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Written Comments for Commissioner Workshop on Scope of Load Management Rulemaking

Part 2 of 2

Additional submitted attachment is included below.

Why We Need National Universal Open Standards for Connected Residential and Small Commercial Appliances

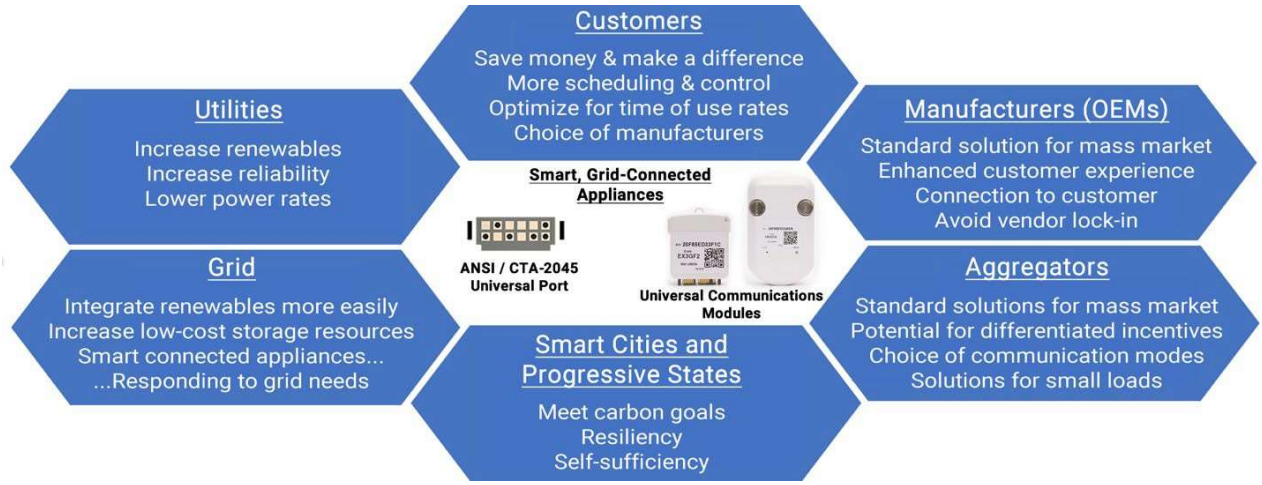
The NEED: The electric grid in the United States has an increasing need for intelligent, flexible and connected resources that can be orchestrated to balance generation and demand, in particular, the output from growing levels of wind and solar generation. The large-scale adoption of "smart," connected residential and small commercial appliances that can intelligently decrease, shift or store energy (i.e. flexibility) will be an important tool for balancing the grid, increasing resiliency, managing system costs, and enabling the integration of higher levels of renewable resources. Based on their high energy usage, flexibility potential, and number of units deployed, the appliance types that have the highest potential to cost-effectively add the intelligence, flexibility and connectivity required to support the electric grid are water heaters, HVAC equipment, electric vehicles, and pool pumps. Other appliances can be added once they can cost-effectively contribute meaningfully to the electric grid. With technologies and standards that exist today, in 20 years all of these devices could possess this intelligence and connectivity and be orchestrated as least-cost grid resources.

There are many obstacles that have prevented the production and wide-spread adoption of intelligent, connected devices. Utilities and manufacturers (OEMs) have been slow to enable standard connectivity with one another, instead piecing together expensive custom solutions. The solutions have hard-wired, embedded communication hardware (typically Wi-Fi or Zigbee, and occasionally cellular, broadcast FM, and others) to connect the appliances, or third-party load control switches to cut power to otherwise completely "dumb" appliances. Once a device is made "smart" and connected by the OEM, a utility has to connect to each OEM's cloud or choose an aggregator that has already done the integration. The need to implement these measures makes integration and orchestration expensive and unnecessarily complex, which hampers adoption.

Most importantly, none of the above connected solutions can be changed in the field to better, faster, cheaper communication methods over the entire 10- to 20-year life of the appliance. Once a communication path is manufactured into the appliance, it cannot be changed unless the OEM provides its own retrofit "module" or "dongle." Forcing the utilities and/or integrators to manage all of these dongles for each manufacturer would be worse than managing USB charging cables; in addition, their costs and effort would undermine the economies of scale inherent in utility-scale solutions.

A **standard communication** port on appliances solves many of these issues. Inclusion of a universal port facilitates sourcing communication modules from multiple manufacturers and with different specifications at economies of scale. Utilities or retailers can stock fewer module SKUs for all the appliances in a particular service territory. As new communication technologies become available, these "plug & play"-type modules can be switched out by the homeowner with minimal effort, reducing the risk to OEMs, service providers, utilities and their customers. This allows utilities across the country to economically orchestrate appliances that meet their grid balancing needs rather than building power plants or installing expensive and lossy batteries to provide equivalent flexibility.

The Market Map below shows an overview of the market actors, their needs, and the open standard universal port option that exists today: ANSI/CTA-2045. The CTA-2045 standard, as a physical port at the appliance for a plug & play, swappable communication module, enables easier implementation of all other standards in the module, at scale, over the 10- to 20-year life of the appliance because they can be updated when needed or when cost-effective. In particular, the next section, describes how OpenADR and CTA-2045 work together to support more rapid adoption of smart, grid-connected appliances. The final section further details the needs and use cases of the market actors and how open standards help meet these needs.



Market Map: Market actors and their specific needs, value propositions, and use cases

THE SOLUTION: Universal Open Standards for Connectivity and Control

Two standards that work well together: OpenADR and CTA-2045

In 2019, the ENERGY STAR® published the Program Requirements Product Specification for Residential Water Heaters, Eligibility Criteria Version 3.3 Draft 2 which not only define the functions to embed in water heaters to increase their flexibility, but also require these functions to be accessed through the exchange of information using an open communication standard, either OpenADR 2.0 or ANSI/CTA-2045-A. These two standards were designed to complement, not compete with one another.

> OpenADR is well-suited for cloud servers and building hubs, or gateways in which the cost of a more powerful CPU and annual security certificates is modest when distributed over many appliances. OpenADR is an open information exchange model that uses standard Internet protocols and so does not require specific hardware. OpenADR can be implemented in the cloud, in the hub, or at the appliance; it is agnostic to these options. However, if OpenADR is implemented at the appliance, there is no guarantee that a different communication path or method of information exchange can be used in the future. OpenADR requires an annual SSL certificate fee. OpenADR is used by many utilities and aggregators because it is a well-established standard.

CTA-2045 was designed to provide flexibility and modularity for smart appliances. It specifically defines a standard hardware port, including the physical dimensions and communications between the CTA-2045 communication module and the smart appliance. It does guarantee that a different communication path or method of information exchange can be used in the future. The appliance only needs to know how to respond to prices or to standard grid commands that have been developed in conjunction with the Consumer Technology Association, Electric Power Research Institute (EPRI), several utilities, grid operators and OEMs. The standard port allows the CTA modules, many of which are available today, with different network communication paths (Wi-Fi, broadcast FM, Zigbee, cellular, AMI, etc.), different information exchange models (OpenADR, 2030.5), and different security schemes (SSL and TLS) to be easily installed by the customer as utilities and aggregators develop better solutions over the long life of the appliance. Additionally, the existence of the standard port prevents stranded assets, similar to Google's cancellation of the "works with Nest" working group without notice and or solution. CTA-2045 guarantees that a different module with a different communication path can simply be mailed to the customer for installation.

CTA-2045 enables broader adoption of OpenADR. The commands in OpenADR that define control functionality can be easily conveyed through the low-cost CTA-2045 physical interface at the appliance by putting it on the CTA-2045 module only when necessary or when the cost is justified. Meanwhile, less expensive CTA-2045 modules can communicate locally to an OpenADR gateway, or to an OpenADR cloud. This prevents the obligation of every appliance to bear the extra cost of adding the OpenADR interface and annual SSL certificate fee. In these ways, CTA-2045 will broaden and support the number of appliances that can be accessed by OpenADR or other grid control information exchange models such as IEEE 2030.5.

As appliances with CTA-2045 ports further penetrate the market, a wide variety of communication paths and information exchange models will be enabled; this will encourage competition and innovation, which generally results in lower costs for consumers. Utilities and aggregators can fine-tune the level of security, the communication path(s), and the information exchange models that their business models can support. The existence of a CTA-2045 port on the appliance guarantees this optionality and flexibility in a way that OpenADR alone does not, and more importantly, in a way that proprietary communication modules "hard-wired" into the appliance do not, thus future-proofing the appliance. As can be seen in the graphic below, OEMs that have hard-wired solutions can maintain them while also adding the CTA-2045 port as an option. This flexibility and future-proofing inspired Washington State to pass HB1444, which mandates a CTA-2045 port in all new water heaters sold in the state after Jan 1, 2021. The features of OpenADR and CTA-2045 work together to create a wide variety of options for low-cost, integrated solutions for customers and utilities that will accelerate adoption of orchestrated, intelligent, flexible loads for grid control.

CTA-2045 modules and appliances have been field-tested for more than seven years and the standard recently received international standard recognition as ISO/IEC 10192-3. CTA-2045 also allows appliance manufacturers to choose the means through which their appliance will communicate to the module, for example, OpenADR, CTA-2045, IEEE-2030.5 , BACnet, LonWorks and others.

Since the CTA-2045 standard does not specify, require or assume anything about the systems, networks or other components that could reside inside the communication module, manufacturers have the freedom to choose how to communicate with the module. The standard also includes many "manufacturer specific" commands to enable communication and end-use device manufacturers to exchange private information to support the value-added commands unique to a specific appliance. All the benefits of the universal communication module make economic sense only if there is a universal port on the appliance. The incremental cost to add a port on an appliance could eventually be less than a dollar, but only if it becomes the universal standard placed on millions of appliances each year. If the appliance doesn't have the port, then there is no possibility of using a standard module. CTA 2045 is a pragmatic solution to the integration of dynamic grid conditions, not just a question of cost/benefit.

*OpenADR is expensive to code, certify, and has a yearly SSL certificate cost! Put it in the module if necessary, NOT IN THE APPLIANCE

Communication path options for OEM and utility to customer through clouds or gateways

OpenADR to CTA-2045 - A Solution that Works for Everyone

Modular open standards enable appliance manufacturers and communication vendors to build to a common specification at scale that lowers capital costs and eases replacement of communication paths, information exchange models, and security to enhance the capabilities in appliances that are already installed in the field. The grid, smart cities and states, and utilities can all unleash the power of flexible smart appliances when a universal port is available in the appliances that are bought by homeowners. The biggest beneficiaries will be utilities and their customers, who will get a simple, effective, and standard experience.

CTA-2045 is a modular open standard for direct connection to smart grid appliances without the need for a communication hub in the home. In the future, a hub/gateway may benefit customers when they have several smart appliances whose control must be coordinated by an in-home energy management system. OpenADR is an open standard that can leverage a CTA-2045 port in every appliance through its location in the cloud, in the hub, or in the CTA-2045 module when desired. The telecommunications, automotive, and computer industries have all created standards that allow for lowest-cost solutions

with maximum interoperability and great customer experiences. CTA-2045 is a fitting addition to that category.

Market Actors: Detailed Needs Value Propositions and Use Cases

THE GRID is moving away from large baseload and dispatchable power plants toward more seamless integration of renewables. This adoption requires more flexibility and rapid response using a combination of increased low-cost electrical and thermal energy storage and load shifting through demand response. These can be provided by dynamic, continuous orchestration of appliance operation.

SMART CITIES AND STATES are developing aggressive carbon reduction targets to further their resiliency and self-sufficiency. Increasing electric load factors and integration of excess renewable generation will be two of their means of accomplishing these goals. Achieving these would be challenging in the absence of an integrated low-cost solution to orchestrate appliance loads, enabled by a universal standard port.

UTILITIES are facing the twin challenges of increasing demand (due to transportation and building electrification) compounded by aging grid assets. Meanwhile, the financial and environmental costs of building new generation facilities or upgrading transmission assets are becoming prohibitive. Alternatives are needed that are flexible, low-cost, and increase reliability.

DISTRIBUTED GENERATION, such as rooftop solar and storage at the grid edge, presents another challenge. A universal port allows utilities to build on their existing relationships and to proactively engage with customers, at scale, to support renewable generation by enrolling their large appliances as flexible resources. A universal port will simplify installation and sign-up, creating a standard customer experience which will increase customer adoption and lower the cost of adding these resources.

MANUFACTURERS are seeking to differentiate their products by developing smart connectivity to enhance customer experiences and maintain ongoing connection to the customer. Current cost and performance improvements in hardware for energy efficiency are running up against the limitations of physics, while energy cost is becoming increasingly important. After the successes of energy efficiency, the next phase is using connected appliances that respond in real time to grid needs, as seen by ENERGY STAR's new focus on connected appliance criteria for grid efficiency and optimization.

Due to the high cost of changing their products, manufacturers are looking for solutions that address large markets and have long lives while adding minimal cost and avoiding lock-in to a single vendor. Using the expanded market adoption created by utility programs and facilitated by a universal port, manufacturers will be able to expand the number of customers availing themselves of their value-added benefits enabled by connectivity, while capitalizing on the port's ease of use and compatibility to maximize the consumer experience (and to minimize tech support contacts due to connectivity issues).

The protocol of a universal port allows manufacturers to differentiate their products by adding unique control features. Most importantly, they can provide their own connectivity solutions in addition to the CTA-2045 port, and the marginal cost of adding one when the other is present is small. Achieving these objectives will require commitments to OEMs from states and utilities, together with streamlined

requirements that are comparable across states.

CUSTOMERS increasingly engage with smart devices as these devices penetrate the home market. They want to save money and be part of the solution for our climate future; however, they lack low-cost, convenient, and secure solutions that they can find and use easily. Similar to the manner in which standards simplify the experience of adding apps to smartphones across all phone OEMs, so too will the universal port on appliances simplify customer enrollment across all OEMs and utilities. Meanwhile, increasing energy costs and rising time-of-use rates are intensifying the criticality of customer-driven control. Apps that allow scheduling and control will enable intelligent "no-touch" energy savings that require little engagement. A universal port makes adding appliances with this functionality easy.

AGGREGATORS are pursuing standard solutions for mass market implementation that offer the potential for differentiated incentives and choice of communication modes. Availability of a universal port will help aggregators enable these types of solutions for small loads.

In parallel to the evolving needs of the above market actors, **energy markets** are moving to a dynamic, transactive model with real-time pricing, taking advantage of decreased cost and increased power of computing to forecast demand and capacity of distributed assets, and to coordinate control. These business models require up-to-date longitudinal datasets, reliable real-time communications, and the ability for appliances with diverse properties to receive grid or price signals. A universal port allows all of these to flourish at scale.

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