



Virtual Power Plants and Wholesale Markets

Nevada Regional Transmission
Coordination Task Force Meeting
July 31, 2024



What Is a VPP?

VPPs many names

Virtual power plants have many names, both old and new:

- Virtual power plants (VPPs)
- Distributed Power Plants
- Demand response (DR)
- Demand flexibility
- Distributed Energy Resource (DER) aggregations (DERA)
- Aggregate Distributed Energy Resources (ADER)
- Others

Two parts to any VPP: Hardware and software

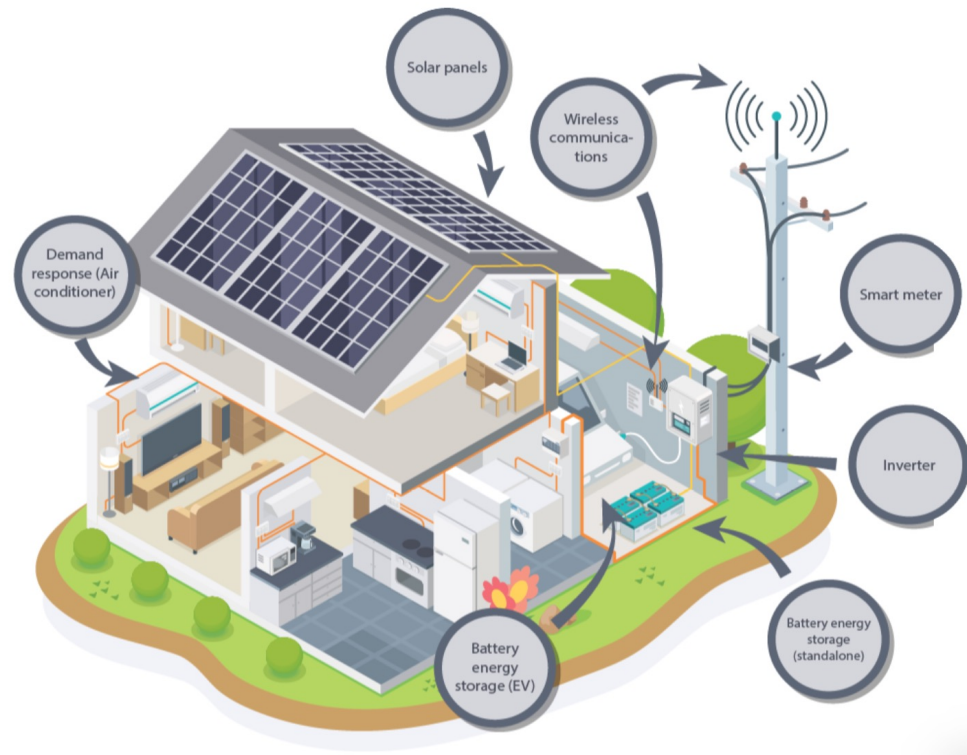
As hardware and software costs fall, VPPs are scaling

A VPP is:

An aggregation of distributed energy resources located on customer premises (hardware)

plus

A mechanism for orchestrating electricity demand, generation, and/or storage from DERs using a common architecture (software)



Source: Cummins

Distributed energy resources (& other hardware)

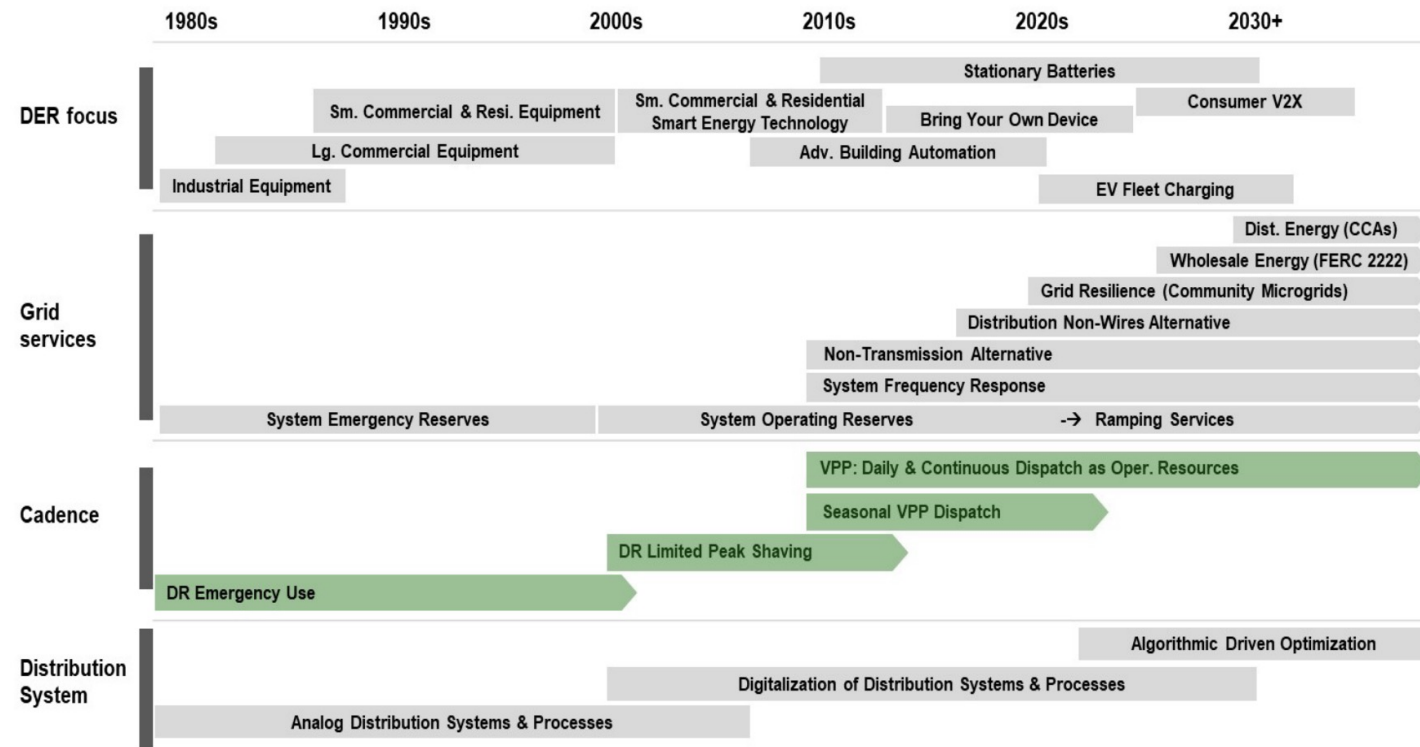
- Can be residential or commercial/industrial
 - Can be behind-the-meter or front-of-meter (generally BTM)
 - Generation: **Solar, fuel-based generation**
 - Flexible demand: **Smart thermostats, smart water heaters, pool pumps, building automation systems**
 - **Battery storage (usually with solar)**
 - **Managed EV charging** and
 - **Vehicle-to-grid (V2G) export from EV batteries**
- **Other hardware:**
 - Advanced Metering Infrastructure (AMI)
 - Gateways



Images: Nuvve, Enphase, Google

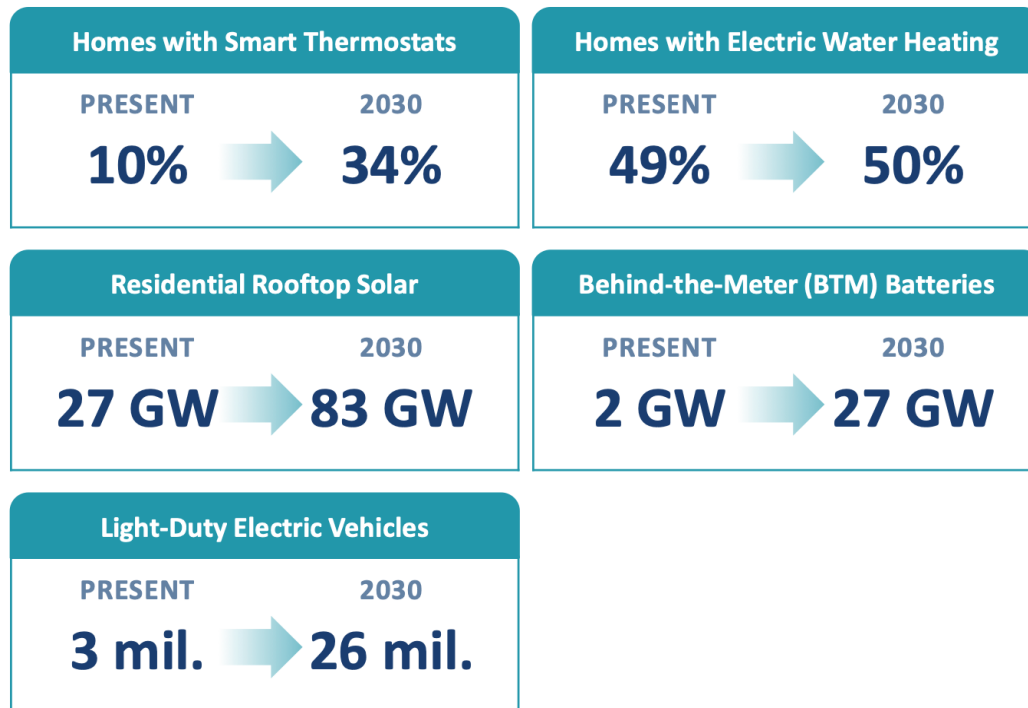
VPPs are not new, but are becoming more sophisticated

Evolution of VPPs



Source: Department of Energy, "Distribution System Evolution" (2023)

The coming wave of DERs

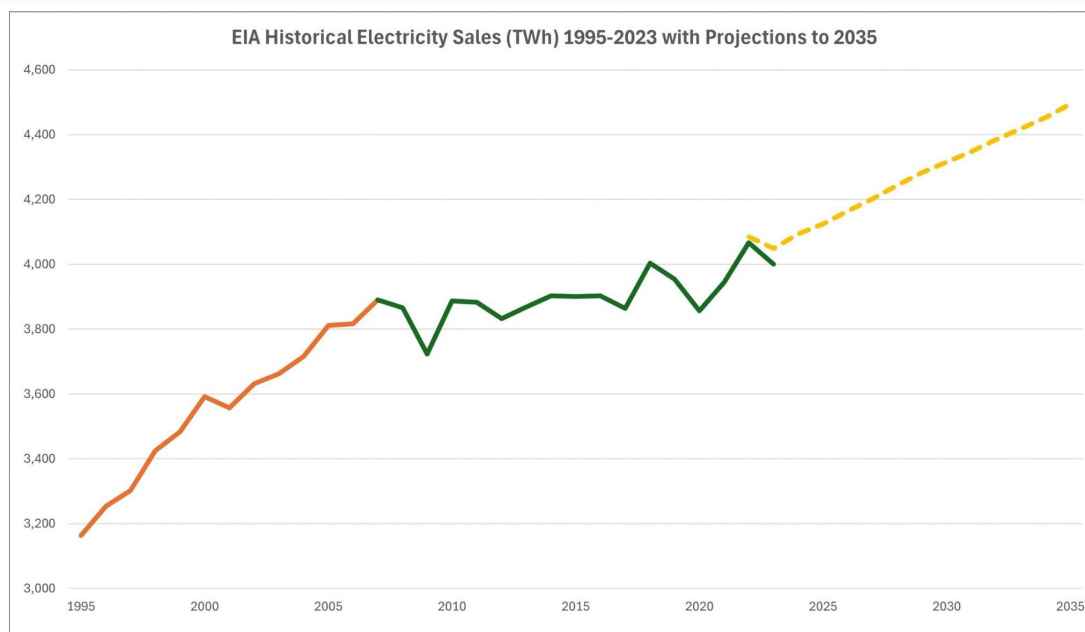


Source: Brattle Group, "Real Reliability: The Value of Virtual Power" (2023)

- The next 5-10 years will see a "tsunami" of DERs added to the grid
- Flexible demand: **Smart thermostats, smart water heaters, building automation systems** – 5-6 GW every year through 2030
- **Battery storage (usually with solar)** - 25 GW by 2030
- **Managed EV charging** (+90 GW by 2030) and **storage in the form of EV batteries** (potentially +540 GWh by 2030)

VPPs can deliver much-needed capacity, fast

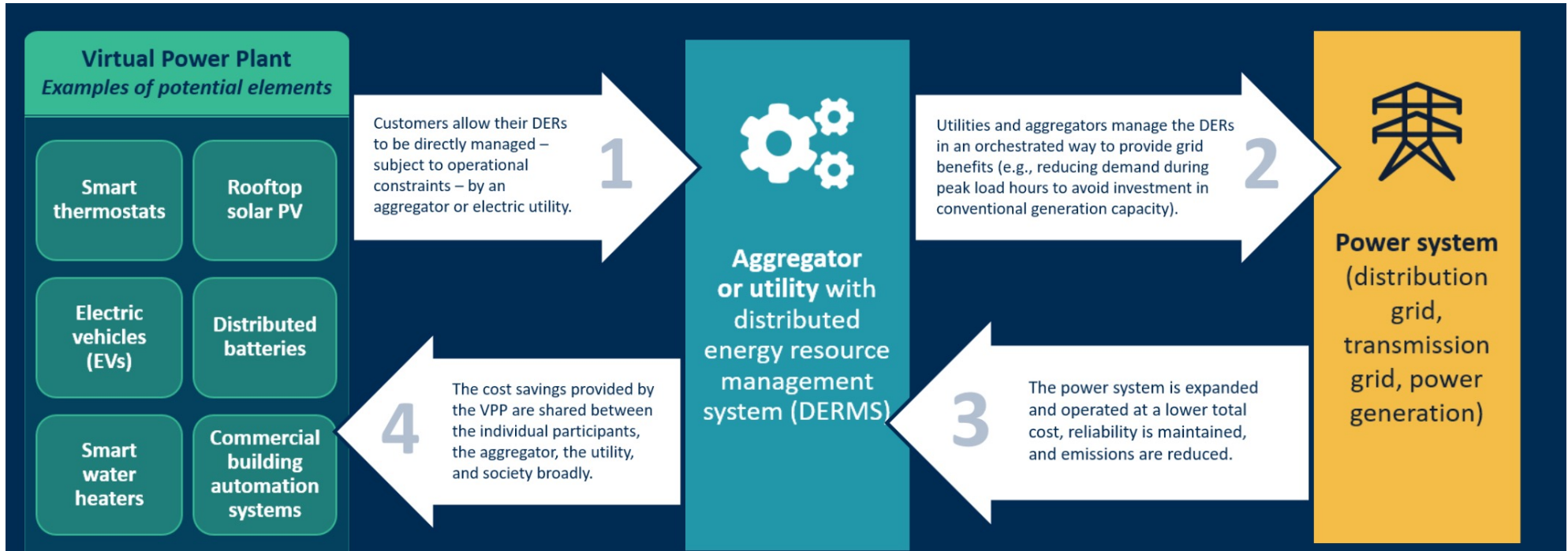
VPPs can come online quickly and be right-sized to match uncertain load growth



- Rapid demand growth (data centers, industrial loads, electrification) is driving a need for new capacity in a short timeframe
- New load is uncertain, putting us at risk of overbuilding new gas
- VPPs come online quickly and can be scaled up and down

How Does a VPP Work?

Overview of virtual power plant operations

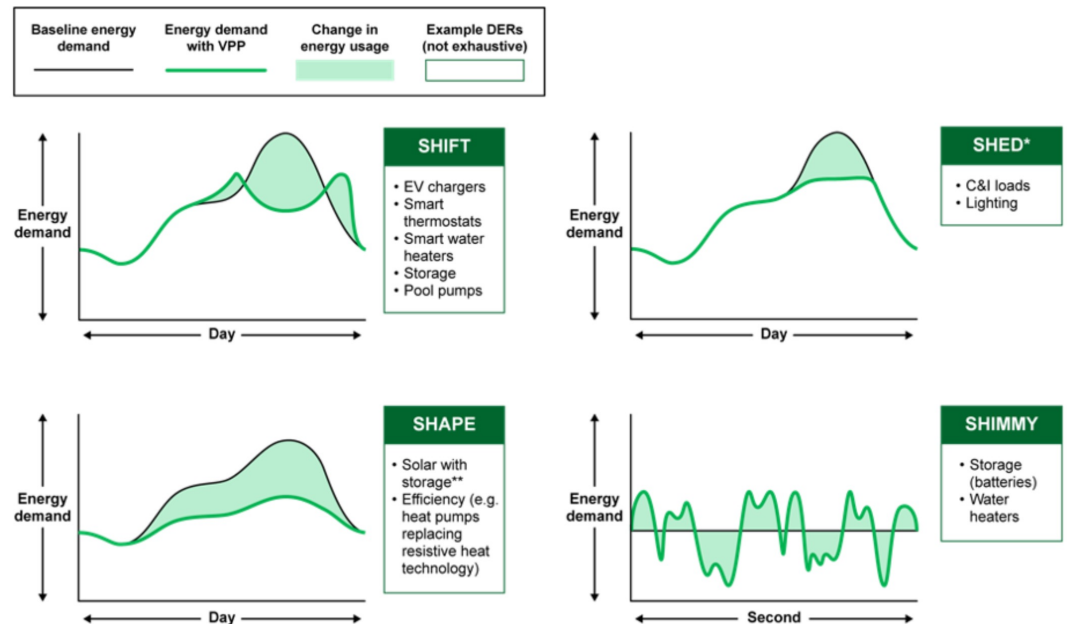


Source: Brattle Group, "Real Reliability: The Value of Virtual Power" (2023).

Addressing peaks with different DERs in a VPP

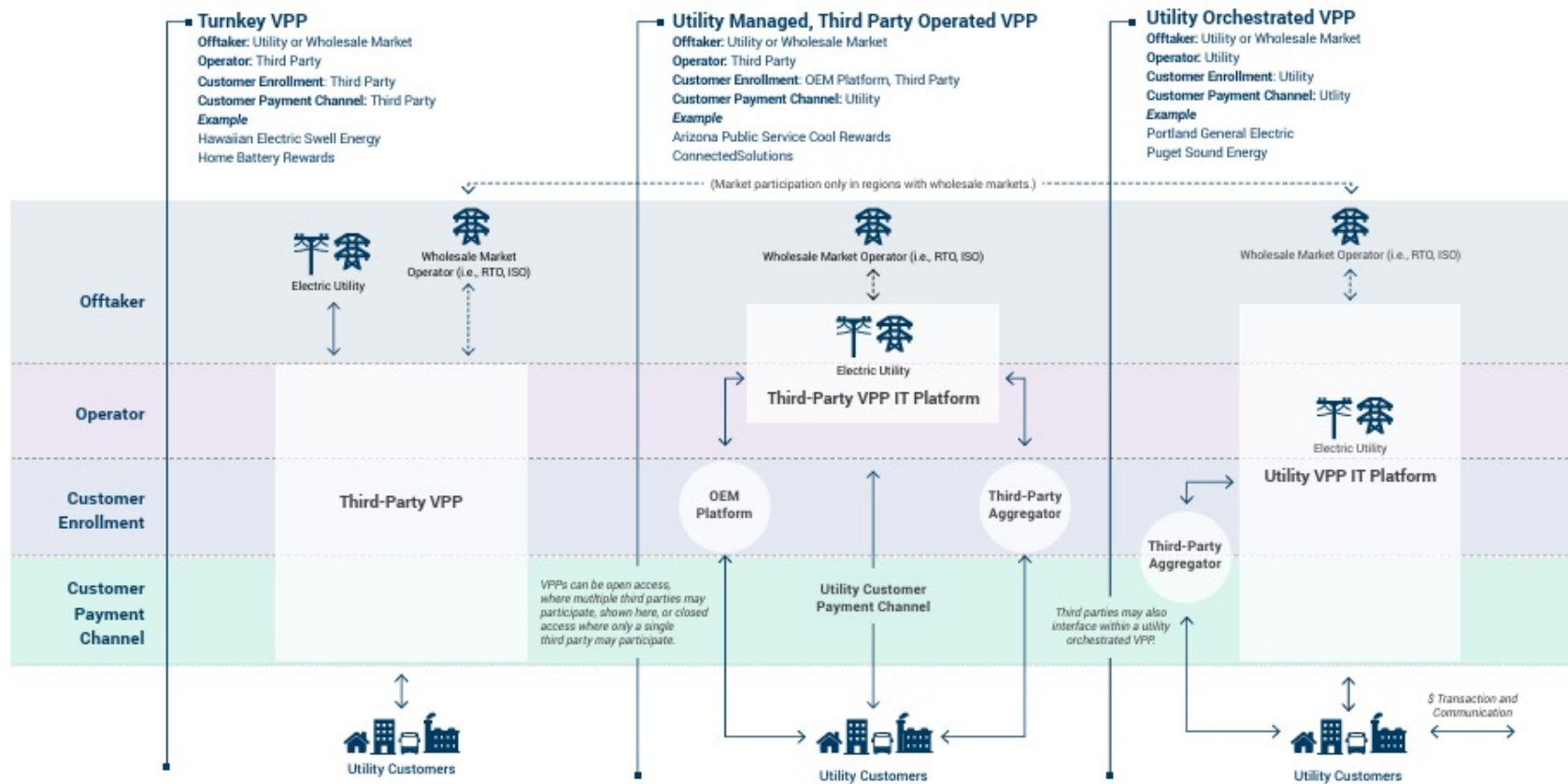
Including more device types in VPPs helps maximize the impact of DERs

- To ensure demand matches supply on the grid during peaks, VPPs can:
 - Reduce usage during peak demand hours or shift consumption earlier or later in the day
 - Shift homes and businesses to run off batteries
 - Export power from batteries and EVs to the grid (if regulations allow)



Source: Department of Energy, "Virtual Power Plants: Pathways to Commercial Liftoff" (2023)

Participation models



VPPs in Wholesale Markets

MARKET LANDSCAPE

How demand response itself is treated across wholesale markets

Market	DR participation model(s)	Paid as standby capacity?	How it's used day to day
PJM	Demand Resource — Economic & Emergency Load Response	Yes — via capacity auction	Offers to cut usage for a price, or responds only in emergencies
ISO-NE	Active Demand Capacity Resource (ADCR)	Yes — via Forward Capacity Market	Qualifies a year+ ahead; obligated to cut usage once cleared
NYISO	Special Case Resources (SCR); also EDRP, DADRP	Yes — via capacity market	Several named programs, mostly capacity-first
MISO	Load Modifying Resource (LMR); Demand Response Resource (DRR)	Yes — via capacity auction	Can also sell into energy and reserve markets on top of the capacity payment
CAISO	Proxy Demand Resource (PDR); Reliability DR Resource (RDRR)	No standing auction — capacity procured bilaterally	Bids economically day to day, or sits in reserve for emergencies only
ERCOT	Load Resource (LR); Emergency Response Service (ERS)	No capacity market at all (energy-only design)	Paid for reserves and real-time load cuts, not for standing by

The core split: in **PJM, ISO-NE, NYISO, and MISO**, demand response can get paid just for being available, the same way a power plant does. In **CAISO and ERCOT**, there's no such standing payment — demand response only gets paid when it actually cuts usage.

MARKET LANDSCAPE

How aggregated DERs / VPPs are handled across markets

Market	Participation model(s)	Status
CAISO	PDR, RDRR, and DERP	Live since Nov 2022; PEM/telemetry rules now under review via DDEMI
NYISO	Single "Aggregated DER" model — individual DERs join one aggregation	Live since Q4 2022
ISO-NE	New Dispatchable DERA & Settlement-Only DERA models	Energy/AS: Nov 1, 2026 · Capacity: Feb 1, 2027 (2028/29 cap. year)
PJM	DER Aggregation Participation Model, run by registered DER Aggregators	Capacity targeted for 2026/27 Delivery Year; E&AS still in compliance process
MISO	New DER aggregation model, phased rollout	Phase 1: June 2027 · Phase 2 (full): June 2029

SPP is still refining rules under FERC direction with no firm date; ERCOT is not FERC-jurisdictional and runs its own ADER pilot outside Order 2222.

VPPs in WEIM/EDAM

CASE STUDY

How Nevada's DR and VPPs may participate in EDAM

Pathway 1: Load Forecast Adjustment (LFA)

- NV Energy reports expected lower usage to CAISO's forecast — it's a heads-up, not a market bid
- No metering or telemetry required, so it's the lowest-barrier option to use today
- Built for WEIM's real-time timeframe; EDAM added an 8am submission deadline and a "performance factor," but no full data-return mechanism yet
- Gap: no settlement data, no event records, and the API doesn't return event-level data back to NV Energy

Pathway 2: Market participant (PDR, RDRR, DERA)

- **PDR** (Proxy Demand Resource): bids economically into energy/AS markets like a supply resource
- **RDRR** (Reliability DR Resource): reliability-only, dispatched during declared emergencies
- **DERA** (CAISO calls its version DERP): the dedicated DER-aggregation model, min. size 0.1 MW
- All three were built around CAISO's own registration and metering infrastructure — for a non-CAISO EDAM entity like NV Energy, these rules need real adjustment before local DERs can use them directly

CAISO STAKEHOLDER INITIATIVE

Demand & Distributed Energy Market Integration

Track 2: Demand Flexibility Enhancements

Launched January 2025 under the WEM Governing Body, DDEMI develops participation models and market rules for demand response and distributed energy resources — bid independently or in aggregation — in CAISO's day-ahead and real-time markets.

Track 1

End-Use Customer Exports in DR Performance Measurement

Lets individual customers inside a DR aggregation net-export (e.g. behind-the-meter storage), so long as the aggregation as a whole stays a net load reduction.

Status: Draft Final Proposal — July 2026

Track 2

Demand Flexibility Enhancements

- Update market models to fit WEIM/EDAM participation
- Consider a new reliability-triggered DR product
- DR participation options for non-CAISO BAAs
- Supply- vs. demand-side pathways for large loads

Status: Issue Paper — March 2026, no straw proposal yet

GOVERNANCE

Who decides DR/VPP rules in EDAM: today, and under ROWE

The Pathways Initiative's Step 2 proposal is mid-handoff from CAISO governance to an independent regional body

Today: WEM Governing Body

- Since Pathways **Step 1** (effective July 2025), the WEM Governing Body holds **primary authority** over WEIM and EDAM market rules — up from joint authority shared with the CAISO Board of Governors
- A DR/VPP proposal (e.g., a DDEMI outcome) moves through CAISO's stakeholder process, then to the WEM Governing Body for approval
- CAISO staff still make the actual FERC Section 205 filing on the resulting tariff change
- CAISO's Board of Governors' role is now largely limited to non-market functions

Future: ROWE

- Pathways **Step 2**, adopted Nov 2024, transfers **sole authority** — including exclusive FERC Section 205 filing rights — to a new independent body, the Regional Organization for Western Energy (ROWE)
- Enabled in California by AB 825 (signed Sept 2025); ROWE incorporated in Delaware in Jan 2026
- CAISO stays on as **market operator** under an operating agreement — it keeps running the software and day-to-day markets, but loses final say over market rules
- ROWE Stakeholder Representatives Committee includes DER Sector
- A DR/VPP proposal would go to ROWE's independent board for approval, and ROWE — not CAISO — would make the FERC filing

Where things stand: ROWE's board is still being seated, and its tariff and operating agreement with CAISO are still being finalized. Until that work closes, DR/VPP decisions — including DDEMI outcomes and future EDAM demand-response rules — still run through the WEM Governing Body, not ROWE.

Nevada Governance

NV Energy's EDAM entry doesn't automatically open the door for aggregated DERs – NV Energy and PUCN decisions are key

FERC requires markets to offer VPP pathways – but NV retains discretion on whether / how to use them

Order 2222 legally binds the RTO — CAISO. NV Energy isn't joining a full RTO; it's a standalone balancing authority electing into a market CAISO operates. That's a different legal posture than a utility inside PJM or MISO becoming a full RTO member on day one.

CAISO's PDR/DERP models are technically available to WEIM/EDAM participants — but making them usable for a specific BA's customers still requires that BA's own state regulator to work out registration and coordination rules.

What's actually happening in Nevada

- PUCN approved NV Energy's EDAM entry, targeted for fall 2028
- PUCN said EDAM entry makes Order 2222 compliance easier — not that it achieves it
- A separate PUCN workshop is planned specifically on DER and demand-side response participation in CAISO markets
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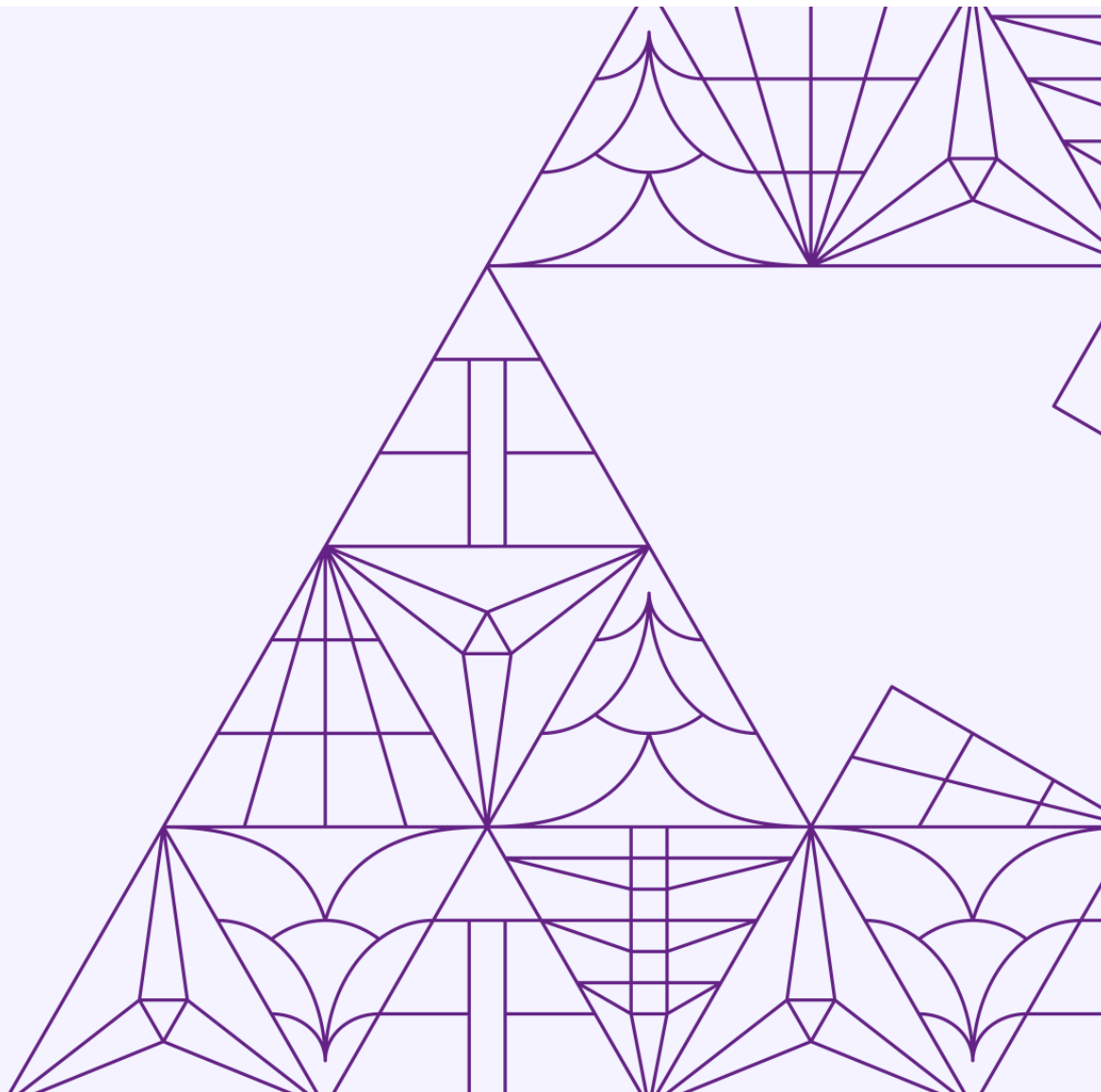
Bottom line: Nevada DERs won't automatically be able to bid into CAISO's PDR model the day NV Energy's EDAM participation goes live. The tariff mechanism exists, but a separate PUCN process still has to define how registration and coordination work locally.

Thank you.



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Extra slides

IN PLAIN TERMS

What is a "Load Forecast Adjustment"?

It's a simple heads-up a utility gives the grid operator: **"expect less electricity use than usual during these hours, because some of our customers are cutting back."**

It's a forecast update, not a sale

The utility isn't offering to sell that reduced electricity use into the market, the way a power plant sells power. It's just adjusting the numbers the grid operator uses to plan the day.

Low effort to use

No special equipment or metering is required to use it — unlike other ways of participating, which need monitoring systems in place. That makes it the easiest on-ramp for a utility that isn't fully set up yet.

The trade-off

Because it's just a number the utility reports, it isn't paid the way a market resource is, and the utility gets little confirmation back about how its numbers were actually used.

TRACK 2 · DEMAND FLEXIBILITY ENHANCEMENTS

DR Participation Options for WEIM/EDAM Balancing Authorities

CAISO's existing DR tools — PDR, RDRR, DERA, and the DRRS registration system — were built around CAISO-native balancing authorities. External WEIM/EDAM entities (e.g. Portland General Electric, NV Energy) lack a clear path to bid their aggregated DER/DR fleets into CAISO markets.

OPEN QUESTION 1

Locational construct

Should WEIM/EDAM demand response be aggregated at sub-LAP, CLAP, or full BAA-level?

Sets how granular DR must be to bid reliably outside CAISO's own footprint.

OPEN QUESTION 2

Registration systems

Is CAISO's DRRS suitable for resources outside the CAISO BAA, or should external BAAs run their own?

Alternative: BAA-managed registration reporting into CAISO.

OPEN QUESTION 3

RDRR construct

Should CAISO modify Reliability Demand Response Resource rules for WEIM/EDAM-specific needs?

E.g. notification windows, telemetry, dispatch built for CAISO-native DR.

Stakeholder asks on the table:

Formal DR participation agreement (NRI/SQMD-equivalent) · telemetry-free aggregation above 10 MW at BA discretion · logical telemetry feeding the load forecast · manual forecast adjustments, as with VER forecasting · PEMs, Metering, and Telemetry by BAA · Derate Flexibility · BAA DER Registration · Separate BPMs for CAISO vs. WEIM/EDAM · Data Access for LFA

Status: Issue Paper posted March 13, 2026 — no straw proposal as of the June 2026 WEM Governing Body update