



# ENERGY STAR® Program Requirements for Central Air Conditioner and Heat Pump Equipment

## Partner Commitments

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

### Qualifying Products

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1. Comply with current ENERGY STAR Eligibility Criteria, which define performance requirements and test procedures for residential HPs and central air conditioners. A list of eligible products and their corresponding Eligibility Criteria can be found at [www.energystar.gov/specifications](http://www.energystar.gov/specifications).
2. **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 residential ASHPs and central air conditioners. As part of this certification process, products must be tested in a laboratory recognized by EPA to perform residential HP and central air conditioner testing. A list of EPA-recognized laboratories and Certification Bodies can be found at [www.energystar.gov/testingandverification](http://www.energystar.gov/testingandverification).

### Using the ENERGY STAR Name and Marks

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3. 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](http://www.energystar.gov/logouse).
4. Use the ENERGY STAR name and marks only in association with qualified products. 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.
5. Provide clear and consistent labeling of ENERGY STAR qualified residential HPs and central air conditioners.
  - 5.1. The appropriate ENERGY STAR mark must be clearly displayed in product literature (i.e., user manuals, spec sheets, etc.) and on the manufacturer's Internet site where information about ENERGY STAR qualified models is displayed.
    - 5.1.1. For CAC: the ENERGY STAR certification mark;
    - 5.1.2. For HPs meeting the Cold Climate criteria only: the ENERGY STAR Cold Climate mark;
    - 5.1.3. For HPs meeting the Moderate and Hot Climate criteria only: the ENERGY STAR Moderate and Hot Climate mark;
    - 5.1.4. For HPs that meet both the Moderate and Hot Climate and Cold Climate criteria: either both climate-designated marks or the standard ENERGY STAR certification mark.
  - 5.2. It is also recommended that the mark appear on the product packaging.

5.3. Partner shall adhere to the following product-specific commitments regarding use of the ENERGY STAR marks on qualified products:

5.3.1. Whenever any of the ENERGY STAR marks are used in connection with a qualifying product in advertising, on specification sheets, on marketing materials, and on manufacturer's Internet site, provide the following disclaimer language: "Proper sizing and installation of equipment is critical to achieve optimal performance. Split system air conditioners and heat pumps (excluding ductless systems) must be matched with appropriate coil components to meet ENERGY STAR criteria. Ask your contractor for details or visit [www.energystar.gov](http://www.energystar.gov)."

5.3.2. Provide detailed information in installation manuals that stresses the importance of proper installation. This information should be written for the equipment installer and should include the following paragraph.

For Package Units:

**IMPORTANT – This product has been designed and manufactured to meet ENERGY STAR criteria for energy efficiency. However, proper refrigerant charge and proper air flow are critical to achieve rated capacity and efficiency. Installation of this product should follow the manufacturer's refrigerant charging and air flow instructions. **Failure to confirm proper charge and airflow may reduce energy efficiency and shorten equipment life.****

For Split-System Units:

**IMPORTANT - This product has been designed and manufactured to meet ENERGY STAR criteria for energy efficiency when matched with appropriate coil components. However, proper refrigerant charge and proper air flow are critical to achieve rated capacity and efficiency. Installation of this product should follow the manufacturer's refrigerant charging and air flow instructions. **Failure to confirm proper charge and airflow may reduce energy efficiency and shorten equipment life.****

**Note:** References to the ENERGY STAR certification mark have been updated to include clear direction for using the Cold Climate and Moderate and Hot climate marks for heat pumps.

### **Verifying Ongoing Product Qualification**

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6. Participate in third-party verification testing through a Certification Body recognized by EPA for residential ASHPs and central air conditioners, providing full cooperation and timely responses. EPA/DOE may also, at its discretion, conduct tests on products that are referred to as ENERGY STAR qualified. These products may be obtained on the open market, or voluntarily supplied by Partner at the government's request.

### **Providing Information to EPA**

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7. Provide unit shipment data or other market indicators to EPA annually to assist with creation of ENERGY STAR market penetration estimates, as follows:

7.1. Partner must submit the total number of ENERGY STAR qualified residential ASHPs and central air conditioners shipped in the calendar year or an equivalent measurement as agreed to in advance by EPA and Partner. Partner shall exclude shipments to organizations that rebrand and resell the shipments (unaffiliated private labelers).

7.2. Partner must provide unit shipment data segmented by meaningful product characteristics (e.g., type, capacity, presence of additional functions) as prescribed by EPA.

7.3. Partner must submit unit shipment 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.

8. Report to EPA any attempts by recognized laboratories or Certification Bodies (CBs) to influence testing or certification results or to engage in discriminatory practices.
9. 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](http://www.energystar.gov/mesa).

### **Training and Consumer Education**

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10. Partner shall comply with the following, product-specific requirements concerning training and education:
  - 10.1. Offer and encourage training to distributors and/or contractors on the following issues: air distribution issues and their effect on equipment performance, refrigerant charging, proper installation of registers, duct work, and plenum to ensure low leakage and to meet insulation requirements, and proper use of the Manual J calculation, or other equivalent calculation, in order to encourage proper sizing of equipment.

### **Performance for Special Distinction**

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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)

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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](http://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](http://www.epa.gov/greenpower).



# ENERGY STAR® Program Requirements Product Specification for Central Air Conditioner and Heat Pump Equipment

## Eligibility Criteria Final Draft Version 6.0

1 Following is the Final Draft Version 6.0 product specification for ENERGY STAR certified central air  
2 conditioner and heat pump equipment. A product shall meet all of the identified criteria if it is to earn the  
3 ENERGY STAR.

4 **1) Definitions:** Below are the definitions of the relevant terms in this document.

5 A. Central Air Conditioner (CAC) or Central Air Conditioning Heat Pump (HP)<sup>1</sup>: A product, other than  
6 a packaged terminal air conditioner or packaged terminal heat pump, which is powered by single  
7 phase electric current, air cooled, rated below 65,000 Btu per hour, not contained within the same  
8 cabinet as a furnace, the rated capacity of which is above 225,000 Btu per hour, and is a heat  
9 pump or a cooling unit only.

10 A central air conditioner or central air conditioning heat pump may consist of: A single-package  
11 unit; an outdoor unit and one or more indoor units; an indoor unit only; or an outdoor unit with no  
12 match. In the case of an indoor unit only or an outdoor unit with no match, the unit must be tested  
13 and rated as a system (combination of both an indoor and an outdoor unit).

14 B. Single-package unit<sup>2</sup>: Any central air conditioner or heat pump that has all major assemblies  
15 enclosed in one cabinet.

16 C. Split System<sup>2</sup>: Any air conditioner or heat pump that has at least two separate assemblies that are  
17 connected with refrigerant piping when installed. One of these assemblies includes an indoor coil  
18 that exchanges heat with the indoor air to provide heating or cooling, while one of the others  
19 includes an outdoor coil that exchanges heat with the outdoor air. Split systems may be either  
20 blower coil systems or coil-only systems.

21 D. Ducted System<sup>2</sup>: An air conditioner or heat pump that is designed to be permanently installed  
22 equipment and delivers conditioned air to the indoor space through a duct(s). The air conditioner  
23 or heat pump may be either a split-system or a single-package unit.

24 E. Non-ducted Indoor Unit<sup>2</sup>: An indoor unit that is designed to be permanently installed, mounted on  
25 room walls and/or ceilings, and that directly heats or cools air within the conditioned space.

26 F. Gas/Electric Package Unit: A single package unit with gas heating and electric air conditioning that  
27 is often installed on a slab or roof.

28 G. Basic Model<sup>1</sup>: All units of a given type of covered product (or class thereof) manufactured by one  
29 manufacturer and which have the same primary energy source and, which have essentially  
30 identical electrical, physical, or functional (or hydraulic) characteristics that affect energy  
31 consumption, energy efficiency, water consumption or water efficiency.

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<sup>1</sup> 10 CFR part 430, Subpart A, § 430.2 Definitions

<sup>2</sup> 10 CFR part 430, Subpart B, Appendix M1

- 32 H. Heating Seasonal Performance Factor 2 (HSPF2)<sup>3</sup>: HSPF2 is the total space heating required in  
 33 region IV during the space heating season, expressed in Btu, divided by the total electrical energy  
 34 consumed by the heat pump system during the same season, expressed in watt-hours. The  
 35 represented value of HSPF determined in accordance with Appendix M1 is HSPF2, and the  
 36 represented value in accordance with Appendix M is HSPF.
- 37 I. Seasonal Energy Efficiency Ratio 2 (SEER2)<sup>3</sup>: SEER2 is the total heat removed from the  
 38 conditioned space during the annual cooling season, expressed in Btu, divided by the total  
 39 electrical energy consumed by the air conditioner or heat pump during the same season,  
 40 expressed in watt-hours. The represented value determined in accordance with Appendix M1 is  
 41 SEER2, and the represented value in accordance with Appendix M is SEER.
- 42 J. Energy Efficiency Ratio 2 (EER2)<sup>3</sup>: EER2 is the ratio of the average rate of space cooling delivered  
 43 to the average rate of electrical energy consumed by the air conditioner or heat pump. This ratio is  
 44 expressed in Btu per watt.h (Btu/W.h). The represented value determined in accordance with  
 45 appendix M1 is EER2, and the represented value determined in accordance with Appendix M is  
 46 EER.
- 47 K. Coefficient of Performance (COP)<sup>2</sup>: COP means the ratio of the average rate of space heating  
 48 delivered to the average rate of electrical energy consumed by the heat pump. These rate  
 49 quantities must be determined from a single test or, if derived via interpolation, must be  
 50 determined at a single set of operating conditions. COP is a dimensionless quantity.
- 51 L. Percentage of Heating Capacity @ 5°F: The heating capacity of a given unit at 5°F, divided by the  
 52 heating capacity at 47°F, expressed as a percentage.
- 53 M. Independent Coil Manufacturer (ICM)<sup>2</sup>: A manufacturer that manufactures only the indoor unit  
 54 (coil) in a Central Air Conditioner or Air-Source Heat Pump Split System.
- 55 N. System Manufacturer (SM): A manufacturer that manufactures all the major assemblies in an Air-  
 56 Source Unitary Heat Pump and/or Unitary Air-Conditioner.

57 **Note:** Definitions pertaining to the Connected criteria have been moved to section 4A.

58 **2) Scope:**

- 59 A. Included Products: Single package, split system, and gas/electric package units that meet the  
 60 definitions of a central air conditioner or heat pump as specified herein are eligible for ENERGY  
 61 STAR certification, with the exception of products listed in Section 2.B. Units may be intended for  
 62 installation into a duct system, or may be ductless.
- 63 B. Excluded Products: Three phase central air conditioners and heat pumps, and products rated at  
 64 65,000 Btu/h or above are not eligible for ENERGY STAR.

65 **3) Certification Criteria:**

- 66 A. Climates: ENERGY STAR requirements for heat pumps are divided into the following two climate  
 67 applications.
- 68 a. Cold Climate – Criteria designed for applications where performance should be optimized for  
 69 peak heating and part-load cooling performance.

<sup>3</sup> Based on definition in 10 CFR part 430, Subpart B, Appendix M and M1

- 70 b. Moderate and Hot Climate – Criteria designed for applications where performance should be  
 71 optimized for peak cooling performance.

72 **Note:** EPA received comments supporting the effort to develop climate-differentiated criteria, as well as  
 73 comments expressing concern over having multiple ENERGY STAR levels. EPA will maintain the climate-  
 74 differentiated criteria so that programs can leverage a set of standardized levels that are climate  
 75 appropriate. As many programs are starting to identify heat pumps that provide excellent performance in  
 76 cold climates, EPA believes that delaying a climate label would result in further profusion of different levels  
 77 for different programs.

78 Under this proposal, heat pumps meeting cold climate requirements will use a modified ENERGY STAR  
 79 Cold Climate mark. Heat pumps that meet the minimum criteria for moderate and hot climates but do not  
 80 meet the additional cold climate criteria would be identified with an ENERGY STAR Moderate and Hot  
 81 Climate mark. In the case where units meet the cold climate criteria as well as the higher EER for the  
 82 moderate and hot criteria, those units may use both climate labels, or may use the standard ENERGY  
 83 STAR mark. There is no requirement that a physical label be installed on the unit, only that the appropriate  
 84 climate mark is used in place of the standard ENERGY STAR certification mark on product literature and  
 85 marketing materials.

86 B. Energy Efficiency Requirements:

87 a. Certification Metric Criteria

- 88 i. Version 6.0 allows an alternative for early certification using the Appendix M test method  
 89 and associated metrics. This certification pathway will be available until January 1, 2022.  
 90 After the specification effective date, all products certified early shall submit their relevant  
 91 performance ratings per the Appendix M1 test method.

92 **Table 2: Energy-Efficiency Criteria for Certified Residential Central Air Conditioners**

Product Type	SEER2	EER2
CAC Split Systems	≥ 15.2	≥ 12.0
CAC Single Package Equipment <sup>1</sup>	≥ 15.2	≥ 11.5
Allowable Prior to January 1, 2022		
Product Type	SEER	EER
CAC Split Systems	≥ 16.0	≥ 12.5
CAC Single Package Equipment <sup>1</sup>	≥ 16.0	≥ 12.0

- 93 1. Including gas/electric package central AC units.  
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 95 ii. For purposes of ENERGY STAR certification, a Heat Pump model may be designated as  
 96 Moderate and Hot Climate and/or Cold Climate as per the associated requirements in Table  
 97 3 and Table 4.  
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99 **Table 3: Energy-Efficiency Criteria for Certified Residential Moderate and Hot Climate Heat Pumps**

<b>Moderate and Hot Climate Heat Pumps</b>			
<b>Product Type</b>	<b>SEER2</b>	<b>EER2</b>	<b>HSPF2</b>
HP Split Systems	≥ 15.2	≥ 12.0	≥ 7.8
HP Single Package Equipment <sup>1</sup>	≥ 15.2	≥ 11.5	≥ 7.2
<b>Allowable Prior to January 1, 2022</b>			
<b>Product Type</b>	<b>SEER</b>	<b>EER</b>	<b>HSPF</b>
HP Split Systems	≥ 16.0	≥ 12.5	≥ 9.2
HP Single Package Equipment <sup>1</sup>	≥ 16.0	≥ 12.0	≥ 8.5

1. Including gas/electric package heat pumps, which are only eligible for the Moderate and Hot Climate designation.

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**Table 4: Energy-Efficiency Criteria for Certified Residential Cold Climate Heat Pumps**

<b>Cold Climate Heat Pumps</b>			
<b>Product Type</b>	<b>SEER2</b>	<b>EER2</b>	<b>HSPF2</b>
HP Split Systems	≥ 15.2	≥ 11.0	≥ 8.5
HP Single Package Equipment	≥ 15.2	≥ 10.6	≥ 8.1
<b>Allowable Prior to January 1, 2022</b>			
<b>Product Type</b>	<b>SEER</b>	<b>EER</b>	<b>HSPF</b>
HP Split Systems	≥ 16.0	≥ 11.5	≥ 10.0
HP Single Package Equipment	≥ 16.0	≥ 11.0	≥ 9.5

iii. Cold Climate Heat Pumps Low Ambient Performance: To earn the Cold Climate designation, heat pumps must demonstrate low ambient performance by meeting the following:

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- 108 • COP at 5° F  $\geq$  1.75, measured in accordance with Appendix M1.<sup>4</sup>
- 109 • Percent of Heating Capacity at 5° F  $\geq$  70% of that at 47F, with both the 5° F and 47° F
- 110 capacities measured in accordance with Appendix M1.<sup>4</sup>
- 111 • Perform a controls verification procedure (CVP) to confirm that the above performance
- 112 metrics measured at the Appendix M1 low ambient test point at 5° F are achieved by the
- 113 native controls operating as they would in a customer's home.
- 114 Alternative available prior to January 1, 2022:
- 115 • COP at 5° F  $\geq$  1.75, based on manufacturer provided application data.
- 116 • Percent of Heating Capacity at 5° F  $\geq$  70% of that at 47F, with the heating capacity at 5°
- 117 F based on manufacturer provided application data, and the heating capacity at 47° F
- 118 measured in accordance with Appendix M.<sup>5</sup>

119 **Note:** In response to stakeholder feedback, EPA is proposing the revised levels above to ensure that the  
 120 products recognized under this specification are at an efficiency level that is representative of where the top  
 121 performers in the market will be in 2023. To ensure that a range of products are recognized and that they  
 122 have an appropriate payback period, the SEER2 levels have been lowered from the Draft 2 proposal. The  
 123 HSPF2 level was also lowered for the Moderate and Hot Climate packaged heat pumps to recognize a  
 124 larger portion of those units. The revised levels reflect better payback for single package air conditioners as  
 125 well as Cold Climate Split system heat pumps, which are included in the [Final Draft Data Package](#). On  
 126 average, a version 6.0 central air conditioner or heat pump will save 10.3% of the energy used by a units  
 127 that meets the DOE minimum standards in 2023.

128 At these proposed levels, 28% of split system air conditioners and 14% of currently available single package  
 129 air conditioners that are likely to meet the 2023 federal minimum requirements will meet the SEER and EER  
 130 criteria. While not all of these units will meet the installation criteria, EPA believes this is an appropriate  
 131 segment of the market to recognize. Similarly, 20% of currently available split system heat pumps that are  
 132 likely to meet the 2023 federal minimum efficiency standards will meet the Moderate and Hot heat pump  
 133 criteria. EPA notes that the Cold Climate criteria do recognize a very small portion of the current market but  
 134 anticipates that more products will meet those levels in 2023. EPA made an effort to harmonize with the  
 135 Consortium for Energy Efficiency (CEE) levels to the extent possible.

136 Manufacturers have raised a concern that the heating capacities at 5° F and 47° F needed to be measured  
 137 according to the same test method, which EPA has allowed for. They were also concerned that the 5° F  
 138 testing in Appendix M1 is specified in such a way as to be unrealistic, in that they thought the compressor  
 139 speed for the 47° F test must also be used for the 5° F condition. EPA is satisfied this is not the case and  
 140 invites other parties to send questions directly to DOE at [ApplianceStandardsQuestions@doe.gov](mailto:ApplianceStandardsQuestions@doe.gov) for  
 141 clarification.

142 EPA is aware of a variety of efforts to improve testing for low ambient performance and has explored  
 143 different possibilities for the cold climate criteria. In the interest of aligning with existing programs and  
 144 ensuring that cold climate heat pumps will satisfy consumers with their performance, the COP at 5° F and  
 145 the Percentage Heating Capacity at 5° F remain the criteria for the Cold Climate designation. While no  
 146 changes to the low ambient criteria are proposed in this draft, in the future EPA may add alternative  
 147 methods to demonstrate low ambient performance.

148 EPA does believe there is significant value in allowing currently available products to certify promptly to the  
 149 Version 6.0 specification, so the criteria above have been provided as equivalent levels to the Appendix M

<sup>4</sup> 10 CFR part 430, Subpart B, Appendix M1 – Section 3.6 Heating mode tests for Different Types of Heat Pumps, Including Heating-Only Heat Pumps

<sup>5</sup> 10 CFR part 430, Subpart B, Appendix M – Section 3.6 Heating Mode Tests for Different Types of Heat Pumps, Including Heating-Only Heat Pumps

150 metrics. The levels above have been adjusted from the draft 2 in accordance with the SEER2 and HSPF2  
151 levels as proposed earlier in this document. The two sets of criteria were selected to be equivalent, and if  
152 stakeholders feel these values are not entirely aligned, EPA appreciates further information on aligning  
153 them.

154 For products that certify under the Cold Climate designation prior to 2022, the low ambient criteria can be  
155 certified with the use of manufacturer data and the CVP will not be required until January 2, 2023. This  
156 reflects that the CVP is most economical when performed along with regular efficiency testing, but  
157 significantly burdensome when performed by itself. The intent is to allow those units that are ready for cold  
158 climate applications to be recognized in the program without the need for additional testing at a time that  
159 industry testing capacity is fully occupied. Products will be able to certify to Version 6.0 using the Appendix  
160 M test method until twelve months prior to the effective date of the specification. After the effective date, all  
161 products certified early via the Appendix M test method shall submit SEER2, EER2, and HSPF2 ratings as  
162 required by DOE, as well as the test the Low Ambient criteria and perform the CVP for Cold Climate heat  
163 pumps.

164 EPA did receive significant feedback surrounding the requirement that all products be capable of providing  
165 two or more capacities. EPA has removed this requirement as the efficiency criteria appear to be sufficiently  
166 exclusive for the Version 6.0 specification. EPA does believe there is significant value in staged and variable  
167 capacity units and will continue to promote those units through marketing and educational efforts.

168 C. Installation Capabilities: To certify as ENERGY STAR, CAC/HPs must be capable of providing at least  
169 three of the following capabilities to aid in quality installation. For purposes of this section, a  
170 thermostat or controller can be considered part of the system. Items a, b, and c are understood to  
171 be measured at maximum fan speed and capacity.

172 a. Refrigerant charge – System can verify that the refrigerant charge is within manufacturer  
173 recommended tolerances at a range of conditions including outdoor temperatures at least as  
174 low as 55°F.

175 b. Airflow measurement or external static pressure – System shall have some capability to display  
176 airflow and confirm that it is within the OEM recommended settings, or to display external static  
177 pressure and fan speed setting. (Not relevant to ductless units.)

178 c. Blower fan power draw – System shall have the capability to measure and report the watt draw  
179 of the blower fan.

180 d. If systems DO NOT include any of the capabilities in a, b, or c, and have multiple or variable  
181 capacities, the system provides an easily accessible test mode that locks the system into the  
182 highest fan speed and compressor capacity setting available in that installation, such that a  
183 technician can measure the quantities in a, b, and c with external equipment.

184 e. Automatic system discovery – System is capable of automatically recognizing compatible  
185 communicating indoor/outdoor units, furnaces. Automatic discovery of humidifiers and  
186 dehumidifiers is encouraged.

187 f. Preprogrammed system tests – System shall automatically prompt the installer to run  
188 preconfigured system tests following the initial setup. These tests should verify, at a minimum,  
189 fan blower, cooling-mode, defrost mode, heat pump only heating, and auxiliary heating tests as  
190 applicable to the product. The test should require installer verification of the results before  
191 exiting test mode.

192 **Note:** EPA proposed the above capabilities with the understanding that some are likely easier to achieve  
193 than others, but many of these features will be available on the market by 2023. Extensive conversations  
194 with manufacturers and other who commented confirmed this impression. These features will help ensure  
195 that the estimated savings from an ENERGY STAR CAC/CP are realized in the field.

- 196 D. Multiple Assemblies: For split system central air conditioners and heat pumps, ENERGY STAR  
 197 certification shall be determined by the rated performance of the particular combination of indoor  
 198 and outdoor units as tested in accordance with the appropriate regional test procedure, regardless  
 199 of the fact that the components may be used in other combinations
- 200 E. Gas/Electric Package Units: To certify as ENERGY STAR, gas/electric package units shall meet the  
 201 cooling portion of the single package specification requirements in Table 2 for CACs, or in Table 3  
 202 for HPs, above. Gas/electric packaged heat pumps may only achieve the Moderate and Hot Climate  
 203 heat pump label.
- 204 F. ICM coil combinations: To certify as ENERGY STAR, ICM coil combinations shall meet the Central  
 205 Air Conditioner and Heat Pump Split System specification requirements in Tables 2 and 3, above  
 206 and include a condensing (outdoor) unit listed in the ENERGY STAR program by a system  
 207 manufacturer.
- 208 G. The HSPF2 and SEER2 (or HSPF and SEER) ratings for split systems shall be identical to the  
 209 levels reported to DOE and appropriately reflected on the current Federal Trade Commission (FTC)  
 210 Energy guide label. For packaged units, the HSPF2 and SEER2 ratings shall be identical to the  
 211 levels reported on the Federal Trade Commission (FTC) Energy guide label and to those reported  
 212 to DOE. For all units where EER2 (or EER) is reported to DOE, the EER2 reported to EPA shall be  
 213 identical.
- 214 H. Significant Digits and Rounding:
- 215 a. All calculations shall be carried out with actual measured or observed values. Only the final  
 216 result of a calculation shall be rounded. Unless otherwise directed below, calculated results  
 217 shall be rounded to the nearest significant digit as expressed in the corresponding  
 218 specification limit.
- 219 b. Unless otherwise specified, compliance with specification limit shall be evaluated using exact  
 220 values without any benefit from rounding.
- 221 c. As specified in 10 CFR, 430.23(m)(3), SEER2, and HSPF2 shall be rounded off to the nearest  
 222 0.025 Btu/W.h. Similarly, EER2 should also be rounded off to the nearest 0.025 Btu/W.h.
- 223 d. As specified in 10 CFR, 430.23(m)(3), capacity shall be expressed in accordance with Table  
 224 4, below:

225 **Table 5: Rounding Requirements for Capacity**

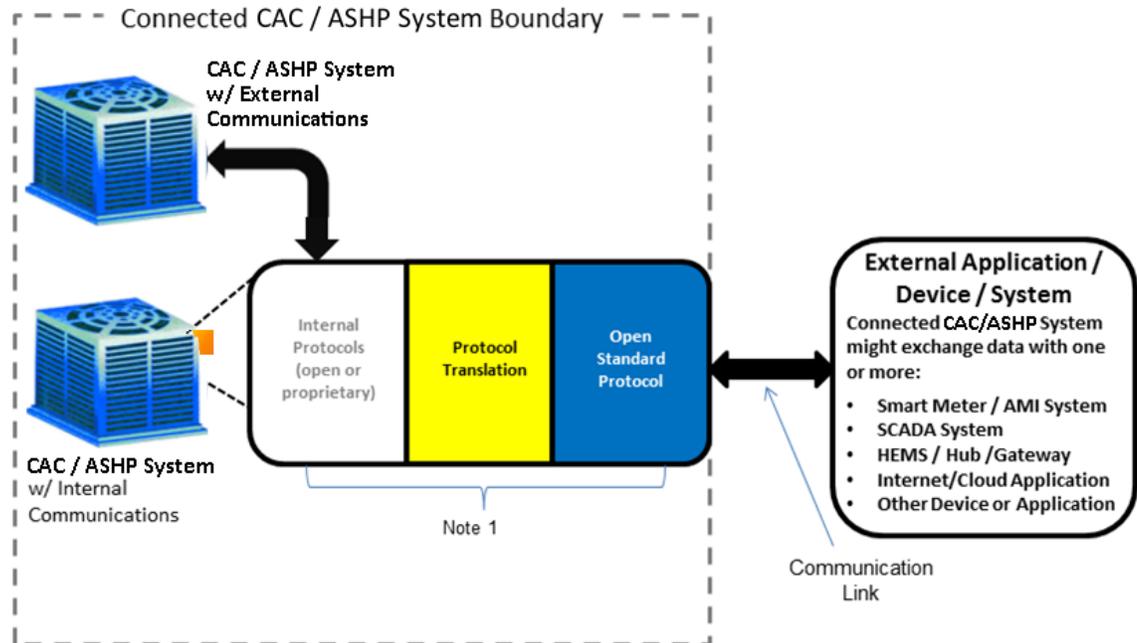
Capacity Ratings, Btu/h	Multiples, Btu/h
< 20,000	50
≥ 20,000 and < 38,000	100
≥ 38,000 and < 65,000	250

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 227 **4) Connected Product Criteria:**

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

232 A. Definitions

- 233 a. Connected CAC/HP System (CCS): Includes the ENERGY STAR certified Central Air  
234 Conditioner or Heat Pump product, integrated or separate communications hardware, and  
235 additional hardware and software required to enable connected functionality, including  
236 controllers/thermostats. In the case of a CCS that implements Open ADR 2.0 with a virtual end  
237 node (VEN) in the cloud, that VEN is part of the CCS for purposes of this specification. For  
238 products implementing CTA-2045A, the module is not considered part of the CCS for  
239 purposes of this specification. A product implementing both using a communication module in  
240 a CTA-2045 port could be tested both ways and identified as implementing both standards for  
241 the purposes of the ENERGY STAR product finder.



242 **Figure 1.** Connected CAC/HP System (CCS)

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

- 247 b. Consumer Authorized Third Party: Any entity for which the consumer has provided explicit  
248 permission to access the CCS connected functionality, in whole or in part, via a  
249 communication link.
- 250 c. Communication Link: As shown in Figure 1, the mechanism for bi-directional data transfers  
251 between the connected CAC/HP system and one or more external applications, devices or  
252 systems.
- 253 d. Demand Response (DR)<sup>6</sup>: Changes in electric usage by demand-side resources from their  
254 normal consumption patterns in response to changes in the price of electricity over time, or to

<sup>6</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.

- 255 incentive payments designed to induce lower electricity use at times of high wholesale market  
256 prices or when system reliability is jeopardized.
- 257 e. Demand Response Management System (DRMS): The system operated by a program  
258 administrator, such as the utility or third party, which dispatches signals with DR requests  
259 and/or price signals to the CCS products and receives messages from the CCS product.
- 260 f. Interface Specification: A document or collection of documents that contains detailed technical  
261 information to facilitate access to relevant data and product capabilities over a  
262 communications interface.
- 263 g. Load Management Entity: DRMS, home energy management system, and the like.
- 264 h. Open Standards: Communication with entities outside the CCS that use, for all communication  
265 layers, standards:
- 266 • included in the Smart Electric Power Alliance (SEPA) Catalog of Standards<sup>7</sup>, and/or
  - 267 • included in the NIST Smart Grid Framework Tables 4.1 and 4.2<sup>8</sup>, and/or
  - 268 • adopted by the American National Standards Institute (ANSI) or another well-established  
269 international standards organization such as the International Organization for  
270 Standardization (ISO), International Electrotechnical Commission (IEC), International  
271 Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE) or  
272 Internet Engineering Task Force (IETF).<sup>9</sup>
- 273 i. On-Premises: Refers to a function that relies only on equipment present at the physical  
274 installed location of the ENERGY STAR certified device/equipment.
- 275 j. Consumer Override (of DR events): Choosing to opt out of a scheduled and/or active DR  
276 event the product would otherwise respond to, without cancelling program enrollment.

277 **Note:** EPA is not proposing changes to the above definitions but has moved them to the Connected Product  
278 Criteria section. EPA will be adopting this placement for all connected product specifications, reflecting our  
279 understanding that a different engineer is often responsible for connected capabilities.

280 B. Communications

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

<sup>7</sup> <https://sepapower.org/knowledge/catalog-of-standards/>

<sup>8</sup> <https://www.nist.gov/sites/default/files/documents/smartgrid/NIST-SP-1108r3.pdf>

<sup>9</sup> <http://www.gridstandardsmap.com/>

286 C. Consumer Feedback

287 a. **User Alerts**

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

290 i. On the product (if intended to be installed in conditioned space) or its consumer  
291 control interface, and/or

292 ii. Transmitted to consumers and consumer authorized third parties via a  
293 communication link. This link can include open standards protocols used for  
294 Demand Response or could use a secondary communication link.

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

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

300 b. **Energy Reporting**

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

307 **Note:** Commenters expressed that the energy reporting requirements may be too burdensome or did not  
308 align fully with AHRI 1380. EPA has intentionally left this requirement less explicit than the measurement  
309 standards specified by AHRI 1380 in Appendix C4.6 to allow for different methods of energy reporting, but  
310 products that report their energy use in that manner would meet this requirement. Energy reporting is  
311 standard across all ENERGY STAR connected products, as it can facilitate integration into a home energy  
312 management system and provide valuable information to homeowners. EPA also would like to clarify that  
313 the energy reporting capability will not require additional testing or verification but can be met through  
314 examination of product literature.

315 D. Demand Response (DR)

316 a. **DR Communications Protocols**

317 The CCS shall meet the communication and equipment performance standards for CTA-  
318 2045-A or OpenADR 2.0b, or both.

319 b. **Consumer Override**

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

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

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

328 c. **DR Information and Messaging**

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

333 Required DR Messaging I/O:

Messaging I/O Operation	Messaging Operation Description
Verifying Connectivity	Ensures target CCS is connected to DRMS and prepared to accept DR signals.
System Capabilities	Requests basic CCS level information on target device, including equipment type response capability.
Operational State(s)  (see c ii. below)	Requests information on CCS 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:

334 Operational State Codes:

Operational State Code	Operational State Definition
Idle Normal	Indicates that no DR event is in effect and the CCS has no/insignificant energy consumption.
Running Normal	Indicates that no DR event is in effect and the CCS is running normal under local control.
Running Curtailed	Indicates that a curtailment type DR event is in effect and CCS is running in General Curtailment mode
Running Heightened	Indicates that a heightened-operation type of DR event is in effect and CCS is running in Critical Curtailment mode.
Idle Curtailed	Indicates that a curtailment type DR event is in effect and the CCS is in off mode.
CCS Error Condition	Indicates that the CCS is not operating or is in some way disabled (for example, no response to the grid).
Idle Heightened	Indicates that a heightened-operation type of DR event is in effect and the CCS is in off mode.

Idle Opted Out	Indicates that the HVAC system is presently opted out of any DR events and the system is in off mode.
Running, Opted Out	Indicates that the SGD is presently opted out of any DR events and the SGD is operating normal under local control.

336

337 **Note:** Commenters requested certain language adjustments to the above, however EPA is maintaining the  
 338 language as it is in alignment with AHRI 1380.

339 **d. DR Requests and Responses**

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

342

343 **i. Required Operational Mode Functionality:**

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. 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° 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 manufacturer may provide user with the means to configure system to automatically respond to peak load price signals.
Customer Override	Notifies DRMS that a consumer has overridden a current / scheduled DR event.

344

345 **ii. Operational Requirements:**

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

348 E. Additional Information for Consumers

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

357 **5) Test Requirements:**

- 358 A. One of the following sampling plans shall be used for purposes of testing for ENERGY STAR  
 359 certification:

360 a. A single unit is selected, obtained, and tested. The measured performance of this unit and  
 361 of each subsequent unit manufactured must be equal to or better than the ENERGY STAR  
 362 specification requirements. Results of the tested unit may be used to certify additional  
 363 individual model variations within a Basic Model as long as the definition for Basic Model  
 364 provided in Section 1, above, is met; or

365 b. Ratings are determined pursuant to the sampling requirements defined in 10 CFR Part 429,  
 366 Subpart B § 429.16 either by selecting units for testing or by the application of an alternative  
 367 rating method (ARM) as defined in 10 CFR Part 429.70. The certified rating must be equal  
 368 to or better than the ENERGY STAR specification requirements. Results of the tested or  
 369 simulated unit may be used to certify additional model variations within a Basic Model as  
 370 long as the definition for provided above and in 10 CFR Part 430.2 is met. Further, all  
 371 individual models within a Basic Model must have the same certified rating per DOE's  
 372 regulations in Part 429 and this rating must be used for all manufacturer literature, the  
 373 certified product list, and certification of compliance to DOE energy conservation standards.

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

376 **Table 6: Test Method for ENERGY STAR Certification**

ENERGY STAR Requirement	Region	Test Method Reference*
SEER2, EER2, HSPF2	All Climates	10 CFR part 430 Subpart B Appendix M1, including the optional H4 very low temperature condition
SEER, EER, HSPF		Alternative prior to January 1, 2022: 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, including the optional H4 very low temperature condition
		Alternative prior to January 1, 2022: Manufacturer provided application data**
Controls Verification Procedure	Cold Climate	Controls Verification Procedure for Residential Heat Pump Low Ambient Performance
		Alternative prior to January 1, 2022: N/A
Installation Capabilities	All Climates	Determined by examination of the product, its control system and its documentation

Connected Products: Demand Response	All Climates	Evaluation of Demand Response in CAC/HP (in development) or certification to AHRI 1380*** and examination of product documentation and interfaces
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377 \* Note that cold climate heat pumps certified using Appendix M1 data shall also use Appendix M1  
378 data for low ambient performance and shall perform a Controls Verification Procedure

379 \*\* Prior to 1/1/2022, products may certify COP @ 5° F and heating capacity @ 5° F with  
380 manufacturer provided application data. Percent Heating Capacity @ 5° F will be heating capacity  
381 @ 5° F (based on manufacturer provided application data) divided by heating capacity @ 47° F (as  
382 measured by Appendix M).

383 \*\*\* Until a test method is established, products may certify as Connected through examination of  
384 the product, its control system and its documentation. Recognition as meeting ENERGY STAR  
385 connected criteria is optional.

386 **Note:** Several commenters noted that the CVP would add significant test burden, notably for units that were  
387 not already testing the 5° F test point. As a result, EPA is not requiring the CVP for units certifying  
388 immediately as cold climate until 2023, at which time any product will need to perform the Appendix M1 test  
389 to remain on the market. As of January 1, 2022 new products will need to use Appendix M1 to certify as  
390 ENERGY STAR, and both the 5° F performance test and the CVP will also be required for cold climate heat  
391 pumps. As indicated in section 3B., EPA may consider additional methods to demonstrate low ambient  
392 performance for cold climate heat pumps. In that case, the associated test methods would be added to  
393 Table 6.

394 EPA would also like to clarify that the installation criteria would not require further testing but would be  
395 determined through examination of the product and associated documentation.

396 **6) Effective Date:** This ENERGY STAR Central Air-Conditioners and Heat Pump Specification shall take  
397 effect on **January 1, 2023**. To certify for ENERGY STAR, a product model shall meet the ENERGY  
398 STAR specification in effect on the date of manufacture. The date of manufacture is specific to each  
399 unit and is the date (e.g., month and year) on which a unit is considered to be completely assembled.

400 **Note:** EPA received further feedback about the January 1, 2023 effective date and the allowance for early  
401 certification. EPA is finalizing the specification now with the effective date in 2023 to allow for manufacturers  
402 to prepare for the criteria, but would like to encourage products with the ability to gain the Connected  
403 recognition or Cold Climate Heat Pump designation to certify as soon as the specification is finalized.

404 **7) Future Specification Revisions:** EPA reserves the right to change the specification should  
405 technological and/or market changes affect its usefulness to consumers, industry, or the environment.  
406 In keeping with current policy, revisions to the specification are arrived at through industry discussions.  
407 In the event of a specification revision, please note that the ENERGY STAR certification is not  
408 automatically granted for the life of a product model.

409 EPA's ENERGY STAR Emerging Technologies program currently recognizes highly efficient air to  
410 water heat pumps that have acceptable cold climate performance. As this technology gains a foothold  
411 in the US, EPA anticipates it will eventually make sense to include this type of product in the scope of  
412 the CAC/HP specification.

**Appendix A: Demand Response Messaging:**

Category	Sub-type	Demand Response Messaging	Response Result	CTA (2045-A)	OpenADR (2.0b)
<b>Basic Signals</b>	Curtailment	<b>General Curtailment</b>	Reduce load (moderate)	Shed <sup>10</sup>	oadrDistributeEvent: SIMPLE level 1. <sup>11</sup>
		<b>Emergency Curtailment</b>	Reduce load (major)	Critical Peak Event <sup>10</sup>	oadrDistributeEvent: SIMPLE level 2. <sup>11</sup>
		<b>Off Mode</b>	Turn off (if possible)	Grid Emergency <sup>10</sup>	oadrDistributeEvent: SIMPLE level 3. <sup>11</sup>
	Operational State	<b>Return to Normal Operation</b>	Return to defaults	End Shed / Run Normal <sup>10</sup>	oadrDistributeEvent: CANCELLED. <sup>12</sup>
		<b>Advance Notice</b>	No requirement (flexible)	Pending Event Time / Type <sup>10</sup>	oadrDistributeEvent: NEAR / FAR / ACTIVE <sup>12</sup>
<b>Advanced Signals</b>	Device State (in event)	<b>Maximum Indoor Temp. Offset</b>	Adjust setpoint for use in curtailment / price response	Get / Set Temperature Offset <sup>13</sup>	oadrDistributeEvent: LOAD_CONTROL, x-loadControlSetpoint <sup>11</sup>
	Device Logic	<b>Utility Peak Load Price Signal</b>	Use / do not use energy when appropriate	Present Relative Price <sup>10</sup>	oadrDistributeEvent: ELECTRICITY_PRICE <sub>1</sub> <sup>1</sup>
<b>Device Properties &amp; Enrollment</b>	Opt Out	<b>Consumer Override</b>	Skip response to event within opt out time window	Customer Override. Sent each time device is queried while opt out is active <sup>10</sup>	oadrCreateOpt, oadrCancelOpt <sup>14</sup>
	Dev. Info	<b>Device Information</b>	Indicates product type	Info Request <sup>13</sup>	ei:eiTargetType (endDeviceAsset) <sup>15</sup>
	Status	<b>State Reporting Requirements</b>	Provide state information to requestor	Query / State Query Response <sup>13</sup>	EiReport. oadrPayloadResource-Status <sup>12</sup>

<sup>10</sup> CTA-2045-A: Table 8-2

<sup>11</sup> OpenADR 2.0b, Section 8.2.2

<sup>12</sup> OpenADR 2.0b, Section 11.2

<sup>13</sup> CTA-2045-A: Table 9-2

<sup>14</sup> OpenADR 2.0b, Section 8.5

<sup>15</sup> OpenADR 2.0b, Annex A

	Hardware	<b>Hardware Requirements</b>	Design of product & comms.	AC or DC Form Factor physical interface	-
Device Energy	Energy	<b>Power (Instantaneous)</b>	Demand of product (W)	Get CommodityRead, code 0 <sup>16</sup>	oadrReport: energyReal <sup>12</sup>
		<b>Energy (Cumulative)</b>	Energy used by product (kWh)	Get CommodityRead, code 0 <sup>16</sup>	oadrReport: energyReal <sup>12</sup>

415

<sup>16</sup> CTA-2045-A, Section 9.3.1