



ENERGY STAR®

Connected Criteria for Large Load Products Discussion Guide Webinar

March 7, 2019





Webinar Agenda

- Introductions
- Landscape: The market and the Grid; EPA response w/ENERGY STAR
- Considerations for Specific Products
 - Pool Pumps
 - CAC/ASHP
 - Water Heaters
 - EVSE
- Test Methods and Data Reporting
- Wrap Up



Introductions

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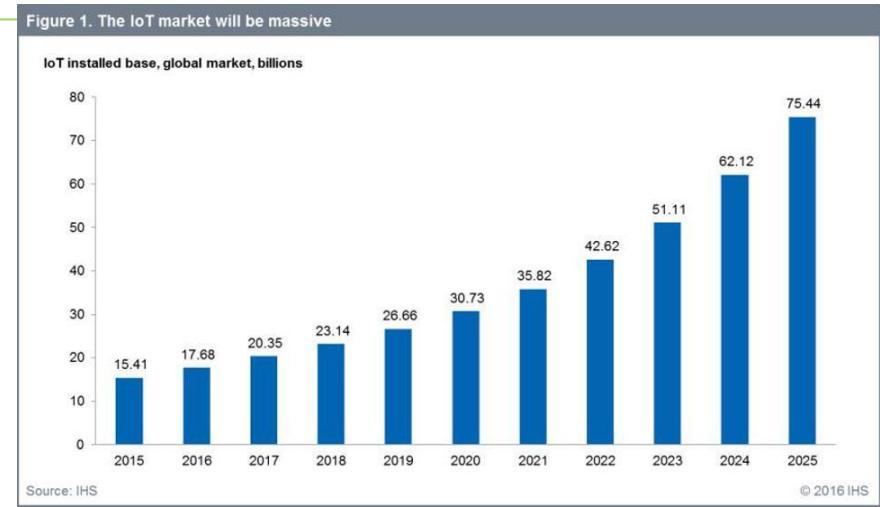
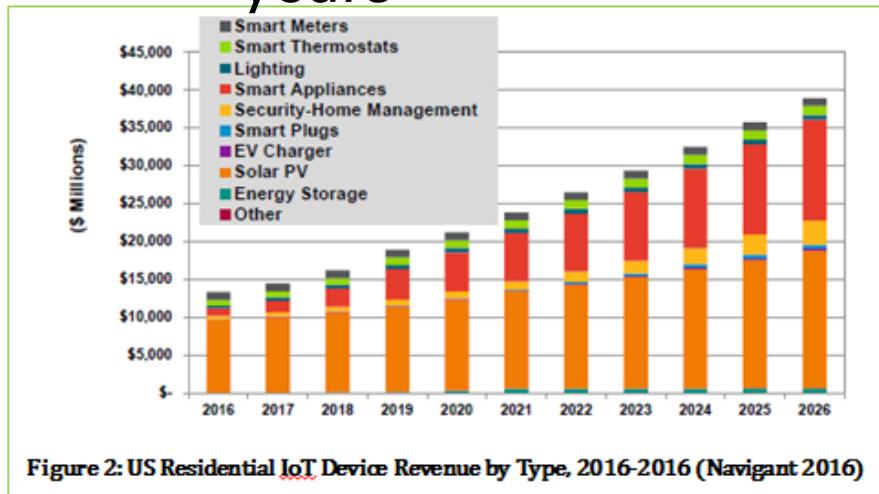
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ICF



Context: Growth of IoT

- All “Connected”, “Smart” and “IOT” product forecasts show significant growth over next 10 years





Crowded field (2017 snapshot)

Product and Service Leaders

Leading brands in the Smart Home



Apple
30%

SAMSUNG

Samsung
21%

Google

Google
20%

amazon

Amazon
13%

nest

Nest
13%

vivint.
SmartHome



Home security just got smarter



ALARM.COM

SOLUTIONS PRODUCTS & SERVICES

AT&T
digital *life*SM



Popular Connected Products

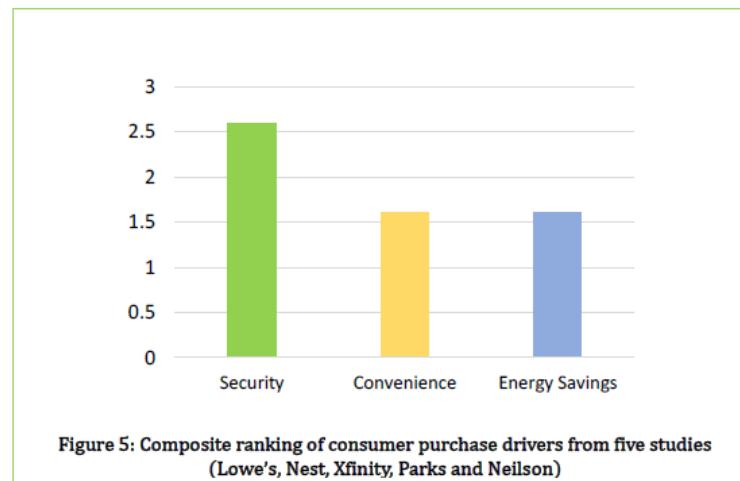
- Curb & Sense home Monitoring Devices
- Ecobee 4 smart thermostat.
- Sonos Wireless Speaker system.
- Philips Hue Smart Light Bulbs.
- Amazon Echo Show.
- SmartThings System.
- Belkin WeMo Switch.
- Lutron Caseta lighting control system + more
- Kwikset Z-wave Lock
- Chamberlain Garage Door Opener

Sources: Fortune Magazine, February 17, 2017.
Engadget, November 16, 2017



Consumer Drivers: safety, comfort, convenience

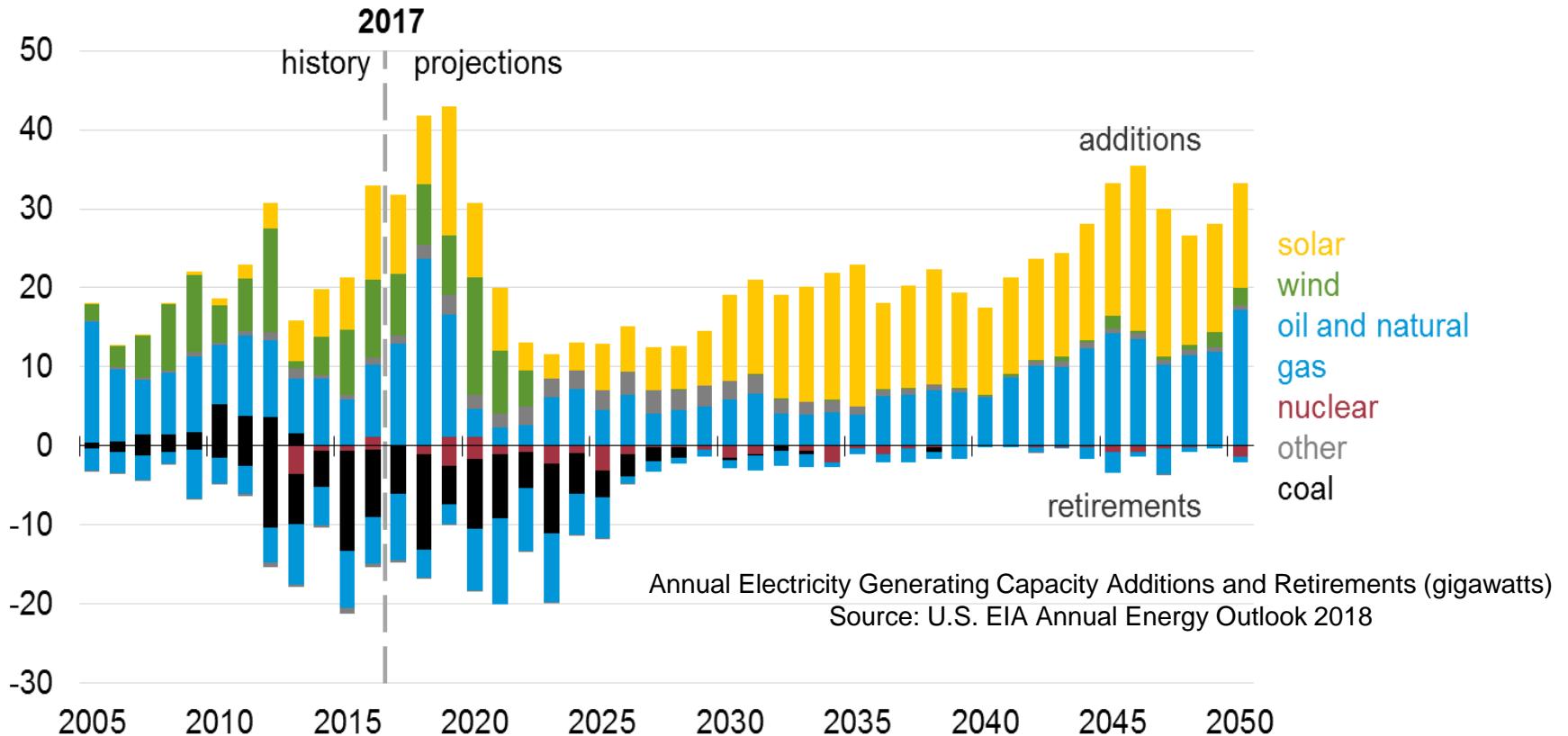
- Security was dominant reason for buying a connected product across all surveys.
- Ease of control with mobile device is an appealing feature
 - Adjust a thermostat, turn on lights, or start coffee pot while still in bed.
- **Energy efficiency** an important but secondary consideration.



Sources: Lowe's 2014, Parks 2014, Neilson 2015, Nest 2016, Xfinity 2016.



Meanwhile on the grid side, less fossil fuel generation, more wind and solar





Grid interest in Connected Technologies

- Energy efficiency continues to be cost effective component in the overall electricity supply market
- Effective DER bundles need some loads that can be controlled automatically to
 - reduce energy consumption,
 - shift to another time period, or
 - accept electricity during a time of oversupply



Different products, drivers & energy implications

Type	Driver of market adoption	Energy Implication and/or Opportunity	Examples
Large loads, load flexibility doesn't impact consumer	Grid services	Enable cleaner grid	Pool pumps, water heaters
Large loads, load flexibility can impact consumer somewhat	Grid services	Enable cleaner grid; protect consumer interest	EVSE, HVAC
Convenience and quality of maintenance	Consumer and brand owner interest	Better maintenance saves energy	White goods, HVAC
Safety and security	Consumer interest	Added load; may provide occupancy info	Door locks, window sensors
Additional functionality	Consumer interest	Added load	Color changing lights, VADAs



Why these products?

- Large loads compared to other common residential equipment
- WH, CAC/ASHP, pool pumps: common target for direct load control switches
- Water heaters and pool pumps: flexibility w/o affecting user experience
- Water heaters and EVSE (CAC and ASHP too, but much less): Energy storage
- CAC and ASHP (and EVSE in some markets): Highly peak coincident, so both EE and DR extra useful for limiting demand



EPA Approach Evolves

- EPA began including connected criteria in specifications in 2011
- Currently cover 11 specifications
 - Criteria optional in all but connected thermostat specification
- New approach intends to recognize increasing value of grid services versus consumer amenity for large load products



Modest changes from previous connected criteria

	Existing (in most specifications)	Expected to be proposed (large loads only)
Energy Consumption Reporting	Required; accuracy must be documented	
Operational Status Reporting	Defined more specifically for some product types, not all	Able to receive and respond to application layer messages typical of Open ADR or CTA-2045 that are relevant to these elements.
Demand Response	Defined responses for Type I, Type II and Type III requests for some but not all product types	
Open Access	Uses standards in the SGIP catalog or similar; interface documentation or API required; open access may be cloud to cloud	Uses standards in SGIP catalog or similar; revisit ability to receive and respond to application layer messages w/o cloud connection, consider role of separate controller
Modular DR communication	Allowed and encouraged, not required	Allowed and encouraged, not required
Consumer alerts	Many product types: alert consumers to energy wasting conditions (e.g. open refrigerator door)	Look for opportunities
Data elements reported	<p>On-premise connectivity protocol (e.g. Wi-Fi, zwave, etc.)</p> <p>What additional hardware is needed to connect (e.g. WiFi router, module)</p> <p>For a few products, DR capability summary in lieu of specific criteria</p>	<p>On-premise connectivity protocol (e.g. Wi-Fi, zwave, etc.)</p> <p>What other additional hardware is needed to connect (e.g. WiFi router, module)</p> <p>Whether a specific controller, sold separately, is needed to access connected capability</p> <p>Additional data elements to be identified.</p>



On site protocol translation vs. in cloud

- On-site application layer protocol translation:
 - Utility compromise position
 - Load control throughout product lifetime, w/o regard to service provider business model
 - More expensive and harder to set up (firmware and/or upgraded processor)
 - Cheaper and easier than modular physical port on device
- Cloud application layer protocol translation
 - Allows use of existing (proprietary) link to product
 - Cheapest/easiest/fastest/most flexible access to DR resource
- Both require separate agreement w/every manufacturer/service provider



Questions on General Connected Approach

1. What are we missing in our understanding?
+/- of DR application layer protocol translation locally in the product or of using a cloud connection for DR response?
2. Is there a way to quantify additional utility support available for products that do have local application layer protocol translation?
3. What mechanisms are used currently to provide allow distribution system operators to know where flexible load resources sit in the grid topology? Are there specification criteria that could facilitate this?

Pool pumps



- Success of ENERGY STAR Pool Pumps:
 - 121 pool pumps currently certified
 - Use up to 65% less energy than standard pool pumps
 - Average \$445/year savings, with payback under 1 year
 - Can support in ground, above ground, and pressure cleaning booster applications



Changing Pool Pump market presents opportunities

- 2021 regulation → variable speed pumps widely adopted (inground pools at least)
- Multiple market leaders already offer connected functionality
 - Separate controllers typical
 - Not certified as connected under current specification
- All hardware must be outside/wet rated, increasing expense of physical port



Questions specific to Pool Pumps

1. What are the technical barriers to pool pump DR and creating an out-of-the-box product? Would industry or reference standards mitigate any potential hurdles?
2. What are the current adoption barriers for pool pump DR? What about ENERGY STAR connected specifically?
3. Does industry anticipate incremental costs for connected and DR equipped pool pump products to decrease significantly?



CAC and ASHP





Much work has already been done...

- AHRI 1380p
 - AHRI (with the support of CEE) work since 2016 or earlier
 - To some extent, reflects compromise between manufacturers and utility interests
 - Applies to variable speed central AC and heat pumps providing load flexibility (unique properties make them more desirable)
 - Includes test protocol, and intended to support AHRI certification program
 - Contains specific responses to specific CTA-2045 and OpenADR signals, e.g. use no more than 40% of nameplate power
- EPRI field trials of grid responsive equipment (CTA-2045)



...Which EPA will build on

- Harmonize with AHRI 1380p
 - Probably will not outright require 1380p, but will harmonize requirements
 - Intend for certification to 1380p to be sufficient demonstration of DR capability
- EPA has launched Version 6.0 development – optional connected criteria to be rolled in if possible
 - Expect Draft 1 in April
 - Intend to finish by end of 2019



Questions on CAC/ASHP

1. Has the process of working with manufacturers on AHRI 1380p altered utilities' positions on the question of on-premise standards and their place in an ENERGY STAR specification?
2. Should EPA refer directly to a table of appropriate responses to specified grid requests, as expected to be in the AHRI 1380p standard?
3. Should controllers or thermostats be included or considered to meet connected criteria for system types beyond variable capacity systems with proprietary thermostats?



Water Heaters





A great target

- Familiar target for direct load control programs, and well understood balancing resource for municipal utilities and rural electric co-operatives – but all with electric resistance
- Also third party WH controllers that provide load flexibility for ERWH and gas storage WH
- Heat pump water heaters (the only electric ones that meet ENERGY STAR requirements) work poorly with power cycling, will need specific controllers, but are typically electronic anyway
- Opportunity for grid balancing with the ability to store energy on the scale of hours to days without adversely impacting consumer



Staying clear of DOE “grid responsive WH”

- Such a great target that DOE 2015 regulation carved out a special product type for large ERWH with load flexibility
- These units do not meet ENERGY STAR requirements
- The criteria we seek to establish would not be relevant to these units; instead, we seek to address other water heaters



Also considerable work here

- Existing connected efforts include:
 - CEE Residential Water Heating Initiative
 - NEEA Advanced Water Heating Specification
 - CEC work on California standards
 - EPRI field trials of grid responsive equipment (CTA-2045)
 - NEEA and BPA field trials of grid responsive equipment
- EPA tracking each effort, aims to work together to minimize contradictions
- Worth noting that NRDC, BPA and PGE have all done work showing that heat pumps can work well for load shifting



Next steps for Water Heaters

- Connected criteria for water heaters will be introduced in a Version 3.3 specification amendment
 - Will be discussed in stakeholder meeting in conjunction with ACEEE HWF Meeting on March 11
- EPA will develop an accompanying DR test method
- Also interested in consumer amenities that connectivity can facilitate, e.g. leak detector and notification
- Note: Electric resistance water heaters and after-market water heater controllers will remain out of scope of the Water Heater specification
 - Potential for criteria/test method to be useful in encouraging DR capabilities water heaters outside of ENERGY STAR scope?



Questions on Water Heaters

1. What issues specific to heat pump water heaters DR response would need to be addressed in either the method or the spec?
2. What is the appropriate length of time before a water heater returns to a normal DR-ready operation after temporary consumer override?
3. What data would water heaters need to be able to send to DR management entities about their state to optimize usefulness to the grid?
4. Is inclusion of connected and DR criteria for gas storage heaters important? What kind of DR responses make sense?



Electric Vehicle Chargers





EVSE current status

- Current Version 1.0 specification has very general optional connected criteria; asks for a summary of DR capabilities
- EPA is developing a Version 1.1 specification amendment to add DC-output EVSE, and sees an opportunity to revisit the connected requirements for future AC and DC EVSE.
 - If EV charging can be managed and coordinated based on grid conditions, EVSE can be powerful resource to increase grid stability



EVSE are different than the other products

- Typically, bi-directional cloud connectivity and energy metering included, to support financial transactions
- Installations in public places are very different than those in private homes (latter are similar to other products discussed here)
- System architecture: DR functionality in the charger or vehicle itself – some systems have dumb chargers and smart cars
- EPA may reference ISO 15118 *Vehicle to Grid Communication* as appropriate when revising connected criteria



A great target, and grid awareness necessary for EVSE

- Broad recognition that added load highly problematic unless grid aware
- Thus, currently widespread AC chargers include grid communications
- AC vs. DC chargers
 - Grid service potential highest for AC chargers where vehicles are parked for longer periods
 - AC chargers typical of home installations
 - DC chargers are faster; imagined in refueling station scenarios



Questions on EVSE

1. Are there other open source protocols available to enable DR beyond those currently covered in the ENERGY STAR Version 1.0 specification?
2. Are EVSE manufacturers considering integrating the CTA-2045 interface into their network connected products?
3. Have EVSE manufacturers adopted the ISO 15118 standard or plan to in the future?
4. If EPA develops a grid response test method, what issues specific to EVSE would need to be addressed?
5. What are the business models of companies currently offering grid services through EVSE?



Test Methods and Data Reporting

- EPA intends to work with DOE to establish (or revise) methods for grid responsiveness of these product types
 - Will be similar to those DOE has already established for pool pumps, refrigerators, and room air conditioners.

Product test method	Action	Timing
CAC/ASHP	Create or refer to industry	2019/2020
Water Heaters	Create	2019
EVSE	Create if needed	TBD
Pool pumps	Revise	2019/2020



Test Methods and Data Reporting

- Data about grid responsiveness would be submitted through QPX system
- Certification bodies collect and review test data of candidate products and upload specified product data to EPA's product data base using the QPX
 - Database is publicly accessible and commonly used by entities that want to highlight a subset of ENERGY STAR products
- EPA welcomes feedback on maximizing usefulness of the certified product database



Specification Development Timeline/ Next Steps

- CAC/ASHRAE:
 - Draft 1 V6.0 expected April 2019
 - intending to finalize in 2019
- Pool pumps:
 - TBD (2020?)
- Water Heaters:
 - Draft 1 V3.3 expected March 2019
 - intending to finalize in 2019
- EVSE:
 - Currently working on DC fast charge test method
 - Draft 1 V1.1 expected Q3 2019, will include updated connected criteria



Discussion Guide Comment Deadline

- Please send written feedback to ConnectedProducts@energystar.gov

Comment Deadline

Monday, March 18, 2019



Final Questions or Comments





Thank You!

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