



SAVE TODAY. SAVE TOMORROW.
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ENERGY STAR® Water Heaters

Draft 1 Version 4.0

Stakeholder Meeting

November 20, 2020





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Webinar Participation

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- Feel free to ask questions at any time using the question box or by raising your hand, and please state your name and organization
- Please be advised that this webinar is being recorded and will be publicly available.

Written comments can be sent to waterheaters@energystar.gov by **December 9, 2020**

The screenshot displays a GoToWebinar interface. At the top, there are menu options: File, View, Help, and a globe icon. Below this is a 'Audio' section with a 'Sound Check' indicator and three bars. Two options are visible: 'Computer audio' (selected with a blue dot) and 'Phone call'. A red box highlights a hand icon in the left sidebar, which is used for raising the hand. Below the audio settings, it says 'MUTED' in orange. There are two dropdown menus for 'Transmit (Plantronics Savi 7xx-M)' and 'Receive (Plantronics Savi 7xx-M)'. A volume bar is also present. Below the audio controls, it says 'Talking: Liz Davis'. A red box highlights a 'Questions' section, which includes a text input field with the placeholder '[Enter a question for staff]' and a 'Send' button. At the bottom of the interface, it says 'Webinar Housekeeping' with 'Webinar ID: 608-865-371' and the GoToWebinar logo.



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Meeting Agenda

1. Introductions
2. Background
3. Energy Efficiency Criteria
4. Connected Criteria
5. Test Method
6. Next Steps
7. Questions



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Introductions

Abigail Daken

U.S. Environmental Protection Agency

Catherine Rivest

U.S. Department of Energy

Julia Hegarty

ICF

James Phillips

Guidehouse



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ENERGY STAR is the simple choice for energy efficiency.

EPA's ENERGY STAR identifies the most energy-efficient **products, buildings, plants, and new homes** – all based on the latest government-backed standards.

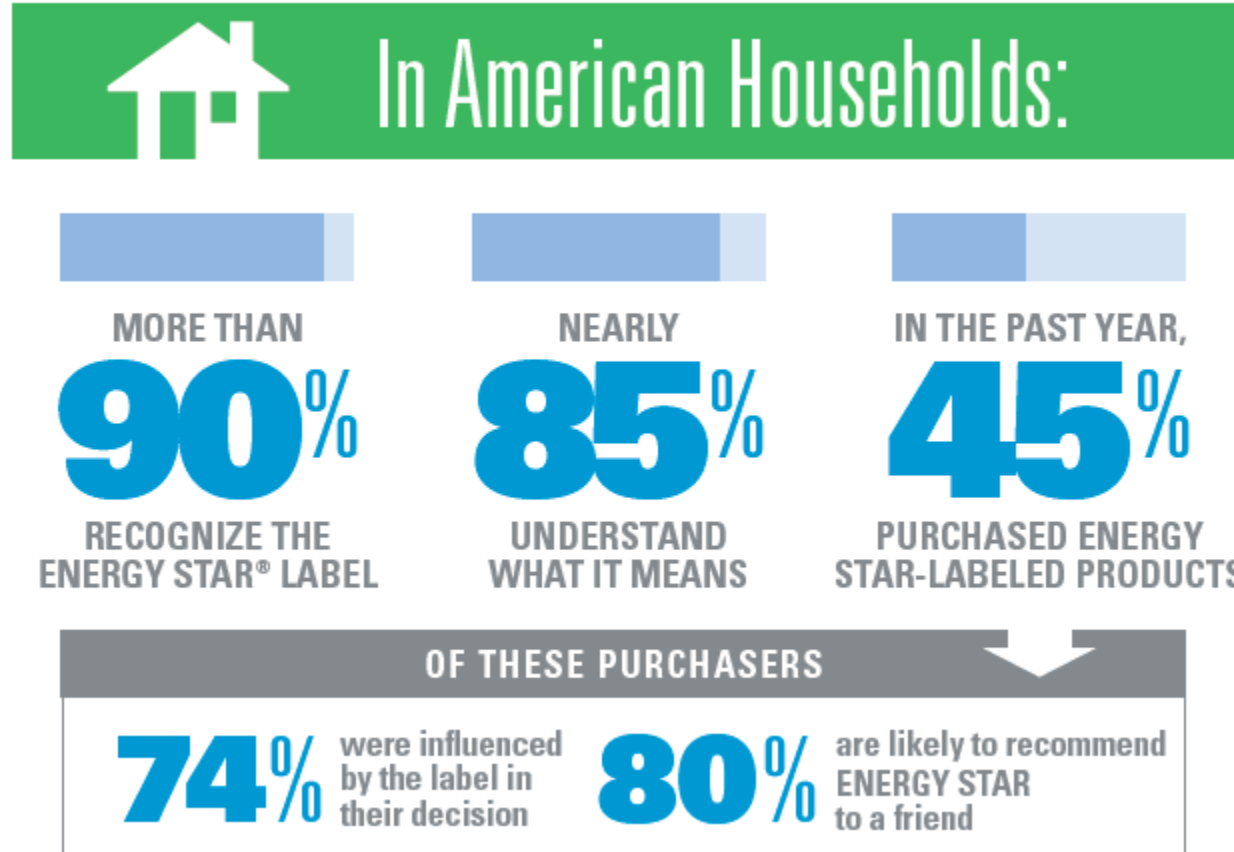
Today, every ENERGY STAR label is verified by a rigorous third-party certification process.





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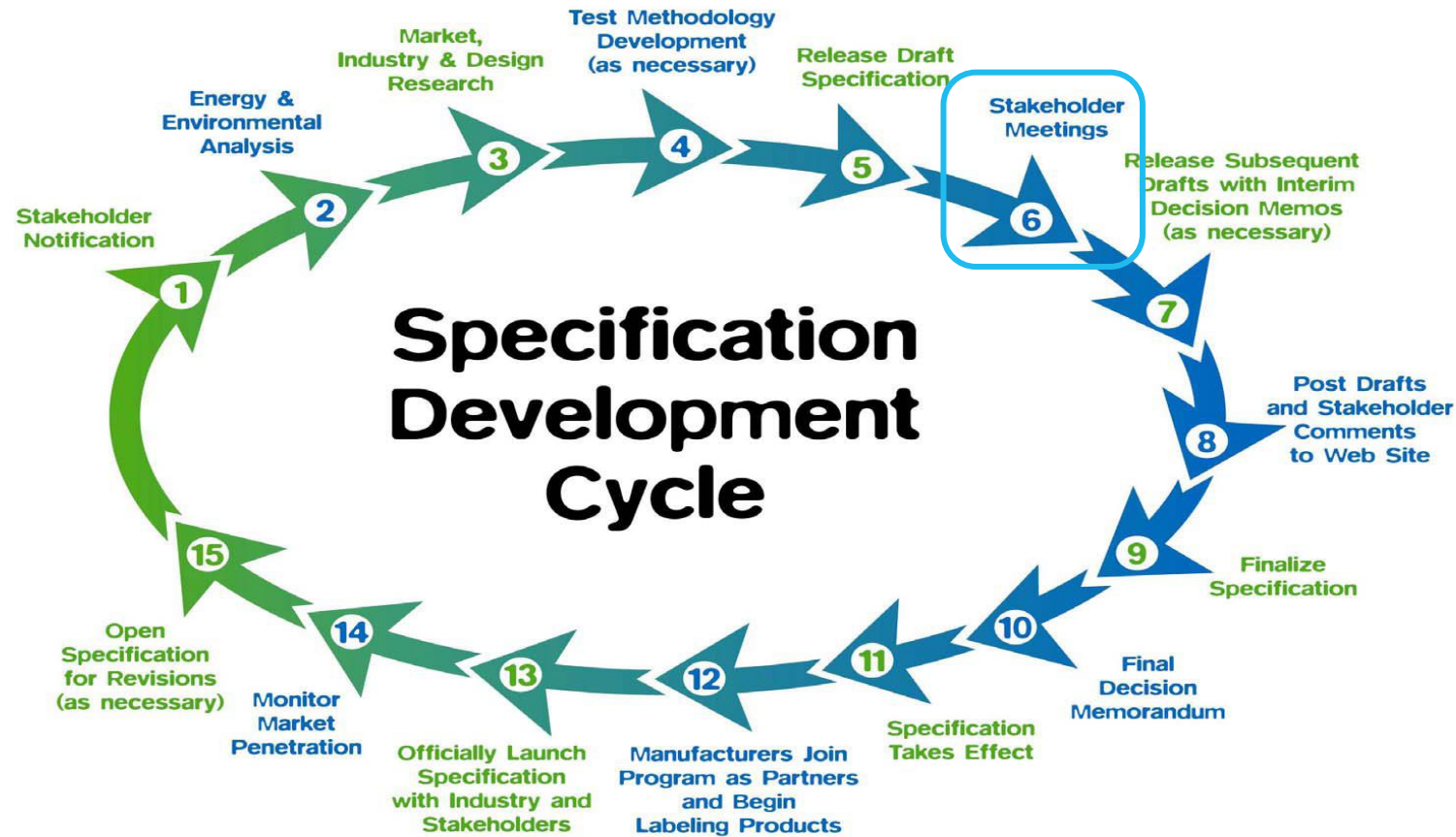
Brand Preference and Loyalty





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Specification Revision Process





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Water Heater Specification

- **April 2015:** Water Heaters Version 3.0 effective date
- **April 2019:** EPA released the Draft 1 Version 3.3 specification to add Connected Criteria
- **November 2019:** EPA released Draft 2 Version 3.3 Specification and Draft 1 Test Method to Validate Demand Response
- **September 2020:** DOE concludes testing product testing and revises test method
- **October 2020:** EPA released Draft 1 Version 4.0 Specification and Draft 2 Test Method



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Transition to Version 4.0 Process

- While finalizing the Connected Criteria, EPA noted a need to adjust the ENERGY STAR levels for heat pump water heaters to reflect that products on the market had gotten much more efficient.
- This revision was intended to recognize that there are more savings available from HPWH currently on the market
- EPA also analyzed levels for gas-fired storage and gas-fired instantaneous categories, reviewed FHR and Max GPM requirements, and updated criteria for solar water heaters



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Summary of Changes in Version 4.0

- Adjusted the energy efficiency criteria for Electric Water Heaters
- Revised First hour rating and Max GPM requirements for gas-fired units
- Updated the Solar Water Heater Test Method and criteria
- Supersedes the Version 3.3 process, and includes minor updates to Connected Criteria



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Electric Water Heaters Criteria

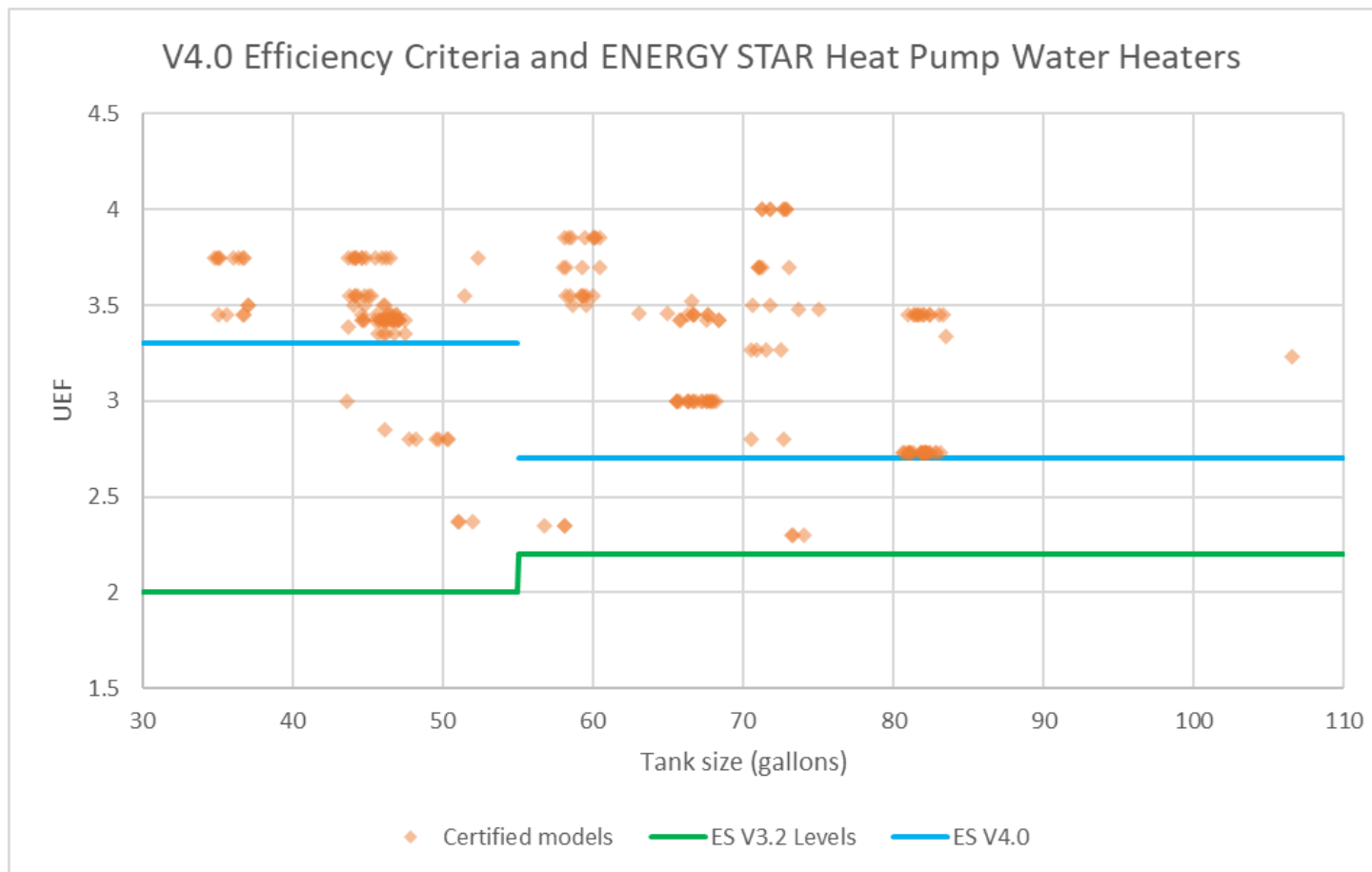
Criteria	Size	ENERGY STAR Version 4.0 Proposed	ENERGY STAR Version 3.2 (Current)
UEF	≤ 55 gallons	3.30	2.00
	> 55 gallons	2.70	2.20
FHR		45 gallons per hour	45 gallons per hour

- Levels were raised to reflect where the market currently is, approximately 90% of currently certified ENERGY STAR units meet the proposed levels



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Electric Water Heaters Criteria





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Updated FHR/GPM for Gas Units

Category	Requirement	ENERGY STAR Version 4.0 Proposed	ENERGY STAR Version 3.2 (Current)
Gas-Fired Storage Water Heaters	FHR	≥ 51 gallons per hour	≥ 67 gallons per hour
Gas-Fired Instantaneous Water Heaters	Max. GPM	≥ 2.8 over a 67°F rise	≥ 2.9 over a 67°F rise

- FHR and Max GPM were adjusted to align with the DOE medium draw pattern minimums



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UEF Criteria

- As proposed in the Draft 2 Version 3.3 Criteria, EPA is proposing the UEF criteria as the primary metric for water heaters
 - All products sold in the U.S. must certify to the UEF metric using the Appendix E Test Method
- The EF Criteria have been moved to Appendix A, and products sold only in Canada may still certify using those criteria. Products sold in the U.S. and Canada may optionally report EF



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Solar Water Heaters

Product Category	ENERGY STAR Version 4.0 Proposed SUEF	ENERGY STAR Version 3.2 (Current) SEF
Electric backup	3.0	1.8
Gas Backup	1.8	1.2

- SRCC has developed a revised test method to produce a Solar Uniform Energy Factor (SUEF) that mirrors the UEF test procedure
- The levels above were selected to recognize approximately the same units as the current ENERGY STAR SEF requirements, although EPA notes there will be some variation between products



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Version 3.3 Process and Feedback

- EPA generally received support for the Draft 2 Version 3.3 Connected Criteria proposal
- Rather than offer a final draft of the Version 3.3 specification, EPA has included minor updates to the connected criteria in line with stakeholder comments in this Version 4.0 draft



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Changes to Connected Criteria

- Clarifications to the data freshness requirement
 - This only requires that any information provided in a response is less than 60 seconds old, but does not require that information is provided every 60 seconds
 - EPA understands and notes that the frequency of communication will affect the energy consumed
 - *Does the data freshness requirement affect energy use or product cost?*
- General Curtailment – Updated language to allow use of electric resistance elements when user needs cannot be met



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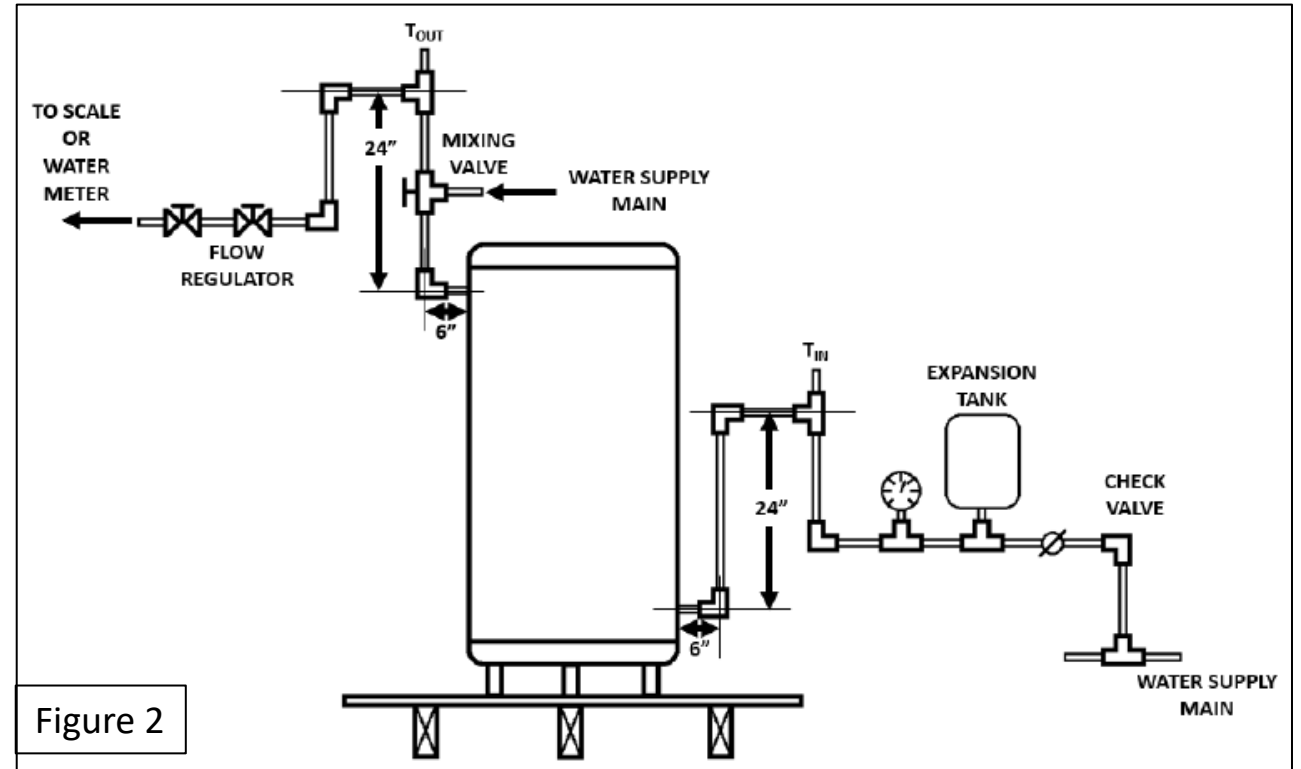
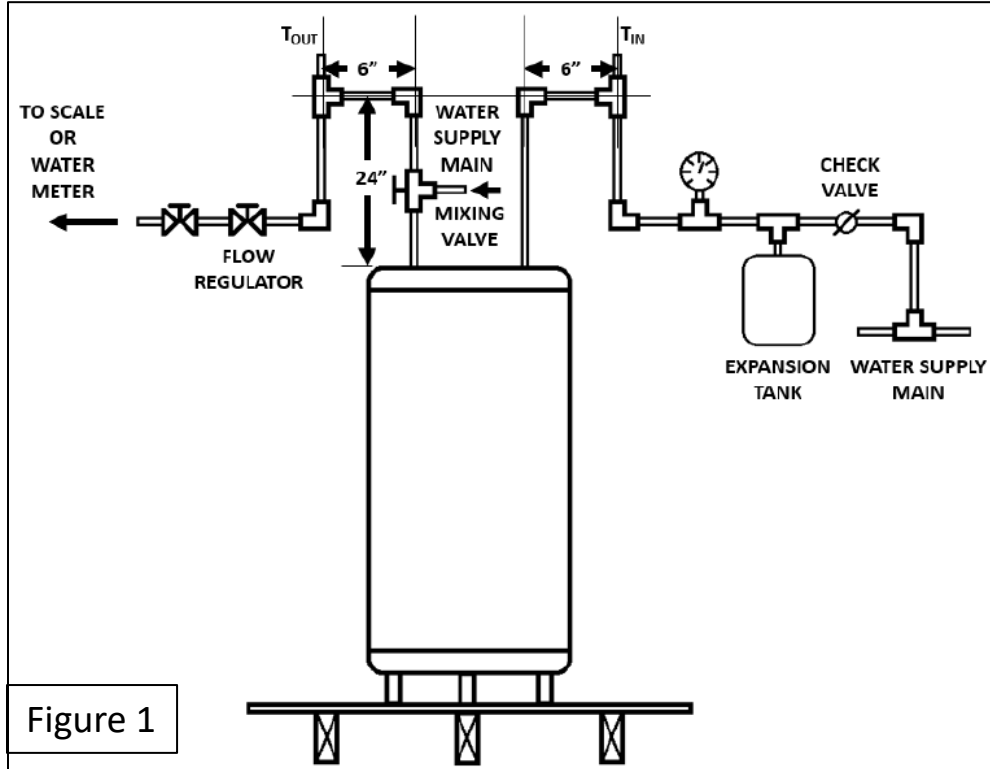
Test Method to Validate Demand Response

- Section 1: Overview (No significant changes)
- Section 2: Applicability (No significant changes)
- Section 3: Definitions (No significant changes)
- Section 4: Test Setup
- Section 5: Water Heater Preparation
- Section 6: Demand Response Tests
- Section 7: Calculations

Test Method references sections from DOE's Uniform Test Method for Measuring the Energy Consumption of Water Heaters (DOE TP), which can be found at:

[Appendix E to Subpart B of Part 430 of the Code of Federal Regulations \(CFR\).](#)

Section 4: Test Setup



- Setup to sections 2 (Test Conditions), 3 (Instrumentation), and 4 (Installation) of the DOE TP.
- Addition: Figures 1 and 2 to show the installation location of the mixing valve (if necessary).
 - Should the tee to the mixing valve on the inlet line be specified? If so, where?



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Section 5: Water Heater Preparation

- Perform the procedures found in sections 5.1 (Operational Mode Selection) and 5.2 (Water Heater Preparation) of the DOE TP.
- Addition: Instructions to test the CWHP as shipped by the manufacturer, unless the conditions required by section 5.2.2 (Setting the Outlet Discharge Temperature) of the DOE TP cannot be met.
 - JA13 section 3.3(b) requires that the default set point as shipped from the manufacturer be used when determining the load shift.
- Addition: Instructions that allow sections 6.1 through 6.4 (CWHP Initialization, User Interface, Consumer Override, and Loss of Connectivity) to be conducted without performing the water heater preparation tasks in this section.



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Section 6: Demand Response Tests

- Addition: Description of terms used for DR request Start Time and Duration.
 - Immediately: as soon as the request is received by the CWHP start performing the DR request.
 - Maximum: no ending to the request unless the CWHP is incapable of receiving a DR request that does not end, if so, the duration will be at least 4 hours.
- No significant changes to sections 6.1 (CWHP Initialization), 6.2 (User Interface), 6.5.1 (Emergency Curtailment and Grid Emergency), and 6.6 (DR Information and Messaging).
- Section 6.3: Consumer Override
 - Addition: Steps to verify that a CWHP in an overridden state does not start a scheduled DR event.
- Addition: Section 6.4: Loss of Connectivity (LOC) (No test was proposed in Draft 1)
 - Checks operation of the CWHP after a LOC when a DR request
 - has an end time or,
 - does not have an end time.



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Section 6: Demand Response Tests - Continued

- Section 6.5: Demand Response Requests and Responses
 - Addition: The term “settle,” which replaces “wait until a maximum mean tank temperature is observed.”
 - To “settle” in this test method is to allow the CWHP to operate without drawing water or recovering for 10 minutes after a cut-out. If a cut-in occurs before 10 minutes have elapsed after cut-out, then the recovery should be allowed to continue until cut-out, at which time the 10-minute settling period will begin again, and, if necessary, repeat until a full 10-minute settling period is performed.
 - A settling period was chosen instead of defining how to determine the maximum mean tank temperature mid-test.
 - **Is 10 minutes long enough for the CWHP to settle?**
 - **Should a CWHP be considered “settled” when “the measured mean tank temperature does not vary by more than $\pm 0.25^{\circ}\text{F}$ for a period of 30 seconds?”**
 - If so, what temperature variation and length of time should be used?
 - **Should a maximum number of “settling” period restarts be established?**



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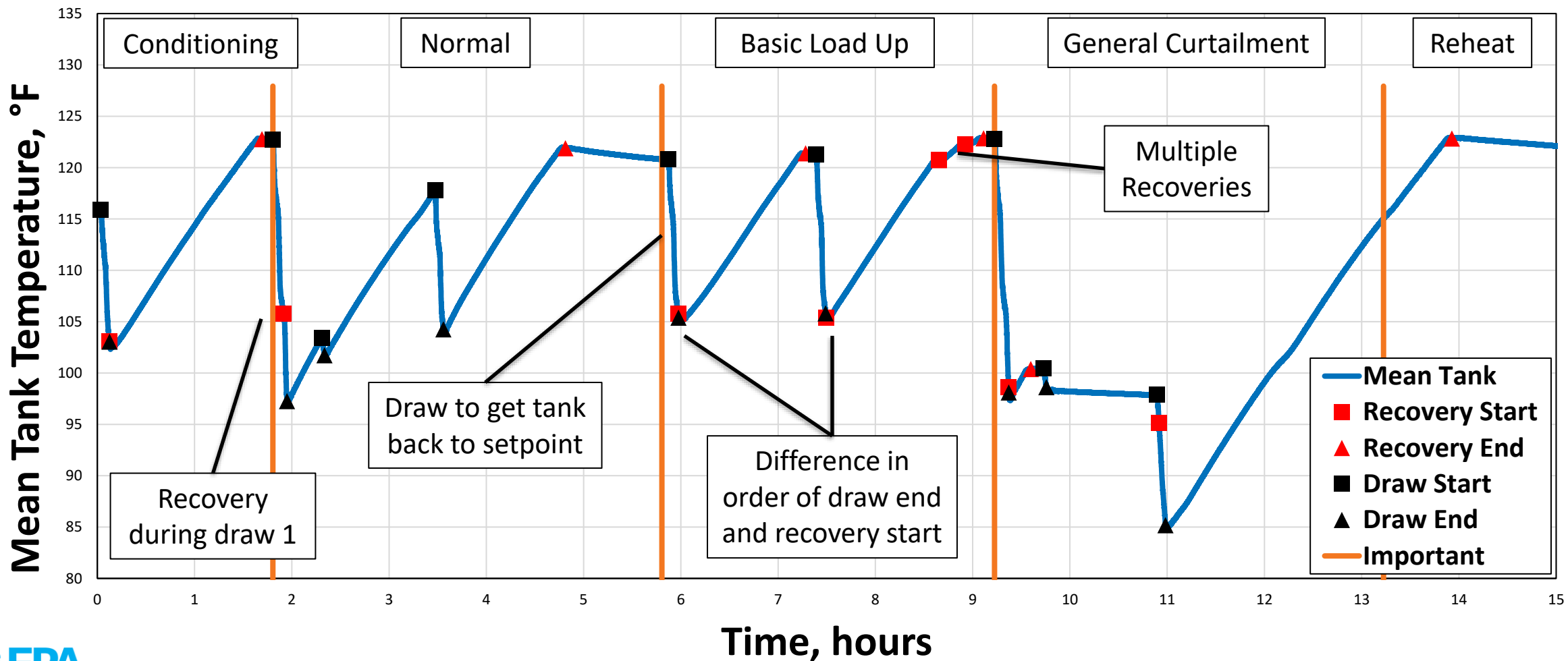
Section 6: Demand Response Tests - Continued

- Section 6.5.1: Load Shift
 - Addition: A draw prior to sending the Advanced Load Up (ALU) request (the same as prior to the Basic Load Up (BLU)) to get the CWHP in a depleted energy state.
 - Addition: Verification that a cut-in occurs within 5 minutes of sending the BLU or ALU request, if not, then the CWHP fails.
 - **Should a CWHP in a depleted energy state (after a draw) always cut-in when a Load Up request is received?**
 - Addition: A reheat period after the General Curtailment portion of the test is over.
 - **Is the amount of energy used valuable to a utility? What other uses could this section be put to?**
 - Removed: Verification that the mean tank temperature is higher after the ALU than when after returning to the user defined setpoint.



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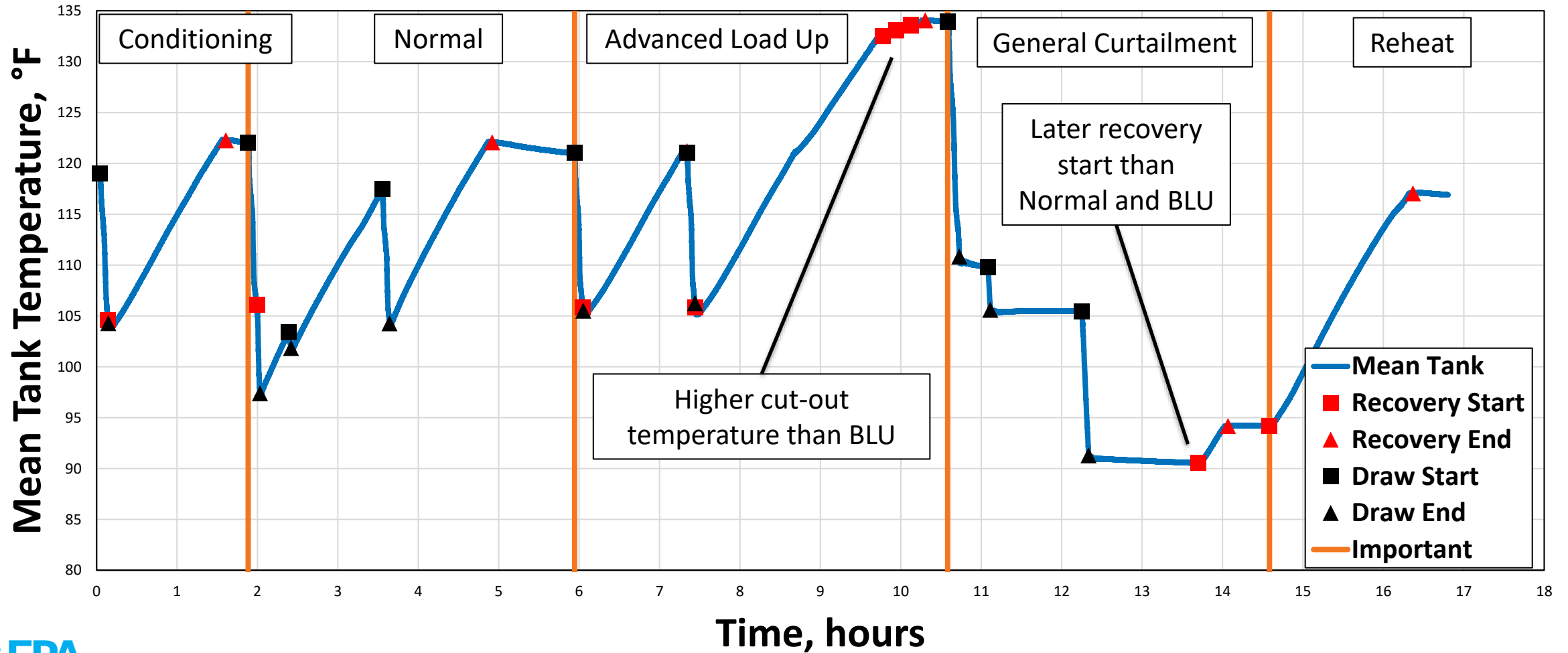
Load Shift Test: Basic Load Up Verification





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Load Shift Test: Advanced Load Up Verification





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Section 7: Calculations

- Addition: Within the accuracy calculation for the Current Available Energy Storage Capacity (AE) request, divide the available thermal energy in the tank by the rated Recovery Efficiency (RE) so that grid energy, not the available thermal energy of the tank, is compared to the value reported by the CWHP.
 - $AE = 100 * (E_{\text{Setpoint}} - E_{\text{Step}}) / RE.$
- Addition: Calculations to determine the accuracy of the optional Current Total Energy Storage Capacity (TE) request.
 - Calculations are similar to those used to determine the accuracy of the Current Available Energy Storage Capacity request.
 - Determine the difference in thermal energy within the tank between the highest and lowest mean tank temperatures that are observed and divide by the rated RE.
 - $TE = 100 * (E_{\text{High}} - E_{\text{Low}}) / RE$



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Section 7: Calculations - Continued

- Section 7.1.3: Load Shift
 - No change in calculations,
 - However, the Load Shift test now requires a draw prior to sending the ALU request (similar to the BLU verification).
 - This change results in a higher Advanced Load Shift due to the inclusion of the grid energy to bring the CWHP from a depleted energy state to setpoint.
 - Two prototype CWHP's, with storage volumes of 50 and 80 gallons, were tested and verified both the Basic and Advanced Load Shift.
 - Tested Basic and Advanced Load Shift values were all above the minimum Load Shift required by the Specification.
 - Advanced Load Shift is greater than Basic Load Shift.
 - The 80-gallon CWHP shifted more energy than the 50-gallon CWHP when tested with the same draw pattern.



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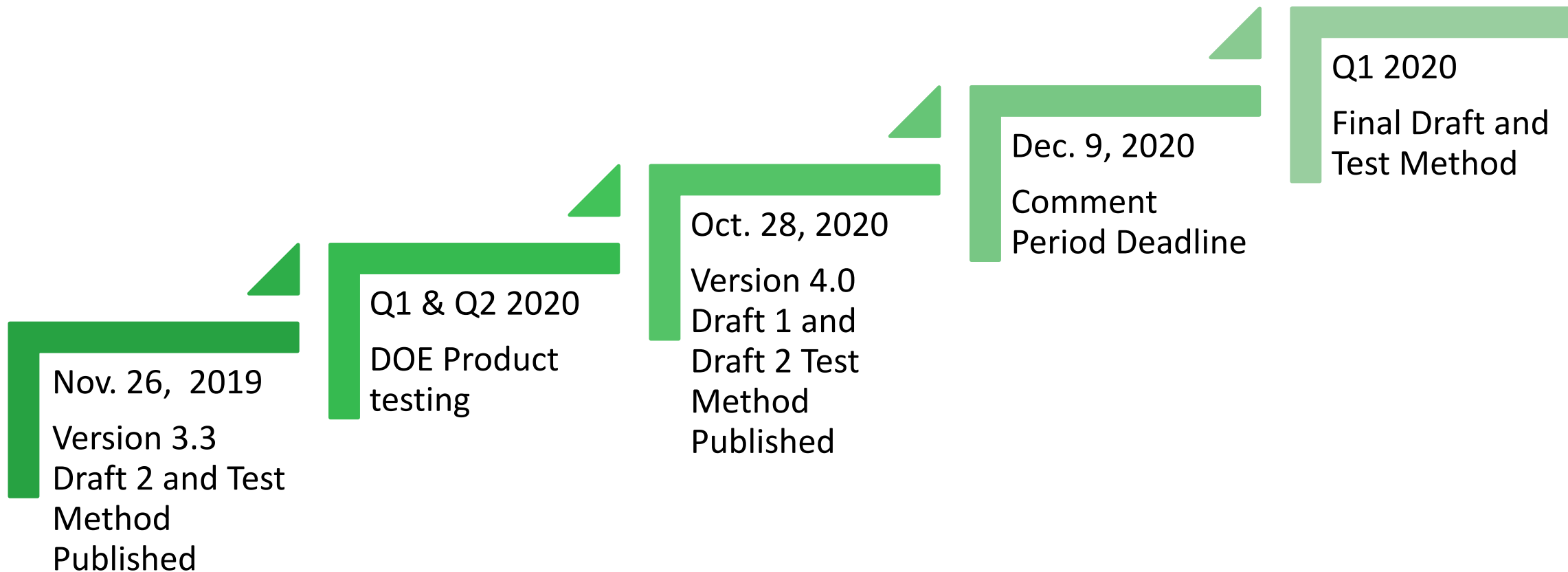
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Next Steps





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Questions

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Stakeholders are encouraged to provide written comments for consideration to waterheaters@energystar.com by Dec 9, 2020.