Mandates for Appliance Support for Demand-Response, Energy-Shifting & Power-Control Functionality

Why CTA-2045 has failed, and what we should do going forward

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What Should the Policy Goal Be?

What

Provide the capability for high-load appliances (SGDs) to:

- Curtail (or encourage) power consumption
- Shift energy usage

Cost

Provide demand flexibility **affordably**, allocating costs thoughtfully:

- Adding controls to appliances adds both unit (hardware) and development (NRE) costs

Control

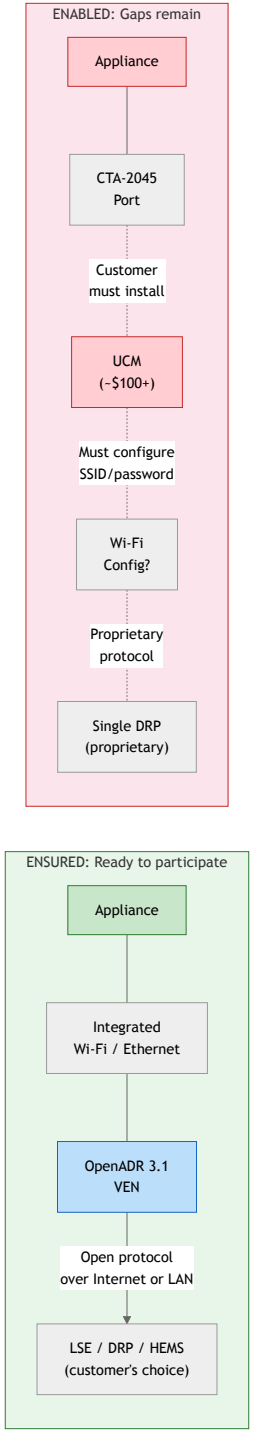
Provide DR management wherever needed to maximize grid benefits:

- LSE / Utility
- Demand Response Provider (DRP)

Ensured vs. Enabled

Ensured: Open protocol + network interface = ready to participate. No additional cost or effort.

Enabled: Port for aftermarket module = gaps remain. Additional cost, installation, configuration required.



CTA-2045: Components and How It Works

SGD (Appliance)

- CTA-2045 SGD interface
- Microcontroller

UCM (Communications Module)

- CTA-2045 UCM interface
- Network interface: Wi-Fi, cellular, Ethernet
- Proprietary protocol to DRP
- Microcontroller

CTA-2045 *enables* flexible demand control — it doesn't *ensure* it.

How CTA-2045 Addresses Policy Goals

Goal	How CTA-2045 Addresses It
What	Standard port on appliances; aftermarket UCM connects
Cost	Manufacturer absorbs port cost; DRP pays for UCM, recoups via reduced incentives
Control	UCM connects to DRP via Internet using proprietary protocol

Limitations

- UCM typically specific/tied to a single DRP
- No end-user ability to control appliance locally
- No standard protocol between UCM and DRP

CTA-2045 Water Heater Enrollment: The Data

> *"As of March 2025, comprehensive data on the exact percentage of CTA-2045-enabled water heaters actively participating in DR programs is limited"*

- The percentage of enrolled & connected CTA-2045 water heaters is **far closer to 0% than 100%**
- This connection percentage is **unlikely to materially change**

Conclusion

CTA-2045 mandates have **failed** to accomplish the goal of shifting water heater energy usage.

Worse: Manufacturers must include CTA-2045 for mandated markets, consuming the "budget" for device communications — **precluding** incorporation of better solutions.

> *Continuing to mandate CTA-2045 is PREVENTING increased flexible-demand appliance participation.*

What Went Wrong with CTA-2045?

Ex-ante it seemed like a great idea, and everyone had the best intentions…

1. CTA-2045 only **enables** connection via a UCM obtained and installed separately
2. UCM must be configured to home Wi-Fi — technically challenging for many
3. UCMs are expensive: **~$100-150+**
4. **No standard protocol** between UCM and DRP — increases cost for DR providers
5. The cost & effort to bridge from *enabled* to *ensured* was **too large**

The world has changed since CTA-2045 was developed:

- Appliances now include microcontrollers and network interfaces at low cost
- Vast majority of households have Internet and Wi-Fi

The Proposed Solution

Many/most new water heaters now include Wi-Fi for manufacturer cloud connectivity.

Requirements:

1. SGDs with network interfaces **must** support an open standard protocol for DR
2. SGDs **must** support/integrate **OpenADR 3.1**
    - Adds no/little incremental hardware cost to appliances with existing Wi-Fi
3. SGDs **must** provide a **USB-C** connector for additional network interfaces
4. OpenADR 3.1 VTN URL **must** be customer-configurable
5. OpenADR 3.1 becomes the standard protocol for LSE/DRP communication

No UCM needed — saving cost to both homeowner and DR provider.

> *The exact same solution works for HVAC and EVSE.*

What About Dynamic Prices?

- Increasing agreement that **highly dynamic pricing** is better than legacy DR events for shifting energy usage
- **OpenADR 3** fully supports communication of dynamic prices from grid/LSE to appliance and/or local HEMS
- OpenADR 3 provides **both** conventional DR events **and** dynamic prices

> *CTA-2045-B has no support for dynamic prices. "Peak price" doesn't count.*

Proposed Requirements for Future Mandates

SGDs must:

- Support connection to the home network
- Integrate at least one network interface (Wi-Fi)
- Provide a USB-C port for additional interfaces (cellular, Ethernet)
- Support **OpenADR 3.1** (or later)
- Support customer configuration of the OpenADR VTN URL

Enabling customer choice of connection to:

- DRP
- LSE
- Local Home Energy Management System (HEMS)

What About Matter?

- Matter excels at smart-appliance interoperability **within** the home
- Does **not** provide utility-to-customer coordination alone
- Combined with OpenADR 3.1: HEMS uses Matter for local device control

The Best of Both Worlds

Protocol	Role
OpenADR 3.1	Grid-to-home: prices, DR events, power limits
Matter DEM	Within-home: device energy management

> *Requiring BOTH OpenADR 3.1 and Matter energy management would provide consumers the most choice and flexibility.*

DR Protocol Options

Requirement	What It Achieves
Require **OpenADR 3.1**	**Ensures** SGDs can directly receive DR events and dynamic prices
Require **Matter DEM**	**Enables** SGDs to be managed by consumer's HEMS
Require **both**	Maximum choice and flexibility for innovative energy solutions

Addressing Objections

"Manufacturers want proprietary cloud control"

- Limits consumer choice of DRP
- Reduces economic benefit to consumer
- Consumers with multiple SGDs shouldn't be forced to use DRPs
- Consumers cannot manage SGDs locally via HEMS

The fix:

Even if manufacturers integrate OpenADR 3.1, they **must also** enable the homeowner to configure the VTN URL — giving the customer the choice.

Wi-Fi Reliability Concerns

Obstacles experienced with Wi-Fi-connected UCMs:

- Wi-Fi may not reach water heater location (garage, basement)
- Configuring UCM to Wi-Fi is technically challenging
- SSID/password changes disconnect the UCM silently
- Cybersecurity objections from some customers

Solution: Ethernet for stationary appliances

- Water heaters, HVAC, and EVSE are **not mobile**
- Incentivize Ethernet connections during installation
- Amend building codes to require Ethernet near high-amperage outlets

> *~92% of US households have Internet. Equity issues should be addressed via assistance programs, as with electric service.*

CTA-2045 Mandates Today

Jurisdiction	Status
Washington	Required since Jan 1, 2021 (RCW 19.260.080)
Oregon	Required since Jul 1, 2023 (HB 2062, delayed from Jan 2022)
Colorado	Considering similar requirements
Federal	S. 4061 / HR 7962 directed DOE to evaluate by end of 2024

These mandates have produced near-zero participation rates.

> *It is time to move from enabling demand flexibility to ensuring it — with open protocols built into the appliance.*