CleanEnergy States Alliance

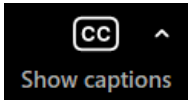
Virtual Power Plants and Energy Justice

April 22, 2026

Webinar Logistics

All attendees are in **“listen only” mode** – your webcam and microphone are disabled.
The Chat function is also disabled for attendees.

Submit questions and comments via the Q&A panel 

Automated **captions** are available 

Speakers' bios will be made available in the chat

This webinar is being recorded. We will email you a webinar recording within 48 hours. This webinar will be posted on CESA’s website at **www.cesa.org/webinars**

Clean Energy States Alliance

The Clean Energy States Alliance (CESA) is a national, nonprofit coalition of public agencies and organizations working together to advance clean energy.

CESA members—mostly state agencies—include many of the most innovative, successful, and influential public funders of clean energy initiatives in the country.

www.cesa.org

CleanEnergy States Alliance

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Wisconsin Office of Energy Innovation

VPP Acceleration Initiative

Helps states, local governments, communities, and financial institutions deploy and scale virtual power plants (VPPs)—advancing affordability, strengthening grid reliability, and supporting decarbonization.

Our goal: Enable gigawatt-scale VPP deployment nationwide by 2028.

WORLD RESOURCES INSTITUTE

CleanEnergy Group

Justice Climate Fund

www.cesa.org/projects/vpp

WEBINAR SPEAKERS

Virtual Power Plants and Energy Justice

Adam Warren

Former Director, Accelerated Deployment and Decision Support Center at NREL

Lisa Morris

Energy Services Planner at Vermont Electric Co-op

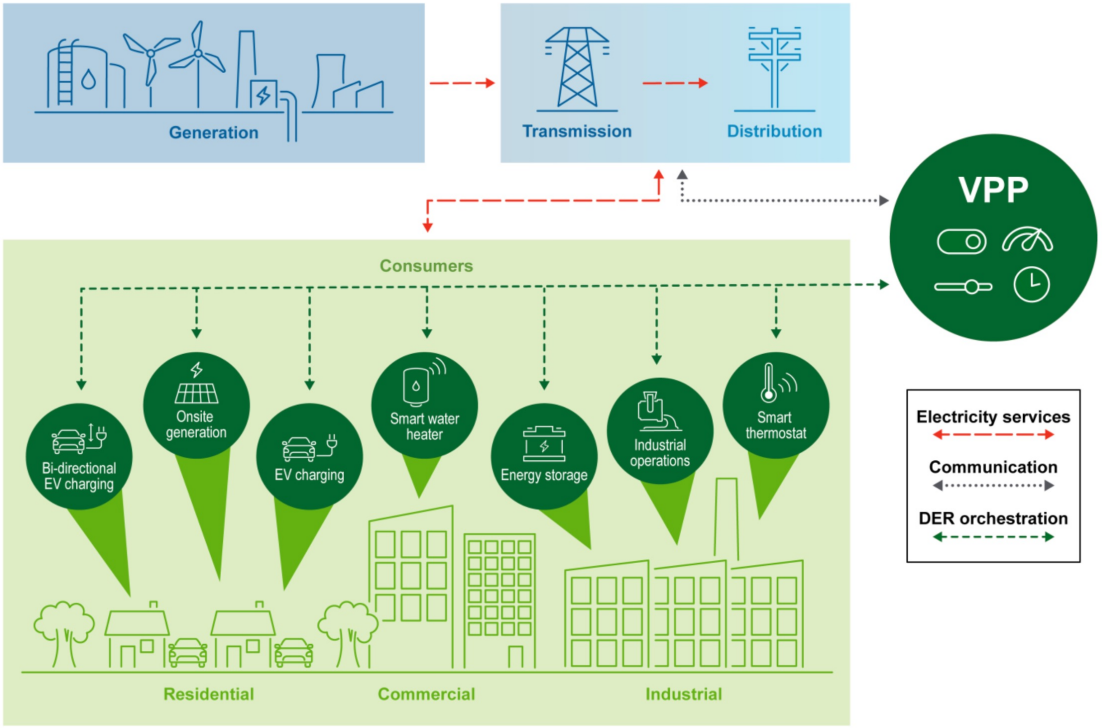
Warren Leon

Executive Director at CESA
(Moderator)

Virtual Power Plants and Energy Justice

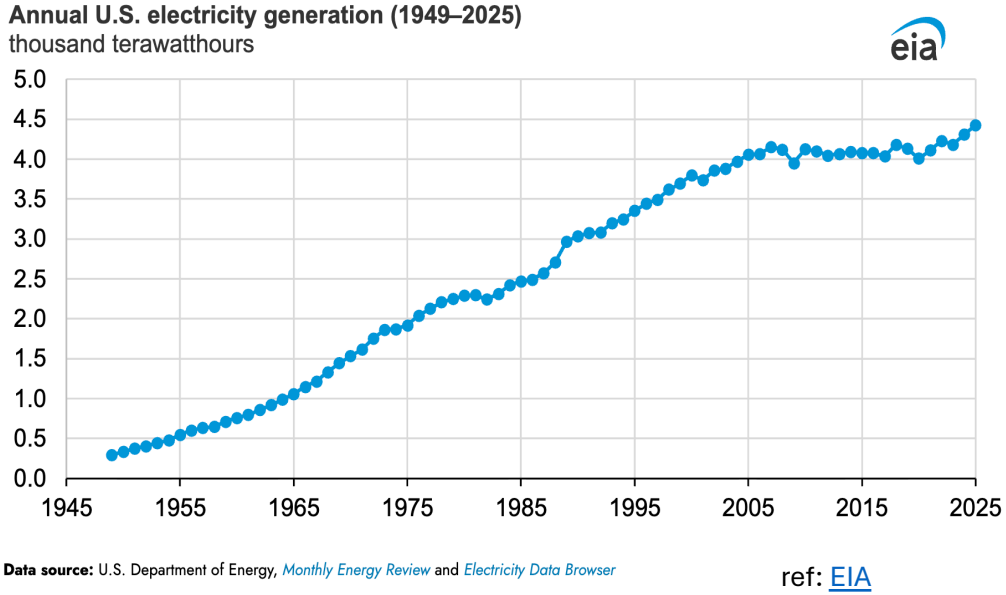
Equity, access, and shared benefit

Adam Warren, PhD
adam.warren.home@gmail.com



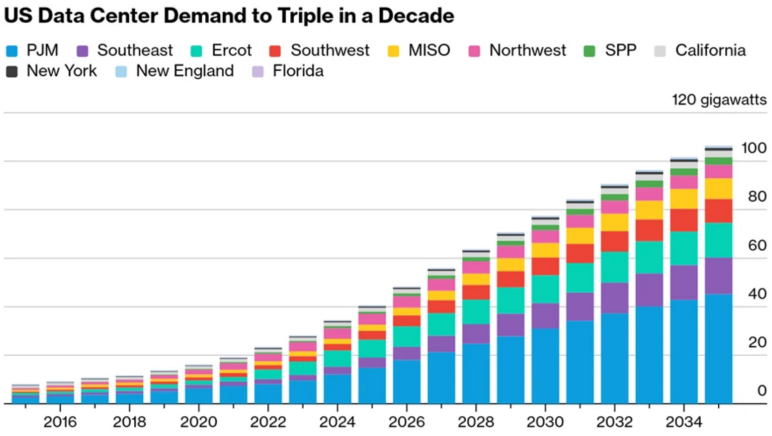
ref: DOE – LPO , VPP Liftoff Report

Today's Grid



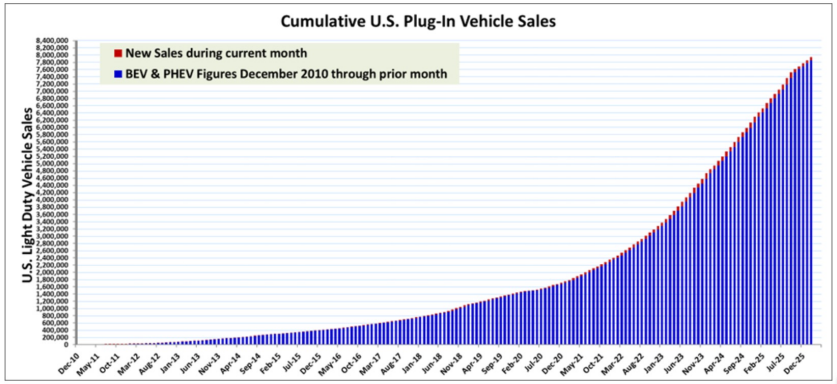
Data source: U.S. Department of Energy, *Monthly Energy Review* and *Electricity Data Browser*

ref: EIA



Source: BloombergNEF, DC Byte.
Note: "Power demand" refers to the total electricity used by the entire data center facility. Ercot is Electric Reliability Council of Texas. MISO is Midcontinent Independent System Operator. SPP is Southwest Power Pool.

ref: BNEF



February 2026 Cumulative U.S. Plug-In Vehicle Sales

ref: ANL

A decade of market expansion - in four numbers

The U.S. market is shifting to renewables-plus-flexibility.

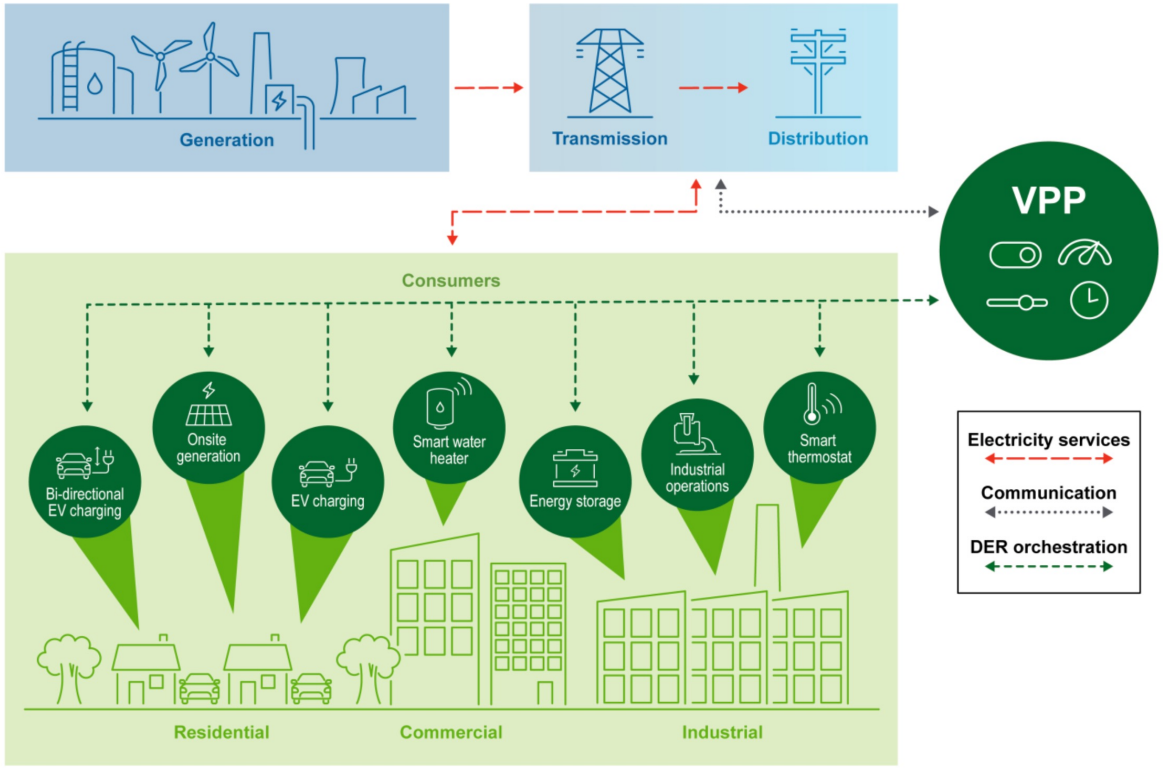
2014		2024
13 %	*Renewables share of U.S. generation* →	24 %
207 TWh	*Wind + solar generation* →	752 TWh
16 GW	*Solar PV installed capacity* →	175 GW
0.1 GW	*Utility-scale battery capacity* →	>26 GW

Bottom line: wind, solar, and storage will continue to grow.

ref: EIA

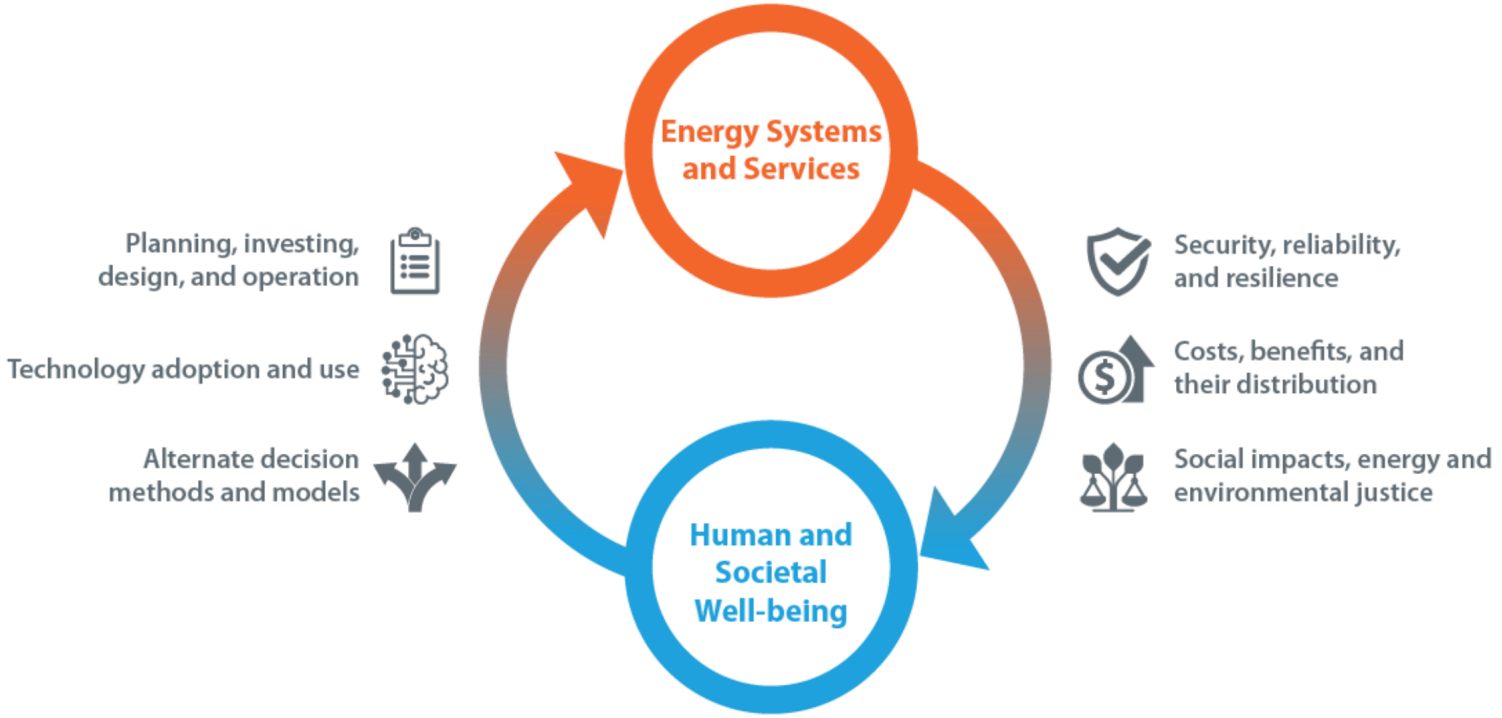
Sources: EIA Electric Power Annual 2024; EIA Today in Energy (Mar. 12, 2025).

Virtual Power Plants (VPP) will play a role during this time of growth



ref: DOE – LPO , VPP Liftoff Report, Pathways to Commercial Liftoff.

We must consider the Human Dimension of Energy Systems

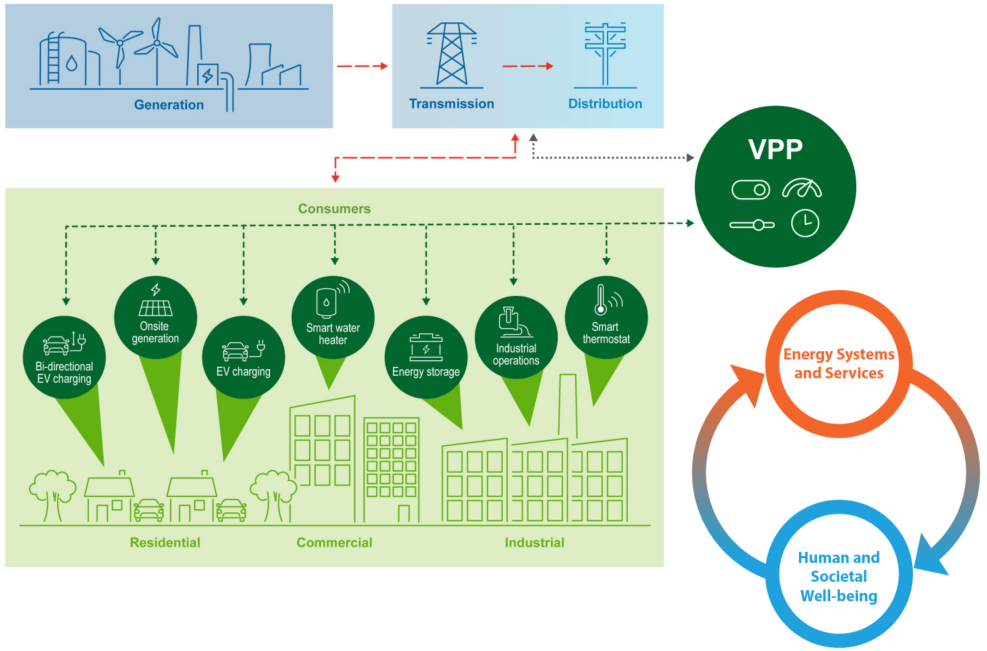


ref: NREL

We must consider the full system of systems

- The core question is not whether VPPs scale, but **who benefits, who bears risk, and who gets to participate.**

- The expanded use of VPPs **can improve energy outcomes** or **reproduce or even worsen inequities** if they are not designed with Energy Justice in mind.



Energy justice as the evaluative lens

Energy justice must be explicitly considered when designing programs

Distributive justice

Who receives the benefits and who bears the costs, risks, or disruptions?

Procedural justice

Who participates in decision-making, enrollment, program design, and governance?

Recognition justice

Whose needs, constraints, and vulnerabilities are considered?

Restorative justice focuses on the past harms—such as pollution or displacement—caused by energy development to communities and the environment.

VPPs can reproduce or worsen inequities

by deepening exclusion, weakening consent, or shifting risks onto vulnerable households

RISKS

1 Focus on assets

If participation depends mainly on EVs, rooftop solar, and batteries, benefits can accrue disproportionately to higher-income homeowners.

Risk: VPPs can create new "energy elites" unless access is widened beyond asset ownership.

2 Thin consent

Opaque tariffs, automation, and hard-to-understand controls can weaken informed consent for many.

Risk: households may bear comfort or reliability risks without meaningful control, transparency, or recourse.

3 Unequal constraints

Energy-poor households often face tighter comfort needs, older buildings, and less ability to absorb bill volatility.

Risk: program designs built around an "average customer" can impose disproportionate burdens on already vulnerable households.

4 Privacy concerns

VPPs rely on detailed household and device data. Can expose vulnerable customers to unequal surveillance and limited ability to contest data practices.

Risk: weak data governance can deepen inequity even as grid outcomes improve.

Speaker notes include paper links for the cited literature.

VPPs can improve equity outcomes

by creating benefits that *intentionally* targets burdens, access, and resilience.

PATHWAYS

1 Reduce local air pollution through peaker displacement

Because peaker burdens often fall on disadvantaged communities, avoided use can align with our EJ goals.

Design implication: value locational and temporal benefits so VPPs prioritize harm reduction where pollution burdens are highest.

2 Lower system costs and energy burden

VPPs can lower system costs… but savings do not automatically flow equitably to customers.

Design implication: pair VPPs with LMI adders and non-ownership pathways so benefits are not limited to "energy elites."

3 Improve resilience during extreme events

VPPs can reduce harm during heat, cold, and outage events.

Design implication: resilience benefits must be intentionally protected so flexibility does not increase vulnerability.

4 Enable community-centric participation models

Community-centric DER aggregation can improve access for LMI households, including renters and multifamily residents.

Design implication: community-scale VPPs can broaden participation and align benefits with local priorities.

Speaker notes include paper links for the cited literature.

Five design principles for justice-centered VPPs

Value Services, not Assets

Compensate flexibility from low-capital devices and aggregator-owned equipment to broaden participation.

Embed protections by default

Guarantee override rights, temperature bounds, and exemptions

Enable informed participation

Use transparent rules, plain language, and community intermediaries.

Target locational benefits

Prioritize deployments where avoided congestion or peaker dispatch yields community health gains

Measure equity outcomes explicitly

Track enrollment, retention, bill impacts, and comfort outcomes across demographic groups

Bottom line: VPPs can accelerate the energy transition while addressing energy justice.

Excellent examples

- Vermont's Energy Storage Access Program (ESAP)
- California Self-Generation Incentive Program (SGIP)
- Connecticut Energy Storage Solutions (ESS)
- Puerto Rico's Customer Battery Energy Sharing (CBES)
- Hawai‘i Bring Your Own Device (BYOD) Plus / Battery Bonus programs

Final Thoughts

VPPs are neither inherently just nor unjust.

Their impacts depend on who can participate, how value is allocated, what protections exist, and whether equity is measured explicitly.

- Treat justice as a core VPP performance metric. Value resilience, health, and participation alongside MW and MWhs.
- Design for inclusion, not just aggregation.
- Build VPPs that are faster, cleaner, and fairer.

Further Reading

- *On Virtual Power Plants*
  - DOE's Pathways to Commercial Liftoff: VPP
  - CESA' work on Battery-Based VPPs and Puerto Rico's 1st VPP

- *On Energy Justice*
  - BU's Institute for Global Sustainability
  - Email me at Adam.Warren.Home@gmail.com

Discussion

What good program design looks like in practice

Emerging best practices from battery-based VPP and storage program design.

- Combine upfront support with performance payments to lower capital barriers and reward real grid services.
- Allow multiple ownership models, including customer-owned, third-party-owned, and utility-owned where appropriate.
- Permit third-party aggregators to expand marketing reach, enrollment pipelines, and customer support.
- Include equity provisions such as carve-outs, incentive adders, and low- or no-cost financing.
- Preserve customer agency with clear opt-out rights, backup reserve controls, and transparent communication.

Implication

Justice-centered VPPs should value services, not just asset ownership.

The design challenge is to make participation broad, legible, and trustworthy.

The strongest positive case for VPPs

Reduce local harms

Peak shaving and peaker displacement can lower local pollution exposure in overburdened communities.

Lower energy burden

Bill savings and performance payments can direct economic value to participating households.

Strengthen resilience

Backup power, pre-conditioning, and storage can reduce outage-related harm during extreme events.

Broaden participation

Community-centric aggregation, multifamily models, and non-asset-based participation can open access beyond affluent homeowners.

Support policy goals

Well-designed programs can align with reliability, affordability, decarbonization, and public-health objectives at the same time.

Bottom line: VPPs can accelerate the energy transition while addressing energy justice.

Energy Storage Access Program

Vermont Electric Cooperative

Lisa Morris

Energy Services Analyst

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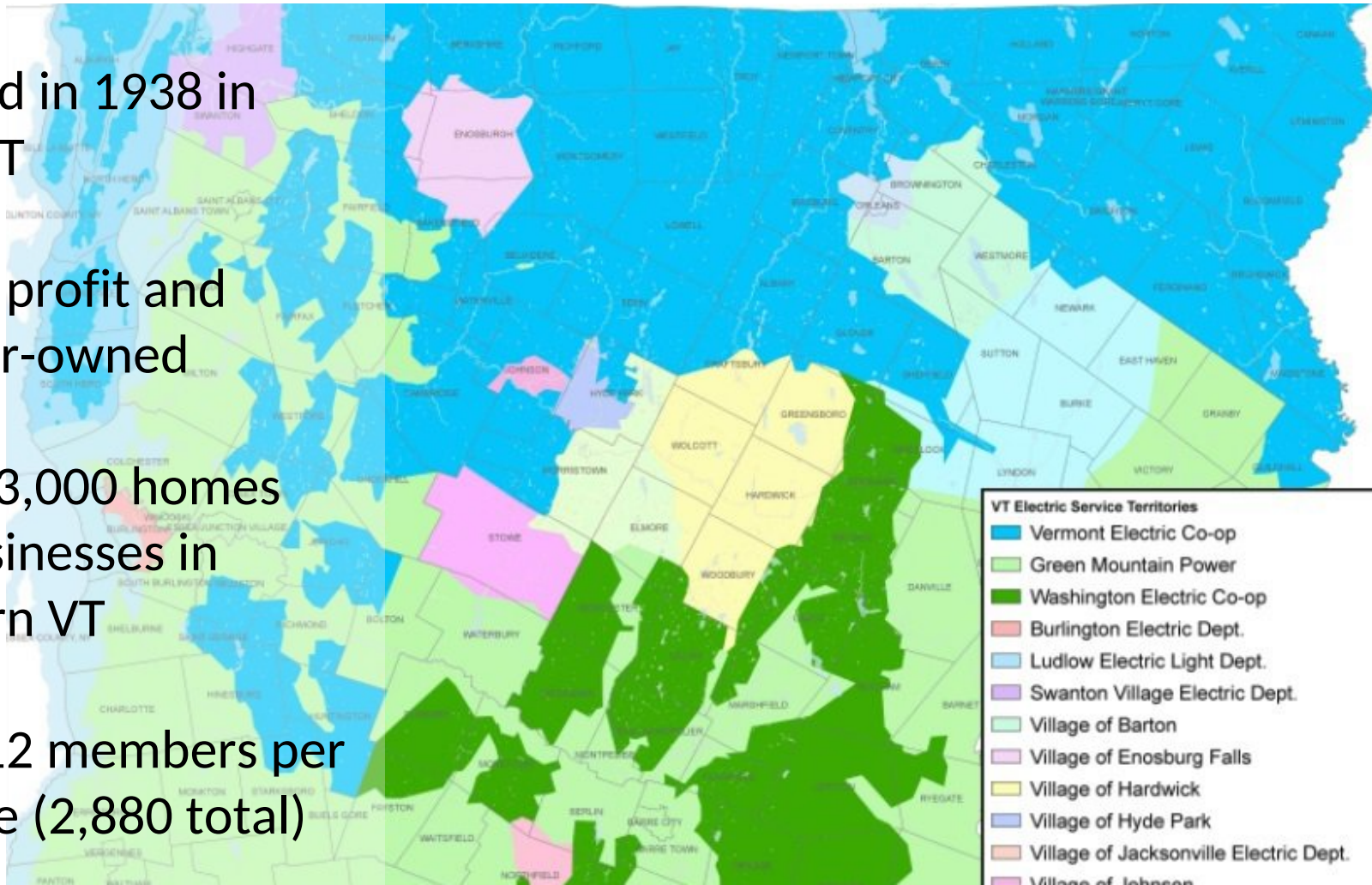
About Vermont Electric Co-op

- Founded in 1938 in Eden, VT
- Not-for profit and member-owned
- Serve 33,000 homes and businesses in Northern VT
- About 12 members per line mile (2,880 total)



Flexible Load Program - Home Batteries

- Incentive for members who allow VEC to access home batteries
- Tesla, Enphase, Franklin, and Emporia batteries are eligible, among others
- About 200 batteries are enrolled, providing about 1 MW of dispatchable load

Barriers to Participation

- Cost – installation cost of two batteries is about $25k

- Flexible Load Program requires the participant to pay for the installation of the battery, and VEC provides an incentive for using them

Energy Storage Access Program (ESAP)

- $900k grant through the American Rescue Plan Act (ARPA)
- Fully funding ~45 installations of two Tesla Powerwalls for low and moderate income households
- Targeted outreach to members on the medical alert list, then to households with less reliable service
- Sent emails and letters to about 400 members and received about 70 responses

Program Benefits

- Battery backup in the event of an outage – 27.5 kWh
- About 450 kW of peak shaving capacity
- Opportunity to explore a non wires alternative for a constrained distribution circuit

Questions?

Email Lmorris@vermontelectric.coop or call 802-730-4399