

Demand Flexibility Technology, New Programs and Emerging Policies

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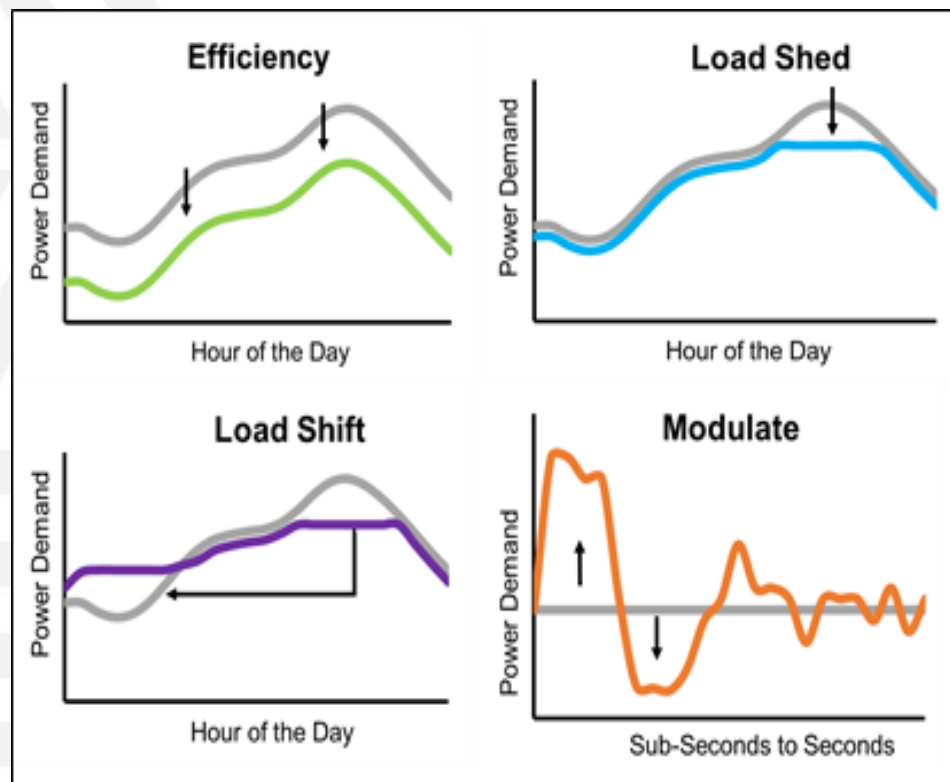
Integrated Distribution System Planning
Training for Western States
February 26, 2021

Presentation Outline

- ▶ Introduction to Grid-Interactive Efficient Buildings
- ▶ Utility Programs Using Advanced Automation
- ▶ Use of Open Standards
- ▶ California Load Management Standards
- ▶ Where Are We Headed?

Grid-Interactive Efficient Buildings

1. **Efficiency:** minimize load
2. **Load shed:** reduce load at peak demand times (event-based)
3. **Load shift:** Store energy for use during peak (routine or event-based)
4. **Modulate:** Increase/decrease loads or generation when called upon
5. **Generation:** behind the meter energy supply such as PV



Grid-Interactive Efficient Buildings Support an Electric Grid with More Renewables

Efficient Components



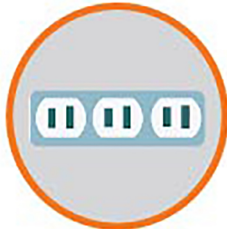
LED Lighting



Facades

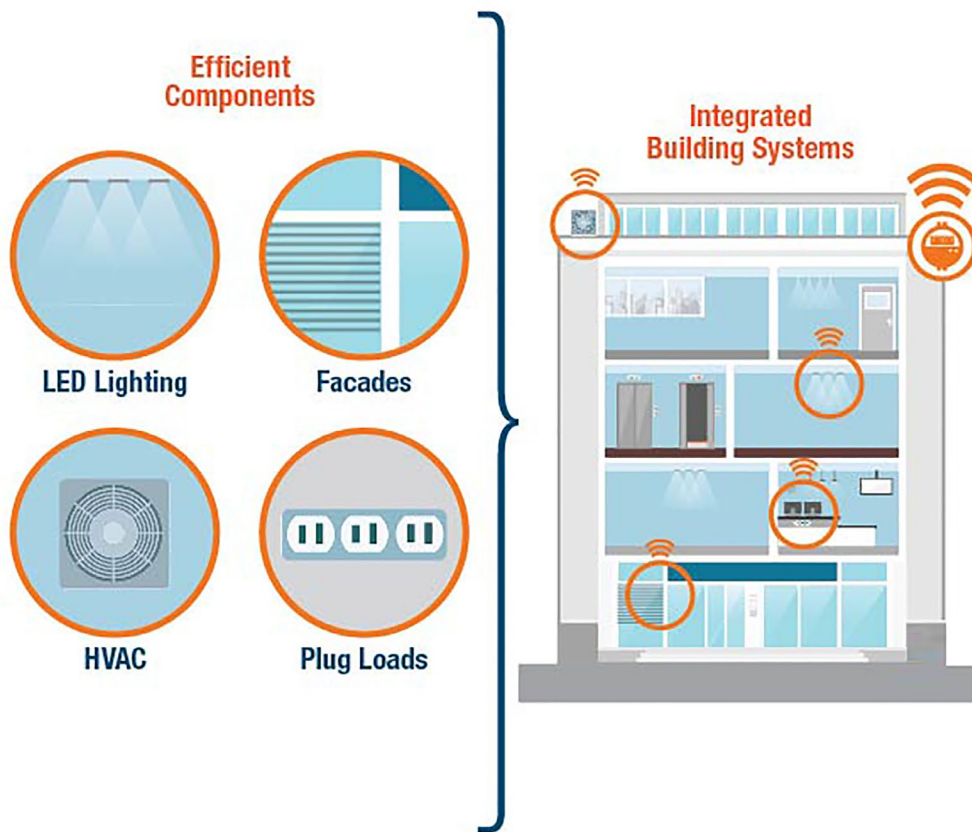


HVAC

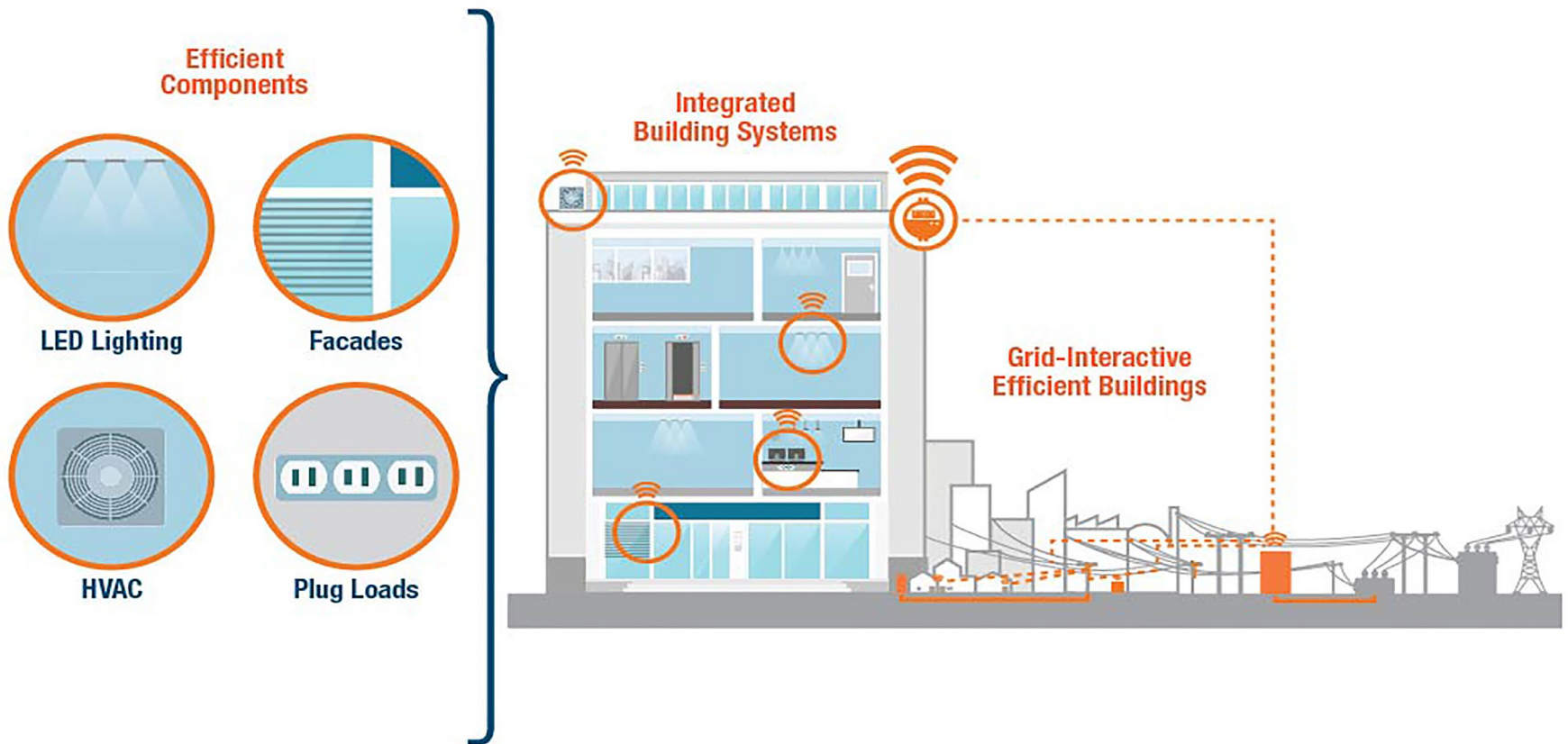


Plug Loads

Grid-Interactive Efficient Buildings Support an Electric Grid with More Renewables



Grid-Interactive Efficient Buildings Support an Electric Grid with More Renewables



Examples of Demand Response Programs in California from Investor Owned Utilities



DR Program	Program Type	Notification
Load Modifying Programs		
Critical Peak Pricing	Manual or Auto-DR	Day-ahead and Emergencies
Real-Time Pricing (RTP)	Manual or Auto-DR	Day-ahead (temperature in Downtown LA)
Supply Side Programs		
Capacity Bidding Program (CBP)	Manual or Auto-DR	Day-ahead or Day-of
Base Interruptible program (TOU-BIP)	Manual or Aggregated	15 or 30 min based on customer option
Summer Discount Plan (SDP) Enhanced Plan	Direct Load Control (DLC)	No notification time

See <https://www.cpuc.ca.gov/General.aspx?id=6442464470>

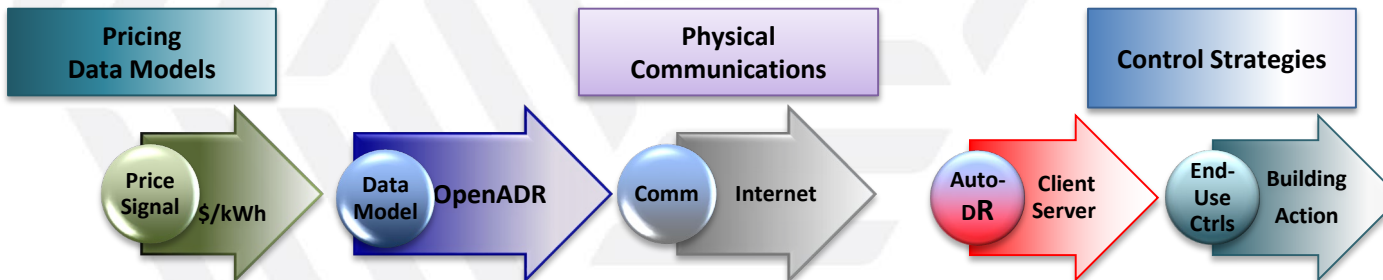
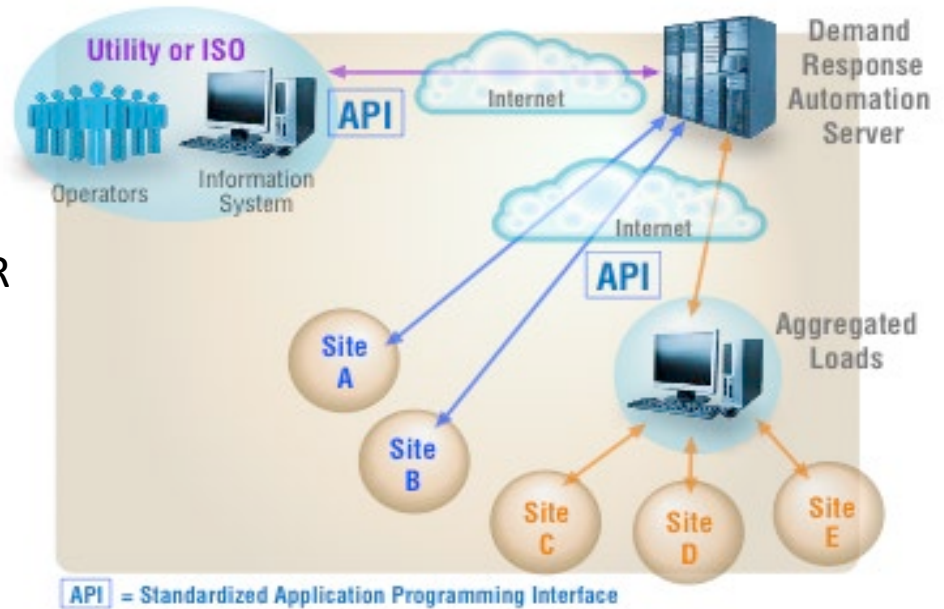
3 Current Communication Standards

- ▶ **OpenADR2.0A/B:** communications data model, with transport & security mechanisms, **facilitates information exchange between 2 end-points**, electricity service provider & customer. *Software application.*
- ▶ **CTA 2045-A:** Modular Communications Interface for Energy Management standard from Consumer Technology Association. *Hardware and software components.*
- ▶ **SEP2.0/IEEE 2030.5:** Defines mechanisms for **exchanging application messages**, exact messages exchanged including error messages, security to protect application messages. *Software application.*

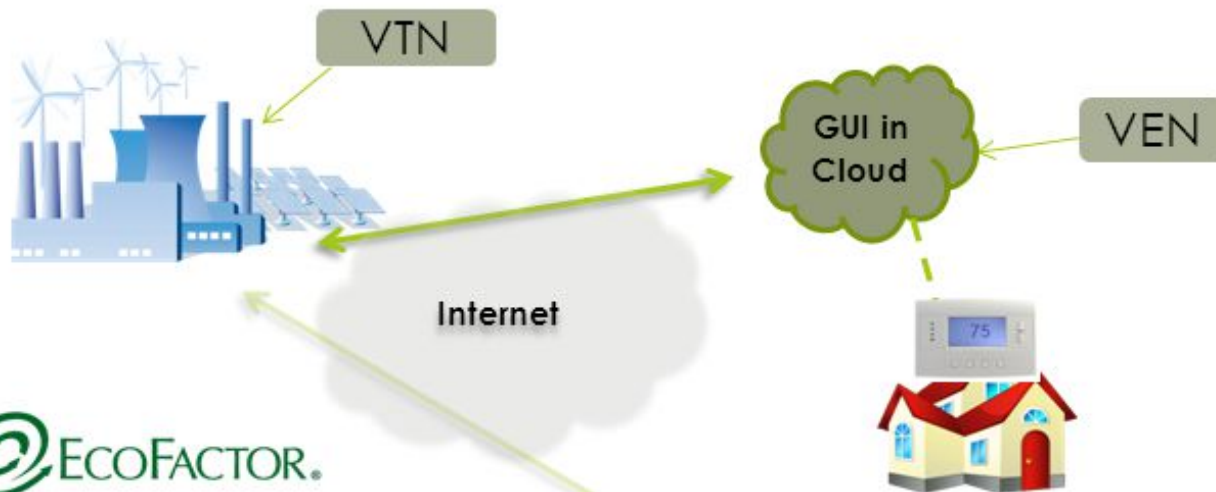


OpenADR Overview

- Server is virtual top node (VTN)
- Client is virtual end node (VEN)
- Over 160 manufacturers support OpenADR



Cloud Interface



EMERSON

Honeywell

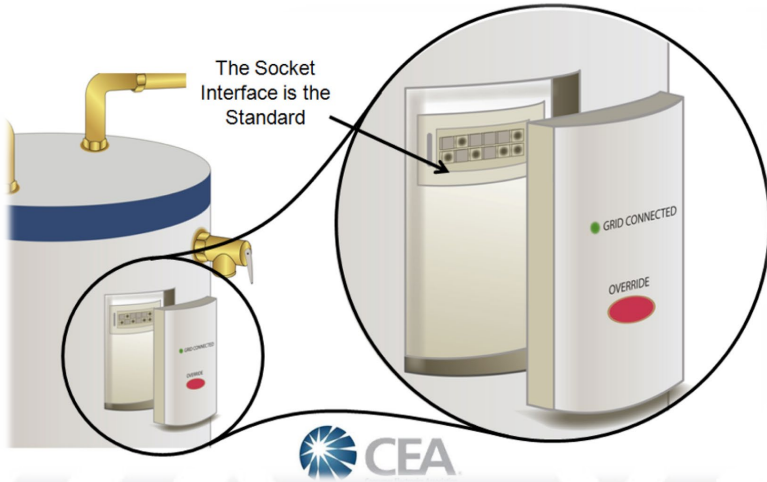
nest

thinkeco

- **OpenADR 2.0 a or b** enabled
- Retail or Operator provided or bring your own thermostat
- Cloud interface
- No resource constraints
- Feedback supported



CTA-2045 Appliance Family



PTAC – Packaged
Terminal AC



EV Chargers



Water Heaters

Pool Pumps



Heat Pump HVAC

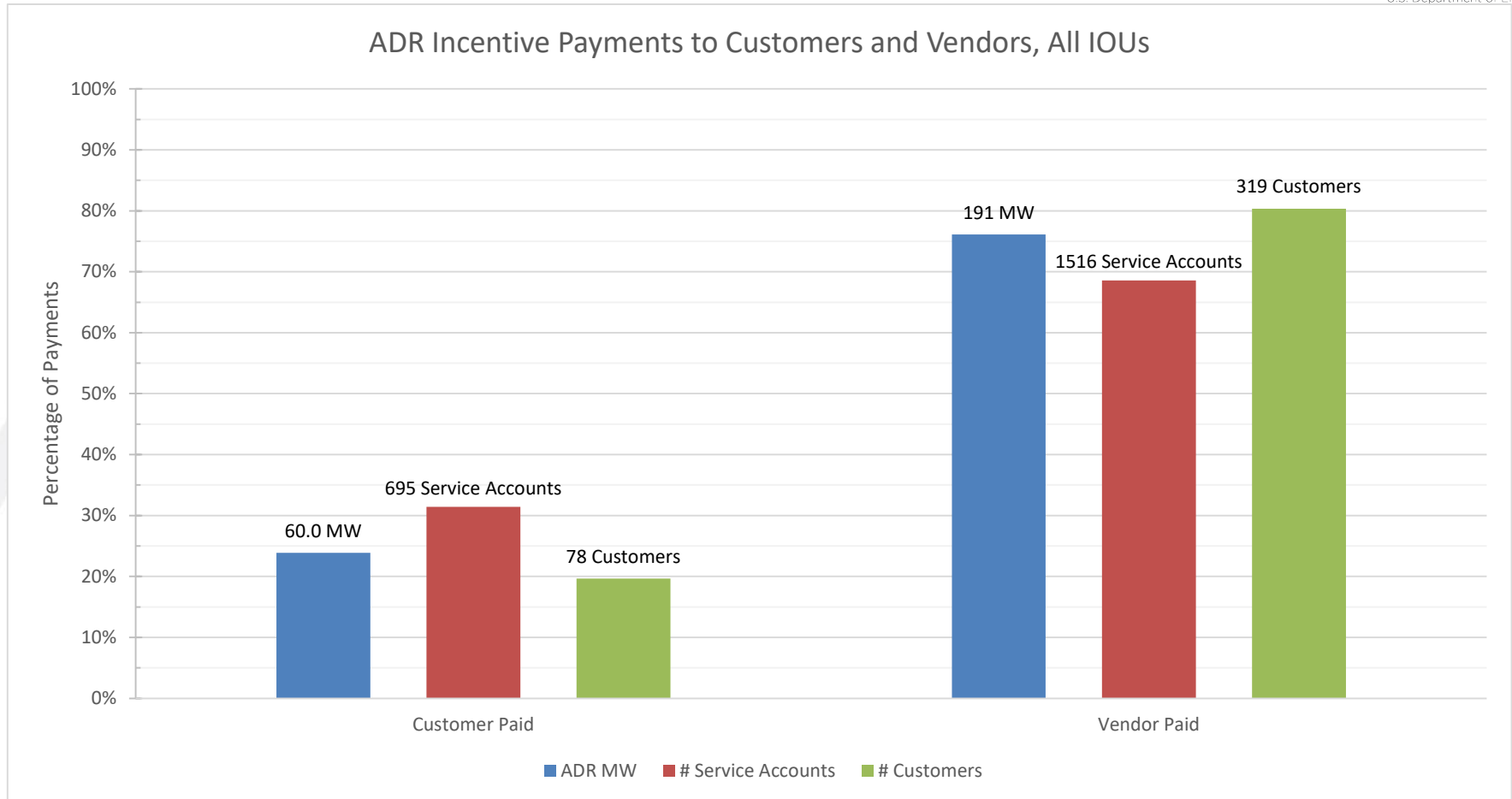
Examples of CTA-2045, OpenADR in Laws, Regulations and Programs



State	Regulation	Date of Implementation	Details
WA	SB 5115 HB 1444	January 1, 2021	New electric water heaters CTA (Heat pump 1/21, Electric resistance 1/22) 40 – 120 Gal
OR	EO 2020-04	January 1, 2022	New electric water heaters CTA (Heat pump & Electric resistance 1/22)
Energy Star National	Connected Appliances	TBD	Energy Star connected appliances need OpenADR or CTA-2045-A or equivalent standard at appliance or in cloud.
Energy Star National	Connected Appliances	Water Heaters	Connected device specification in progress
National	AHRI 1380	2019	DR-ready Variable Capacity HVAC systems rated to 65,000 Btu/hr or less shall have CTA-2045-A or OpenADR 2.0 or both.
National	AHRI 1430*	2021	DR-ready commercial water heaters to have a CTA-2045
CA	Title 24	2016	OpenADR required for Commercial HVAC, lighting and electronic message centers
CA	Title 24, JA13	July 8, 2020	NEEA Tier 3 v7, which requires a CTA-2045 port (New Construction)

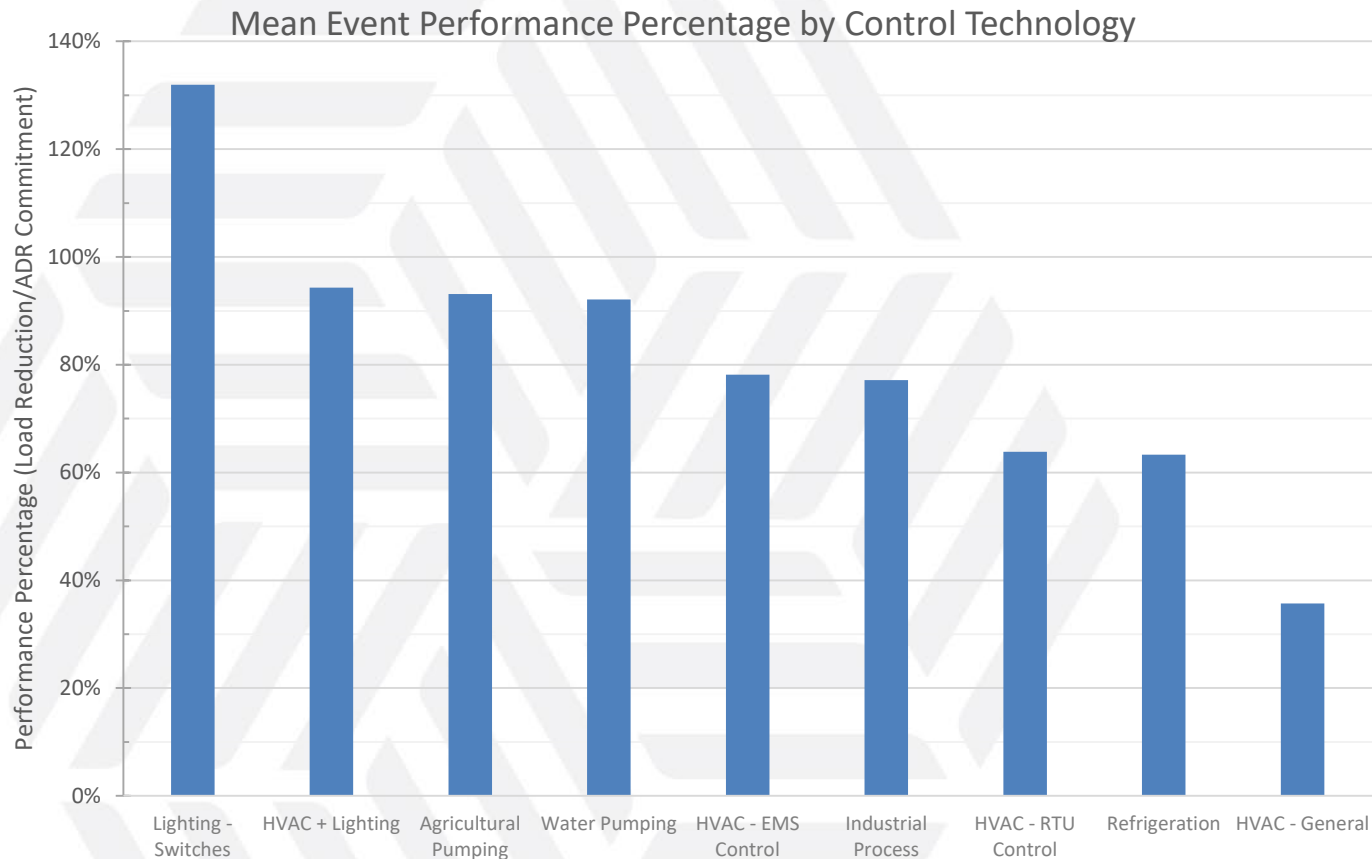
Source of data: Skycentrics. *AHRI spec in draft form

Structure of OpenADR Incentive Payments for Commercial and Industrial Programs



Source – Energy Solutions and LBNL report, *Automated Demand Response (ADR) Non-Residential Incentive Structure Research Project*. 2020. <https://www.etcc-ca.com/reports/automated-demand-response-non-residential-incentive-structure-research-project>

Examples of Performance by Technology



Source – Energy Solutions and LBNL report, *Automated Demand Response (ADR) Non-Residential Incentive Structure Research Project*. 2020.

California Senate Bill 49 Energy: Appliance Standards and State Water Project Assessment



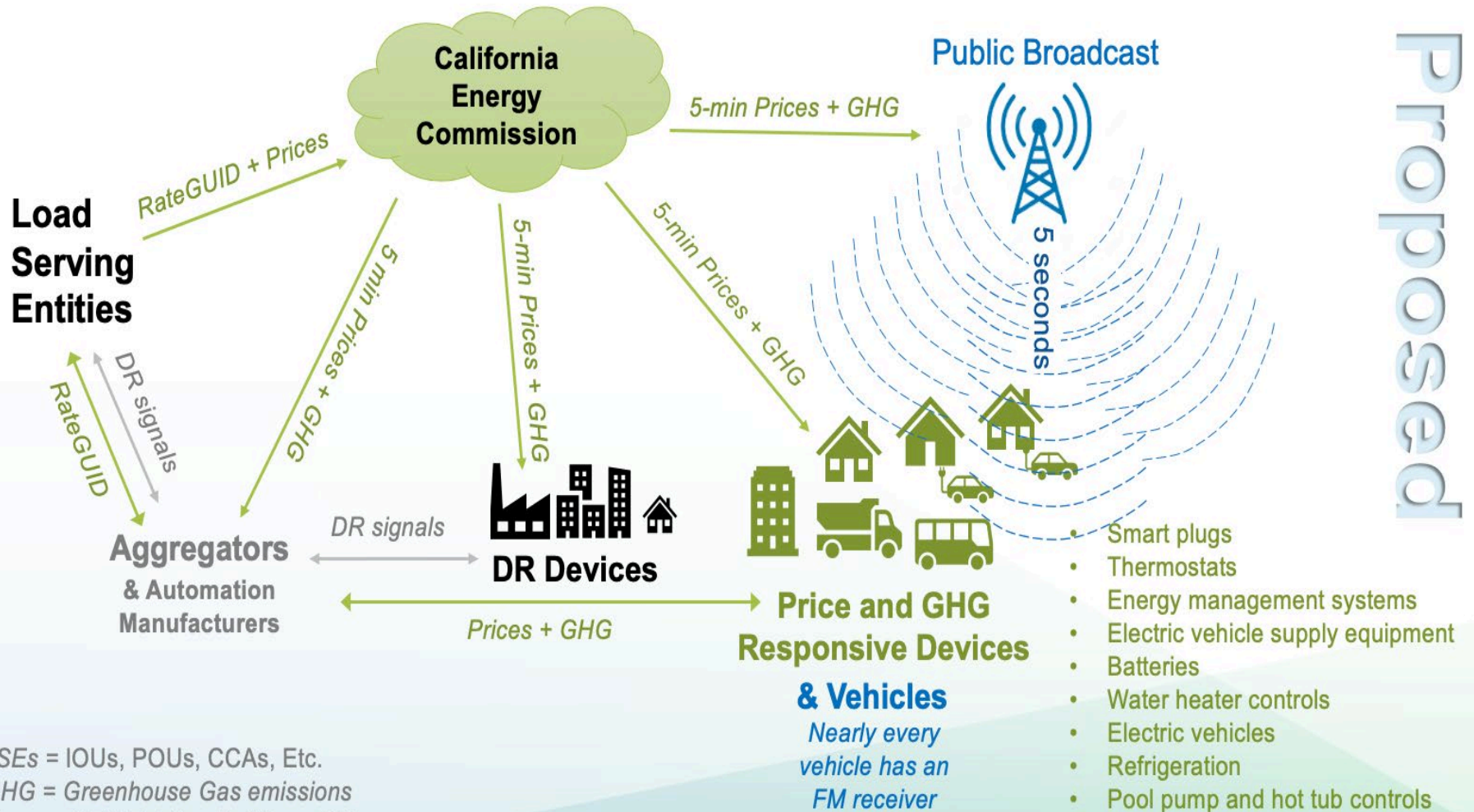
- ▶ Energy efficiency standards to **manage energy loads** to help maintain electrical **grid reliability**.
- ▶ Require California Energy Commission (CEC) to adopt and periodically update standards for appliances to **facilitate deployment of flexible demand technologies** and require standards be cost effective and prioritize appliances with specified attributes.
- ▶ CEC to consult with CPUC and load-serving entities to align flexible demand appliance standards with DR programs and to **incentivize flexible demand appliances**.

Load Management Standards Rulemaking

- ▶ STATE GOAL: Carbon-free electricity generation by 2045 (SB100)
 - Problem: Some carbon-free supplies are inherently inflexible, variable
 - Solution: Encourage flexibility in the demand

- ▶ CEC Proposed Plan
 1. Create the Statewide MIDAS Price Portal (19-OIR-01)
 2. Investigate load management strategies to reduce GHG emissions (AB 3232)
 3. Create standards for flexible demand appliances (SB 49)
 4. Update Load Management Standards as needed

CEC Vision - Proposed Price Communication System



Proposed

LSEs = IOUs, POUs, CCAs, Etc.
GHG = Greenhouse Gas emissions
Source: CEC Existing Buildings Office

Upcoming Events on Load Management Standards



- Draft report will be posted on the **CEC Docket 20-OIR-01**

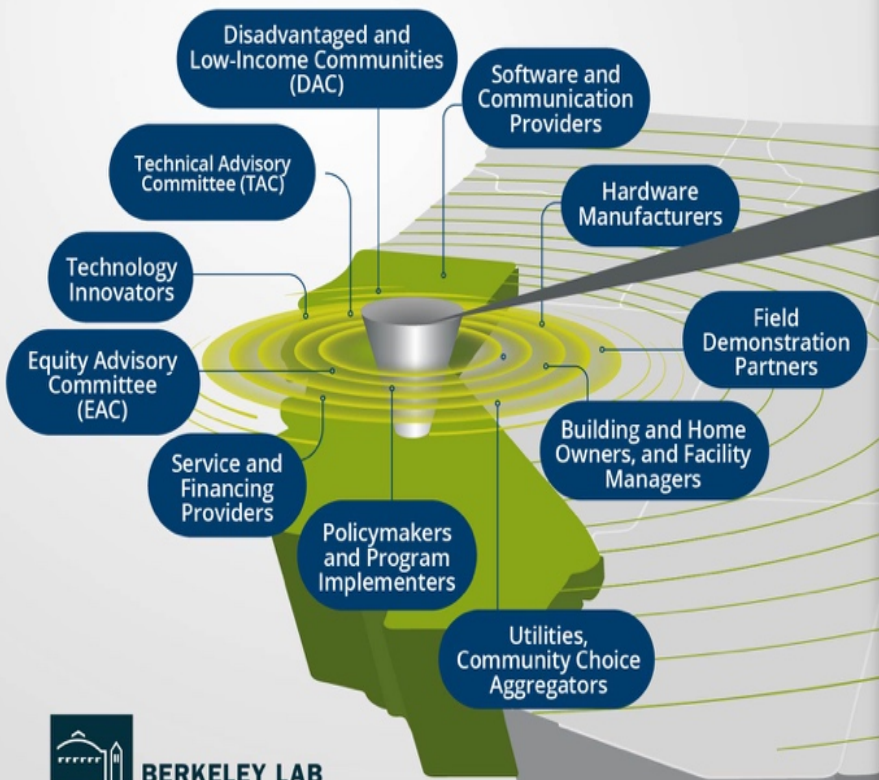
- Workshop is being planned for March or April

Note the **Order Instituting Rulemaking** is applicable to

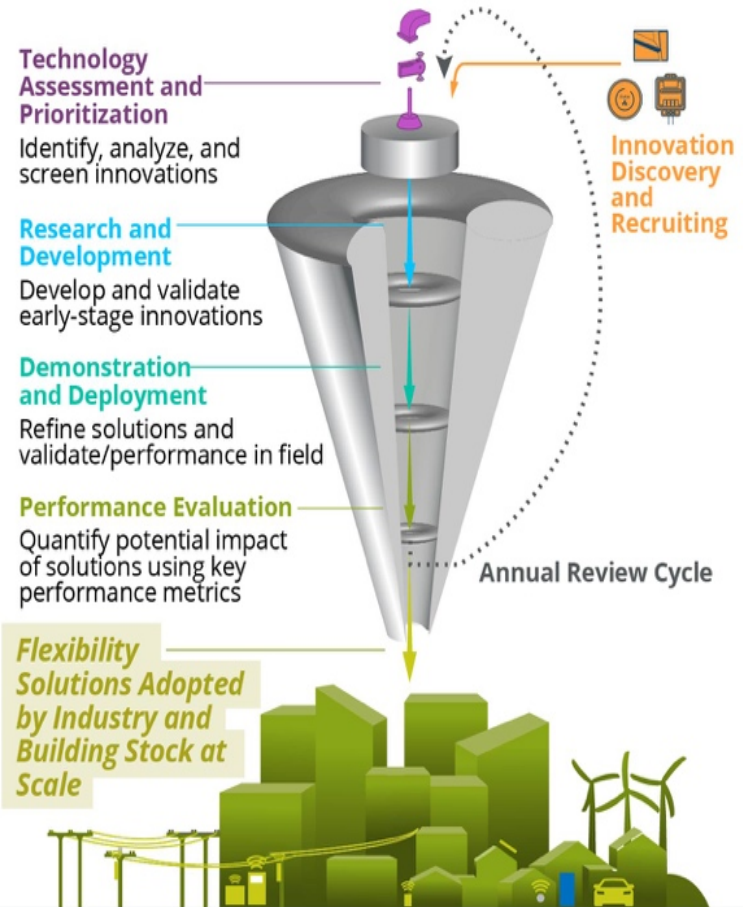
- Investor owned utilities
- Municipal utilities
- Community choice aggregators

California Load Flexibility Research and Deployment Hub (CalFlexHub)

CalFlexHub Ecosystem



Hub Portfolio Management



Summary and Future Directions

- ▶ Several evolving standards can be used to automate demand response.
- ▶ Many states have requirements for communicating devices and systems.
- ▶ California is exploring the use of digital tariffs to communicate price and requirements for appliances.
- ▶ For the future – we need:
 - Cost-benefit data from programs
 - Persistence of savings/participation rates
 - Stable incentives and programs, with simple enrollment methods

Questions States Can Ask

- ▶ What steps can be taken to promote interoperability for demand flexible loads?
- ▶ What interoperable automation standards are the most important to invest in?
- ▶ How can building codes and state load management standards complement utility programs?
- ▶ How do planned or proposed grid modernization efforts contribute to integrating flexible loads?

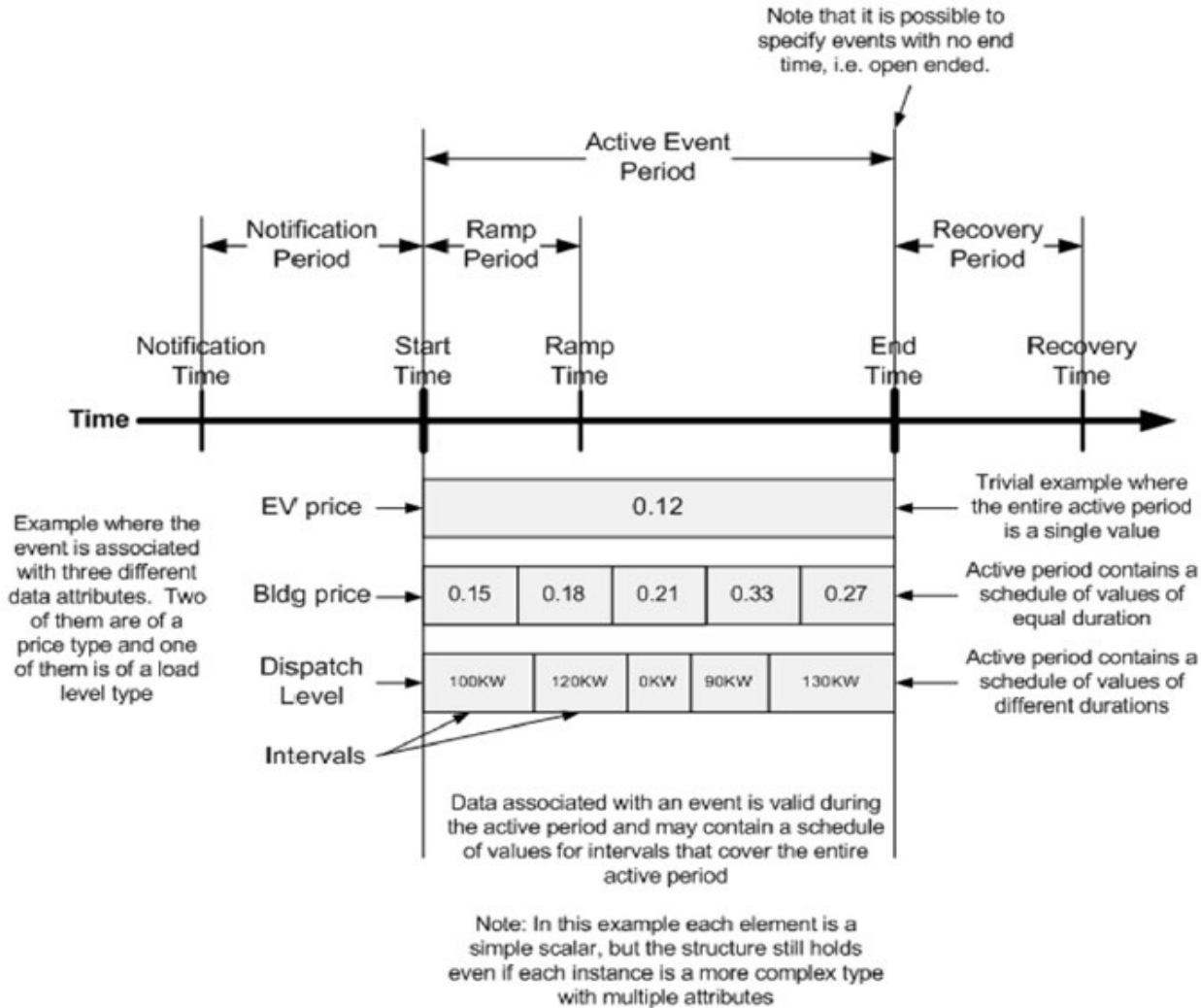
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APPENDIX

OpenADR 2.0 Application



Realizing the Vision: DOE Building Technologies Office GEB initiative



EFFICIENT

Persistent low energy use minimizes demand on grid resources and infrastructure



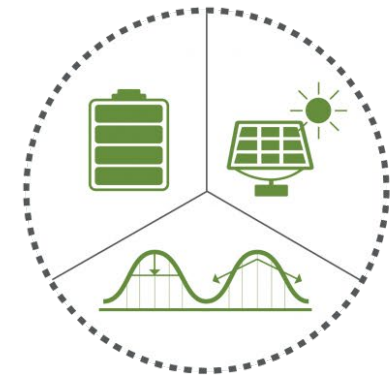
CONNECTED

Two-way communication with flexible technologies, the grid, and occupants



SMART

Analytics supported by sensors and controls co-optimize efficiency, flexibility, and occupant preferences



FLEXIBLE

Flexible loads and distributed generation/storage can be used to reduce, shift, or modulate energy use

<https://www.energy.gov/eere/buildings/grid-interactive-efficient-buildings>