

DOCKETED

Docket Number:	20-FDAS-01
Project Title:	Flexible Demand Appliance Standards
TN #:	236601
Document Title:	AHRI Comments in Response to the CEC Flexible Demand Appliance Standards Rulemaking
Description:	N/A
Filer:	System
Organization:	AHRI
Submitter Role:	Public
Submission Date:	2/3/2021 1:43:23 PM
Docketed Date:	2/3/2021

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Submitted On: 2/3/2021
Docket Number: 20-FDAS-01*

**AHRI Comments in Response to the CEC Flexible Demand
Appliance Standards Rulemaking**

Additional submitted attachment is included below.

February 3, 2021

Mr. J. Andrew McAllister, Ph.D.
Commissioner
California Energy Commission
Docket Unit, MS-4
Re: Docket No. 20-FDAS-01
1516 Ninth Street
Sacramento, CA 95814-5512

(submitted electronically to Docket 20-FDAS-01)

Re: AHRI Comments in Response to the December 14, 2020 Lead Commissioner Workshop on Senate Bill 49 Flexible Demand Appliance Standards and December 9, 2020 Staff Paper, Introduction to Flexible Demand Appliance Standards [*Docket Number 20-FDAS-01*]

Dear Commissioner McAllister:

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) respectfully submits this letter in response to the California Energy Commission (CEC) December 14, 2020 Lead Commissioner Workshop on Senate Bill 49 Flexible Demand Appliance Standards (FDAS) and December 9, 2020 Staff Paper, *Introduction to Flexible Demand Appliance Standards* (Staff Report).

AHRI represents 332 air-conditioning, heating, and refrigeration equipment manufacturers. In North America, the annual output of the HVACR and water heating industry is worth more than \$44 billion. In the United States, the industry supports 1.3 million jobs and \$256 billion in economic activity annually. AHRI represents the majority of the manufacturers of North American water heater, central air conditioners, and heat pumps, all of which manufacture products within the scope of the rulemaking. AHRI's members are continuously working to review and design new higher efficiency equipment that improves consumer comfort, without compromising consumer choice, product quality, or safety. In fact, AHRI members offer the most technologically advanced and efficient HVACR and water heating equipment available anywhere in the world. AHRI and its members support the reduction of greenhouse gas (GHG) emissions and will continue to collaborate with stakeholders to work toward that goal.

AHRI supports California's grid modernization and Senate Bill 49 (SB 49, Skinner, Chapter 697, Statutes of 2019) requirements that CEC develop standards, "that promote flexible demand technologies **centered around consumer interests and benefits,**

mandating opt-in for participation in any load flexibility programs while prioritizing open-source standards that maintain privacy and security.”¹ AHRI supports CEC adopting standards that are limited to products marketed as Demand Response (DR). The success of these standards is conditioned on California utilities’ guarantee that customers can participate in a DR program that, state-wide, accepts all communication protocols specified in consensus performance standards for appliances. In addition, utilities should incentivize the adoption of DR-ready products.

Meeting these criteria supports market-driven solutions for appliances that will ultimately make the grid more effective, efficient, responsive, secure, and green while also continuing to allow manufacturers to provide consumers with a full range of products. In California alone there are 80 load-serving entities, and these utilities are not all supportive or capable of implementing DR programs in the way that CEC has envisioned in the Staff Report. Indeed, Sacramento Municipal Utility District (SMUD) – the utility serving CEC’s offices and the state house – is not positioned to implement the advanced time-varying rate structures necessary to capture the full value of DR appliances.² If utilities are grappling with the complexities of real-time pricing structures, specifically the uncertainty and risk of valuing capacity of DR assets, there is no guarantee of consumer benefit resulting from a DR mandate. The disparity between product cost and benefit is particularly severe for low-income consumers who are already struggling to make ends meet. While the added cost of DR to an appliance does not compare to that of a new power plant, all additional costs are wasted if California utilities are not all positioned to successfully implement DR programs. CEC must acknowledge that not all consumers want, need, or can afford the mandated purchase of DR appliances.

CEC should follow industry-consensus standards and only set standards or requirements for products marketed as Demand Response

AHRI urges CEC to follow industry and set requirements to standardize the performance of products marketed to respond to DR signals. For example, AHRI Standard 1380 (I-P/2019): Demand Response through Variable Capacity HVAC Systems in Residential and Small Commercial Applications (AHRI 1380) fully supports the correct application of both OpenADR and CTA-2045 communication protocols for demand management of residential HVAC systems. This standard establishes requirements for variable capacity HVAC systems 65,000 Btu/hr and less that are capable of supporting DR strategies to benefit the electric grid in a predictable manner and to facilitate end users to participate in DR, price response, or similar incentive programs offered by electric utilities or related entities. AHRI 1380 does not seek to limit either manufacturers or utilities from choosing the optimal protocol for their needs, while supporting competition and innovation. However, to prevent protocol selection varying by zip code, AHRI encourages the utilities to support multiple compliance pathways that would be adopted state-wide. To comply with AHRI 1380, manufacturers’ descriptive and technical literature

¹ CEC Staff Paper, Introduction to Flexible Demand Appliance Standards. CEC-400-2020-013. November 2020.

² Comments of SACRAMENTO MUNICIPAL UTILITIES DISTRICT on Load Management Rulemaking, CEC Docket 19-OIR-01, March 16, 2020

for DR-ready HVAC System are required to reference Standard 1380 and designate which DR communication protocol(s) the system is capable of supporting. Further, while conformance with this standard is voluntary, conformance cannot be claimed or implied for products or equipment within the standard's purpose and scope unless such product claims meet all the requirements of the standard, and all of the testing and rating requirements are measured and reported in full compliance with the standard. AHRI 1380 is explicit: any product that has not met all the requirements of the standard shall not reference, state, or acknowledge the standard in any written, oral, or electronic communication. This means that products claiming compliance with 1380 using OpenADR, will be able to be used in utility programs employing OpenADR, as intended. The scope of AHRI 1380 is limited to two-stage and variable speed equipment, products that are optimal for DR programs. Multi-stage compressors allow for reduced speed operation, keeping consumers comfortable for longer at lower power inputs than single capacity products would if simply turned off. Compliance options must be available for single-stage systems, such as pairing with DR-thermostats, or other practical design options. With the California Air Resource Board (CARB) positioned to adopt regulations limiting refrigerant options to 750 global warming potential (GWP) or below for HVAC equipment, it will likely not be acceptable to completely power off HVAC equipment using A2L refrigerants. The HVAC equipment needs the ability to keep refrigerant sensors powered and operative, along with the ability to turn on air circulation fans, ventilation fans, and other required mitigation measures operational in the unlikely event of a detected refrigerant leak during a DR event. Thus, it is even more critical that CEC adopt AHRI 1380, because then HVAC OEMs will have the proper safety responses embedded into all the controls.

To ensure cost effectiveness of standards for appliances to facilitate the deployment of flexible demand technologies, CEC in consultations with the California Public Utilities Commission (CPUC) must ensure that all utilities in California implement plans to accept all communication protocols specified in consensus performance standards for appliances. Diverging utility actions on preparedness for communication protocols will hinder widespread adoption of flexible demand technologies. Additionally, CEC must ensure that existing communication protocols in California's 2019 Building Energy Efficiency Standards (Title 24, Part 6) are not adversely impacted because of any new CEC standards activity as regulated parties have already made significant efforts to ensure that demand responsive controls satisfy the criteria set forth in Title 24.³

AHRI is also developing AHRI Standard 1430P, an analogous standard for residential electric resistance and heat pump water heaters, but with a broader objective to establish a more comprehensive standard and consolidate various patchwork requirements within the industry for water heaters. The standard committee, comprised of multiple interest groups, including utilities, EPA, and DOE, met for the first time in September 2020. AHRI encourages CEC to rely on California's Building Energy Efficiency Standards, Joint Appendix 13 on Water Heater Demand Management (JA13) until AHRI 1430P is complete. EPA is concurrently developing demand response standard and recently, released the first draft of the Version 4.0 ENERGY STAR specification for

³ Section 110.12(a)(1) of the 2019 edition of Title 24

Residential water heaters that includes optional connected product criteria including minimum load shifting requirements. Working collaboratively with DOE and AHRI members, EPA also issued the second draft Test Method to Validate Demand Response for Residential Water Heaters.

Harmonization with industry standards will allow manufacturers the ability to produce appliances for a broader market. Narrowing the focus of the rulemaking to apply only towards incentivizing the adoption of DR-products (e.g. performance compliance credits) will not limit product availability for consumers. While AHRI appreciates CEC's preliminary efforts to tabulate appliances within the scope of this rulemaking, AHRI recommends that CEC continue to identify opportunities to add more into the scope as performance standards become available.

If appliance-specific standards are required, multiple compliance options are necessary

As is evident from the existing or in-development standards discussed above, CEC will need to develop FDAS standards that account for the significant difference in performance requirements, operating patterns and consumption needs of various classes of home equipment and appliances. While some overarching, common frameworks will be necessary for the FDAS program, CEC should structure its work on FDAS with a focus on category-by-category standards.

Further, CEC must ensure that FDAS standards allow for multiple compliance paths even within a product-type. While utilities may be inclined to seek uniformity of implementation and a narrow compliance pathway, they will need to be flexible with implementation of FDAS. With an estimated 3,300 electric utility companies operating in the United States, and 80 in California alone, manufacturers will need different compliance pathways to continuing producing equipment that can be sold nation-wide. While performance standards are certainly preferred, there may be cases, such as CEC/HP where the standard does not cover all products available on the market, or all ways for a product to connect to the grid. For example, there are multiple ways to control and communicate with CAC/HP equipment including smart thermostats, radio signals from utilities, compliance with AHRI 1380, API-based network interfaces, and control by the consumer through a manufacturer app. While compliance with AHRI 1380 is preferred to a prescriptive requirement, the scope of the standard does not cover single-capacity CAC/HP. However, these single stage units are easily controlled either by thermostat, as first included in the 2008 edition of Title 24 (and later refined in the 2019 edition), or as utilities currently control these products, directly with a control device. Title 24's current demand response control strategy was implemented at the zone-level by requiring the temperature setpoint to adjust by four degrees Fahrenheit in non-critical zones whenever a demand response signal is received and applies to all connected CAC/HP.⁴ CEC must acknowledge that there are multiple methods to communicate with products and that multiple compliance pathways should be permitted to not exclude products from the

⁴ Section 110.2(c) of Title 24-2019

marketplace. AHRI recommends additional workshops to develop metrics and product-specific requirements.

Utilities, like manufacturers, understand the need for simplicity and options to be able to serve consumers. In comments to the Load Management rulemaking, SMUD noted, “To drive innovation, prevent future monopolistic practices, and safeguard the cost benefit for consumers, the CEC should not mandate any specific communications software, application, or apparatus.”⁵

Consumer choice is critical, so is consumer education

SB 49 acknowledges the importance of consumer choice – mandating opt-in participation for any load flexibility programs. But consumers also need to be able to choose the appliances they want and need. CEC December 14th workshop highlighted the considerations for low-income consumers and the difficulties they face. Any standard that increased the upfront cost may prove to be an insurmountable barrier that would drive a low-income consumer to less efficient, less expensive options for space heating and cooling, or in the worst case, may cause consumers to forgo necessary equipment replacements. It is important to note that for many classes of equipment, adding DR capacity is not simply a matter of adding components. Rather, conversion requires a complete overhaul of the equipment control system from electro-mechanical control to electronic control. This causes not just a marginal cost increase but can shift entire product cost structures. HVAC equipment and water heaters are necessities, not luxuries. In CDC’s June 2020 analysis of heat-related deaths in the United States, key finding was that, “Observed differences in heat-related mortality across racial/ethnic groups can also be associated with social vulnerability, which often tracks with factors leading to heat exposure (e.g., less green space and more heat-absorbing surfaces), health disparities manifested by lower income, and absence of structural adaptations such as air conditioning.”⁶ Similarly, in June 2020, *The Guardian* published an article noting that, “in the last six decades, the number of annual heatwaves in 50 US cities has, on average, tripled.”⁷ All California consumers need access to affordable HVAC and water heating equipment.

When HVAC equipment or water heaters are replaced in an existing home, it is often done upon failure of the current system. The homeowner has typically not planned or budgeted for the replacement. This circumstance needs to be considered and evaluated in the next Staff Report.

It is critical that any Appliance Standards enacted do not prohibit the sale of any non-communicating products. Not all appliances include electronic controls that allow for

⁵ *ibid*

⁶ CDC June 19, 2020 Morbidity and Mortality Weekly Report, Heat-Related Deaths in the United States, 2004-2018 <https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6924a1-H.pdf>

⁷ “Deadly heat is killing Americans: A decade of inaction on climate puts lives at risk” June 16, 2020. *The Guardian*. Accessible, here: <https://www.theguardian.com/us-news/2020/jun/16/climate-deaths-heat-cdc>

effective flexible demand response. Many lower-cost home appliances use electro-mechanical controls. These controls are simpler and allow manufacturers to produce appliances that distributors may sell to lower income consumers at prices significantly lower than those offered for higher cost electronic controls models. Any standards adopted be limited to products marketed as DR.

While AHRI 1380 does not specifically address single-speed systems, incentivizing time-based demand response programs for this equipment have been implemented successfully across the country and should be evaluated. These programs include, but are not limited to, direct load control, time of use, and peak time rebates. CEC should coordinate with CPUC to enhance the incentive pathway and make DR programs attractive and cost-effective for customers with single-speed systems to voluntarily enroll in such programs.

AHRI encourages CEC to facilitate conversations between appliance manufacturers and utilities to develop these DR programs. These conversations should also include consumer education regarding the impact to appliance operation. Once these programs are in operation, there are several complications that may interfere with the nominal function of a connected appliance. In those situations, consumers will need to be made aware of which problems are related to utility demand-response programs, and which problems are related to the product itself.

Connected appliances offer consumers benefit beyond grid connectivity, that cannot be sacrificed

A consumer's remote connection allows for features such as energy management capabilities beyond demand response, meaningful consumer convenience features, and the ability to effectively integrate into whole house automation and management systems. It is important that any flexible demand standards promulgated by CEC do not limit or interfere with a consumer's ability to connect remotely to their appliance.

Cybersecurity standards should be robust but flexible

There is industry consensus around the relevant excerpt of model legislative text, below, that if adopted into regulation, would provide meaningful, and flexible cybersecurity. CEC must consider cybersecurity within the context of existing California laws.⁸⁸ AHRI recommends all connected devices certified under the flexible demand appliance standards shall be equipped with a means to protect the product consistent with one or more of the following provisions outlined in section (b), below, or follow security certifications of OpenADR2.0b. AHRI notes that section (c), below, advocates for

⁸⁸ Existing California cybersecurity and privacy laws include (1) SB-327: California Information Privacy Law on Connected Devices - https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB327 and (2) California Consumer Privacy Act of 2018 – Civil Code, Division 3, Part4, Title 1.81.5: http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?division=3.&part=4.&lawCode=CIV&title=1.81.5

a one year allowance for manufacturers to comply with newly published of an amended consensus standard; however, if a hardware change is required, manufacturers will likely require an additional year in order to fully adapt to new hardware, including possible recertifications.

(a) A manufacturer of an IoT device shall equip the product with a reasonable security feature or features, appropriate to the nature and function of the product, and the information it may collect, contain, or transmit, designed to protect the product and any information contained therein from unauthorized access, destruction, use, modification, or disclosure. Compliance with subdivisions (b) and (c) of this section fulfills the requirement of this Act to equip an IoT device with a reasonable security feature or features but compliance with subdivisions (b) and (c) of this section is not the sole sufficient method of equipping a product with a reasonable security feature.

(b) Equipping an IoT device with a means to protect the product consistent with one or more of the following:

- (i) A consensus standard that addresses commonly known or reasonably foreseeable vulnerabilities where such consensus standard is effective on the date of manufacture of the product shall be deemed a reasonable security feature or features under subdivision (a). Examples include ANSI/UL/CSA 2900 or ANSI/CTA 2088;
- (ii) A security rating from a Certifying Body (CB) with a recognized expertise in security or connected or IoT technologies. Examples include security ratings programs at UL, Intertek, CSA, or CTIA; or
- (iii) Design features that are based on widely recognized guidelines such as NISTIR 8259, the CSDE C2 Consensus Guidelines, or IEST Safe By Design - UK Code of Practice for Consumer IoT Security/ETSI TS 103 645; or
- (iv) Standards and guidelines promulgated by the National Institute of Standards & Technology under the Cybersecurity Improvement Act of 2020.

(c) When a consensus standard is used as the basis for determining that an IoT device has been equipped with a reasonable security feature or features under subdivision (b) of this section and that consensus standard is amended, a manufacturer whose products conform to the previous version of the consensus standard shall be deemed to have equipped its IoT device with a reasonable security feature or features under subdivision (b) of this section so long as the product is manufactured not more than one year after the effective date of the amended consensus standard.

OpenADR2.0b includes robust security provisions. This protocol is explicitly referenced in both AHRI 1380 and Title 24. For example, OpenADR 2.0b specifies the necessary level of security essential to meet the U.S. cybersecurity requirements for data

confidentiality, integrity, authentication, and message-level security. Such security requirements are essential for non-repudiation and to mitigate any resulting cybersecurity risks. The following security levels apply to OpenADR 2.0b: a). Standard Security (mandatory); and b). High Security (optional).

Section 9.2 of OpenADR 2.0b⁹ specifies that TLS 1.2 must be used to encrypt all traffic, regardless of the authentication method used. The client must always validate the server's TLS certificate given during the handshake. Subsection 9.2.1.1 further prescribes the steps related to establishing validity of a certificate during the TLS 1.2 handshake, establishment of connection, and authentication. All clients are required to support the authentication provisions in subsection 9.3.4.7.

Per Section 10, OpenADR 2.0b¹⁰ aspires to conform to the cybersecurity requirements prescribed by NIST and requires manufacturers to refer to the latest version of the NIST Special Publication 800-131A when choosing a security algorithm. Subsection 10.1 of OpenADR 2.0b states that "Standard" security uses Transport Layer Security (TLS) 1.2 for establishing secure channels between a VTN and a VEN for communication. "High" security additionally uses XML signatures providing non-repudiation for documentation purposes. To provide security services like authentication, confidentiality and integrity, Virtual End Nodes (VENs) and Virtual Top Nodes (VTNs) must use Public Key Infrastructure (PKI) certificates. Subsection 10.4 mandates default cipher suites related to the ECC and RSA PKIs along with TLS 1.2, unless there exists a specific TLS and cipher suite combination for a specific VTN and VEN configuration. Expired certificates are not allowed to be used. CEC should explicitly permit the use of OpenADR2.0b as providing meaningful security for DR.

Effective date must be reasonable

AHRI is concerned that a one year after compliance date after the finalization date would not provide sufficient time for all types of HVAC equipment to comply. Direct adoption of AHRI 1380 will shorten the compliance time for variable speed and two stage products, as a certification program is currently under development. For the certification program to support CEC compliance, the standards must not differ from current basic demand response functions with that type of equipment. If the standard significantly impacts this equipment, then a three-year effective from the publication of the final rule would be the minimum requirement.

There also must be confirmation from the utilities that there will be programs will be ready for consumers to participate in. As of June 2020, California's 80 electric load-serving entities includes six investor-owned utilities (IOU), 48 publicly owned utilities, 4 rural electric cooperatives, 21 community choice aggregators, and 15 electric service

⁹ OpenADR 2.0 Profile Specification. Accessible online, here: <https://openadr.memberclicks.net/specification>

¹⁰ *ibid*

providers serving the state's deregulated electricity market.^{11,12} If time-varying rate structures and DR programs have not been fully launched by the compliance date, consumers will have been saddled with extra cost, without any benefit. AHRI recommends that in the next Staff Report, CEC include a full analysis of the status all 80 load serving entities. If CEC is to promulgate a regulation, consumers must be guaranteed the opportunity to participate in a DR program. Utilities must also ensure they can accept all communication protocols specified in consensus performance standards for appliances. Stakeholders must be apprised if some or all the utilities are not currently capable of creating and managing DR programs, and how long California consumers would need to wait. Any regulation needs to ensure that the investment by the manufacturing community is put to good use in a timely manner.

Responses to CEC Staff Report Questions

AHRI responses to CEC Staff Report questions are as follows:

Flexible Appliance Demand Response Modes

- What demand response mode signals are accepted by flexible appliances? And why should this standard be considered as a priority?

AHRI Response: For water heaters, CTA-2045-A lists out communication for several different messages and modes to send back and forth to the appliances; however, there are only a few that mandatory such as Shed, Critical Peak Event, and Grid Emergency. AHRI notes that for water heaters these should be mandatory because they allow the utility to restrict energy usage based on the supply on the grid, while also limiting the effects on homeowner. Load Up is an example of a non-mandatory message that can also benefit the utility based on supply; however, Load Up is typically used on off-peak times. AHRI recognizes the availability of CTA-2045-B, an updated version with added functionality, however members are still evaluating to determine changes and time frame to transition. AHRI Standard 1430P is still under development and exact communications protocols have not been finalized.

The mandatory demand response signals in AHRI Standard 1380 (I-P/2019): Demand Response through Variable Capacity HVAC Systems in Residential and Small Commercial Applications includes general curtailment (30-percent reduction in input power, critical curtailment (60-percent reduction in input power, grid emergency (power system off), pending event notification, and customer

¹¹ CEC Electric Load-Serving Entities in California <https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/electric-load-serving-entities-lses>

¹² [List of registered ESPs](#), provided pursuant to California Public Utilities Code Section 392.1(a), and PUC Decisions (D).98-03-072 and 03-12-015

override.^{13,14} Curtailment commands are limited to a maximum temperature drop of 4 °F in heating mode. The management of dual-capacity equipment is slightly different for curtailment signals. While a dual-capacity system would respond to a general curtailment by using one of two compressors, the response to the critical peak event would not be supported. In the case that the utility DR administrator system, upon receipt of a “not accepted” signal from discretely variable capacity equipment it may then automatically send a “General Curtailment” or “Turn off” signal depending on the agreement with the customer. There is an optional utility peak load price signal command that informs HVAC system that a peak price period is in effect and of the relative price value during this event. This function is differentiated from the “Curtailment” functions in that a response is not mandatory. Manufacturers that elect to include this feature may provide consumers with the ability to configure how they want the equipment to respond automatically to utility peak load price signals. AHRI supports utilities adopting the standardized requirements for DR-ready HVAC systems, DR program managers can be assured the equipment is enabled to communicate in standardized messages on OpenADR 2.0 standardized DR communication protocols. The AHRI certification program for AHRI 1380 is expected to be launched within the year.

- What responses are provided by the flexible appliance?

AHRI Response: Most water heater legislation currently is vague on this topic among others; however, to some degree, the response of the heater is the manufacturer's discretion. For instance, when a Shed message is received, a heat pump water heater turns off the elements (leaving only the heat pump running) until the tank temperature is low enough that the User's "needs cannot be met." This is a threshold that is determined by the manufacturer, who is ultimately responsible for the performance of their product in the field.

CAC/HP responses to the utility required by AHRI 1380 are limited to verifying connectivity, systems capabilities, maximum indoor temperature offset, operational state query response, and acknowledgement of receipt of signals. Refer to Tables 1 and 2 of AHRI 1380 for the complete list of signals and responses.

- Can an appliance react to a price or a GHG signal to modify its operation? If so, describe the modification to the operation.

AHRI Response: For water heaters, similar to the modes that result from the commands above, appliances can react to pricing signals at the discretion of the

¹³ For single-phase and 3-phase <65,000 ACs and HPs, refer Tables 1, 2, 3 and 4 of AHRI Standard 1380-2019 for details related to communication, discovery and management across multiple communication protocols.

¹⁴ AHRI Standard 1380 references the rated load conditions in AHRI Standard 210/240 as the baseline for power reduction. A_{Full} applies in cooling mode for all products. H1_{Full} for two-stage HPs and H1_{Nom} for variable-speed HPs are applicable in heating mode.

manufacturer. If an appliance receives 24 hours of pricing data, the manufacturer can take that information and plug into an algorithm to determine how the appliance can operate. For instance, if the highest price occurs between 5pm and 9pm, a heat pump water heater may do the exact same function as a Shed message (mentioned above), which would ultimately, reduce the amount of energy being used unless the User's "needs cannot be met".

For certain systems in the scope of AHRI Standard 1380-2019, communication and discovery provisions help establish a relationship between a virtual top node and a virtual end node. The establishment of such a relationship opens up DR and energy storage opportunities (i.e., thermal energy storage via pre-heat or pre-cool while utilizing a building's thermal mass). AHRI Standard 1380-2019 also helps reduce transients in the electrical grid via a ramp requirement of greater than or equal to 5 seconds for variable-speed systems. AHRI 1380 includes an optional utility peak load price signal command that informs HVAC system that a peak price period is in effect and of the relative price value during this event. This function is differentiated from the "Curtailement" functions in that a response is not mandatory. Manufacturers that elect to include this feature may provide consumers with the ability to configure how they want the equipment to respond automatically to utility peak load price signals. Use of this signal is not a requirement of complying with AHRI 1380.

- Identify communication and load control requirements to enable flexible demand in appliances.

AHRI Response: AHRI 1380 provides two main protocols to communicate to CAC/HPs – OpenADR 2.0 and CTA-2045-A. Compliance with the standard does not dictate which protocol the manufacturer should take, but under minimum data requirements for published ratings, specifies that the manufacturer include in relevant advertising if the product uses either or both acceptable protocols. The standard includes flexibility with interfaces communicating to the Virtual End Node (VEN, HVAC system in this case) specifically including IEEE/ISO/IEC 8802-2 (Ethernet) and IEEE 802.11 (Wi-Fi) with the option of access to a Cloud Server. In the case that Wi-Fi is utilized, the manufacturer shall provide a means by which the consumer can commission the HVAC system to their Wi-Fi LAN, including SSID and security settings. The manufacturer can also provide consumer means to terminate VEN signals at manufacturer Cloud Server to enable that other service capabilities can be reliably and correctly provisioned. The test setup may also include a thermostat, system controller, or establish connectivity with a remote communication device. For the Cloud Server approach, the HVAC system shall be registered with an account on the server associated with the manufacturer or an aggregator. To be in compliance with AHRI 1380, the manufacturer is required to provide written instructions on account setup, access, and use. While the CTA-2045 port is more straight forward, in either method, the messages from the utility to the devices are roughly the same.

To be in compliance with JA13, for water heaters marketed as DR, the equipment must be equipped with a demand response function and be capable of receiving the following automatic event responses: basic load up, advanced load up, return to standard operation, light shed, deep shed, and full shed. Water heaters are also required to permit homeowners to override and permanently disable demand management features. Importantly, JA13 requires that a thermostatic mixing valve conforming to ASSE 1017 shall be installed on the hot water supply line following all manufacturer installation instructions or the water heater shall conform to UL 60730-1, ASSE 1082, or ASSE 1084.

- Describe the benefits and costs to the consumer, and to the manufacturer, of an internal vs. an external communications module that accepts signals for flexible demand modes.

AHRI Response: The decision to include internal versus external communications module, CTA-2045 for example, will vary based on manufacturer, appliance type, and sometimes, specific product. To use CAC/HP as an example, it is possible to comply with AHRI 1380 using CTA-2045 or OpenADR over wireless Ethernet IEEE 802.11 with the option of access to a Cloud Server. The Open ADR controls could be located in the indoor or outdoor unit of a split system or reside in the manufacturer's thermostat. Water heaters have similar options, a CTA-2045 port, or integrated internal controls. Many lower-cost home appliances use electro-mechanical controls. These controls are simpler and allow manufacturers to produce appliances that distributors may sell to lower income consumers at prices significantly lower than those offered for higher cost electronic controls models. Simpler products may be more easily controlled by a utility smart meter or radio device. Any regulation should not limit manufacturer options to comply and delivery a full range of products to California consumers.

Flexible Demand Appliance Standards

- What flexible demand appliance standards would you propose?

AHRI Response: Any flexible demand appliance standard should be limited to products advertising connectivity with grid benefits. As outlined in these comments, introducing the requirement for all products sold in California will limit consumer choice and impose significant costs on consumers. AHRI supports standards on two-stage and variable speed products marketed as DR to be compliant with AHRI 1380. For single-speed systems marketed as DR, AHRI encourages the incentivizing of time-based demand response programs such as direct load control, time of use, and peak time rebates.

For water heaters, any DR standards should align with aspects of those already in place, in addition to industry standards presently being developed such as AHRI Standard 1430, which is expected to be finalized soon. Water heaters should continue to follow JA13 until AHRI 1430P is published and a certification program is launched.

- Would the standard proposed rely on appliance design or performance criteria?

AHRI Response: Standards should rely on performance criteria, when possible to promote innovation and lowest cost. Where that is not possible, even within a product-type, design features should be considered, as an optional compliance path.

For water heaters, this question is being considered by industry in the formation of AHRI Standard 1430 and information may be forthcoming once the standard is finalized.

- What flexible demand appliance test procedures would you propose for performance criteria?

AHRI recommends AHRI 1380 for two-stage and variable speed CAC/HP. For water heaters, industry is currently considering this question in the process of finalizing AHRI Standard 1430. More information may be forthcoming pending finalization of the standard.

Cost-Effectiveness and Avoided Greenhouse Gas Emissions

- Identify costs of a flexible demand appliance compared to a standard appliance including purchase price, installation, operation, and communications technology costs.

AHRI Response: Regardless of method of DR control, the purchase price of a DR product is usually higher than the standard appliance. The communications cost is either built into the price of the appliance or absorbed by the utility company to provide DR functionality.

For the state of California to be able to implement a successful flexible demand appliance standards strategy, it is imperative that California utilities be able to accept all communication protocols specified in consensus performance standards for appliances. California utilities have already shown successfully that when called upon by their state-based statutory requirements, California utilities are to meet or exceed aggressive goals (e.g. renewable energy targets set by SB 100). California's current renewable portfolio standard provides further confirmation of utilities being well on track to meet these state targets.¹⁵

However, it is not clear how many California utilities are currently offering time-varying rate structures and to quantify the consumers served by these utilities. As outlined in these comments, it can take nearly one decade for a utility to change rate structure in a careful, regulated process. AHRI does not support limiting California consumer choices, particularly when there may be no immediate or

¹⁵ <https://www.cpuc.ca.gov/rps/>

future plans for certain jurisdictions to offer a viable DR program. AHRI urges CEC to only adopt standards for products marketed as DR and to investigate the number of consumers that would be adversely impacted by virtue of not having a program to participate in.

- Identify benefits of participating in flexible demand appliance programs including rebates, utility bill savings, and environmental and health impacts.

AHRI Response: AHRI notes that connected products help the utility control their grid and reduce the energy use during peaks, ultimately reducing the energy bill for the homeowner. Connected products also offer non-energy benefits to consumers. An incentive-based approach to flexible demand appliance standards is essential to the swift adoption of DR-enabled technologies while making them cost-effective for consumers.

As the environmental benefits are well realized through DR-enabled systems during peak load events, full load requirements should be waived for DR-enabled products meeting the provisions of flexible demand appliance standards. For example, EER as a metric is rendered irrelevant if a DR-enabled system is able to shape its behavior in accordance with a utility's signal during a peak load event. Since California is part of the U.S. Southwest, the minimum DOE regional standards would remain applicable for ACs installed in the state, but generally speaking, incentive programs should move away from full load requirements for such products.

- Identify needs of disadvantaged communities and how proposals may affect these communities.

AHRI Response: Setting standards on all products would certainly increase the cost of products and reduce choices, negatively impacting all consumers, but particularly disadvantaged communities. CEC should analyze if the utilities serving predominately disadvantaged communities are poised to serve these customers with time-varying rate structure programs. Adopting AHRI 1380 without an option for single stage equipment would certainly significantly increase the cost of products for all consumers.

Utilities could increase rebates for DR-capable products in disadvantaged communities.

- Identify types of flexible demand programs offered by government, utilities, and third parties.

AHRI Response: Coordination with Federal agencies and regulating bodies is particularly important, particularly surrounding cybersecurity for appliances. NIST's

Smart Grid Interoperability Panel and the Consumer Product Safety Commission¹⁶ are pursuing research and regulatory efforts to establish a baseline of reasonable security needs for connected products.

Utilities have different preferences as to what programs they utilize. This is one reason AHRI supports the Consortium for Energy Efficiency (CEE) Residential Heating and Cooling Systems Initiative, published January 15, 2021.¹⁷ These specifications, developed through a stakeholder process with much industry engagement, offer utilities a slate of options for efficiency and DR programs to adopt. For connectivity and load management, the specification recognizes both performance-based and features-based approaches, where necessary. For example, connected thermostats can qualify using performance-based criteria (US EPA ENERGY STAR® Connected Thermostat Program Requirements Version 1.0 and Method to Demonstrate Field Savings Version 1.0) for applications in conjunction with single speed systems or a features-based approach for applications in conjunction with variable speed systems. The specifications recognize AHRI 1380 as the compliance path for two-stage and variable speed HVAC systems. There are energy management criteria for other electric and gas systems. For CAC/HP, EPA ENERGY STAR version 6.0 specifications also includes connected criteria; however, AHRI has expressed significant concerns with version 6.0 and has opted to not support certification for CAC/HP.

The first draft of the Version 4.0 ENERGY STAR specification and the second draft Test Method to Validate Demand Response for Residential Water Heaters was issued in October 2020. AHRI recommended harmonization with CEC's JA13, particularly with respect to the installation of a thermostatic mixing valve, both during the test procedure and when installed.¹⁸ AHRI also recommended EPA correct ambiguity regarding the water heater's set temperature. AHRI's assumption is that the water heater for validation testing should be set in accordance with the outlet temperature as specified by the DOE test procedure. These critical safety precaution must be accounted for in any DR program or in specifications. Of course, AHRI also notes that AHRI 1430P is under development.

Lastly, AHRI notes that every 5 years DOE issues a request for information to collect information on issues concerning the physical characterization of grid-connected commercial and residential buildings end-use equipment and

¹⁶ Consumer Product Safety Commission, The Internet of Things and Consumer Product Hazards Notice of Public Hearing and Request for Comments [Docket No. CPSC–2018–0007]

¹⁷ CEE Residential Central Air Conditioners and Air Source Heat Pumps Specification accessible, here: <https://library.cee1.org/content/cee-residential-high-efficiency-central-air-conditioners-and-air-source-heat-pumps-specifica> . The accompanying Initiative paper is accessible, here: https://library.cee1.org/system/files/library/12006/CEE_ResHVAC_Initiative_15Jan2021.pdf

¹⁸ Version 4.0 ENERGY STAR specification for Water Heaters is currently under development. Materials related to this revision process are accessible, here: https://www.energystar.gov/products/spec/residential_water_heaters_specification_version_4_0_pd

appliances, including but not limited to processes and metrics for measurement, identification of grid and building services that can be provided, and identification of values and benefits of grid connectivity. AHRI recommends CEC staff review relevant docketed material from the last issuance.¹⁹

Cybersecurity

- What minimum cybersecurity protocols should be required?

AHRI Response: AHRI recommends CEC rely on existing cybersecurity standards that provide robust security, and which are appropriate for each device type and function in the broad flexible demand ecosystem of products. This can be achieved by adopting the principles outlined, above.

Compliance Assistance and Enforcement

- Staff believes the current Appliance Efficiency Enforcement regulations provide a good template for the Flexible Demand Appliance Standards (Title 20, Sections 1608 and 1609) and seeks comments on approach to enforcement of new flexible demand appliance standards.

AHRI Response: Products certified to AHRI 1380 could be submitted via AHRI using the Modernized Appliance Efficiency Database System (MAEDbS); however, it is very likely that changes will need to be made to Title 24, particularly for products that need to employ a design feature to comply. As CEC staff is aware, the adoption of the 2022 edition of Title 24 is scheduled for the June 2020 Board meeting. If changes are not made to the California Building Energy Standard, it is difficult to envision a clear, comprehensive approach to enforcement

For water heaters, AHRI recommends the compliance mechanism in place in JA13. To receive the HPWH Demand Management System compliance credit, the completed Certificate of Installation shall be a model that has been certified to the Energy Commission as qualified for the credit. As part of their normal enforcement activities, this certification shall be subject to local building department checking.

- What unique considerations should be given for enforcement of flexible demand appliance standards as compared to the existing appliance efficiency enforcement approach?

AHRI Response: AHRI notes that many, if not most, single and two-stage CAC/HPs are not supplied with an OEM thermostat. In this case, a compliant thermostat may be required to enable DR status, unless communication happens directly with the equipment. In this case, it is not clear who is accountable in enforcement.

¹⁹ DOE Physical Characterization of Smart and Grid-Connected Commercial and Residential Buildings End-Use Equipment and Appliances, Docket EERE-2014-BT-NOA-0016

AHRI also recommends that for products complying with AHRI 1380, utility programs not include full load requirements in DR-programs. These products include multiple ways to control the input power during grid events and thus performance at full load no longer needs to be considered as a program requirement.

AHRI appreciates the opportunity to provide these comments and would like to continue to be engaged with this effort as CEC develops its future work in this arena. If you have any questions regarding this submission, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read 'LPG', with a long horizontal flourish extending to the right.

Laura Petrillo-Groh, PE
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