



# ENERGY STAR Connected Water Heaters

## Water Heaters Version 3.3 Draft 1

Abigail Daken, EPA  
Dan Baldewicz, ICF

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## Agenda

- Welcome, Introductions
- Reminder: Specification Scope
- Proposed Connected Water Heater Criteria
  - How criteria are integrated into spec
  - User Amenity (a.k.a not DR)
  - Demand Response
- Test Method meeting
- Spec and Test Method Timeline
- Open Q & A



## Reminder: Specification Scope

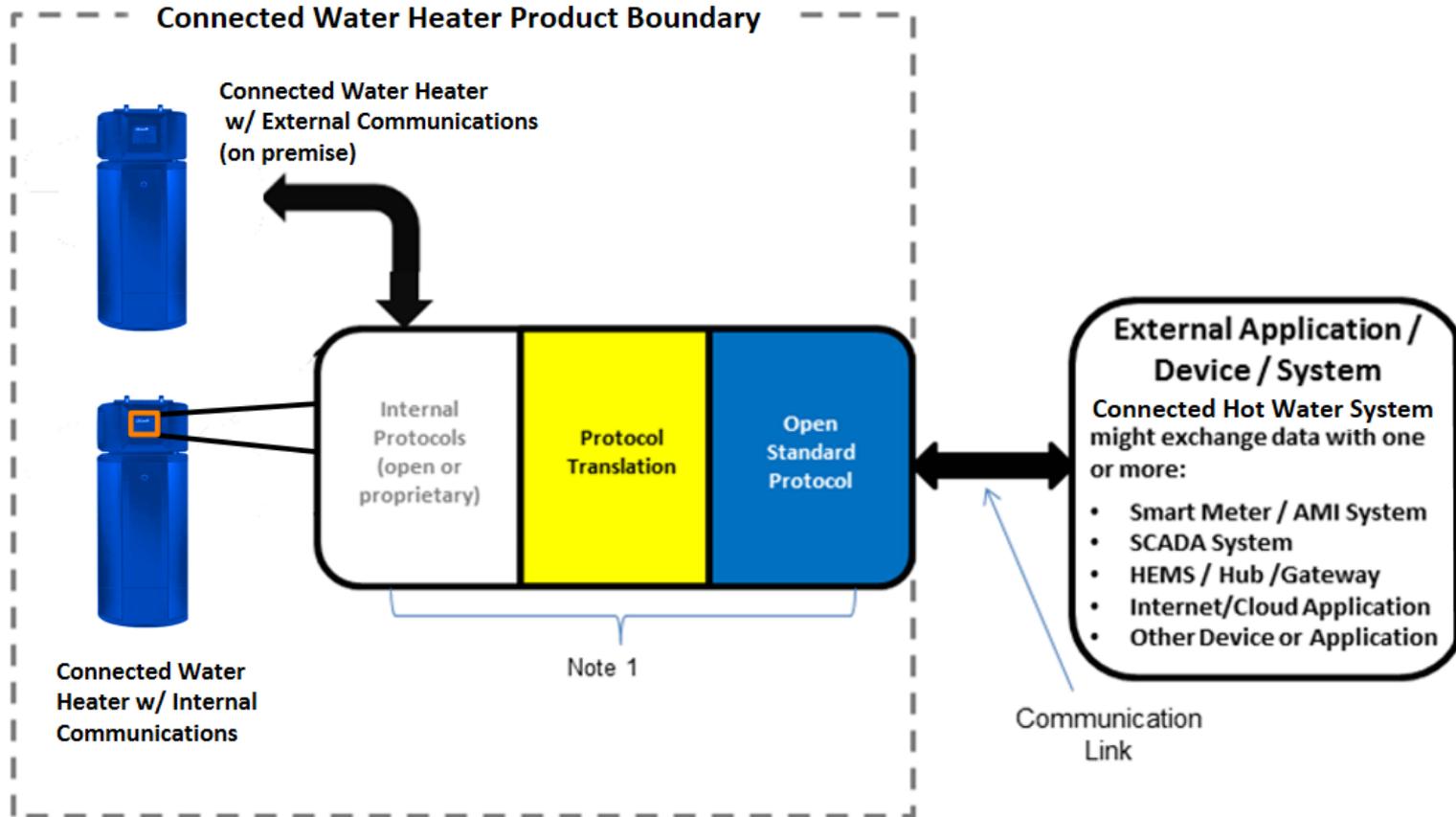
- **Electric Heat Pump Water Heaters (HPWH) included**
  - Electric Resistance Water Heaters (ERWH) excluded, do not meet V3.X ENERGY STAR levels
  - Connected criteria do not apply to DOE Grid Enabled Water Heaters – out of scope b/c ERWH
- **Gas Storage & Instantaneous Water Heaters included**
- **Excluded:**
  - Products intended only for commercial applications
  - Combination space-heating and water-heating appliances
  - Add on heat pump water heaters
  - 3<sup>rd</sup> party water heater controllers



## Connected Criteria

- **Meeting connected criteria is OPTIONAL**
  - Identify models that meet as “Connected” on the Qualified Products List (for web visitors + API access)
- **Connected criteria = user functionality + grid services**  
(as appropriate for product type)
  - Electric Heat Pump Water Heaters: Full DR requirements
  - Gas Storage Water Heaters: Limited DR requirements, as per current gas curtailment programs (polar vortex)
  - Instantaneous Gas Water Heaters: Exempt from DR, connected if meets non-DR requirements
- **This revision will not affect ENERGY STAR certification**

# Connected Water Heater Product (CWHP)





## How are Connected Criteria organized in the Spec?

- **Communications:** Open standard(s) and API or interface docs
- **Functionality:**
  - User Amenity: Similar to other specs, services for homeowners and for home energy management integration
  - Demand Response: Specific choices of communication protocols, responses to specific messages and requests
    - Let manufacturer protect user experience; avoid prescriptive requirements (e.g. reduce tank temp by X °F)
    - Let manufacturers compete on optimal logic/control strategies to provide grid services
- **Testing:** Refer to test requirements section
- **Appendix,** details on how a given open standard implementation would look (e.g. OpenADR 2.0 / CTA 2045-A).



## User Amenity Criteria (a.k.a. not DR)

- **Remote Management**
  - Product responds to remote consumer requests
  - Temporary remote change to higher energy mode: Within 72 hours, revert to previous state
- **User Alerts**
  - At least 2 alerts relevant to reducing energy consumption (e.g. faults, settings)
  - Communicated either
    - On the product (e.g. controller), and/or
    - Via a communication link (e.g. app)
- **Energy Reporting**
  - Measured or estimated instantaneous power
  - May be met via DR required functionality



## Demand Response Requirements (Summary)

- Communication Protocols
- Consumer Override
- Loss of Connectivity
- Information and Messaging Requirements
  - Required
  - Optional
- Requests and Responses
  - Required
  - Optional



## Communication Protocols

- Specifically CTA 2045-A and/or Open ADR 2.0
- CTA 2045-A offers
  - On premises application layer translation
  - Direct product endpoint, with physical layer
  - Provides connectivity options, e.g. FM antenna → CTA port
- Open ADR 2.0 offers
  - Implementation on existing cloud endpoints
  - No requirement on backhaul, can be proprietary (if needed)
  - Easily reconfigurable



## Consumer Override/ Loss of Connectivity

- Consumer Override:
  - Consumer can override product's DR activity → normal operation
  - Override should be easily accessible
  - Implement override messaging as per chosen protocol(s), upstream and 2 way responses as required, e.g. Open ADR 2.0 EiOpt framework
  - Grid Emergency (Off Mode) events do not require override capability
- Loss of Connectivity
  - If DR activity contradicts a stored schedule (e.g. shed event at low TOU price), on loss of connectivity revert to original stored schedule



## Information and Messaging: Required

- **Device Type**
  - ERWH, HPWH, Gas Storage, Gas Instantaneous, etc.
- **Operational State**
  - Current product activity and DR event status
  - States listed on next slide
- **Current Available Energy Storage Capacity (kWh or Btu)**
  - Energy capacity available for load up, in current conditions
- **Power / Demand (Instantaneous) (kW or Btu)**
  - Measured or Estimated



## Operational States

- Idle Normal, Running Normal
  - Current activity, no Grid DR Command in effect
- Running Curtailed Grid, Running Heightened Grid, Idle Grid
  - Current activity, Grid DR Command in effect
- SGD Error (fault)
  - Fault Conditions
- Cycling On / Cycling off
  - Autonomous cycling, advanced DR run modes
- Idle Opted Out, Running Opted Out
  - Current activity, Opt Out in effect



## Information and Messaging: Optional

- **Energy Use (kWh or Btu)**
  - Measured or estimated cumulative power consumption
- **Current Total Energy Storage Capacity**
  - Based on current conditions
  - Over and above the current stored hot water (at that moment)



## Requests and Responses: Required (1/3)

- **General Curtailment (Shed)**
  - Expect common / frequent usage
  - Reduce energy consumption
  - Low/Minimal consumer impact
  - HPWH: on recovery, should not use resistance elements
- **Emergency Curtailment (Critical Curtailment)**
  - Less common/rare event
  - Reduce energy consumption substantially and urgently
  - Demand reduction oriented
  - Tank may reach much lower temp
  - Optional for Gas Storage Water Heaters



## Requests and Responses: Required (2/3)

- **Grid Emergency (Off Mode)**
  - Extremely rare [less than once/year]
  - Stop using power immediately if safe to do so
  - Avoid blackout situations
  - May impact consumer
  - Optional for Gas Storage Water Heaters
- Consumer opt-out not required for this event type
- If misused (e.g. often), EPA will change spec to require opt-out



## Requests and Responses: Required (3/3)

- **Load Up**
  - Expect common / frequent usage
  - Increase energy consumption within product limits
    - Mixing valve products may have considerable additional capacity. No specific requirements proposed at this time.
  - Take in excess grid capacity and/or prep for later shed
  - HPWH: Avoid resistance element usage to satisfy Load Up
  
- **Return to Normal Operation**
  - Event cancellation (in progress and/or advance event)
  - Return to normal pre-event operation



## Requests and Responses: Optional

- **Set Point Adjustment**
  - Adjust product thermostat set point up or down,
  - If safe to do so
  - Direct product control alternative to behind the scenes operation strategies
- **Relative Price Signals**
  - Information to WH endpoint on
    - Current energy cost
    - Upcoming pricing changes (e.g. relative price)
  - Allows product control logic to react to data
    - E.g. Shed / Load Up



Appendix B (Informational) – Demand Response Messaging

# Informational Appendix

- For each message/request:
  - Same scenario, different message format
- Captures simplicity and/or complexity for different application layer structures
- Work towards same message → Identical product response for every model

Category	Sub-type	Demand Response Messaging	Response Result	CTA (2045-A)	OpenADR (2.0b)
Basic Signals	Curtailment	<b>General Curtailment</b>	Reduce load (moderate)	Shed <sup>21</sup>	oadrDistributeEvent: SIMPLE level 1. <sup>22</sup>
		<b>Emergency Curtailment</b>	Reduce load (major)	Critical Peak Event <sup>21</sup>	oadrDistributeEvent: SIMPLE level 2. <sup>22</sup>
		<b>Off Mode</b>	Turn off (if possible)	Grid Emergency <sup>21</sup>	oadrDistributeEvent: SIMPLE level 3. <sup>22</sup>
	Load Up	<b>Load Up</b>	Use more energy (if possible)	Pending Event Warning and Pending Event Type <sup>21</sup> . Autonomous Cycling (9.1.8)	oadrDistributeEvent: NEAR / FAR flag, CHARGE STATE, LOAD_DISPATCH.
Run Normal	<b>Return to Normal Operation</b>	Return to defaults	End Shed / Run Normal <sup>21</sup>	oadrDistributeEvent: CANCELLED. <sup>22</sup>	
Advanced Signals	Device State (in event)	<b>Set Point Adjustment</b>	Adjust water setpoint (if possible)	Get / Set SetPoint (9.1.6)	oadrDistributeEvent: LOAD_CONTROL. <sup>22</sup>
	Real Time / Device Logic	<b>Real Time System Load</b>	Use / do not use energy when appropriate (follow programming)	Request for Power Level [8.2.1]	
		<b>Utility Peak Load Price Signal</b>		Present Relative Price <sup>21</sup> , 9.1.3	oadrDistributeEvent: ELECTRICITY_PRICE <sup>22</sup> .
	<b>Excess Capacity (DER)</b>	Grid Guidance <sup>21</sup>			
Device Properties & Enrollment	Opt Out	<b>Consumer Override</b>	Skip response to event within opt out time window	Customer Override Message. Sent each time device is queried while opt out is active <sup>21</sup>	oadrCreateOpt: device sends upstream opt message. <sup>23</sup>
	Dev. Info	<b>Device Information</b>	Indicates product type (e.g. HPWH)	Device Information Request	Ei:eiTargetType (endDeviceAsset)
	Status	<b>State Reporting Requirements</b>	Provide state information to requestor	Operational State Monitoring (8.2.4)	EiReport. oadrPayloadResource Status



## Test Method

- DOE in-person kick off meeting
- RSVP: [WaterHeaters@energystar.gov](mailto:WaterHeaters@energystar.gov)
- Location:
  - Navigant Consulting, Inc.
  - 1200 19<sup>th</sup> St. NW, Suite 700
  - Washington DC, 20036
  - Conference Room 7A
- Time: May 21, 2019: **10:00 AM to 3:00 PM Eastern Time**



## Draft 1 Specification Comment Deadline

- Send written feedback to [WaterHeaters@energystar.gov](mailto:WaterHeaters@energystar.gov)
- **Please include any supporting data for additions or revisions to proposed requirements and/or adders with your written Draft 1 specification feedback.**

**Comment Deadline**

Friday, May 17, 2019



## Next Steps and Anticipated Timeline

- Specification and Test Procedure (DOE) developed concurrently
  - Specification finalizes when test method is mostly done
  - Remains to be seen exactly how they'll march together
- Specification Draft 1 released April 16, 2019; comment deadline May 17, 2019
- Test Procedure Kickoff May 21, 2019
- Anticipated Q3-2019: Specification Draft 2
- Stakeholder meeting ENERGY STAR Products Partner Meeting, September 10-12, Charlotte, NC
- Anticipated Q4-2019: Specification and Test Method Draft 1
- Anticipated Q1-2020: Specification and Test Method Draft Final; not necessarily at exactly the same time
- Anticipated Q2-2020: Test Method Final



## Contact Information

### **Specification:**

Abigail Daken, EPA

[Daken.Abigail@epa.gov](mailto:Daken.Abigail@epa.gov)

202-343-9375

Dan Baldewicz, ICF

[Dan.Baldewicz@icf.com](mailto:Dan.Baldewicz@icf.com)

518-452-6426

### **Test Procedure:**

Catherine Rivest, DOE

[Catherine.Rivest@ee.doe.gov](mailto:Catherine.Rivest@ee.doe.gov)

202-586-7335