

ENERGY STAR® Central Heat Pump Water Heater Systems Stakeholder Comments & Responses

Topic

Comment Summary

EPA Responses

Version 3.0 Discussion Guide

Specification Approach

Five stakeholders supported a system-based approach to the specification. One of these stakeholders suggested testing with specific tanks to better reflect the integrated system performance. Another three of these stakeholders recommended modeling the specification off of the ENERGY STAR Homes prescriptive and performance options.

One stakeholder recommended maintaining a component-based approach. They note that many of these systems are custom-built, and a component-based specification would allow ENERGY STAR to set minimum levels for eligibility for each component, but not require that each component be paired or sold together.

One stakeholder recommended adding to rather than replacing the current CHPWH specification until the full system metrics and specification are fully vetted.

Two stakeholders recommended that the EPA adjust the specification to use elements of the Advanced Water Heating Specification (AWHS), specifically the design configurations.

One stakeholder noted that HP units actually were included in the Version 2.0 specification. They also added that the change in the DOE definition wasn't about electric resistance, nor was there such a limit in the ENERGY STAR specification.

One stakeholder recommended that DOE clarify that manufacturers may make efficiency representations at non-DOE test conditions if the DOE test condition is present alongside these claims and clearly identified.

The first draft represents a step on the way to a full system approach, in which certification is by system but performance is identified only for major system components. The EPA and DOE consider identifying system products in a regular way, and having solid component tests, as pre-requisites to developing metrics for the performance of systems as a whole. Custom designed systems may be able to participate, if the business model of the designer allows them to be characterized as fully specified.

Using an approach similar to that for the ENERGY STAR New Homes specification would require certification of individual installations, which is beyond the scope of the ENERGY STAR products program.

The EPA has adopted the design configurations from the Advanced Water Heating Specification.

The EPA acknowledges that HP units are in scope for the current specification. While there was no explicit bar to units with electric resistance backup heat, our understanding is that the 12kW input power requirement acted to bar some units from participation. In our view the burden of the proposed approach is light enough to allow broad participation.

DOE clarifies that with the publication of the Final Test Method for Central Heat Pump Water Heater Systems, manufacturers may make efficiency representations for WHEER and the various COP measurements that are defined within that document.

Compliance and Marketing per ENERGY STAR Homes	<p>Three stakeholders recommended that the EPA consider compliance and marketing for this specification similar to the ENERGY STAR Single-Family New Homes program, including the following:</p> <ul style="list-style-type: none"> > Education materials and verification checklist > Partner with organizations for training and field verification > Submit completed checklist to EPA or 3rd party before certification > Marketing for building owners 	<p>The field verification and submission of a checklist before certification are impractical because the ENERGY STAR products program doesn't certify individual installations. However, the EPA may adopt some of these items once the specification is final and marketing activities begin.</p>
Interim Actions	<p>One stakeholder supports this specification development but noted that it would take several years to complete if it is done thoughtfully, thus they recommended for the EPA to do things in the interim to help the nascent market.</p>	<p>The EPA intends the specification development to proceed at a normal pace and is proposing an approach to the specification that will support this nascent market.</p>
Custom Designed Systems	<p>Two stakeholders raised the questions of how custom-designed systems, which are common, will be certified and which parties will be responsible for certification.</p>	<p>The party that designs the complete system would be the ENERGY STAR partner and be responsible for performance of the system. Custom designed systems, however, are not in scope for the specification. We believe the way system product models and product families are defined will allow a relatively small set of system product models to cover the needs of most buildings.</p>
Market Delivery Structure	<p>Two stakeholders recommended including a market delivery structure to categorize products and recommend steps for validating performance. For example, a more stringent performance validation process for field-built than packaged skid-mounted systems.</p>	<p>The EPA has adopted the definition of market delivery mechanisms to clarify the scope of the specification. Because an ENERGY STAR partner must be responsible for the performance of the system as a whole, only integrated HPWH and central HPWH systems that can be characterized as fully specified or fully integrated are in scope.</p>
Connectivity	<p>Three stakeholders recommended including optional connectivity. One of these stakeholders recommended referencing AHRI 1530 once it is completed. The other two stakeholders also recommended that the EPA promote non-communications demand response functions and load shift controls.</p> <p>Four stakeholders recommended requiring connectivity. One of these stakeholders suggested referencing the CEE Principles of Connectivity. The other three stakeholders recommended including non-communications demand response functions and reporting additional demand response features.</p>	<p>While the EPA anticipates that many installations will take advantage of connectivity, we have proposed it only as a reporting requirement. We include AHRI 1530 compliance and non-communications demand response functions. We would welcome stakeholder comments on how to further define such.</p>
Pumps and Recirc	<p>Two stakeholders recommended requiring manufacturers to provide guidance on recirculation pump controls and balancing of the hot water distribution system.</p> <p>One stakeholder recommended not specifying pump efficiency as it increases costs for marginal efficiency gain.</p>	<p>The EPA has included extensive requirements for partners to provide information on certified systems, their applications, and their operations. These requirements are meant to ensure purchasers are satisfied with the performance of their system and it delivers the environmental benefits it claims.</p>

		The requirement for circulating pumps has been proposed at a level that is consistent with the 2028 federal minimum efficiency standard. This requirement allows for the reporting of the circulator pump efficiency and a transition to the circulator energy index (CEI) metric consistent with the upcoming minimum efficiency standard. As explored thoroughly in the May 2024 Energy Conservation Standards Circulator Pump Final Rule, this level of efficiency is justified for the component itself, regardless of its contribution to system efficiency.
HP-Only Efficiency Levels	Five stakeholders recommended setting efficiency levels for the heat pump only, but not making them too stringent.	The levels chosen for HP unit efficiency are intended to include most products on the market.
Swing Tank	Two stakeholders recommended that manufacturers must specify if a swing tank is needed. This stakeholder also recommended allowing backup/swing tanks to be gas-fired.	Thank you for your comment, the Draft 1 proposes allowing backup/swing tanks to be gas fired.
Configurations	Four stakeholders recommended listing single- and multi-pass separately for the same HP unit. Another stakeholder recommended allowing both into the program.	The proposed specification allows both single-and multi-pass designs. Systems including the same HP unit but different configurations would be in different model families.
Electric POU	One stakeholder recommended including point-of-use (POU) water heaters in the specification given the system-based focus on water heating.	The EPA has considered inclusion of Electric POU water heaters in the past, and concluded there is not sufficient distinction between them to make labeling useful. However, as resources allow, we will highlight how they can be useful for an efficient system.
Final Draft Test Method		
Test method approach and Authority	<p>One stakeholder stated that the seasonal metric around only the heat pump component of the system will further embolden jurisdictions to favor component efficiency over the efficiency of the system and potentially increase energy consumption, total installation cost, and operating costs.</p> <p>This stakeholder also stated they have concerns over DOE and EPA's authority to regulate CHPWH systems within the DOE and EPA framework, along with the stated understanding of a heat pump water heater's (HPWH) role within a CHPWH system.</p>	DOE and the EPA believe the component-based approach to testing is the most appropriate based on the data available at this time, and that the system-based approach of the specification itself will mitigate the risk of jurisdictions favoring component efficiency. DOE and EPA have provided further information in the Draft 1 Version 1.0 Product Specification for Commercial Heat Pump Water Heaters on how the specification will address the heat pump unit's role in a CHPWH system. We emphasize that ENERGY STAR remains a voluntary program and that this test method is not a regulatory action.
Test Conditions, Indoor/Outdoor	One stakeholder supports DOE's decision to align test points with the space heating industry and recognizes the importance of the inclusion of low temperature test points. One stakeholder expresses concerns that the WHEER metric for outdoor units is not comparable to the COP _{80.6} for indoor units because the indoor unit will see variable supply	DOE and EPA do not intend for the WHEER and COP _{80.6} metrics to be directly comparable to one another. Indoor units can be compared using their individual COP _{80.6} efficiencies while outdoor units can be compared using the WHEER metric. Units that can operate both indoors and outdoors will have both a WHEER and COP _{80.6} that can be

	<p>water temperatures that are dependent on the time of year. This stakeholder also has concerns that “indoor” doesn’t just mean boiler/mechanical room. It could be in a parking garage, which is “protected” from weather but will see lower ambient temperatures.</p>	<p>used to compare with other indoor/outdoor units with both metrics. DOE and EPA are aware that the indoor test condition is only representative of higher temperature mechanical/boiler rooms; a unit in a parking garage would still experience a range of air conditions more typical of an outdoor unit and would not be considered an indoor unit within this test method. DOE and EPA have updated the definitions for indoor and outdoor heat pump units to be clearer on how to determine whether a model qualifies as an indoor only, outdoor only, or indoor/outdoor unit. The classification relies on manufacturer provided labeling and manuals.</p>
<p>Off-Cycle Energy Consumption</p>	<p>One stakeholder commented that the test method does not include a procedure for evaluating base pan heat and other off-cycle energy consumption and stated that incorporating off-cycle energy consumption would make this test method more representative and align it with other industry heat pump test procedures, such as AHRI 210/240, AHRI 1340, and AHRI 310/380.</p>	<p>DOE and EPA may consider this in future iterations of this TP, but do not have the resources evaluate and incorporate into a WHEER metric at the moment.</p>
<p>Seasonal Metric</p>	<p>Several stakeholders expressed concerns about the use of an integrated efficiency metric and requested that DOE/EPA not move forward with developing a seasonal metric outside of AHRI's development process. Two stakeholders have stated that the draft test procedure seemed rushed, and that the comment period was too short for the stakeholders to complete their comments on each topic. One stakeholder requested that the timeline for the CHPWH metric process be extended, allowing for more draft versions and longer comment periods between them.</p> <p>One stakeholder stated that the seasonal load requirements for CHPWH may differ from other types of heat pump metrics that were referenced for this test method and the WHEER metric approach does not currently reference specific CHPWH load or run-time data. This stakeholder also strongly recommended requiring reporting performance at all relevant test conditions if the test method were to be published.</p>	<p>DOE and EPA believe the integrated efficiency metric calculated in the central HPWH test method is comparable to other established integrated metrics within the space heating industry for products such as central air conditioners, commercial unitary air conditioner, and room heat pumps. Using the same bin hours (which express the environmental conditions the unit experiences) makes sense, and although the WHEER metric does not account for a varying seasonal load, DOE and EPA do not have data to suggest that there is a consistent pattern for varying seasonal load across the variety of potential commercial applications for CHPWHs. Therefore, DOE and EPA decided on a constant load which will fairly evaluate all units.</p> <p>DOE and EPA are also including traditional COP calculations within the test method in addition to the WHEER metric. Whether the specification will have traditional COP and/or WHEER requirements for heat pump units is a separate question and will continue to be discussed through the specification development process.</p>
<p>Compressor Cut-in/Cut-out</p>	<p>One stakeholder noted that there was not enough time to review the cut-in / cut-out temperatures test but expresses concerns about the repeatability and time burden of this test. One stakeholder requests clarification why T_L only appears to apply to the Type B model calculations. One stakeholder also recommended EPA/DOE evaluate cut-in/cut-out temperatures at high ambient temperatures (i.e., >95F).</p>	<p>DOE and EPA referenced the cut-in/cut-out test from the ENERGY STAR Test Method to Determine Room Air Conditioner Heating Mode Performance and believe it will not be overly burdensome if an accurate compressor cut-out temperature estimate is used for determining the starting ambient temperature. DOE only uses T_L for Type B models as these models do not have another test point below</p>

		35°F that can be used to calculate linear approximations below 35°F. Type C and Type D have the 17°F test point below 35°F which is used in place of T _L . At this time DOE and EPA do not believe an upper compressor cut-off temperature is needed, however this may be revisited in a future revision.
Entering Water Temperature Test Condition	One stakeholder stated that, since single pass HPWH units are more efficient than multi-pass HPWH units, the WHEER calculation would overestimate the efficiency of single pass units and underestimate the efficiency of multi-pass units due to the entering water temperature test points being more representative of multi-pass operation.	DOE and EPA are aware that the entering/leaving water temperature conditions for single-pass units will make the single-pass WHEER metric appear much more efficient compared to the multi-pass test conditions. However, DOE and EPA do not have the data available to determine what a representative amount of time the unit would be expected to operate at single-pass vs multi-pass and have therefore decided to keep these configurations separately reported to allow for comparisons of the same configuration between units.
Manufacturer Reporting	One stakeholder recommends DOE and EPA to require manufacturers to report the average CHPWH demand (in kW) during a defrost cycle and the average defrost cycle duration while continuing to refine a comprehensive defrost test for inclusion in the next version of the CHPWH test method. Another stakeholder recommends adding to the list of supplemental test instructions whether the outdoor AS HPWH model was tested in the ducted or non-ducted configuration.	DOE and EPA agree that additional information to assist in the defrost testing would be beneficial for test labs to double check their defrost findings. DOE and EPA also agree that reporting the ducting configuration of the unit would be appropriate to be documented in the test report. These additional requests have been included in the list of manufacturer provided information.
Defrost Test Condition	One stakeholder stated that there was not enough time to review and comment on the defrost test. Another stakeholder recommended DOE/EPA remove the instruction to disable the electric resistance on line 252 of the draft, stating that this would benefit consumers and installers alike by showing total system efficiency instead of the heat pump's efficiency. This stakeholder also requested further clarification on the language in line 391 of the draft and suggested the implementation of a requirement that manufacturers report defrost type and frequency. In the event that the timeline for version 3 of the test method is not extended, this stakeholder urged DOE/EPA to require manufacturers to report the average CHPWH demand and duration of a defrost cycle.	DOE and EPA referenced the defrost test procedure from the ENERGY STAR Test Method to Determine Room Air Conditioner Heating Mode Performance and modified instructions and tolerances based on testing. DOE and EPA are aware that units rely on supplemental electric resistance heat for defrost and reaching lower ambient temperatures. However, the final test method disables supplemental electric resistance heat to isolate the efficiency of the heat pump.
BL and Sizing Load	One stakeholder asked whether BL stands for "building load" and how the sizing factor (SF) of 1.1 was determined.	DOE and EPA referenced other heat pump industry standards which typically use BL or "building load" to determine the demand that the heat pump unit is expected to meet. While the BL used in the WHEER metric is not a building load it is intended to represent the same water heating demand that is used in other heat pump metrics. The sizing factor of 1.1 was determined based on reference from other industry standards which use a similar value.

Coefficient of Performance Calculation	One stakeholder requests clarification on why “1/(C _{fg} x ρ)” is used instead of density in gal/lb for the calculation of heat capacity (Q). This stakeholder also requests clarification why C _p does not change with temperature, like ρ is required for ρ . Finally, the stakeholder requests the temperature that should be used to find ρ and C _p be clarified. Another stakeholder also recommended that a conversion factor to convert the COP equations from W to Btu/h be included in the denominator of the COP equation.	DOE is aware that some test labs use mass flow and density rather than volumetric flow and specific volume of water to determine the heating capacity of the unit. However, DOE aligned with the equations used in the industry standard, ANSI/ASHRAE 118.1, which use volume and use a constant C _p . DOE has updated the calculation of ρ to clarify which water temperature to use depending on the location of the flow meter. DOE did not follow the recommendation to include a conversion factor in the calculation of COP as both factors are already in Btu/h and do not need to be converted.
Metric Definition	One stakeholder recommends removing "using the national average temperature fractional bin hours" from the WHEER definition, stating that a reference to the section is sufficient and that a description of the calculation is unnecessary.	DOE and EPA acknowledge that different fractional bin hours based on climate regions could be used for calculation of WHEER but wanted to clearly differentiate between WHEER and cold-climate WHEER _c within the ENERGY STAR test method.
Interpolation and Defrost Test Calculations	One stakeholder noted that the equations 4.3-10 and 4.3-12 would more closely align with the Energy Star Room Heat Pump Test Method by interpolating between the 17°F test and the 35°F test within the temperature range of 17°F to 42°F. However, this stakeholder recommended accounting for degradation capacity at 17°F in these equations, as well as all temperatures below 17°F, using the rationale that frost impact below 17°F should not be affected by whether or not the 35°F test is conducted.	DOE agrees that the interpolation within the 17°F to 42°F temperature range should be between the 17°F and 35°F test conditions and has updated the equations for all Type C and D equations accordingly. However, DOE intentionally did not account for degradation capacity at 17°F and below, which is more consistent with defrost testing across product categories, including the ENERGY STAR Room Heat Pump Test Method.
Editorial Revisions	Two stakeholders had various comments on revisions, clarifications, and editing suggestions.	DOE appreciates the editorial revision suggestions and has included those that were appropriate.