Appliance Standards Awareness Project
American Council for an Energy-Efficient Economy
CLASP
Natural Resources Defense Council
Oregon Department of Energy
Southwest Energy Efficiency Project
Washington State Department of Commerce

September 26, 2023

Ms. Julia Hegarty
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Office, EE-5B
1000 Independence Avenue SW
Washington, DC 20585

**RE: Docket Number EERE–2017–BT–STD–0019/RIN 1904–AD91: Notice of Proposed Rulemaking for Energy Conservation Standards for Consumer Water Heaters**

Dear Ms. Hegarty:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP), American Council for an Energy-Efficient Economy (ACEEE), CLASP, Natural Resources Defense Council (NRDC), Oregon Department of Energy (ODOE), Southwest Energy Efficiency Project (SWEEP), and Washington State Department of Commerce on the notice of proposed rulemaking (NOPR) for energy conservation standards for consumer water heaters. 88 Fed. Reg. 49058 (July 28, 2023). We appreciate the opportunity to provide input to the Department.

We strongly support the proposed standards for consumer water heaters, which are generally consistent with the recommendations submitted by a multistakeholder coalition of water heater manufacturers, energy efficiency organizations, environmental advocates, and consumer advocates in October 2022.[1] This group of stakeholders entered discussions voluntarily in early 2022—with no involvement from DOE—after informal conversations between parties revealed a set of mutual goals. The joint stakeholder recommendations were designed to transition the majority of electric storage water heaters to heat pump technology, make important incremental steps to improve gas-fired water heater efficiency, and offer manufacturers, consumers, and professional installers flexibility for certain applications. We appreciate that DOE's proposed standards similarly reflect these objectives.

[1] https://www.regulations.gov/comment/EERE-2017-BT-STD-0019-0049.

DOE estimates that over 30 years of sales, the proposed standards would result in more than 27 quads of energy savings and up to $161 billion in net present value savings for consumers. Additionally, the proposed standards would cut 501 million metric tons of $CO_2$ emissions and provide up to $49 billion in net health benefits due to reduced $NO_x$ and $SO_2$ emissions.[2]

The proposed standards would provide large utility bill savings, which would particularly benefit low-income consumers. The greatest energy and cost savings would result from shifting most electric storage water heaters[3] to heat pump technology. Taking into account additional upfront costs—which would pay off in only three years—households purchasing medium electric storage water heaters at the proposed levels would save $1,868 on average over the lifetime of the products; annual utility bill savings would be $238 per year on average relative to the current standards.[4] For gas storage and gas instantaneous water heaters, consumers would save $19 and $22 per year, respectively.[5]

Furthermore, the proposed standards would provide significant peak demand reductions due to the large electricity savings, thereby improving grid reliability.

**The proposed standards would provide significant benefits for low-income households.** Nationally, 67% (25.8 million) of low-income households face a high energy burden; low-income households spend three times more of their income on energy costs compared to the median spending of non-low-income households (8.1% versus 2.3%).[6] The proposed standards would help reduce these energy burdens.

Low-income households are more likely to have an electric water heater compared to all households;[7] thus, low-income households would disproportionately benefit from the large utility bill savings associated with the proposed standards for electric storage water heaters. DOE estimates that low-income households with medium electric storage water heaters would see average life-cycle cost savings of $2,475, and 69% of low-income households with a medium electric storage water heater would experience a net benefit from the proposed rule (with 21% of low-income consumers not impacted).[8] In addition, renters, who are disproportionately low-income households, would especially benefit from the standards since

[2] 88 Fed. Reg. 49159.
[3] Specifically, "medium" electric storage water heaters that have effective storage volumes between 20 gallons and 55 gallons, excluding "small electric storage water heaters."
[4] 88 Fed. Reg. 49137-49139.
[5] Ibid.
[6] https://www.aceee.org/sites/default/files/pdfs/u2006.pdf.
[7] According to RECS 2020 survey microdata, about 55% of low-income households have an electric water heater compared to 46% for all households.
https://www.eia.gov/consumption/residential/data/2020/index.php?view=microdata.
[8] 88 Fed. Reg. 49141.

landlords typically have no incentive to install efficient water heaters (since the tenants usually pay the energy bills). DOE's analysis shows that 65% of low-income households with medium electric storage water heaters are renters; of these, the vast majority pay their electricity bill. These households would incur no incremental cost while realizing $230 in average annual electricity bill savings.[9]

Low-income households with gas water heaters would also benefit from the proposed standards. For gas storage water heaters, the proposed standards would save low-income households an average of $137 over the lifetime of the product.[10] Only 2% of all low-income households have a gas instantaneous water heater as these are typically premium products with a higher baseline price point.[11,12] Still, low-income households with gas instantaneous water heaters would see savings of $158 on average over the lifetime of the product as a result of the proposed standards.[13]

**The proposed standards would significantly reduce peak demand and improve grid reliability.** The large electricity savings from the proposed standards would shrink demand on power plants, thereby reducing strain on the electric grid. Specifically, the shift from electric resistance to heat pump technology would provide significant reductions to peak demand since heat pump water heaters (HPWHs) consume less than half as much energy than electric resistance water heaters. DOE estimates that the proposed standards would reduce installed capacity for electric utilities by about 34,000 megawatts in 2050.[14] In addition, like electric resistance water heaters, HPWHs can be used as part of voluntary demand response programs, which can divert or reduce power from certain appliances during peak demand periods. A study led by the Pacific Northwest National Laboratory (PNNL) found that for peak days in both the summer and winter months, connected HPWHs used about 87% less energy during the morning peak period and at least 90% less energy during the evening peak period relative to a non-connected electric resistance water heater.[15] The proposed standards would thus enable critical energy load reduction to help improve grid reliability.

**The proposed standard levels would preserve access to electric water heaters designed for space-constrained installations.** Space-constrained installations are often served by small or "lowboy" water heaters, for which heat pump technology is not yet available. The proposed standards address these installations through a separate class for small electric storage water

[9] https://www.regulations.gov/document/EERE-2017-BT-STD-0019-0058. pp. 11-3 and 11-6.
[10] 88 Fed. Reg. 49140.
[11] 2020 RECS Survey Data. https://www.eia.gov/consumption/residential/data/2020/index.php?view=microdata.
[12] DOE's analysis shows that the installed cost of a baseline gas instantaneous water heater is 50% more than that of a gas storage water heater.
[13] 88 Fed. Reg. 49141.
[14] https://www.regulations.gov/document/EERE-2017-BT-STD-0019-0058. p. 15-8.
[15] https://www.bpa.gov/-/media/Aep/energy-efficiency/emerging-technologies/ET-Documents/demand-response-final-report-110918.pdf.

heaters, for which the standards would continue to allow electric resistance water heaters.[16,17] Thus, the proposed standards would preserve access to water heaters designed for space-constrained installations, thereby ensuring that households living in multi-family housing, for example, would not be disproportionately burdened by the proposed rule.

**HPWHs can be installed in small spaces and operate efficiently.** While the proposed standards would allow water heaters designed for space-constrained installations to remain electric resistance, HPWHs can be installed in small spaces, such as closets and utility rooms, and still operate efficiently. In the past, manufacturers typically recommended that HPWHs be placed in rooms of at least 700 cubic feet (e.g., basements or garages) in order to provide adequate space and airflow around the water heater. However, a study conducted by the Northwest Energy Efficiency Alliance (NEEA) found that HPWHs can be installed in small spaces and still maintain high efficiencies.[18] Specifically, NEEA found that at room volumes of 200 cubic feet, the measured efficiency of the HPWH under test was still about twice as high as an electric resistance water heater. Furthermore, even in a room as small as 84 cubic feet,[19] NEEA found that simple interventions such as the addition of a louvered door, a door stop, or wall vents were able to successfully prevent cold air from building up in the room, thereby maintaining high efficiencies. Some of these findings are already reflected in the installation guidelines for HPWHs from major manufacturers.[20]

**DOE's analysis provides a thorough evaluation of installation costs, including for challenging installations.** In estimating the installation costs associated with replacing an electric resistance water heater with a HPWH, DOE accounted for installations with limited space, additional labor hours, condensate removal, updated electrical connections, and various other additional costs that may be associated with installing HPWHs. DOE also incorporated costs for a subset of households that may install a venting system to remove cooled exhaust air from a conditioned space during the heating season. For gas-fired instantaneous water heaters, DOE included the costs associated with installing a new venting system and condensate removal when replacing a non-condensing model with a condensing model. We believe that DOE has appropriately accounted for installation costs across efficiency levels.

**DOE has adequately captured the impact of heat pump technology on broader home energy consumption.** HPWHs draw heat from the space in which they are located and exhaust cooled

[16] "Small" electric storage water heaters would include water heaters with effective storage volumes between 20 and 35 gallons in the very small or low usage draw patterns.
[17] 88 Fed. Reg. 49080-49081.
[18] Heat Pump Water Heaters in Small Spaces Lab Testing: "The Amazing Shrinking Room". https://neea.org/resources/heat-pump-water-heaters-in-small-spaces-lab-testing-the-amazing-shrinking-room.
[19] For example, a space measuring 3 ft. x 2.8 ft. x 10 ft. in length, width, and height.
[20] https://www.aosmithatlowes.com/media/1798/aosmith_signature_900_hybrid_ventilation_guidelines.pdf; https://rmc-cdn.s3.amazonaws.com/media/uploads/iat/sites/36/2020/04/AP21681-UseAndCare.pdf.

air to the surrounding space.[21] This means that if a HPWH is installed in a conditioned space, in the winter, the space heating system may have to replace some of the heat that the HPWH absorbs. In the summer, HPWHs, if placed indoors, can decrease a home's cooling load because the exhaust air helps cool the space. We believe that DOE's analysis for the proposed rule appropriately takes into account the indirect energy impacts of HPWHs both from increased space heating and reduced space cooling for homes in which the water heaters is in the conditioned space.

**We believe that DOE's assignment of efficiency levels in the no-new-standards case reasonably reflects actual consumer behavior.** We note that the assignment of water heater efficiency is not entirely random. In particular, DOE used data from the American Home Comfort Studies to adjust the water heater efficiency distributions based on square footage. Furthermore, we agree with DOE's determination that the method of assigning water heater efficiencies is more representative of actual consumer behavior than assigning efficiencies based solely on cost-effectiveness. As DOE describes in the NOPR, there are various market failures as well as aspects of consumer preference that significantly impact how products are chosen by consumers.[22] DOE notes that consumers are often motivated by more than simple financial trade-offs and tend to underestimate the energy use of large energy-intensive appliances like water heaters, resulting in less cost-effective purchases. In addition, there are often misaligned incentives in rental properties where the landlord purchases and installs the water heater while the renter is responsible for paying the utility bill. Similarly, contractors install a large share of water heaters in replacement situations and can often influence the type of model purchased. Furthermore, the installation of a water heater is done infrequently (consumers will likely purchase only a few, at most, water heaters throughout their lifetimes); information about the purchase price, installation cost, and projected energy costs of a water heater is not always transparent; and consumers are likely to make decisions that do not result in the highest net present value for their specific scenario. We therefore believe that DOE's assignment of efficiency levels in the no-new-standards case is sufficiently representative of actual consumer behavior.

In addition, as DOE notes in the NOPR, the efficiency distributions for gas-fired storage and electric storage water heaters below 55 gallons are heavily weighted toward the baseline efficiency or Efficiency Level (EL) 1.[23] Since DOE's analysis already assigns most consumers to baseline levels (i.e., EL 0) or EL 1 in accordance with market data, any variation from DOE's assignment methodology would not produce substantially different results than those in the NOPR.

[21] For split system heat pump water heaters, where the heat pump is located outdoors, no cool air is exhausted indoors.
[22] 88 Fed. Reg. 49115-49116.
[23] 88 Fed. Reg. 49118.

**We do not believe that the proposed standards for gas instantaneous water heaters would result in product switching.** The proposed standards for gas instantaneous water heaters effectively require condensing technology, reducing energy use by about 13%.[24] One manufacturer has argued that the proposed standards for gas instantaneous water heaters would result in many consumers choosing less-efficient gas storage water heaters.[25] However, we find such an outcome to be highly unlikely for several reasons. First, gas instantaneous water heaters are a premium product, typically selected for their ability to provide "endless hot water" and/or to save space; DOE's analysis shows that the installed cost of a baseline gas instantaneous water heater is 50% more than that of a gas storage water heater.[26] Second, the incremental installed cost at the proposed standard levels for gas instantaneous water heaters is slightly lower than that for gas storage water heaters ($127 vs. $144). Therefore, the cost differential between gas storage and gas instantaneous water heaters would remain essentially unchanged with the proposed standards. Finally, DOE's analysis shows that two-thirds of sales of gas instantaneous water heaters today are condensing models, and more than half of current sales already meet the proposed standard levels.[27]

**We do not believe that the proposed standards would result in fuel switching.** In most cases, a household switching from a gas to an electric water heater would need to add a 240 V circuit to the existing electrical panel or upgrade the panel altogether, which would significantly increase installation costs. Similarly, switching from an electric to a gas water heater would require a gas hookup and additional costs for venting and piping the water heater, especially if there is no other vented gas-fired equipment already in use. DOE modeled the small fraction of homes with an electric water heater that also have vented gas-fired space heating equipment and still found that switching from an electric to a gas water heater would be extremely limited.[28] Moreover, in emergency replacement scenarios, consumers are unlikely to invest in switching the fuel-type of their water heater. Thus, given the substantial hurdles involved with fuel switching for these products, we believe that fuel switching due to the proposed standards would be highly unlikely.

**We support the proposal to limit tabletop water heaters to products in the very small and low draw patterns.** DOE notes that tabletop water heaters typically have rated storage volumes around 35 gallons and specific dimensions in order to be used as a kitchen workspace. In the NOPR, DOE proposed to specify that the tabletop designation be applicable only to products with very small or low draw patterns.[29] This proposed change would align the standards for

[24] https://www.regulations.gov/document/EERE-2017-BT-STD-0019-0058. p. 7-22.
[25] https://www.rinnai.us/tankless-water-heater-doe-ruling#/2/.
[26] The installed cost of baseline gas storage and gas instantaneous water heaters are $1,524 and $2,320, respectively.
[27] https://www.regulations.gov/document/EERE-2017-BT-STD-0019-0058. p. 8I-4.
[28] https://www.regulations.gov/document/EERE-2017-BT-STD-0019-0058. pp. 9A-8 - 9A-9.
[29] 88 Fed. Reg. 49081.

tabletop water heaters with those for small electric storage water heaters and help ensure that tabletop water heaters are not used as a less efficient substitute for conventional electric storage water heaters.

**We support DOE's proposed implementation of the effective storage volume and high temperature testing provisions.** DOE notes that there are water heaters on the market that offer a user-initiated mode that results in an elevated internal water temperature of the storage tank while maintaining the delivered water temperature at 125°F.[30] In the June 2023 test procedure final rule, DOE established high temperature testing provisions and an effective storage volume metric, which accounts for the thermal energy stored in the water heater.[31] Storage water heaters that allow water to be stored at a higher temperature than the delivery temperature could provide larger effective stored volume capacity than their rated volume. Thus, in the NOPR, DOE proposed to require electric resistance water heaters[32] that are capable of storing water above 135°F longer than 120 hours to be subject to high temperature testing[33] for determining compliance. We agree with DOE's determination that the high temperature test provisions would be expected to be representative of the average use cycle of electric resistance storage water heaters that offer the user the ability to increase the storage tank temperature. Furthermore, the proposed implementation of the effective storage volume provisions for certain electric resistance storage water heaters will help ensure that the expected savings from the proposed standards will be realized in the field.

We also support the proposed threshold of 135°F for the high temperature testing provisions. For the NOPR, DOE thoroughly evaluated the threshold for high temperature testing in order to help ensure that the expected savings from the proposed standards are realized while minimizing any loss of consumer utility. DOE investigated the impact of various mean tank temperatures on the effective capacity of an electric resistance water heater and found that storing water at 140°F would increase the effective storage volume of a 35-gallon rated storage volume tank to 44 gallons.[34] We agree with DOE's reasoning that water heaters with the ability to heat and store water at higher temperatures are increasingly likely to be used to replace larger water heaters as the maximum setpoint increases. Importantly, an effective storage volume of 44 gallons (associated with a 35-gallon rated storage volume water heater at a mean temperature of 140°F) is essentially equivalent to a water heater with a nominal volume of 50 gallons.[35] Thus, we believe that testing in the normal temperature mode (i.e., 125°F) would not

[30] 88 Fed. Reg. 49164.
[31] 88 Fed. Reg. 40458. (June 21, 2023).
[32] Electric resistance water heaters that can only heat and store water above 135°F in response to instructions received from a utility or third-part demand-response programs would be exempt.
[33] The high temperature test requires testing be completed in the "over-heated mode" that results in the highest internal tank temperature while still maintaining an outlet temperature of 125 ±5 °F.
[34] 88 Fed. Reg. 49165.
[35] Water heaters with a nominal storage volume of 50 gallons typically have a rated storage volume of 45 gallons.

be representative for water heaters with mean tank temperatures of 140°F or higher and that a threshold of 140°F could significantly undermine the intent of the proposed standards. We also agree with DOE's tentative conclusion that a threshold of 135°F would not compromise the utility of the water heater for those that desire hotter water for certain situations.

**We encourage DOE to confirm that the current standards based on rated storage volume would continue to apply.** While the current standards for consumer water heaters are based on rated storage volume, DOE's proposed standards are based on the effective storage volume metric. We understand that there is the possibility that a very large (e.g., 80 gallon) electric resistance water heater could be capable of being operated at a high enough tank temperature such that it has an effective storage volume greater than 120 gallons; according to the proposed standards, the standard for such a unit would reflect electric resistance technology (rather than the heat pump-level standard that applies today). We therefore encourage DOE to confirm that the current standards based on rated storage volume would continue to apply after any amended standards take effect.

**We encourage DOE to clarify that electric water heaters that can operate at inputs both above and below 12 kW must meet both the consumer and commercial water heater standards**. We understand that some water heaters with input ratings above 12 kW (i.e., the dividing line between "consumer" and "commercial" water heaters) are configurable in the field to be operated below 12 kW.[36] If a product can operate at inputs below 12 kW, then it should meet the standards for consumer water heaters. Thus, we encourage DOE to clarify that electric water heaters that can operate at inputs both above and below 12 kW must meet both the consumer and commercial water heater standards.

Thank you for considering these comments.

Sincerely,

Kanchan Swaroop
Senior Technical Advocacy Associate
Appliance Standards Awareness Project

Michael Waite, Ph.D., P.E.
Senior Manager, Buildings Program
American Council for an Energy-Efficient Economy

[36] For example, see: https://www.homedepot.com/p/Rheem-Commercial-Light-Duty-80-Gal-240-Volt-12-kW-Multi-Phase-Field-Convertible-Electric-Tank-Water-Heater-ELD80-FTB-240-Volt-12-kW/305229784.

Matt Malinowski
Director of Climate Research
CLASP

Joe Vukovich
Energy Efficiency Advocate
Natural Resources Defense Council

Christine Brinker
Senior Associate, Buildings Efficiency Program
Southwest Energy Efficiency Project

Alan Zelenka
Assistant Director for Planning & Innovation
Oregon Department of Energy

Glenn Blackmon
Manager of the Energy Policy Office
Washington State Department of Commerce