



## OpenADR for DER: CEA-2045 and DER Aggregation Enabling DER Integration

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## Agenda

- Context and Drivers of This Work
- ANSI/CEA-2045
- A Sample Project
- DER Group Management Initiative

# **Context and Drivers of This Work**



## Context

- Concerted worldwide industry effort to enable effective integration of individual DERs with distribution circuits
- Expectation that DER levels will continue to rise (and will cause problems if not properly managed)
- Conviction that standards will be required because of:
  - The availability of many types, brands, and sizes of DER
  - Customer-ownership and -choice of products
  - The transient nature of DER companies (here today, gone tomorrow)
- Confidence that grid codes to require smart DER will follow technical capability/readiness



## **Communication Protocols to Support Common Functions**





## **Three Classes of DER Communications**





## "Inform and Motivate" Signals

 Merely informative, these indiscriminate signals rely on the actions of a user (or a preprogrammed device) to produce a response



- least-specific
- least-directive
- Informative signals
  - In themselves might motivate a change (such as "I'll pay you \$xxx to reduce consumption")
  - Could indirectly motivate a particular course of action (such as "Tomorrow afternoon will see a critical peak [when the tariff price will be 10x higher]").
- Also includes broad signals from ISOs/RTOs
  - Flex Alerts sent to the general public
  - Emergency DR signals requesting that all available load to be shed
- Example: OpenADR 1.0/2.0a



## "Command and Control" Signals

 These signals direct specific outcomes from abstract DERs, but without indicating the mechanism by which the outcomes are to be achieved.



- For example, "Reduce consumption by X amount."
- These messages control the grid impact of DERs without specifying the means of achieving the impact.
- These are directly analogous to dispatch instructions that system operators send to generators.
- Examples: OpenADR 2.0b; IEC 62325-301 Ed. 2:2016



## "Device Manipulation" Signals

 These signals includes device-specific instructions based on knowledge of the impact of explicit actions.



- One example to a HWH might be: "Turn off heating element #2."
- These signals could be used by a local device controller.
- They are generally only part of a wide-area message system if very detailed device behaviors and configurations were known, as might be the case in vendor cloud-to-device communications or with a detailed standardized model of the device.
- Example: IEEE 2030.5 (SEP2) based on 61850 model (CA Rule 21)



# ANSI/CEA-2045



## **ANSI/CEA-2045** *A Modular Approach to Decoupling the Network*





## **Any Service Provider, Any Device**



#### **EPRI OpenADR Communication Module**

- Developed by EPRI to support field deployments
- Wi-Fi network
- AC and DC form factors
- AC tested with DWH, HPWH, and PTAC
- DC module under test and development





#### EPRI Project Update Highlights

Seven different end-use device types are being tested under this project

• Domestic electric and heat pump water heaters, pool pumps, thermostats, electric vehicle supply equipment, packaged terminal air conditioners, solar inverters

#### Eight end-use product suppliers

• AO Smith, Vaughn, General Electric, Emerson, Clipper Creek, Siemens, IslandAire, Fronius

#### Eleven communication module suppliers

 Corporate Systems Engineering (CSE), e-Radio, Landis+Gyr, Nexgrid, Intwine, SkyCentric, Rainforest Automation, Connected IO, Silver Spring Networks, Kitu Systems, Maestro

#### Informing other organizations

 Consumer Electronics Association, USNAP Alliance, AHRI, DOE ENERGY STAR, NREL, CEC, IEC, SGIP, Waseda University (Japan), ORNL, LBNL, PNNL, OpenADR, ASRAC, ACEEE



## **Emerson CEA-2045 Thermostat**

- Shipped to project members in February 2016
- Additional samples are available









## **"Smart Inverters and Smart Consumer Devices to Enable More Residential Solar Energy" (CEC EPC-14-079)**



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# **DER Group Management Initiative**



## **Group Setup**





## **Control Functions**





## Where Can OpenADR Be Used?





## **Usage Pattern 1: Direct Load Control**





## **Usage Pattern 2: HEMS/Thermostat Control**





## **Usage Pattern 3: Smart Device Control**







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