



Pacific Gas and  
Electric Company®



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Abigail Daken  
U.S. Environmental Protection Agency  
Climate Protection Partnership Division  
1200 Pennsylvania Avenue, NW  
Washington, DC 20460

Subject: ENERGY STAR® Connected Residential Water Heaters - Draft 2 Version 3.3 Product Specification and Draft 1 Test Method

Dear Ms. Daken:

This letter comprises the comments of the Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE) in response to the United States (U.S.) Environmental Protection Agency (EPA) *Draft 2 Version 3.3 ENERGY STAR® Connected Residential Water Heaters Product Specification* and the U.S. Department of Energy (DOE) *Draft 1 Test Method to Validate Demand Response*.

The signatories of this letter, collectively referred to herein as the California Investor Owned Utilities (CA IOUs), represent some of the largest utility companies in the Western U.S., serving over 32 million customers. As energy companies, we understand the potential of appliance efficiency standards to cut costs and reduce consumption while maintaining or increasing the consumer utility of the products. We have a responsibility to our customers to advocate for standards that accurately reflect the climate and conditions of our respective service areas to maximize these positive effects.

The CA IOUs support the addition of optional criteria for connected functionality for water heaters including the U.S. EPA's attempt to harmonize with existing efforts to define the performance of connected water heaters. The CA IOUs also support U.S. DOE's efforts to establish a test method for connected water heaters and put forth recommendations to clarify and strengthen the test method. We appreciate U.S. EPA's review of our comment letter on the Draft 1 Specification and appreciate that action was taken on most of our recommendations. We look forward to continuing communication with U.S. EPA and U.S. DOE on this important topic.

The CA IOUs appreciate this opportunity to provide the following recommendations about the *Draft 2 Version 3.3 ENERGY STAR Water Heaters Product Specification*.

**1) The CA IOUs support the inclusion of gas-fired storage water heaters in the specification scope (Section 2).**

Opportunities and expansion of demand flexibility capabilities and programs to manage gas demand continue to develop year after year.<sup>1</sup> The use cases may include managing pipeline constraints, deferring infrastructure upgrades, reducing demand in extremely cold weather, and managing natural gas storage limitations. We appreciate maintaining demand response (DR) criteria

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<sup>1</sup> <https://www.peakload.org/assets/38thConf/Three-Utility-Approaches-to-Gas-Demand-Response.pdf>

where suitable for gas technology, to enable inclusion in existing and future load flexibility portfolios.

**2) The CA IOUs recommend that U.S. EPA update the specification to require a Consumer Technology Association (CTA) Standard CTA-2045-A port, for the physical layer in Section 4.C.a of the specification.**

While we support the requirement to meet communication standards for CTA-2045-A or OpenADR 2.0A/B for DR communication, we recommend the addition of a requirement for a CTA-2045-A native port. This will help to remove the current cost bias that CTA-2045-A solutions suffer from when not deployed at scale due to a lack of market signals. Momentum is gaining with the recently passed bill in Washington State (HB 1444), which requires a physical CTA-2045-A port on all electric storage water heaters, but additional national support is needed for manufacturers to include the port as standard equipment. The port will allow for increased access to regionally optimized communication pathways including non-WiFi options such as cellular and FM between the unit, utility, and/or pricing signal. This increased standardization across all connected water heaters will lower costs due to volume impacts, regionally and nationally, making connected water heaters more accessible to all California residents. The use of a CTA port does not preclude the use of implementations using the OpenADR 2.0A/B application layer, so this requirement would not be expected to bifurcate the market between two competing standards. Instead, this requirement would drive additional off the shelf compatibility with planned and existing DR management systems.

**3) The CA IOUs support the addition of Minimum Load Shift requirements and the alignment of Section 4.C.d. of the specification with the proposed Title 24 Joint Appendix 13 currently under consideration in California.**

The addition of a Minimum Load Shift requirement ensures a baseline amount of load flexibility is achieved for all certified connected water heater products, enabling better use in program planning while still recognizing that this is a test condition load shift as compared to a field condition load shift. We support the values selected of 0.5 kilowatt-hours (kWh) for Basic Load Shift and 1.0 kWh for Advanced Load shift in alignment with the proposed Title 24 Joint Appendix 13<sup>2</sup> under consideration in California. This alignment supports nationwide consistency and promotes faster market adoption for both standards.

**4) The CA IOUs support the changes in Section 4.C.f. of the specification to operational mode functionality, including the prescriptive requirements for Deep Shed and the addition of the Advanced Load Up response to increase alignment with the proposed Title 24 Joint Appendix 13 under consideration in California.**

The electric resistance element is both the most energy intensive and the most demand intensive aspect of the heat pump water heater (HPWH), and it is important to provide guidelines on when it can be used for load flexibility. These guidelines are to ensure that energy isn't being wasted solely to enable demand flexibility; instead, the guidelines can drive flexibility via the use of the energy efficient heat pump. We support the consistent terminology and addition of the Advanced Load Up response that is in alignment with the proposed Title 24 Joint Appendix 13 under consideration in California. The Advanced Load Up response will allow HPWHs to provide even greater load shift capacity when used in junction with a mixing valve to help store energy at times when there is an excess amount of renewable energy. Thermal energy storage is an efficient way to store energy, and we support enabling the full potential of that storage at scale with the Advanced Load Up response.

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<sup>2</sup> <https://efiling.energy.ca.gov/GetDocument.aspx?tn=229351&DocumentContentId=60762>

On the topic of load flexibility and loss of connectivity or power, the CA IOUs recommend the addition of functionality to stagger (randomize) the immediate recovery of blocks of connected water heater products after grid interruption, in order to reduce secondary grid impact. Furthermore, we recommend adding the functionality where after a loss of power, the product could gradually increase recovery power – such as beginning recovery with heat pump only mode – to provide considerable grid resilience benefits. We note that grid interruption recovery can potentially occur in a time period where no consumer draws are present or anticipated in the immediate recovery timeframe.

**5) The CA IOUs support requiring specific message mapping to allow interoperability between CTA-2045-A and OpenADR 2.0A/B in Section 4.C.f. and Appendix B of the specification.**

We support the change from recommending a mapping, to requiring specific message mapping of load flexibility responses in each protocol to help reduce the stranded asset risk in implementation of DR protocols. This will allow for increased interoperability and increased ability for a utility to troubleshoot a communication error knowing there is consistent mapping across the protocols. It may also allow a utility to send a standard message via both protocols and know that connected water heaters will respond consistently. While the required or optional functionality may vary, this will help prevent issues with interpretation of open protocols. We also recommend revisiting the Operational State Messaging in Section 4.C.e to ensure full alignment with CTA-2045-A.

The CA IOUs also appreciate the opportunity to provide the following recommendations about the *Draft 1 Test Method to Validate Demand Response*.

**6) The CA IOUs support U.S. DOE’s efforts to establish a test method for connected water heaters and support the alignment of the test method with the federal water heater test procedure.**

We applaud U.S. DOE for their efforts to establish a test method to validate DR functionality in the ENERGY STAR Product Specification for Residential Water Heaters. This test method will help ensure that water heater products marketed as having connected capabilities will be able to reliably provide a source of flexible load to the power grid. In general, the test procedure structure is reasonable and the alignment of the test setup with the federal water heater test procedure<sup>3</sup> will streamline the testing process for market actors and reduce the time and cost associated with testing these products.

Additionally, we support the proposed direct measurement and verification of DR communication including requests from the utility equivalent communication device and responses from the connected water heater product. We also support that minimum Basic Load Shift and Advanced Load Shift capabilities are quantified in the test procedure, which will help prove that connected water heater products can provide a measurable level of flexible load to the grid in field operation. We support the notion that the 4-hour baseline period in Normal Operation and the 4-hour general curtailment period is a representative time period for DR load shifting events; therefore, the test duration is justified. For load increase events, we support the requirement to verify responses to either a “Load Up” request or an “Advanced Load Up” request. Although the test procedure may not translate perfectly to field operation, it does provide a consistent way to test minimum functionality across devices in a device to device comparable manner.

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<sup>3</sup> Title 10 of the Code of Federal Regulations Part 430, Appendix E to Subpart B

**7) The CA IOUs recommend that U.S. DOE incorporate clarifying changes to the proposed test method to increase its usability.**

We recommend that U.S. DOE add adequate definitions for all terms relied upon within the test procedure. *Test Setup (Section 4.1)* refers to an Interface Control Document or ICD. This document is not defined within the *Definitions (Section 3)*, so we recommend the addition of this definition and a clarification of how this document could be used to support the test method.

Within the tables of test steps, the test procedure proposes to send some load shift requests with a duration equal to “maximum.” However, the test method defines the time period for the Normal Operation baseline period and the general curtailment event period. We recommend that the duration of the event requests sent to the connected water heater product under test be specified to align with a desired test period rather than an unspecified maximum period. This change would add clarity to the test and better reflect how load shift events would occur in actual operation.

Additionally, depending on the communication protocol used, the language used for the test requests may not align with the method by which actual commands would be sent from a utility communication device to an end-use product in real operation. This includes commands such as “Send a Return to Normal Operation request” and other queries to the connected water heater product. This language could be refined to better reflect existing standard protocols such as OpenADR 2.0A/B or CTA-2045-A. Similarly, we appreciate that within the test steps, the acceptable responses from the connected water heater product are similar to the operational state responses outlined in the CTA-2045-A standard. To build on this foundation, we ask U.S. DOE to consider how these responses could be modified to be compatible with other communications protocols such as OpenADR 2.0A/B.

Regarding *Demand Response Information and Messaging (Section 6.6)*, the test procedure specifies that users are to verify that the connected water heater product was not heating water during the emergency curtailment and grid emergency tests. We recommend that U.S. DOE include in the test method clarifying equations or relationships that can be used to verify this point.

**8) The CA IOUs recommend additional prescriptive verification requirements to strengthen the test method and ensure product quality for end users of connected water heater products.**

Regarding the *User Interface (Section 6.2)*, we appreciate U.S. DOE’s request for comments regarding what other features of the user interface might need to be verified. In addition to verifying that manufacturer literature includes instructions for the user to override DR requests, we recommend aligning the user interface requirements with those under consideration in California in the draft Title 24 Joint Appendix 13. We recommend verifying the following features in the user interface: product connectivity status, DR event status and parameters, active control strategy (if any), demand management mode, time-of-use schedule (if applicable), and confirmation of setting changes.

Regarding the *Consumer Override Test (Section 6.3)*, we support the decision to test this functionality with one DR request and not all potential requests. We recommend additionally testing that the consumer override mode expires after a specified time period to ensure that the device is not permanently in a state where all load shift requests are overridden. Furthermore, we recommend that U.S. DOE add a calculation to confirm that the device returns to Normal Operation after consumer override, that is, that the energy use in an override state is approximately equal to energy use in Normal Operation mode. Verifying a Return to Normal Operation after a consumer override would help prevent user dissatisfaction with these products.

The draft test procedure includes a placeholder for a *Loss of Connectivity Test (Section 6.4)*, but currently, it does not propose to verify the product’s ability to respond to a loss of connectivity event. We urge U.S. DOE to include at a minimum a basic test to verify the response to loss of connectivity. Loss of connectivity is a common occurrence that can affect the value of a connected water heater to both the consumer and the utility. A basic test could verify that in the case of a loss of connectivity, defined as a period in which the water heater can no longer communicate with the internet and/or utility communication device and vice versa, users are notified that the device is offline on both the local interface and on any remote user interface.

**9) The CA IOUs recommend modifications to test method metrics to ensure alignment with the specification.**

We support the quantitative DR tests included in the draft test procedure and recommend generalizing the text to clarify that  $Q_{\text{Advanced Load Up}}$  should exceed  $Q_{\text{Normal}}$  in the case that the Advanced Load Up test is performed. This point should be verified in addition to verifying that  $Q_{\text{Normal}} > Q_{\text{General Curtailment}}$ . Additionally, to verify the Advanced Load Up request, the reference to the expectation that the mean tank temperature at Step 21 (Advanced Load Up) should be greater than the mean tank temperature at step 9 (Normal Operation) could be revised or eliminated in the case that manufacturers are able to achieve additional energy storage via other novel routes.

Finally, for the *Connected Water Heater Product Metrics (Section 6.7)*, we recommend including methodology for the calculation of "Current Total Energy Storage Capacity" for reference. This calculation should be optional, but including the methodology would ensure that it is calculated consistently across products. Additionally, we recommend revising the test method calculation for "Current Available Energy Storage Capacity" (Section 6.7.1.3). The proposed calculation is based on energy content during Normal Operation at the tank setpoint compared to energy content in the tank at a given condition within the test method. The specification defines this metric as the amount of grid energy the device can take now. The grid energy the device can take at a given moment will not necessarily align with the energy storage capacity of the tank, depending on the product efficiency. Therefore, we recommend clarifying the calculation to better align with the definition in the specification.

**10) The CA IOUs recommend alignment with Northwest Energy Efficiency Alliance’s (NEEA) Advanced Water Heating Specification in the test method ambient temperature selection and suggest future alignment of the product specification in the next full revision.**

For the *Test Setup (Section 4)*, the draft test method proposes testing the water heater in alignment with the setup requirements in the federal water heater test procedure. Alignment with this test setup will streamline product testing; however, certain deficiencies in this test procedure could be improved upon in testing connected water heaters for ENERGY STAR certification. For example, the federal water heater test procedure requires testing HPWHs at an ambient air temperature of  $67.5\text{ }^{\circ}\text{F} \pm 1\text{ }^{\circ}\text{F}$  dry-bulb temperature and  $50\% \pm 2\%$  relative humidity. We note that HPWHs represent a particularly important water heater product type due to their characteristic as a potential source of flexible electric load. Because they draw from the ambient environment for some of their heating capacity, the performance of HPWHs may vary at different ambient temperatures, and this may decrease or increase their ability to provide load shifting. We recommend current or future requirements that products be tested across a range of temperatures, as per the test procedure outlined in Appendix A of the NEEA Advanced Water Heating Specification v6.0.4. This would

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<sup>4</sup> <https://neea.org/our-work/advanced-water-heating-specification>

help better verify and quantify the load shift potential of connected water heaters across a variety of scenarios.

We also recommend that U.S. EPA consider aligning test measurement points and performance requirements for HPWHs with the NEEA Advanced Water Heater Specification in the next full revision of the product specification.

In conclusion, we commend U.S. EPA and U.S. DOE on the effort to establish requirements and a test procedure for connected residential water heaters, and we thank U.S. EPA and U.S. DOE for the opportunity to participate in this process. We encourage U.S. EPA and U.S. DOE to carefully consider the recommendations outlined in this letter.

Sincerely,



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