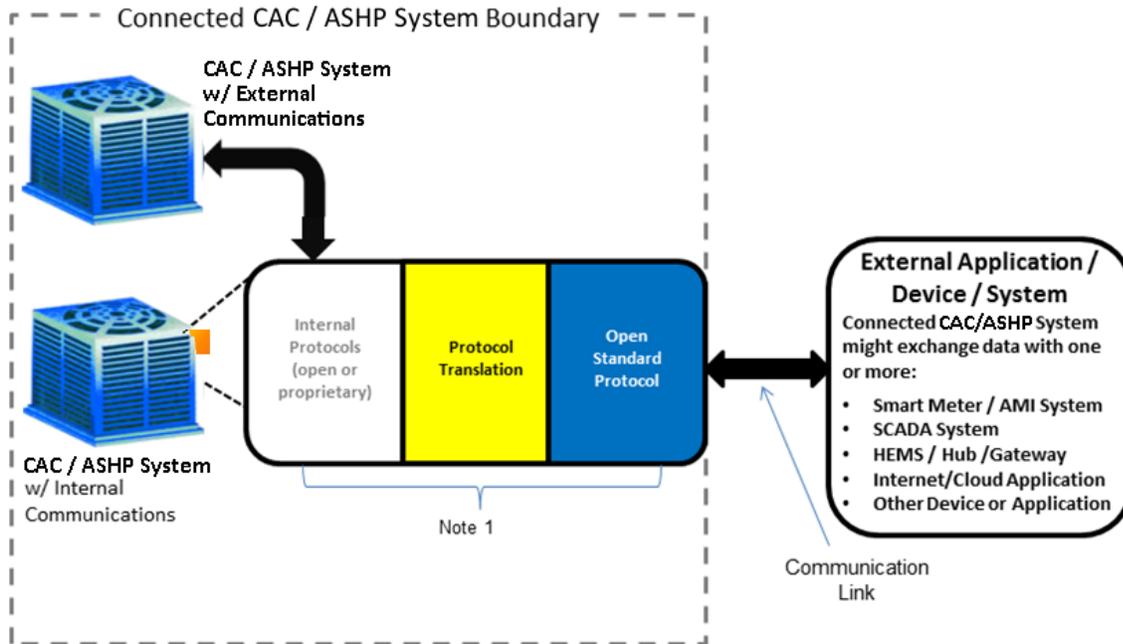
The central air conditioning industry in partnership with the Consortium for Energy Efficiency (CEE) has developed [AHRI Standard 1380](#) over several years. This standard provides a systematic approach to demand response in CAC/ASHP, accounting for the complexity of staged and modulating systems from different manufacturers and on different application layers, ensuring that these products will deliver the same result from a given Demand Response (DR) input message. This standard underwent multiple rounds of revision by interested parties, both manufacturers and DR end users (e.g. utilities), such that the value and consistency of DR was balanced with freedom to innovate and ensure consumer comfort.

On February 14, 2019, EPA released the [Large Loads Discussion Guide](#), detailing a vision that ENERGY STAR specifications for products with the potential for high grid impact would be revised with special consideration to include connected criteria designed for the market conditions of those products. The connected revisions aspire to increase the standardization, availability, and ease of use of the corresponding connected and DR functionality through an approach tailored to each product. EPA had proposed that CAC/ASHP connected and DR criteria would match AHRI 1380 when possible, and incorporate requirements for user amenity, energy reporting, and consumer override as seen in other ENERGY STAR specifications.

Comments EPA received on the discussion guide generally supported incorporating DR by relying on AHRI 1380. One commenter recommended these criteria align as closely as possible among the specifications and avoid introducing requirements not found in 1380.

This limited topic proposal for CAC/ASHP optional connected criteria adds text to the following sections from the CAC/ASHP Version 6 Draft 1 specification: **(1)** Definitions, **(4)** Connected Product Criteria, and **(5)** Test Requirements.

# 1 Definitions



**Figure 1.** Connected CAC/ASHP System (CCS)

**Note 1:** Communication device(s), link(s) and/or processing that enables Open Standards-based communication between the CCS and external application / device / system(s). These elements, either individually or together, could be within the product/controller, and/or an external communication module, a hub/gateway, or in the Internet/cloud.

- N. Communication Link: As shown in Figure 1, the mechanism for bi-directional data transfers between the connected CAC/ASHP system and one or more external applications, devices or systems.
- O. Connected CAC/ASHP System (CCS): Includes the ENERGY STAR certified ASHP or Central Air Conditioner product, integrated or separate communications hardware, and additional hardware and software required to enable connected functionality, including controllers/thermostats. In the case of a CCS that implements Open ADR with a virtual end node (VEN) in the cloud, that VEN is part of the CCS for purposes of this specification. For products implementing CTA-2045, the module is not considered part of the CCS for purposes of this specification. A product implementing both using a communication module in a CTA-2045 port could be tested both ways and identified as implementing both standards for the purposes of the ENERGY STAR product finder.
- P. Consumer Authorized Third Party: Any entity for which the consumer has provided explicit permission to access the CCS connected functionality, in whole or in part, via a communication link.
- Q. Demand Response (DR)<sup>1</sup>: Changes in electric usage by demand-side resources from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market

<sup>1</sup> Federal Energy Regulatory Commission, <https://www.ferc.gov/industries/electric/indus-act/demand-response/dr-potential.asp>. This definition does not cover all aspects of how load flexibility is being used by utilities. For instance, it does not cover behavioral DR, dispatch to prevent spilling wind resources, or reducing peak demand for natural gas. EPA intends to address any and all of these use cases in our criteria in addition to the more traditional DR in the FERC definition.

prices or when system reliability is jeopardized.

- R. Demand Response Management System (DRMS): The system operated by a program administrator, such as the utility or third party, which dispatches signals with DR requests and/or price signals to the CCS products and receives messages from the CCS product.
- S. Interface Specification: A document or collection of documents that contains detailed technical information to facilitate access to relevant data and product capabilities over a communications interface.
- T. Load Management Entity: DRMS, home energy management system, and the like.
- U. Open Standards: Communication with entities outside the CCS that use, for all communication layers, standards:
  - included in the Smart Electric Power Alliance (SEPA) Catalog of Standards<sup>2</sup>, and/or
  - included in the NIST Smart Grid Framework Tables 4.1 and 4.2<sup>3</sup>, and/or
  - adopted by the American National Standards Institute (ANSI) or another well-established international standards organization such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE) or Internet Engineering Task Force (IETF).<sup>4</sup>
- V. On-Premises: Refers to a function that relies only on equipment present at the physical installed location of the ENERGY STAR certified device/equipment.
- W. Consumer Override (of DR events): Choosing to opt out of a scheduled and/or active DR event the product would otherwise respond to, without cancelling program enrollment.

**Note:** EPA proposes definitions N – W to support criteria for connected CAC/ ASHP. These definitions largely parallel those seen in other ENERGY STAR product specifications with connected criteria.

## 2 Connected Product Criteria

This section presents connected criteria for ENERGY STAR certified ASHP and Central Air Conditioners. Compliance with Section 4 criteria is optional. ENERGY STAR certified products that comply with all Section 4 criteria will be identified on the ENERGY STAR website as having 'Connected' functionality.

- A. Communications
  - a. The CCS Communication Link, in Figure 1, shall use Open Standards for all communication layers to enable functions listed in Section 4C).
  - b. An Interface Control Document (ICD), Application Programming Interface (API), or other documentation shall be made available to interested parties that, at minimum, allows access to the functions listed in Section 4C) and is recommended for Section 4B).

<sup>2</sup> <https://sepapower.org/knowledge/catalog-of-standards/>

<sup>3</sup> <https://www.nist.gov/sites/default/files/documents/smartgrid/NIST-SP-1108r3.pdf>

<sup>4</sup> <http://www.gridstandardsmap.com/>

## B. Consumer Feedback

### a. **User Alerts**

The CCS shall be capable of providing at least two types of messages relevant to optimizing its energy consumption, communicating to residents either:

- i. On the product (if intended to be installed in conditioned space) or its consumer control interface, and/or
- ii. Transmitted to consumers and consumer authorized third parties via a communication link. This link can include open standards protocols used for Demand Response or could use a secondary communication link.

For example, messages relevant to existing fault conditions or energy consumption for ASHP/CAC might address a fault condition, a reminder to replace a filter, heat pump refrigerant charge, or a report of energy consumption that is outside the product's normal range.

**Note:** Products meeting ENERGY STAR Most Efficient criteria for system status and messaging are compliant with this requirement.

### b. **Energy Reporting**

The product shall be capable of transmitting measured or estimated instantaneous power draw in current conditions via a communication link to energy management systems and other consumer authorized devices, services, or applications. Provision of this information through the communication link and protocol used for demand response shall meet this requirement. *Example: A CCS uses CTA-2045 to comply with section 4)C, and implements CommodityRead functionality.*

**Note:** The items in the consumer feedback section are typical criteria for ENERGY STAR connected products, intended to provide value and the potential for energy savings independent of a homeowner's participation in demand response programs. EPA requests feedback about whether energy reporting via a DR protocol would meet this goal, and whether manufacturers would prefer such an implementation over energy reporting by some other means.

In addition, EPA typically requires that interface control documentation be provided to allow third parties access to functionality in section 4B), for instance for user alerts. In the long term, EPA believes this is in consumer's best interest for CAC/ASHP products as well – for instance, it would allow a user to give their contractor using a 3<sup>rd</sup> party management application access to these alerts. As the market does not currently provide this access, EPA is only recommending, rather than requiring it, in this version. We welcome feedback on the advantages and disadvantages of our short term approach and long-term intentions.

## C. Demand Response (DR)

### a. **DR Communications Protocols**

The CCS shall meet the communication and equipment performance standards for CTA-2045A or OpenADR 2.0 (Virtual End Note), or both.

**Note:** EPA proposes to align with communication requirements in AHRI 1380, which was developed by industry with considerable involvement by utilities. EPA notes an existing communication module to cloud DR interface (without open standard application layer) can be brought into compliance by connecting the product with an Open ADR 2.0 VEN. EPA requests feedback on the feasibility and potential impact of this proposal.

Note that AHRI 1380 was designed specifically for staged and variable capacity systems. Should single stage products be covered by ENERGY STAR V6.0, EPA does not anticipate that they will be able to be recognized as connected.

**b. Consumer Override**

The CCS shall provide an easily accessible means for consumers to override demand response events during the event or ahead of time for a scheduled event. When the event is overridden, the CCS shall return to its previous operating mode.

Temporary overrides shall be limited to a duration of 72 hours without additional user input; after this time, the CCS will return to its previous operating mode.

**Note:** Long term (persistent) overrides are not restricted, as some users may opt to use this functionality. EPA recommends encouraging the use of temporary overrides to consumers when appropriate.

**Note:** EPA proposes systems to have the capability for consumer override without limitation, as is typical in ENERGY STAR connected criteria. EPA notes that short term overrides with a maximum 72 hour time limit are preferable, as users often forget when a persistent override is used, and would de facto un-enroll in a DR program indefinitely. EPA notes that this does not mean that every DR program in which the model is enrolled must allow consumer override. Rather, this is a requirement that the CCS provide the technical capability to implement overrides.

**c. DR Information and Messaging**

The CCS shall support the following upstream messaging from the device as supported by application layer protocol(s) and may support the additional (optional) messaging capabilities. Support for these messaging signals is implemented via the open standards protocol used in the product. Implementation details are described in Appendix A.

i. Required DR Messaging I/O:

Messaging I/O Operation	Messaging Operation Description
Verifying Connectivity	Ensures target device is connected to DRMS and prepared to accept DR signals.
System Capabilities	Requests basic device level information on target device, including equipment type response capability.
Operational State(s) <i>(see c ii. below)</i>	Requests information on product running state, DR conditions operating on product, opt in/out state, and current fault conditions.  <b>Note:</b> Operational State data structure and layout may vary by application layer protocol, containing the following device state information:

ii. Operational State Codes:

Operational State Code	Operational State Definition
Idle Normal	CAC/ASHP is not heating/cooling, but is in a normal mode of operation.
Running Normal	CAC/ASHP is in a Normal Operating Mode and the system is presently heating/cooling.
Idle Grid	CAC/ASHP is in a grid service (curtailment) operational mode and the system is not heating/cooling.

Running Curtailed Grid	CAC/ASHP is running in a grid service (curtailment) mode of operation and the system is presently heating/cooling.
Idle Heightened	CAC/ASHP is processing a Load Up request and system is not heating/cooling.
Running Heightened Grid	CAC/ASHP is processing a Load Up request and system is heating/cooling.
SGD Error	Device is malfunctioning. Recommended use: Failure of heat pump or compressor.
Cycling On	Cycling type of grid service event is in effect and system is heating/cooling (i.e. cycled on).
Cycling Off	Cycling type of grid service event is in effect and system is not heating/cooling (i.e. cycled off).
Idle Opted Out	CAC/ASHP is overridden the system is not heating/cooling.
Running, Opted Out	CAC/ASHP is overridden and the system is presently heating/cooling

**d. DR Requests and Responses**

The CCS shall also support the required DR operational modes listed below and may support additional open standard defined DR signals.

i. Required Operational Mode Functionality:

<b>Operational Mode Function</b>	<b>Operational Mode Description</b>
Maximum Indoor Temp. Rise	Specifies the maximum indoor temperature rise that the equipment must use when processing curtailment and/or price responsive modes.
General Curtailment	Directs equipment to reduce power consumption to a maximum of 70% of rated load power. In heating mode, temperature drop shall not be more than 4 degrees F. Applicable to both staged and variable capacity equipment.
Critical Curtailment	Directs equipment to reduce power consumption to a maximum of 40% of rated load power. Staged equipment is not anticipated to respond to this message type; DRMS may substitute a General Curtailment message for this equipment type. Both staged and variable capacity equipment in heating mode shall not use resistance heating while indoor ambient temperature is equal to or above 62 degrees F.
Off Mode	Directs equipment to turn to off mode, while maintaining compressor crankcase heater power and system controls power. Applicable to both staged and variable capacity equipment.
End Active Events	Notifies equipment that current or upcoming DR event(s) are cancelled.
Advanced Notification	Notifies equipment of an upcoming DR event. Equipment may perform preheating / precooling as appropriate. Note: Protocol dependent, may be attached to DR signals in some application layers.
Utility Peak Load Price Signal	Notifies equipment that a peak price period is in effect and contains relative pricing info on this event. Equipment response to this information is left to the manufacturer and saved user preferences.
Customer Override	Notifies DRMS that a consumer has overridden a current / scheduled DR event.

ii. Operational Requirements:

Variable capacity equipment must ramp up/down changes in power over a minimum of 5 seconds, to decrease transients generated by operation.

**Note:** EPA proposes to require a set of DR connectivity messaging and demand response requirements in the spirit of AHRI 1380, aligning wherever possible. EPA notes that the industry participation and development of this standard encourages the standardization of equipment responses to each specific DR request. Additional requirements are not specified in price responsive modes; EPA encourages manufacturers to develop algorithms that benefit both product end users and associated grid providers.

D. Additional Information for Consumers

- a. If additional modules, devices, services, particular controllers/thermostats, and/or supporting infrastructure are required in order to activate the CCS’s communications capabilities, installation instructions and a list of these requirements shall be prominently displayed in the product literature and cut sheets. These instructions shall provide specific information on what must be done to activate these capabilities (e.g. the brochure might include, “This product can participate in utility demand response programs if paired with model XD1124 thermostat, which has WiFi capability and would also require Internet connectivity and a wireless router for this functionality.”)

### 3 Test Requirements

- B. When testing ASHPs and central air conditioners, the following test method shall be used to determine ENERGY STAR certification:

Table 5: Test Method for ENERGY STAR Certification

ENERGY STAR Requirement	Region	Test Method Reference
SEER, EER, HSPF	Cold Climate and Moderate and Hot Climate	10 CFR part 430 Subpart B, Appendix M
COP @ 5° F, Percentage of Heating Capacity @ 5°F	Cold Climate	10 CFR part 430 Subpart B Appendix M1 for H4 very low temperature Heating Test condition only
Connected Products: Demand Response	Any	Evaluation of Demand Response in CAC/ASHP (in development)

**Note:** EPA intends this stakeholder development process to produce criteria and a testing regime compatible with AHRI 1380 such that certification to that standard will be sufficient evidence of meeting ENERGY STAR DR criteria.

Please direct any specific questions to Abigail Daken, EPA, at [daken.abigail@epa.gov](mailto:daken.abigail@epa.gov) or (202) 343-9375, and Dan Baldewicz, ICF, at [dan.baldewicz@icf.com](mailto:dan.baldewicz@icf.com) or (518) 452-6426. For test procedure inquiries, please contact Antonio Bouza, U.S. Department of Energy, at [antonio.bouza@ee.doe.gov](mailto:antonio.bouza@ee.doe.gov) or (202) 586-9870.

Thank you for your continued support of ENERGY STAR.

Sincerely,



Abigail Daken, Product Manager  
ENERGY STAR for HVAC