

**Appliance Standards Awareness Project  
American Council for an Energy-Efficient Economy  
California Energy Commission  
Consumer Federation of America  
National Consumer Law Center  
Natural Resources Defense Council  
Northeast Energy Efficiency Partnerships**

July 6, 2020

Ms. Catherine Rivest  
U.S. Department of Energy  
Office of Energy Efficiency and Renewable Energy  
Building Technologies Office, EE-5B  
1000 Independence Avenue SW  
Washington, DC 20585-0121

**RE: Energy Conservation Standards for Consumer Water Heaters; Request for Information (Docket number EERE-2017-BT-STD-0019)**

Dear Ms. Rivest:

This letter provides input from the Appliance Standards Awareness Project (ASAP), American Council for an Energy-Efficient Economy, California Energy Commission, Consumer Federation of America, National Consumer Law Center (on behalf of its low-income clients), Natural Resources Defense Council, and Northeast Energy Efficiency Partnerships regarding the Department of Energy's (DOE) Request for Information (RFI) on energy conservation standards for consumer water heaters. 85 Federal Register 30853 (May 21, 2020). This RFI begins DOE's statutorily required review of the consumer water heater standards, which were last updated in 2010.

Improved consumer water heater standards could potentially save very large amounts of energy. Given substantial changes in water heater technology, the market and the regulatory landscape since the last final rule, DOE must conduct a full rulemaking to determine whether amended standards are warranted. We offer the following input as DOE begins its work on this important rulemaking process:

- DOE should consider the full range of heat pump designs including gas, gas-hybrid, CO<sub>2</sub>, and 120-volt products.
- We support the storage water heater product classes used in the 2010 final rule.
- We urge DOE to again consider standard levels that include capacity break points.
- We strongly oppose a separate product class for non-condensing water heaters, which would be both unnecessary and illegal.

- We urge DOE to eliminate the tabletop water heater product class and avoid adding new product classes that are unnecessary and could undermine future standards if niche classes are subjected to weak standards.
- We urge DOE to fully evaluate higher standards for grid-enabled water heaters and consider consolidating the product class with other storage water heaters.
- DOE should include consumer choices to select smaller storage volume water heaters and adjust set points if needed to meet their water heating needs as part of its consumer choice modeling.
- DOE must enforce its water heater standards.
- We urge DOE to inventory and pay attention to developments in the market for demand flexible water heaters.

We elaborate each of these points in the paragraphs below.

### **DOE must conduct a full analysis.**

In the 2010 final rule, DOE found that the highest trial standard level evaluated (the “max tech” level) at the time would have saved 13.7 quads of primary energy over thirty years compared to the standard level selected.<sup>1</sup> In the new RFI, DOE provides information demonstrating that water heaters with efficiency performance exceeding the max tech levels from the last rule are available.<sup>2</sup> The RFI also describes a range of efficiency performance levels between current standards levels and maximum currently available efficiency levels.<sup>3</sup>

Since 2010, the regulations and the market for water heaters have changed in many ways. In 2014, DOE adopted a new metric for water heaters, uniform energy factor (UEF). UEF entailed substantial changes to make the test procedure more representative of field use, including changes to draw patterns and test conditions.<sup>4</sup> DOE subsequently issued a rule translating the EF-based standards issued in 2010 to the new UEF rating.<sup>5</sup> In addition, in 2015, Congress enacted a new class of “grid-enabled water heaters” with a specific standard.<sup>6</sup>

Manufacturers have heavily invested in improved, energy efficient technologies. All three major U.S. storage water heater manufacturers now offer modern, heat pump water heater product lines that have efficiency performance significantly exceeding the levels evaluated for the 2010 rule. In general, the current generation of US heat pump water heaters are designed to meet the Northwest Energy Efficiency Alliance’s “Advanced Water Heater Specification.” NEEA issued the most recent update to the specification in December 2019.<sup>7</sup> In 2017, a market research firm, Technavio, predicted a compound average growth rate of 11% for the global heat pump water heater market.<sup>8</sup> As DOE shows in Table II.2

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<sup>1</sup> 75 Fed. Reg. 20208, showing TSL 8 savings of 16.73 quads and TSL 5 savings of 2.58 quads primary energy.

<sup>2</sup> 85 Fed. Reg. 30863.

<sup>3</sup> Ibid., 30863 – 4.

<sup>4</sup> 79 Fed. Reg. 40542.

<sup>5</sup> 81 Fed. Reg. 96204.

<sup>6</sup> The Energy Efficiency Improvement Act of 2015 (EEIA 2015) ([Pub. L. 114-11-210](#)).

<sup>7</sup> Available at: <https://neea.org/resources/advanced-water-heating-specification>

<sup>8</sup> See <https://www.businesswire.com/news/home/20170703005277/en/Global-Heat-Pump-Water-Heater-Market-Grow#:~:text=Global%20heat%20pump%20water%20heater%20market%20is%20expected%20to%20grow,heater%20market%20for%202017%2D2021.>

of the RFI, various technologies for improving heat pump water heaters including advanced compressors and improved fan motors were not even considered in the previous rule.<sup>9</sup> New market entries have introduced technologies such as CO<sub>2</sub> heat pump water heaters, including split system configurations.<sup>10</sup> Manufacturers of venting products have further advanced solutions for condensing gas appliances.<sup>11</sup> Work on gas heat pump water heaters has also advanced. Given these and many other changes in the water heater market, DOE must conduct a full analysis to determine if higher standards are warranted.

### **DOE must consider advanced heat pump designs.**

In addition to evaluating mass market electric heat pumps currently available in the U.S. for potential technology options for improving electric storage water heaters, DOE should evaluate emerging heat pump technologies, including those available in markets outside of the U.S. GTI published a survey of the status of gas heat pumps in 2018, which describes products already on the global market and work by GTI and its partner, Stone Mountain, Inc., on a product for the U.S. market.<sup>12</sup> DOE should include gas heat pumps as the “max tech” level evaluated for gas storage water heaters.

DOE should also include dual fuel heat pumps in its analysis, potentially as a technology option in both the gas and electric product classes. In a webinar earlier this year, DOE described this product as combining a fossil fuel burner with either electric resistance or a heat pump.<sup>13</sup>

In the 2010 rulemaking, DOE screened out CO<sub>2</sub> heat pump water heaters. CO<sub>2</sub> heat pump water heaters are now available in the U.S. market and must be included in the new analysis.<sup>14</sup> Washington State University has identified numerous global manufacturers of CO<sub>2</sub> heat pumps.<sup>15</sup>

These products, as well as products using the refrigerants R410a and R134a, can offer the advantage of a split-system design. Split system designs may also be particularly well-suited for some installation locations (e.g., in space constrained locations and locations where the storage tank is within a home’s conditioned space).

Finally, DOE should also consider heat pump water heaters designed to operate on 120 volts. We understand that manufacturers are working on these products, which could potentially offer a lower total installed cost in some applications.

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<sup>9</sup> 85 Fed. Reg. 30859.

<sup>10</sup> Butzbaugh, J., L. Sandahl and M. Baechler. “US HPWH Market Transformation: Where We’ve Been and Where to Go Next.” Pacific Northwest National Laboratory. Proceedings of European Council for an Energy Efficiency Economy Summer Study.

Available at [https://rpsec.energy.gov/tech-solutions/sites/default/files/resources/attachments/ECEEE\\_EEDAL\\_Paper-159\\_US-HPWH-Mkt-Transformation\\_7-21-2017%5B1%5D.pdf](https://rpsec.energy.gov/tech-solutions/sites/default/files/resources/attachments/ECEEE_EEDAL_Paper-159_US-HPWH-Mkt-Transformation_7-21-2017%5B1%5D.pdf)

<sup>11</sup> See, for example, research by Oak Ridge National Labs, published at

<https://web.ornl.gov/sci/buildings/docs/Condensing-Furnace-Venting-Part2-Report.pdf>.

<sup>12</sup> See <https://www.gti.energy/wp-content/uploads/2019/04/Review-of-Research-Development-and-Deployment-of-Gas-Heat-Pumps-in-North-America-June2018.pdf>

<sup>13</sup> “GEB Technical Report Series: Water Heating, Appliances and Refrigeration” U.S. DOE, Office of Energy Efficiency and Renewable Energy, Building Technology Office, June 9, 2020. P. 17. Available at

<https://www.energy.gov/sites/prod/files/2020/06/f75/bto-geb-waterheating-appl-refrig-webinar-061020.pdf>

<sup>14</sup> See <https://www.sandenwaterheater.com/>

<sup>15</sup> See <http://e3tnw.org/ItemDetail.aspx?id=389>

**DOE should maintain the product classes from the 2010 rule for gas-fired storage and electric storage water heaters.**

DOE evaluated heat pump water heaters as a technology option for improving electric storage water heaters in the 2010 rulemaking, ultimately selecting a standard based on heat pump technology for products over 55 gallons. DOE rejected commenter arguments that heat pumps should be a separate product class, stating, “DOE does not believe heat pump water heaters provide a different utility from traditional electric resistance water heaters. Heat pump water heaters provide hot water to a residence just as a traditional electric storage water heater does.”<sup>16</sup>

DOE evaluated a variety of technology options that improve gas storage water heater efficiency which require electricity, including products that require power venting such as condensing water heaters. DOE rejected arguments that unpowered gas water heaters should have a separate product class, finding that, “Both powered and unpowered gas-fired storage water heaters use gas as the primary fuel source, and both provide the same basic utility to consumers, which is to supply hot water to the residence.”<sup>17</sup>

We support the storage water heater product classes contained in the 2010 rule. We agree with DOE’s determinations that heat pump water heaters provide the same utility as electric resistance water heaters and that unpowered gas water heaters provide the same utility as those with power.

**DOE should consider standards that include capacity break points.**

In the 2010 rule, DOE decided that capacity or storage volume-based product classes were unnecessary. DOE instead chose to base standards on, “energy efficiency equations that vary with rated storage volume to describe the relationship between rated storage volume and energy factor.”<sup>18</sup> DOE evaluated a variety of trial standard levels, some of which had “two-slope” or discontinuous functions. These “two-slope” trial standard levels enabled DOE to consider trial standard levels that applied significantly higher standards (e.g. effectively requiring heat pumps or condensing technology) to products above certain storage capacity break points.<sup>19</sup>

We urge DOE to take a similar approach in this rulemaking, which will enable DOE to investigate the impacts of a range of potential standards based on different break points lower than those adopted in the 2010 final rule (55 gallons). DOE should include evaluation of break points that place the largest sales volume units into the high efficiency category. DOE should also evaluate continuous function standards (i.e., without break points).

**DOE should not create a separate product class for non-condensing water heaters.**

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<sup>16</sup> 73 Fed. Reg. 20135.

<sup>17</sup> Ibid.

<sup>18</sup> 74 Fed. Reg. 65870.

<sup>19</sup> 75 Fed. Reg. 20182 describing the approach as follows: “DOE pairs an efficiency level effectively requiring heat pump technology for large-volume electric storage water heaters with an efficiency level achievable using electric resistance technology for small-volume electric storage water heaters. In addition, DOE pairs an efficiency level effectively requiring condensing technology for large-volume gas storage water heaters with an efficiency level that can be achieved in atmospherically-vented gas-fired storage water heaters with increased insulation thickness for small storage volumes.”

In the RFI, DOE acknowledges a proposed interpretive rule that would potentially limit DOE from setting standards that would eliminate the least efficient gas water heaters from the market (non-condensing products). In comments in response to the gas industry petition that instigated DOE's proposed interpretive rule and the subsequent proposal, we and many other commenters explained how the proposed interpretation would cut off consideration of meaningful improvements to gas product standards and, thereby, harm consumers and the environment. We and other commenters also explained how DOE's proposed approach would violate the law.<sup>20, 21</sup> The California Energy Commission filed separate comments opposing the petition and proposed interpretive rule.<sup>22</sup> As explained in comments filed by Natural Resources Defense Council, Sierra Club, and Earthjustice, "The venting and drainage characteristics [of non-condensing products] do not support a conclusion that the adoption of standards that can be met only by products using condensing technologies would violate [the Energy Policy and Conservation Act]." Other commenters opposing the proposed interpretive rule included the Attorneys General of New York, California, Colorado, District of Columbia, Illinois, Maine, Maryland, Commonwealth of Massachusetts, Minnesota, New Jersey, Oregon, Vermont, Washington, and the Corporation Counsel of the City of New York.<sup>23</sup> The policy rationale and legal basis for separate product classes for non-condensing products has been thoroughly rebutted in the comments to that docket.

In the present RFI, DOE once again attempts to justify the potential separation of non-condensing products based on three reasons: condensing products "may result in more complicated/costly installation, require physical changes at a home that impact aesthetics (e.g. by adding new venting into the living space or decreasing closet or other storage space), and may result in some enhanced level of fuel switching." None of these reasons constitute a "performance related feature" that warrants a separate product class. DOE routinely takes into account installation costs in rulemakings. We are not aware of any instance where DOE has ruled out consideration of a higher standard level because of cost. To the contrary, DOE always evaluates a range of efficiency levels, including the max-tech level which may be very costly. DOE cannot treat installation cost differently than equipment cost. For the consumers of water heaters, the equipment and installation cost are typically combined into a single price. Moreover, since nearly every potential increased standard has an impact on cost (generally product cost, but often installation cost too), identifying cost as a feature would subvert the purposes of the statute.

Similarly, it is not uncommon for improved standards to affect the aesthetics of products. For example, the outdoor units of central air conditioners are substantially larger, dehumidifiers are larger, and refrigerators have thicker doors because of efficiency standards. Moreover, technological developments and smart installation techniques can affect how frequently negative aesthetic consequences occur. For example, improved venting technologies such as concentric vents and power vents can allow use of an

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<sup>20</sup> Comments from Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, Alliance to Save Energy, Consumer Federation of America, and National Consumer Law Center to the petitions available at [file:///C:/Users/Andrew/Downloads/ASAP et al comment on gas industry petition FINAL.pdf](file:///C:/Users/Andrew/Downloads/ASAP_et_al_comment_on_gas_industry_petition_FINAL.pdf)

<sup>21</sup> Comments from the same joint commenters to the proposed interpretive rule available at [file:///C:/Users/Andrew/Downloads/ASAP ASE ACEEEE CFA NCLC comment on gas industry interpetive rule.pdf](file:///C:/Users/Andrew/Downloads/ASAP_ASE_ACEEEE_CFA_NCLC_comment_on_gas_industry_interpetive_rule.pdf)

<sup>22</sup> <https://www.regulations.gov/document?D=EERE-2018-BT-STD-0018-0089>

<sup>23</sup> <https://www.regulations.gov/document?D=EERE-2018-BT-STD-0018-0082>

existing flue, eliminating the need for new chases. Undesired aesthetic changes may be avoided in any given installation by placing the vent in a different location.

Finally, any standard that affects the first cost of a product that competes against another product that uses a different fuel will result in some level of fuel switching. Some market segments, such as large-scale builders of new homes, will be most sensitive to first cost increases, since the builder selecting equipment will not benefit from operating cost savings. A prohibition on standards levels that cause some fuel switching would be tantamount to a prohibition on improved standards for the space and water heating products that account for most energy use in U.S. homes. In addition, an increasing range of utility-funded and state-level programs now deliberately incentivize fuel switching from gas, propane, and oil products to highly-efficient electric alternatives, especially in regions with relatively clean electricity generation.<sup>24</sup> While the gas industry may generally oppose policies that cause consumers to buy less gas, others view fuel switching in some cases as a desirable outcome. DOE should not rule out potential standards because they result in outcomes that one industry finds objectionable. DOE noted in the proposed interpretive rule that it has been DOE's "policy to remain neutral regarding competing energy sources in the marketplace."<sup>25</sup> A policy of neutrality should lead DOE to select standards that maximize energy savings that are technologically feasible and economically justified,<sup>26</sup> without eliminating standards options or tilting standards selections to maintain whatever market shares fuels may have at the moment.

Thus, even if DOE finalizes the proposed interpretive rule, DOE cannot legally find that non-condensing water heaters warrant a separate product class or that standards that would eliminate them from the market are off limits.

**DOE should eliminate the tabletop storage water heater product class and avoid exempting or creating new product classes for other niche products.**

We understand that tabletop water heaters have fixed exterior dimensions which limits manufacturers' ability to improve efficiency with thicker insulation without reducing storage volume. However, small reductions in storage volume should do not reduce a water heater's utility to the consumer. Few water heater users know or care about the storage volume of their water heater. Rather, they know whether it meets their hot water needs. The ability of a water heater to meet a consumer's hot water needs is affected by several factors, including storage volume, storage temperature, first hour rating, and the set point selected by the consumer. If a consumer finds that their water heater does not provide an adequate amount of hot water, they will adjust the set point higher. For example, consumers living in climates where temperature vary significantly over the course of the year (much of the U.S.) may adjust water heater set points to maintain consistent temperatures at their faucets and showerheads. Otherwise, they may not have enough hot water when the incoming cold-water supply temperature drops, and they may scald themselves when the cold-water supply warms up during the summer. Because water heaters are designed to allow consumers to adjust set points to meet their hot water needs, a standard that causes manufacturers to reduce the storage volume due to increased insulation thickness would not eliminate this product category from the market. Higher set points, which are

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<sup>24</sup> See for example, Nadel, S. "Programs to Electrify Space Heating are Growing," available at <https://www.aceee.org/blog-post/2020/06/programs-electrify-space-heating-are-growing>

<sup>25</sup> 84 Fed. Reg. 33020.

<sup>26</sup> 42 U.S.C. 6295(o).

available on water heaters sold today, may be combined with tempering or mixing valves to reduce the risk of scalding.

In addition, DOE identifies several technologies in the RFI that could improve insulation without increasing wall thickness, such as aerogels, vacuum insulation panels, and inert gas-filled panels. Some of these technologies increasingly are used in other products (e.g., refrigerators), which may affect their production volumes, reducing costs over time.

Low-boy water heaters are another type of potentially space-constrained product. DOE rejected calls for creating a separate product class for these products in the 2010 final rule.<sup>27</sup> We support DOE's 2010 decision to keep low-boy water heaters in the same class as other storage water heaters and urge DOE to provide the same treatment for tabletop water heaters.

Finally, in the RFI, DOE identifies a number of products that currently have no UEF standard and which could become a loophole if they remain exempt from standards.<sup>28</sup> We urge DOE to investigate the loophole risk of currently exempted products and set standards for these products if warranted.

**DOE should consider consolidating the grid-enabled water heater product class with other storage water heaters.**

Grid-enabled water heaters are a type of large, electric storage water heater that comply with certain design characteristics defined by statute. We believe that the same technology options that can be used for improving electric storage water heaters can be applied to grid-enabled water heaters. Similarly, products available on the market today, including heat pumps, that do not meet the statutory definition for "grid-enabled water heater" can provide grid-flexibility services and their ability to provide these services does not affect their UEF rating. These highly efficient, grid-flexible products were not available when Congress created the grid-enabled water heater product class. Congress anticipated that the separate class for grid-enabled water heater may no longer be needed at some point when it specifically authorized DOE to eliminate the separate efficiency requirement for grid-enabled water heaters.<sup>29</sup> DOE should consider whether this class of water heaters should be consolidated with the electric storage water heater class.<sup>30</sup>

DOE also should consider eliminating the separate product classes for instantaneous water heaters. DOE created separate classes for instantaneous water heaters in the 2001 final rule, citing their storage capacity. As noted elsewhere in this letter, the service provided by water heaters is an adequate supply of hot water, which is not strictly related to storage capacity. Instantaneous water heaters provide the service with very little storage capacity. We recognize that current storage water heater standards are based on storage volume, complicating the consolidation of product classes.

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<sup>27</sup> 75 Fed. Reg. 20131-2.

<sup>28</sup> 85 Fed. Reg. 30862, see Table II.5.

<sup>29</sup> 42 U.S. Code 6296(e)(6)(E)(i)(I)

<sup>30</sup> Under statute, the grid-enabled water heater product class could also be eliminated if sales increase by more than 15% compared to a baseline. 42 U.S.C. 42 U.S. Code 6296(e)(6)(C) and (D) DOE has missed mandatory deadlines for analysis due in 2017 and 2019.

**DOE should incorporate higher set-points and split system products into its consumer choice model.**

We appreciate that DOE will use a consumer choice model to characterize the market's response to higher standard levels, which will account for market share changes between product classes (including between fuels). DOE should also incorporate consumer choices to buy smaller storage water heaters and adjust set-points higher into the consumer choice model. Higher set points may be used in combination with mixing valves to prevent scalding. Alternatively, manufacturers may choose to integrate mixing valves into their products to decouple the internal storage temperature from the customer setpoint. If DOE takes an approach similar to the 2010 rule, which used a discontinuous function for storage water heaters (effectively setting higher standards for products above some storage capacity break point), some consumers may elect to downsize their water heater rather than purchase more efficient products that have a higher up-front installed cost.

In addition, split system heat pumps may be the most cost-effective option for some installations. DOE should include this option in its consumer choice model as well.

**DOE must take action to ensure compliance.**

DOE has issued enforcement guidance that has undercut standards compliance, allowing manufacturers to continue selling non-compliant water heaters.<sup>31</sup> Major manufacturers are taking advantage of this enforcement guidance to sell non-compliant water heaters.<sup>32</sup> We opposed extension of this enforcement guidance but appreciate that DOE has made clear that it will not be extended again. DOE must effectively enforce duly promulgated standards.

**Demand flexibility.**

Water heaters that provide demand flexibility services are an essential component of efforts to improve grid resilience, reduce system costs, and better integrate renewable resources. Energy Star is actively working on a specification that will help distinguish products that can effectively provide grid-flexibility. Washington State requires that all new electric water heaters manufactured for sale in the state comply with CTA-2045, a communication protocol that ensures water heaters have enhanced control capability. The Washington requirements take effect for heat pump water heaters on January 1, 2021 and other electric storage water heaters on January 1, 2022.<sup>33</sup> Oregon is developing a similar requirement. California also is developing requirements to encourage market adoption of demand flexible heat pump water heaters. In general, these efforts focus on ensuring that future electric water heaters are both very efficient and demand flexible.

DOE should investigate and inventory these and other efforts to encourage demand flexible water heaters. Heat pump water heater manufacturers are already incorporating CTA 2045 into their products and Energy Star is designing its grid flexibility specification exclusively for highly efficient water heaters. In other words, the most efficient water heaters on the market today are being designed with grid

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<sup>31</sup> See [https://www.energy.gov/sites/prod/files/2019/07/f64/Enforcement%20Policy-ConsumerWH\\_Def\\_102019.pdf](https://www.energy.gov/sites/prod/files/2019/07/f64/Enforcement%20Policy-ConsumerWH_Def_102019.pdf)

<sup>32</sup> See for example large storage volume Rheem Marathon water heaters and large storage volume Proline water heaters from AO Smith. Both Rheem and AO Smith also sell compliant products in their heat pump water heater lines.

<sup>33</sup> See regulations at <https://apps.leg.wa.gov/WAC/default.aspx?cite=194-24-180&pdf=true>



flexibility in mind. DOE should pay close attention to developments in this area and any potential interactions with improved DOE standards.

Thank you for considering these comments.

Sincerely,



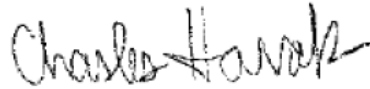
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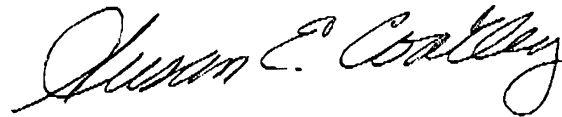
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