

ENERGY STAR. The simple choice for energy efficiency.



ENERGY STAR® Central Air Conditioners & Air-Source Heat Pumps

Limited Topic Proposal on Draft 1 Version 6.0

Stakeholder Meeting

August 19, 2019





Webinar Audio Access

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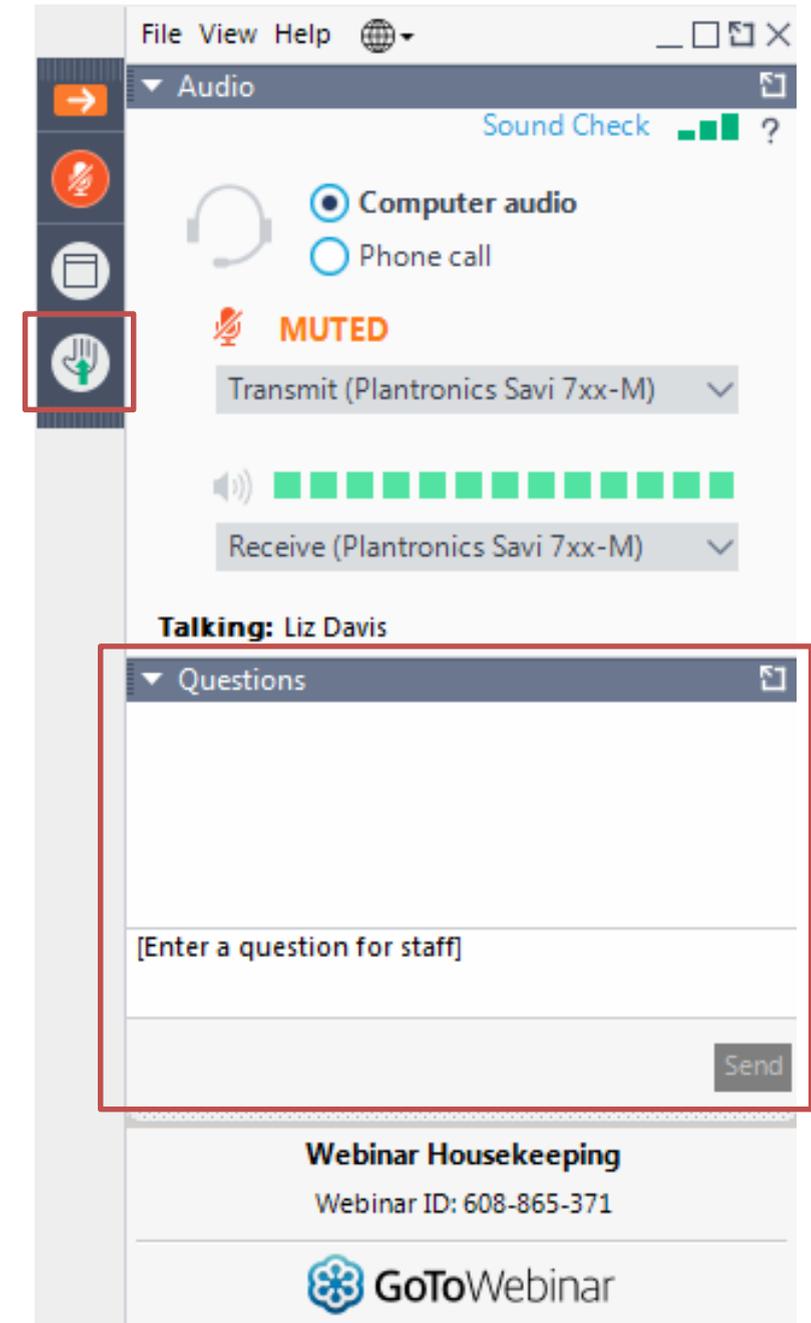


Webinar Participation

- Please mute yourself when you are not speaking (use local mute or dial *6)
- Feel free to ask questions at any time
- Please be advised this webinar is being recorded

Please send written comments to:

CAC-ASHP@energystar.gov by **August 29, 2019**





ENERGY STAR is the simple choice for energy efficiency.

EPA's ENERGY STAR identifies the most energy-efficient **products**, **buildings**, **plants**, and **new homes** – all based on the latest government-backed standards.

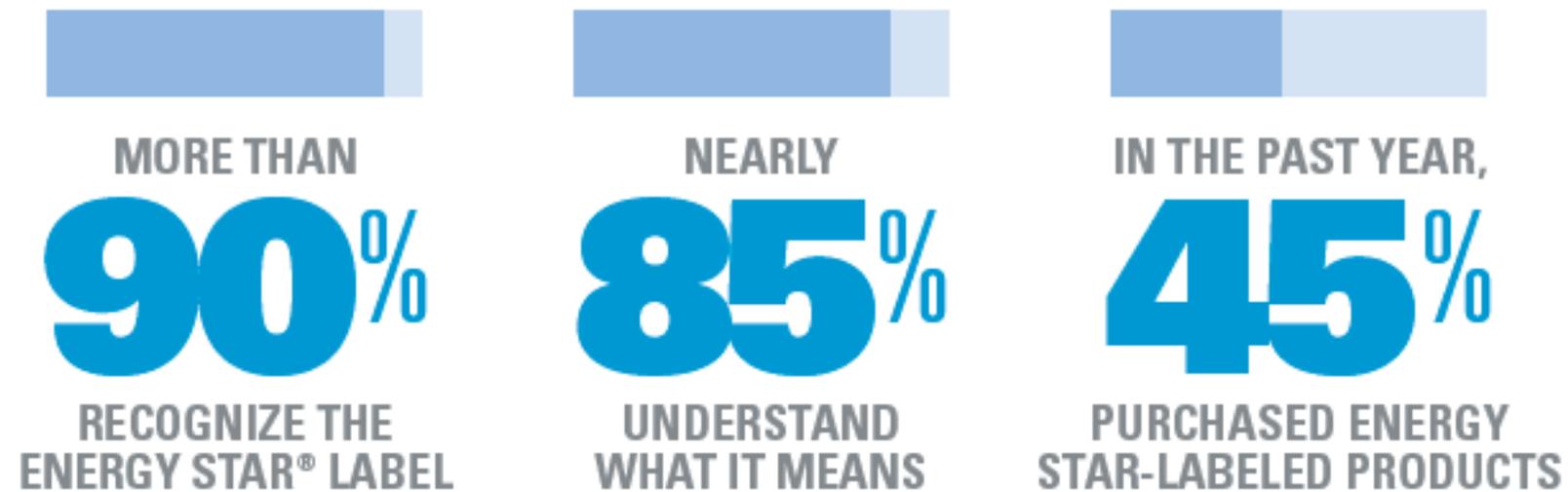
Today, every ENERGY STAR label is verified by a rigorous third-party certification process.



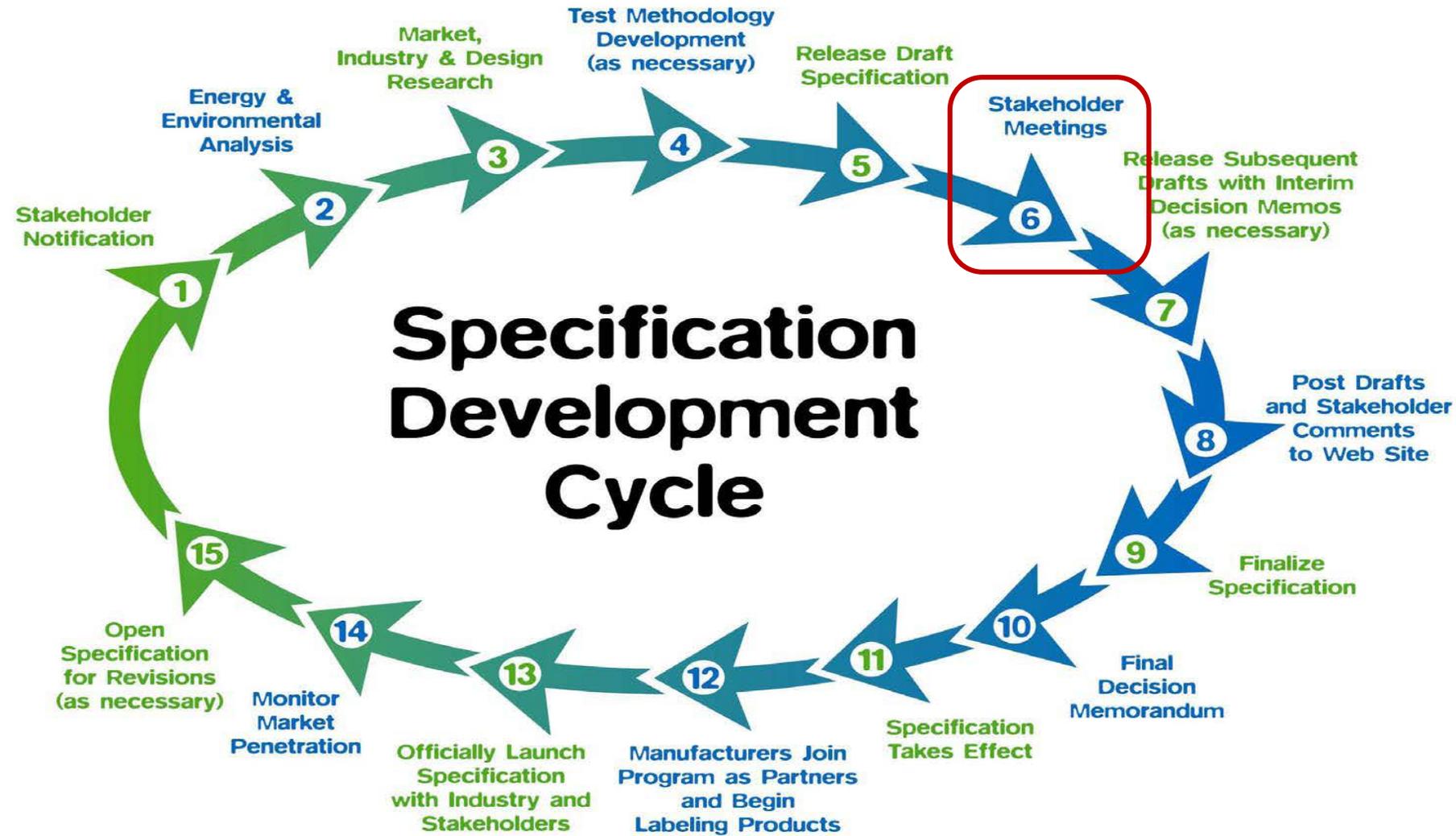


Brand Preference and Loyalty

In American Households:



Specification Revision Process





Version 6.0 CAC/ASHP

Draft 1 April 23, 2019

- Cold Climate performance metrics
- Two or more capacities
- Comment period closed

Limited Topic Proposal July 29, 2019

- Adding optional connected criteria proposals to draft 1
 - Relevant definitions
 - Connected section with criteria
 - Add DR test to Testing section



Introductions

Abigail Daken

U.S. Environmental Protection Agency

Antonio M. Bouza

U.S. Department of Energy

Meeting Attendees



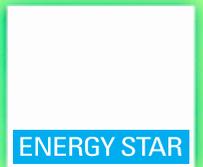
EPA Approach Evolves, Treats Large Loads Differently

- EPA began including connected criteria in specifications in 2011 (Refrigerators)
- Currently cover 11 specifications
 - Criteria optional in all but connected thermostat specification
- Products meeting connected criteria are listed as “connected” on the ENERGY STAR product finder and qualified product list
- New approach intends to recognize increasing value of grid services versus consumer amenity for large load products



Different products, drivers & energy implications

Type	Driver of market adoption	Energy Implication and/or Opportunity	Examples
Large loads, load flexibility doesn't impact consumer	Grid services	Enable cleaner grid	Pool pumps, water heaters
Large loads, load flexibility can impact consumer somewhat	Grid services	Enable cleaner grid; protect consumer interest	EVSE, HVAC
Convenience and quality of maintenance	Consumer and brand owner interest	<u>Better maintenance</u> saves energy	White goods, <u>HVAC</u>
Safety and security	Consumer interest	Added load; may provide occupancy info	Door locks, window sensors
Additional functionality	Consumer interest	Added load	Color changing lights, VADAs



Why CAC/ASHP?

- Attractive load control target:
 - Large load compared to other common residential equipment
 - Highly peak coincident in many markets, so both EE and DR extra useful for limiting demand
 - Common target for direct load control switches; familiar resource for grid operators
 - A small amount of energy storage, depending on home (pre-cooling)
- Attractive for consumer amenity and integration into smart homes:
 - Consumer comfort, convenience, energy savings highly influenced by sophisticated energy reporting and control
 - Potential for energy savings through coordination with other devices



Poll: How familiar are you with AHRI 1380?

AHRI 1380 – 2019: *Demand Response through Variable Capacity HVAC Systems in Residential and Small Commercial Applications.*

RESULTS:

- **Very familiar (e.g. was highly involved in its development) – 33%**
- **Know the general outlines (e.g. followed its development) – 33%**
- Vaguely familiar
- Aware it exists
- **What's AHRI 1380? – 33%**

Connected CAC / ASHP System (CCS)

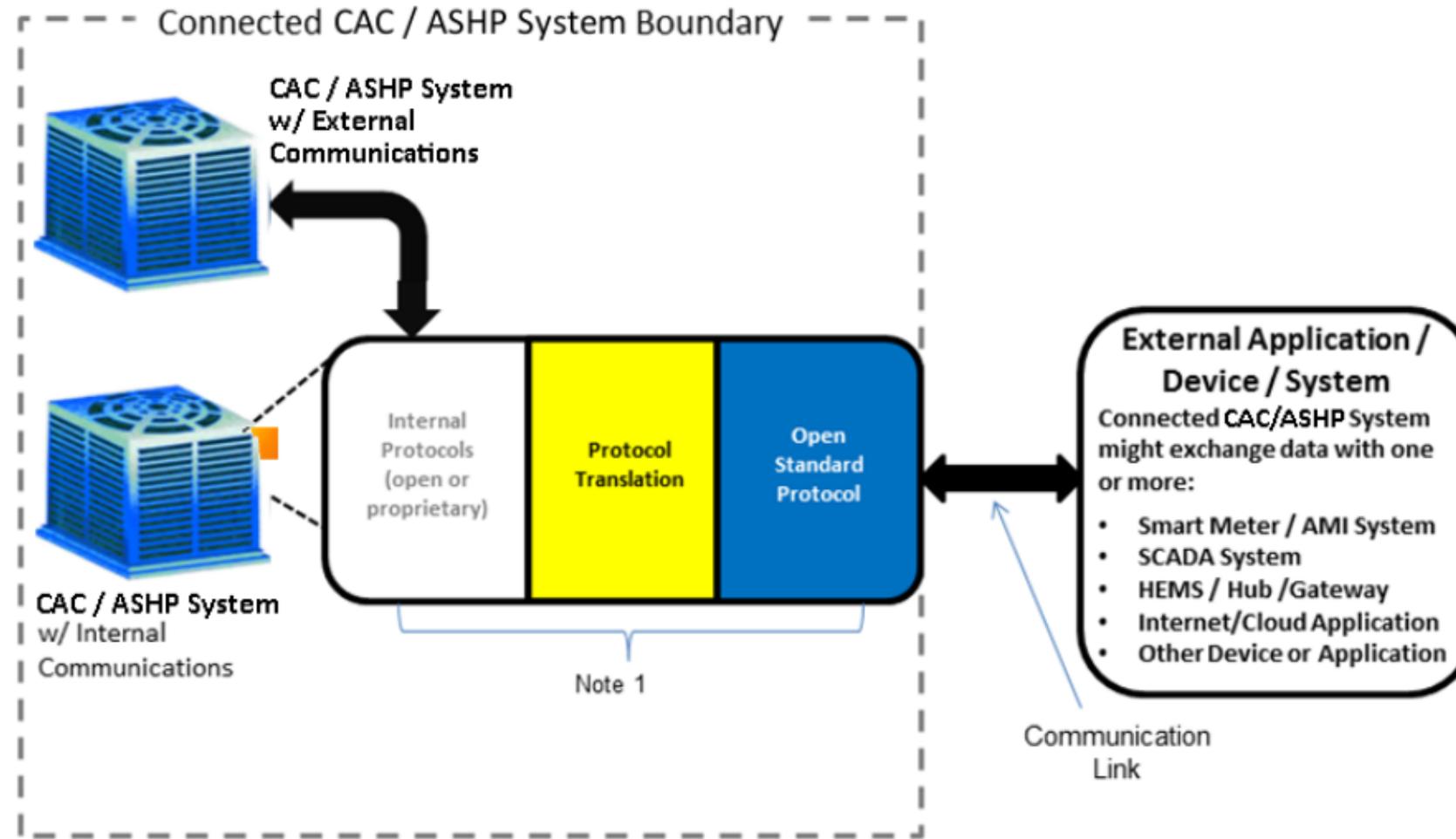


Figure 1. Connected CAC/ASHP System (CCS)



Connected Product Criteria: Overview

- Demand Response (DR) / DRMS Definitions
 - FERC Definition + additional use cases (as noted by stakeholders)
 - DR: Open standards (required)
 - Consumer override (required)
- Connected CAC/ASHP System: CCS
 - The physical CAC/ASHP system, and
 - Integrated or separate communication hardware/software to implement spec criteria (e.g. controller/thermostat, cloud VEN for OpenADR, etc.)
 - Protocol translation: local (CTA) or in the cloud (OpenADR)
 - Non-DR connected (user amenity): Additional proprietary communications allowed



A note about scope for connected

- Proposal limits scope for connected to staged and variable capacity systems
 - Matches scope of AHRI 1380
 - Matches proposed scope of ENERGY STAR V6.0
 - Single speed systems' load control capabilities fully exploited by third party thermostats – not true for variable speed systems
- EPA welcomes stakeholder feedback



Connected Product Criteria: Communications

Communications

- Open Standards for DR Messages
 - OpenADR 2.0, CTA 2045A, OpenADR + CTA
 - On premises, Off Premises / Cloud
 - AHRI 1380 would meet
- Interface Control Document (ICD) or Application Programming Interface (API)
 - Access to DR
 - Optional: Access to consumer alerts and energy reporting
 - Good practice but has limited current availability
 - Value to this information → long term market adoption, home integration



Connected Product Criteria: Feedback & Reporting

Consumer Feedback

- Alerts, 2 types of messages on Energy Consumption
 - On the product or controller; AND/OR
 - Via communication link
 - Aligns with ENERGY STAR Most Efficient

Energy Reporting

- Capable of transmitting instantaneous power to HEMS / 3rd party
- DR application layer meeting this is allowed in this version



DR: Overview

Protocols

- CTA-2045A and/or OpenADR 2.0 ; Aligns with AHRI 1380.

Consumer Override

- Override DR events; temporary limited to 72 hours per override
- Long term overrides (persistent) allowed, but not recommended

DR Messaging and Responses

- [Following slides]

Information to Consumers

- Additional modules, devices, services, particular controllers/thermostats, and/or supporting infrastructure.
- Include this information in product literature.



DR: Messaging

- Ensures system connectivity is known
- Device type, e.g. Heat Pump System
- Operational States contains a majority of device activity information

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) (see c ii. below)	Requests information on product running state, DR conditions operating on product, opt in/out state, and current fault conditions. Note: Operational State data structure and layout may vary by application layer protocol, containing the following device state information:



DR: Messaging: Operational State Codes

- SGD Error
 - SGD-Smart Grid Device
 - Fault conditions
 - Additional information is useful but not required.
- State codes generally indicate
 - Processing DR y/n?
 - Special modes y/n?
 - Run state on/idle?
 - Opt out y/n?

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



DR: Responses Supported, Curtailment

- Temp Rise
 - Ensures consumer comfort vs DR balance.
- Curtailment Modes (AKA)
 - Typical, Low consumer impact
 - Deep, Moderate consumer impact
 - Max (Emergencies only).

Operational Mode Function	Operational Mode Description
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.



DR: Responses Supported, Other

- Price Responsive Support Required
 - Automatic control vs manual control via curtailment signals
 - DR market will settle on preferred approach long term
- Consumer Override
 - 72 hour time limit for temporary
 - Persistent allowed

Operational Mode Function	Operational Mode Description
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.



Operational Requirements

- Variable capacity equipment:
 - Must ramp up/down changes in power over a minimum of 5 seconds
 - Decreases transient behavior, better for equip. life
 - Aligns with AHRI 1380



Test Requirements

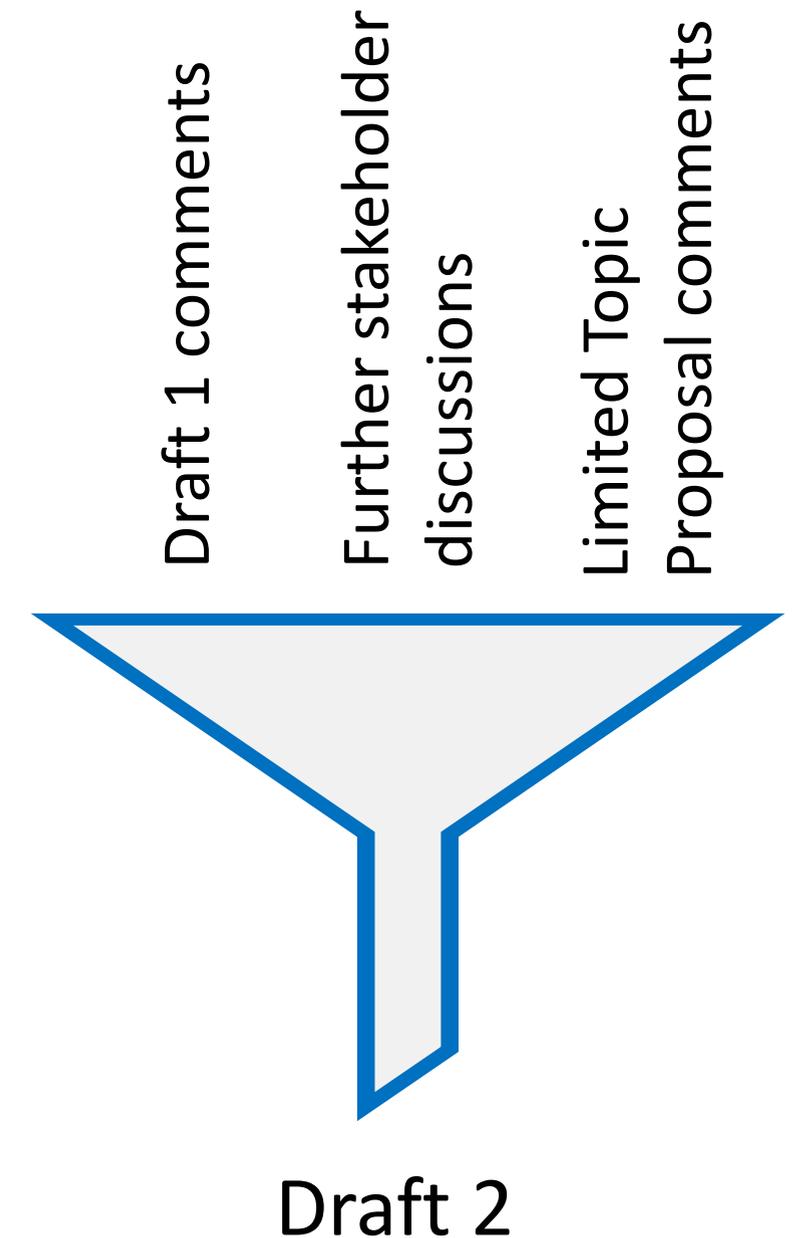
- New Test Procedure to be developed
- Intent is to align with AHRI 1380
 - Intent is to allow AHRI 1380 certified products to avoid additional testing
- Short term, provide a path to connected criteria recognition

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)



Next Steps and Timeline

- Comments due August 29th
- In-person stakeholder meeting September 12th
 - Preview of Draft 2
 - Targeted discussion of specific issues
 - Call-in capability will be available
- Anticipated: Draft 2 Q4 2019
- Anticipated: Finalize Q1 2020





Comments

- In addition to making verbal comments during today's meeting, stakeholders are strongly encouraged to submit written comments and data
 - *Comments will be displayed for public viewing unless otherwise specified by the commenter*
- Please send all comments to: CAC-ASHP@energystar.gov

Comment Deadline

August 29, 2019



Questions

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