THANK YOU REV2026 SPONSORS

2026 REV Conference

Reducing the Cost of Home Electrification

Electrifying without panel and service upsizing

AJ Rossman
Li Ling Young

Efficiency Vermont

Residential Electrification

Customers want to stop using fossil fuels in homes for:

- Space heating
- Water heating
- Clothes drying
- Cooking
- Transportation

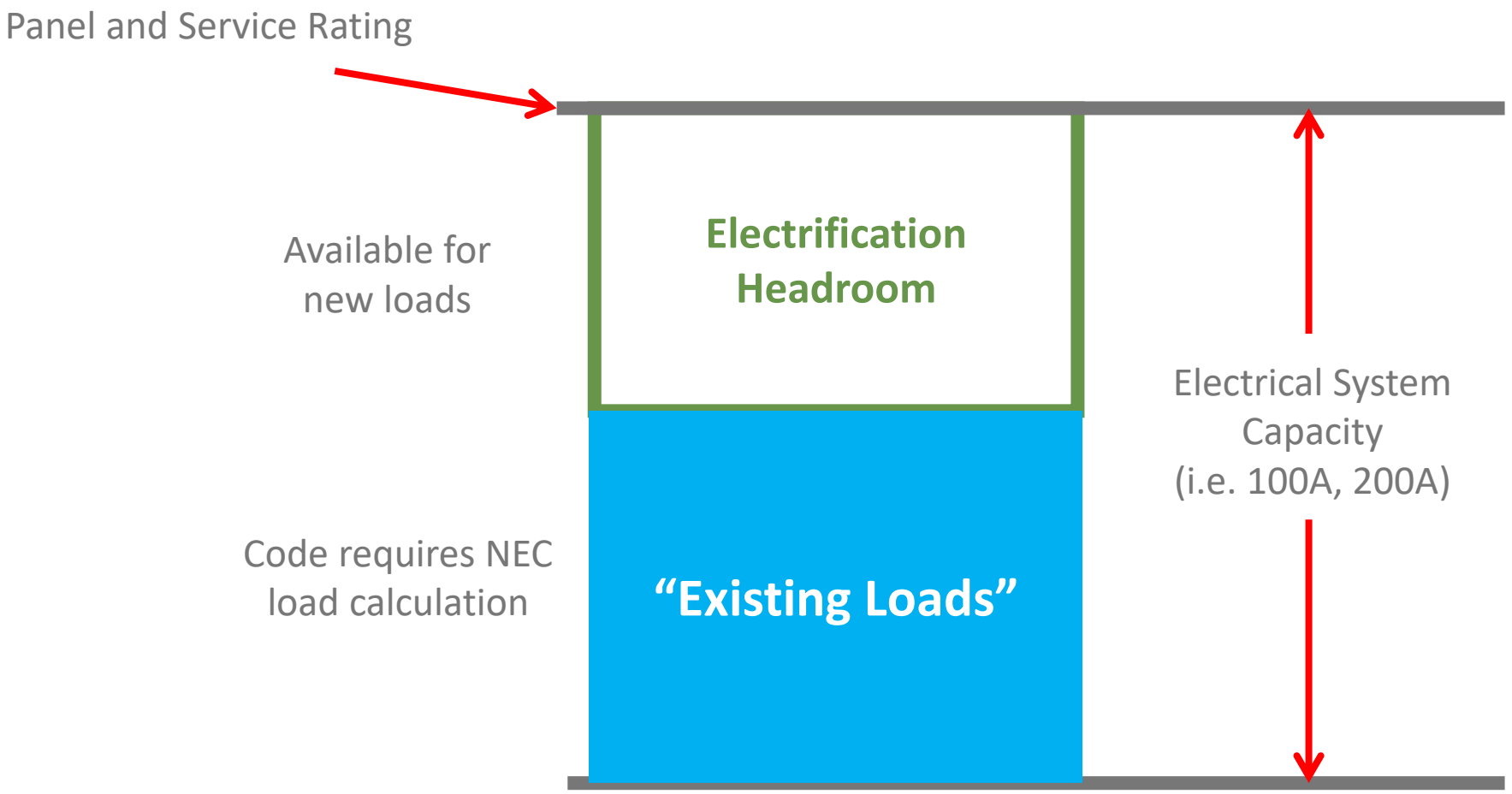
Impact of Home Electrical Upsizing

- Panel and service upsizing -> $3-$20K
- Added costs can kill projects
- Delayed projects due to utility approval can kill projects
- Upsizing all services leads to increased electricity rates
- Early adopters benefit, others may be shut out

Can We Electrify without Upsizing?

Efficiency Vermont

What is Electrification Headroom?



Existing Dwelling Capacity

- New homes built after 1990 are typically 200A
- Older homes are typically 100, 150 or 200A
- Condos typically 100A
- Apartments typically 50 to 100A
- Manufactured homes typically 60 or 100A
- ~40% of homes in NE have 100A Service (LBNL)

Determining Existing Loads per National Electric Code

Calculation-based that requires an Electrician and Worksheet, Spreadsheet or App

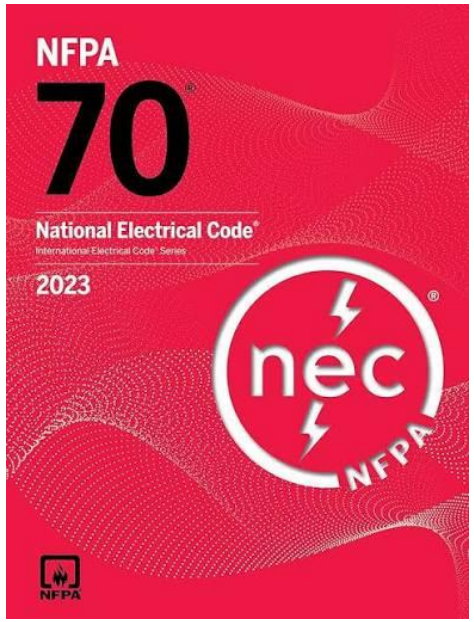
NEC 220.83 Optional Method for Existing Dwelling Units A) and B)

NEC 220.70 / 750.30 – Energy Management Systems (EMS)

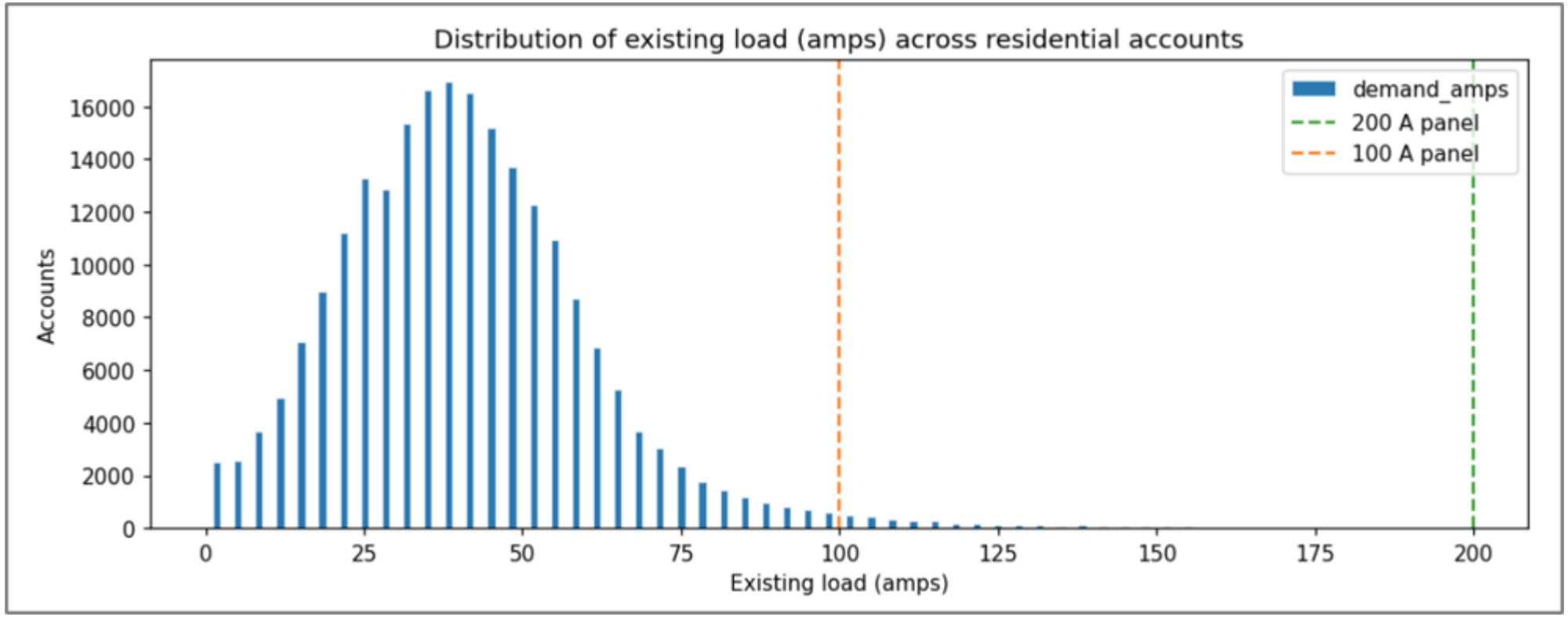
NEC 220.60 – Coincident Loads

NEC 220.87 – The "Metered Data" Method

Data-based that requires Utility AMI Data or 30-day recording amp-meter*



Vermont 220.87 Existing Loads



* Based on AMI data from >200,000 Vermont households and applying NEC 220.87
  Median existing load is 39 amps, 90% of accounts are 65 amps or less.
  1.4% of accounts have demand greater than 100 amps – panel capacities unknown

How Much Load Can We Add to the Existing Load?

Heat pump

15 to 30A

Water heater

20 to 30A

Clothes dryer

20 to 30A

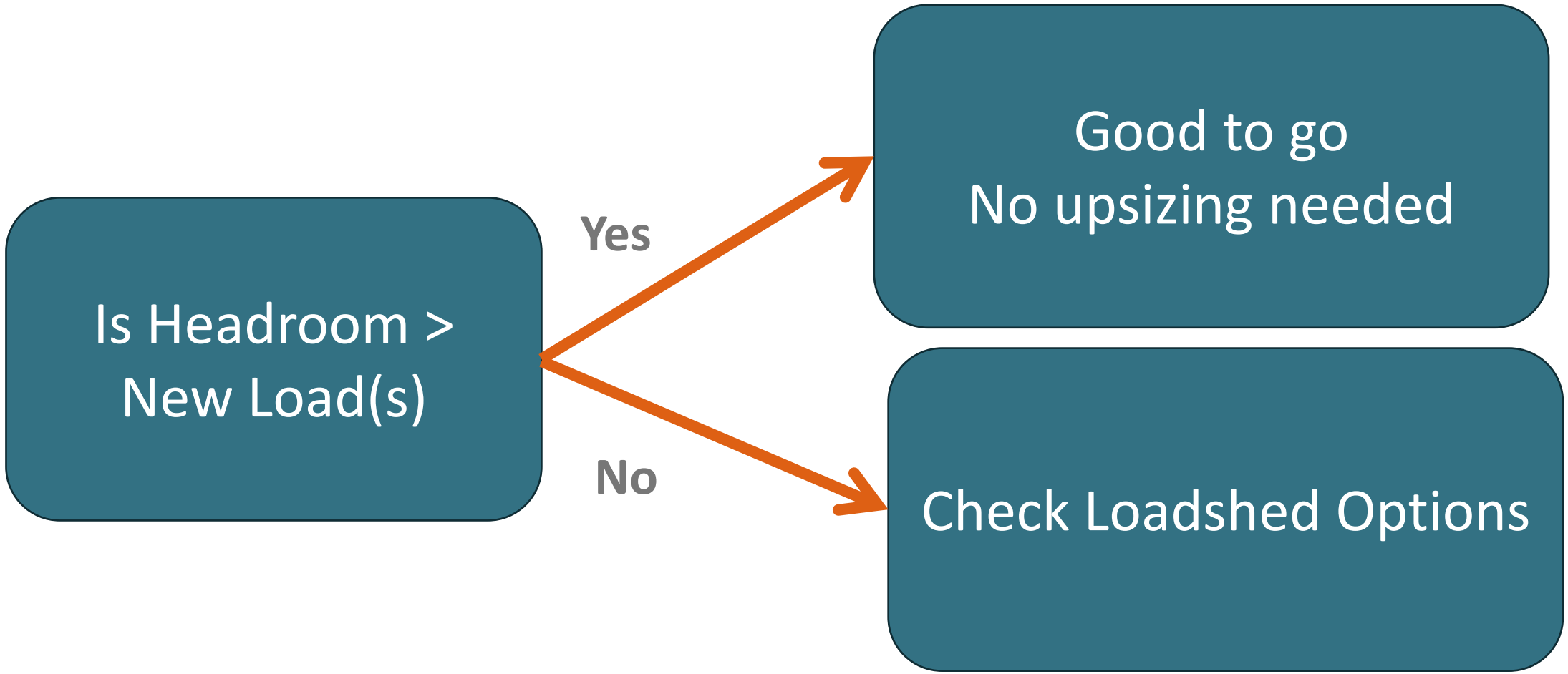
Cooking range

40 to 50A

Electric car charger

30 to 50A

Do You Need to Upsize Service and Electrical Panels ?



Loadshed Options

Efficiency Vermont

UL-listed / NEC-approved Solutions

If Dwelling

Existing Load Calc

+ New Loads >

Existing Capacity

- Meter Socket Adapters
- Circuit Sharing Devices
- On/Off Loadshed Devices
- Dynamic Loadshed Devices

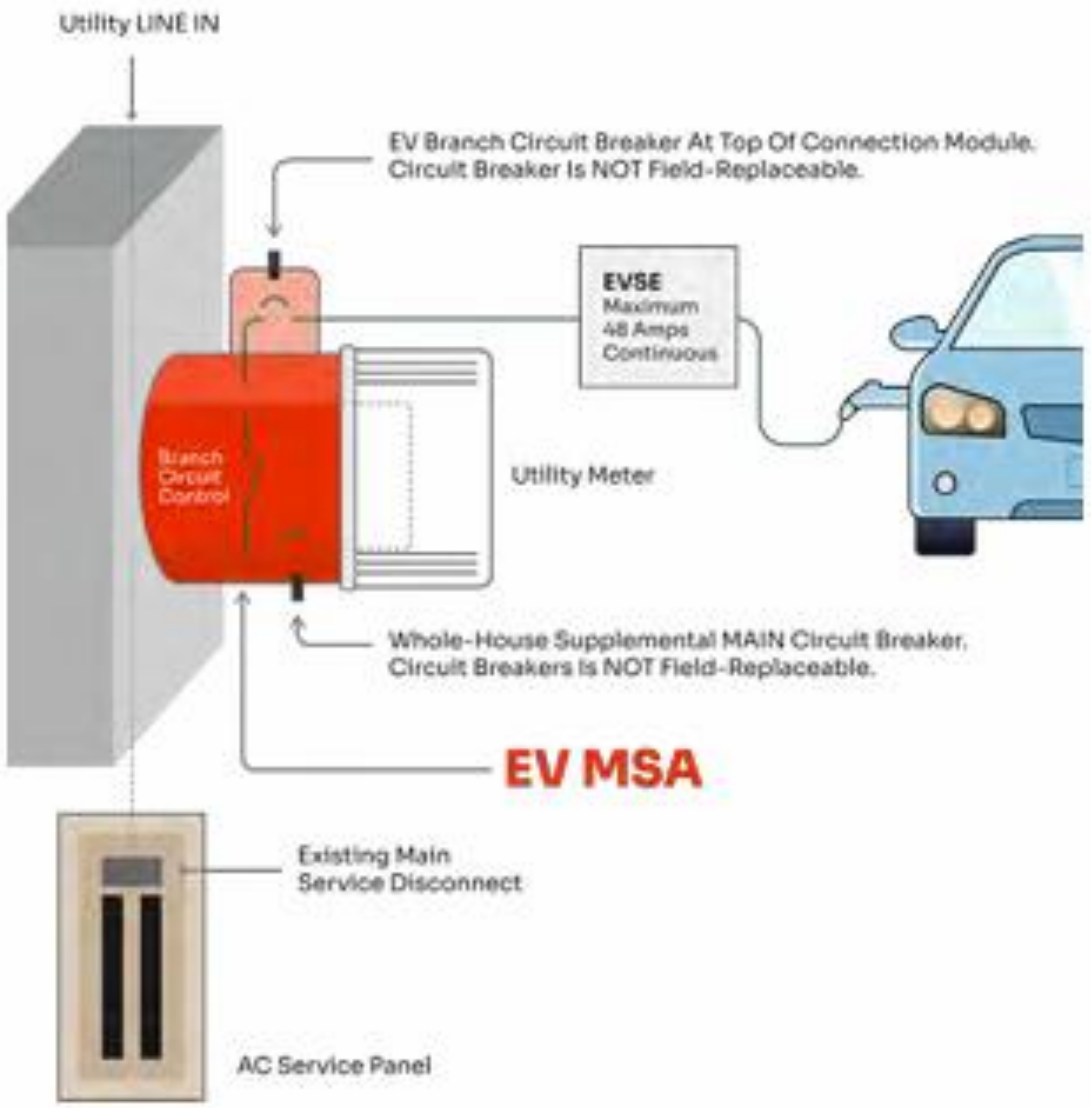
Other Options

- DIY Circuit Sharing
- Smart Panels
- Batteries

Meter Socket Adapters

ConnectDER EV

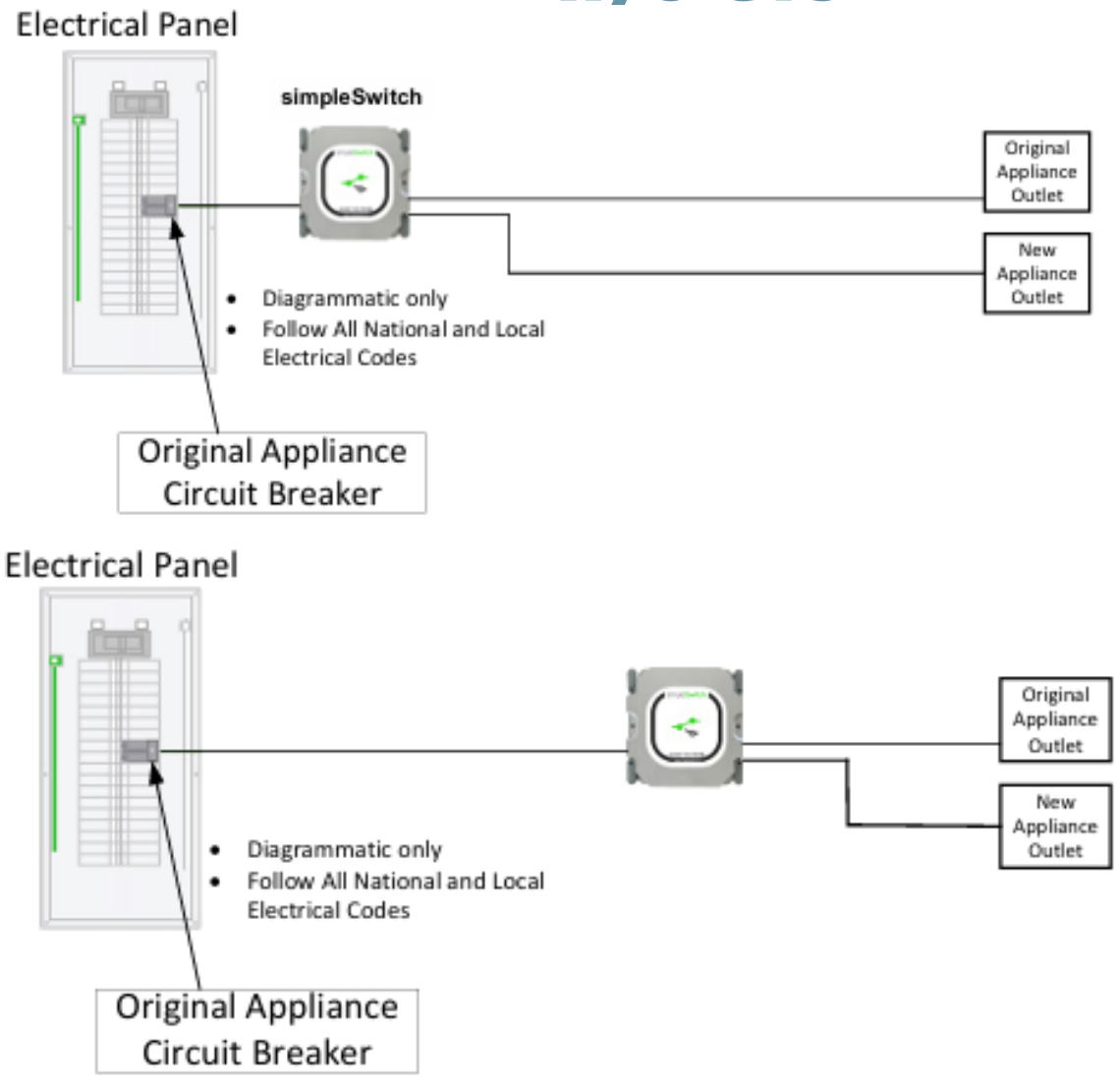
- Connect a load directly behind the meter
- Does not take up a breaker spot in load center
- Originally for PV, now can be used for loads such as EVSE
- Opens relay when load hits capacity threshold to shed load
  - 80% or greater for 15 minutes
  - 95% or greater for 30 seconds
- Power restored after 15 minutes



Circuit Sharing Devices

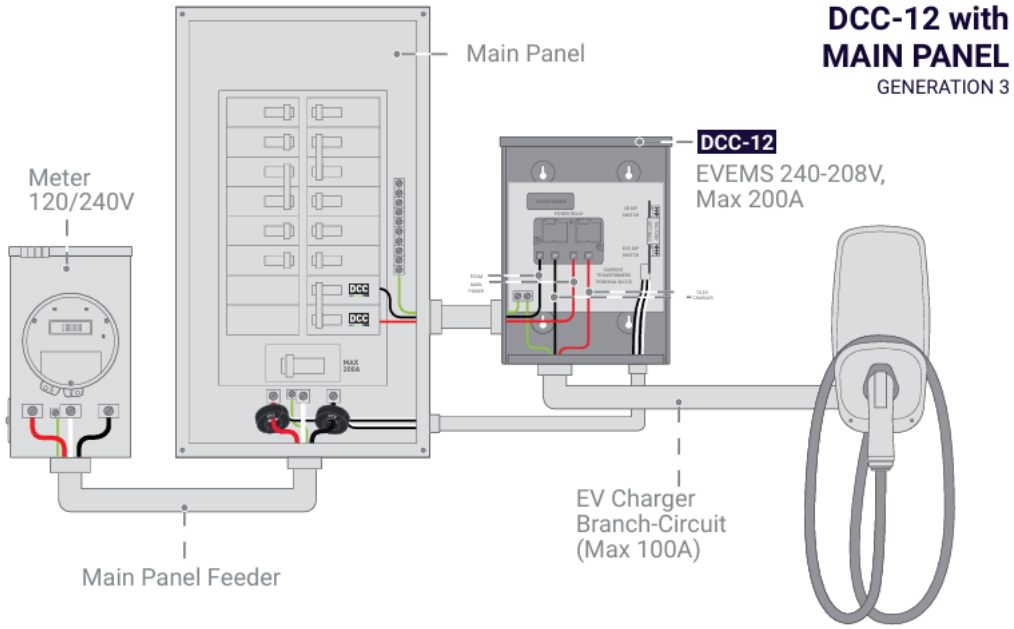
- Chooses between two devices
- No current measurements needed
- Opens relay for secondary load (or subpanel) when primary load drawing current
- Can be used next to panel or end of branch circuit
- NEC 220.60 Coincident Loads

simpleSwitch w/o CTs

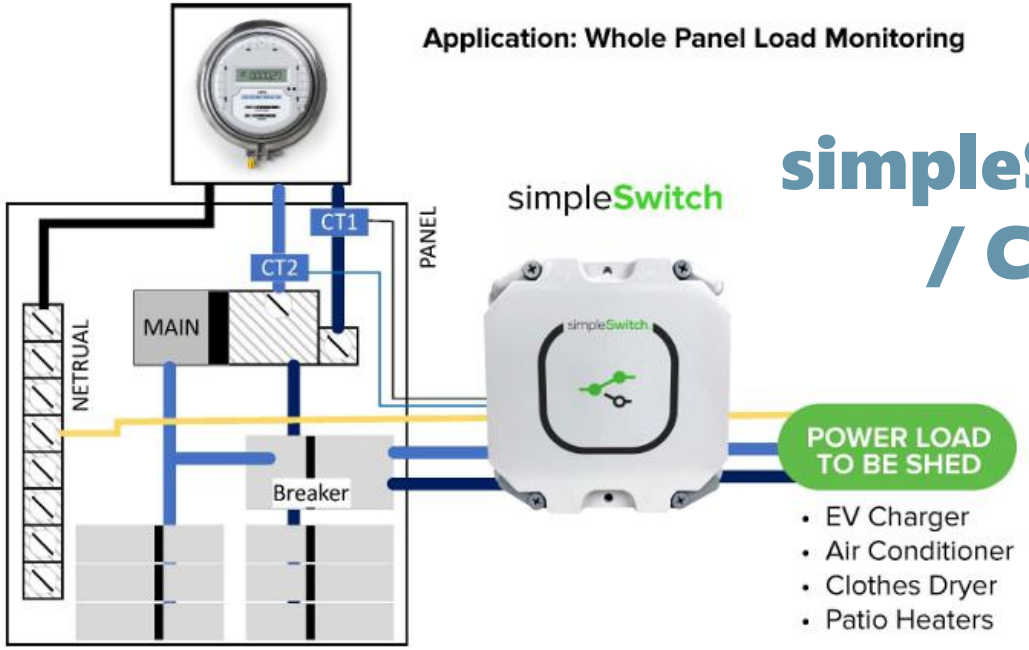


On/Off Loadshed Devices

- Used to shed load at programmed setpoint
- Current Transformers installed on panel mains to know when load nearing capacity
- Opens relay for single load (or subpanel) when mains near capacity threshold
- Can be used to ‘remove’ EV Charger from load calculation (up to 60A for 48V EVSE)
- Power restored after current below setpoint
- NEC 220.70 EMS



DCC



simpleSwitch / CTs

Dynamic Loadshed Devices

- Can be used for EV Chargers only
- Current Transformers installed on panel mains to know when whole home load nearing capacity
- EVSE load tapered to stay under programmed capacity threshold
- Can be used to ‘remove’ EV Charger from load calculation (up to 60A for 48V EVSE)
- NEC 220.70 EMS

Emporia Vue with PowerSmart

Thank you. Please Contact Us

AJ Rossman
Electrical Engineer
arossman@veic.org

Li Ling Young
Lead Engineering Consultant
lyoung@veic.org

20 Winooski Falls Rd, 5th Floor
Winooski, VT 05404

efficiencyvermont.org

Efficiency Vermont

FRANKLINWH

How far off was my home's NEC 220 calculation?

2,500 sq ft	Single-family home
100%	Fully electric
EV	Home EV charger (load controlled)

200+ A

NEC 220.83 Load Calc result

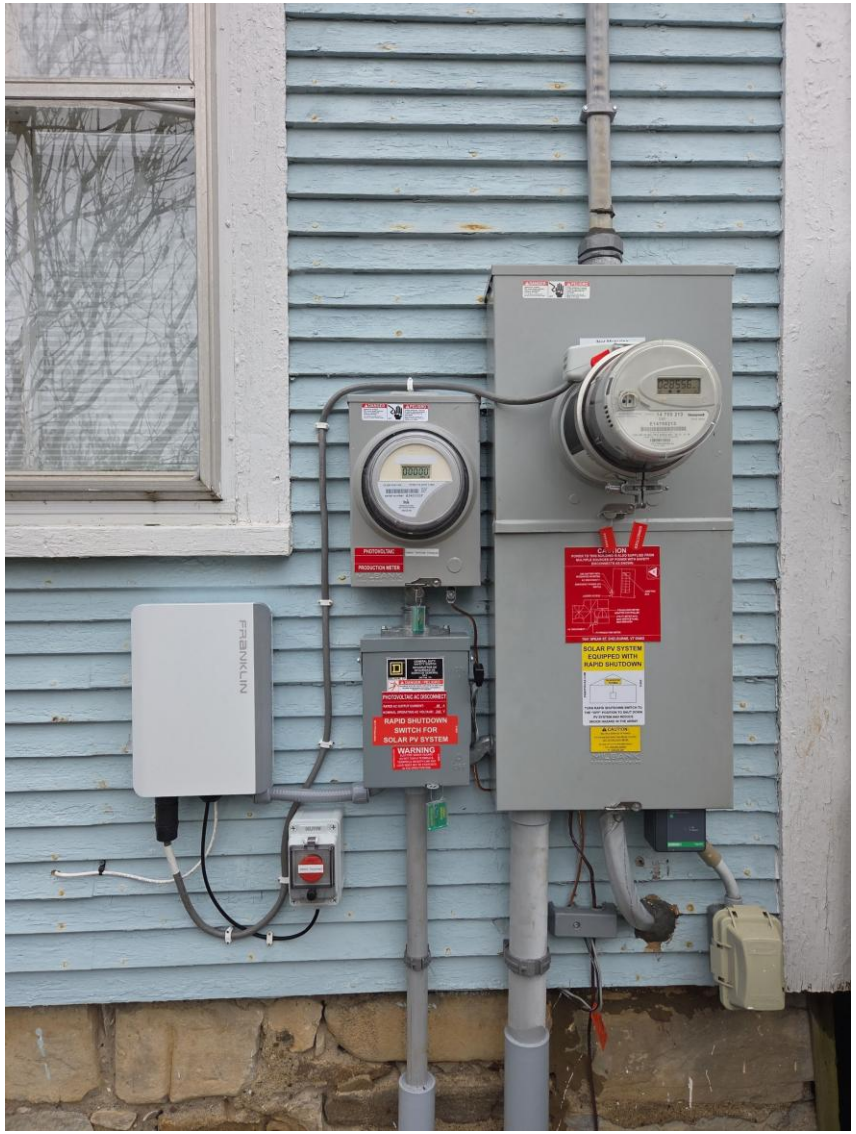
Guess my measured peak

A 50 to 100 A

B 100 to 150 A

C 150 to 200 A

Existing technology supports us



FRANKLINWH

Existing technology supports us

HOMEOWNER VALUE

Meter socket adapter

Faster, simpler install

Smart breakers

Stretch the battery further during an outage

Battery

Backup power for the home

GRID SUPPORT

Smart breakers

Avoid a service upgrade

UL 916 · NEC 120.7

Power control system

Avoid a service upgrade

UL 1741 PCS · NEC 705.13

Battery

Charge and discharge with grid needs

Smart inverter

Local power quality

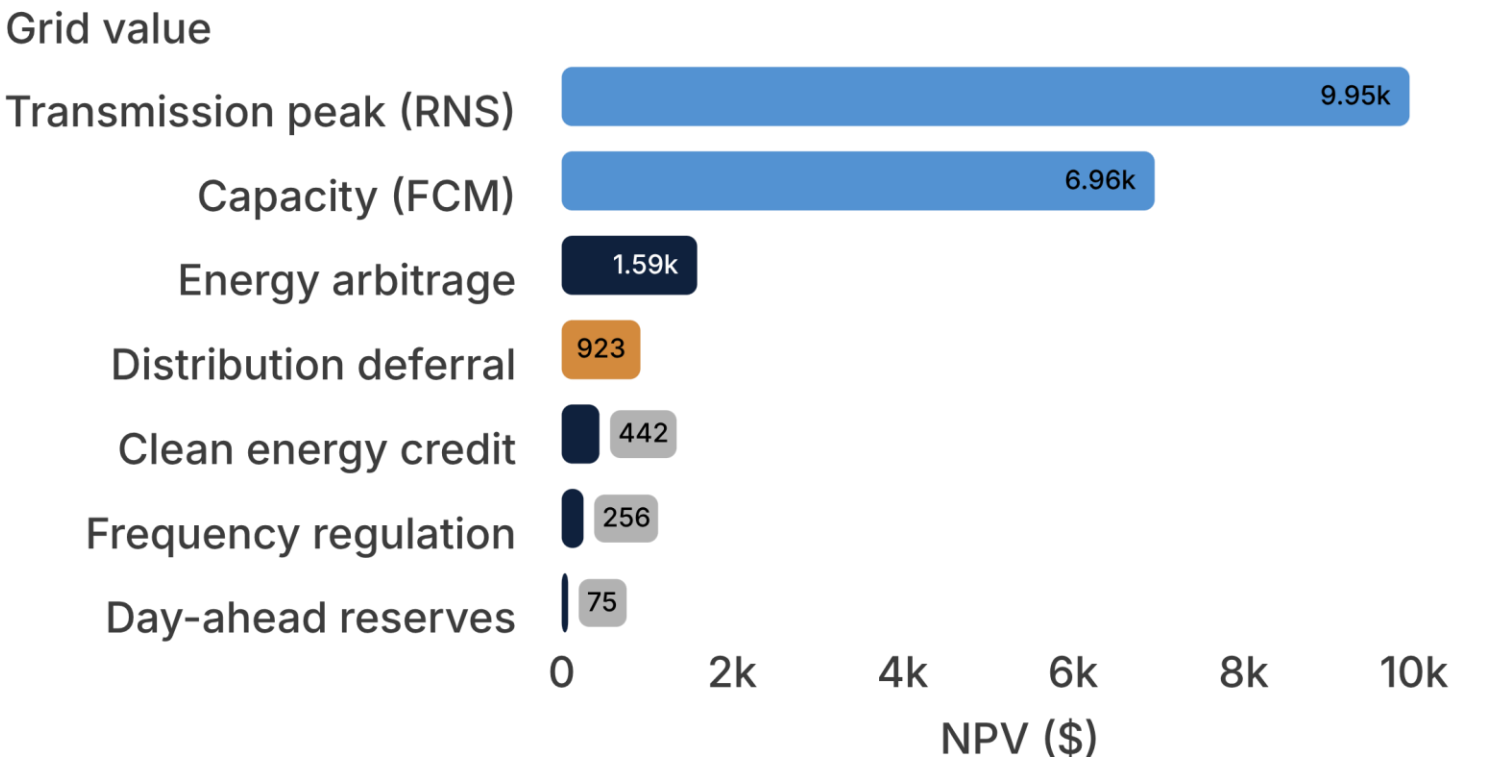
UL 1741 · IEEE 1547

Sources: FranklinWH aPower and aGate data sheets, PCS technical brief; 2026 NEC

FRANKLINWH

Utility residential battery stack in the wild

Lifetime value per leased system (27kWh), NPV in 2025 dollars



Total grid value: $20,187 per system

84%

from cutting peaks: transmission transmission plus capacity

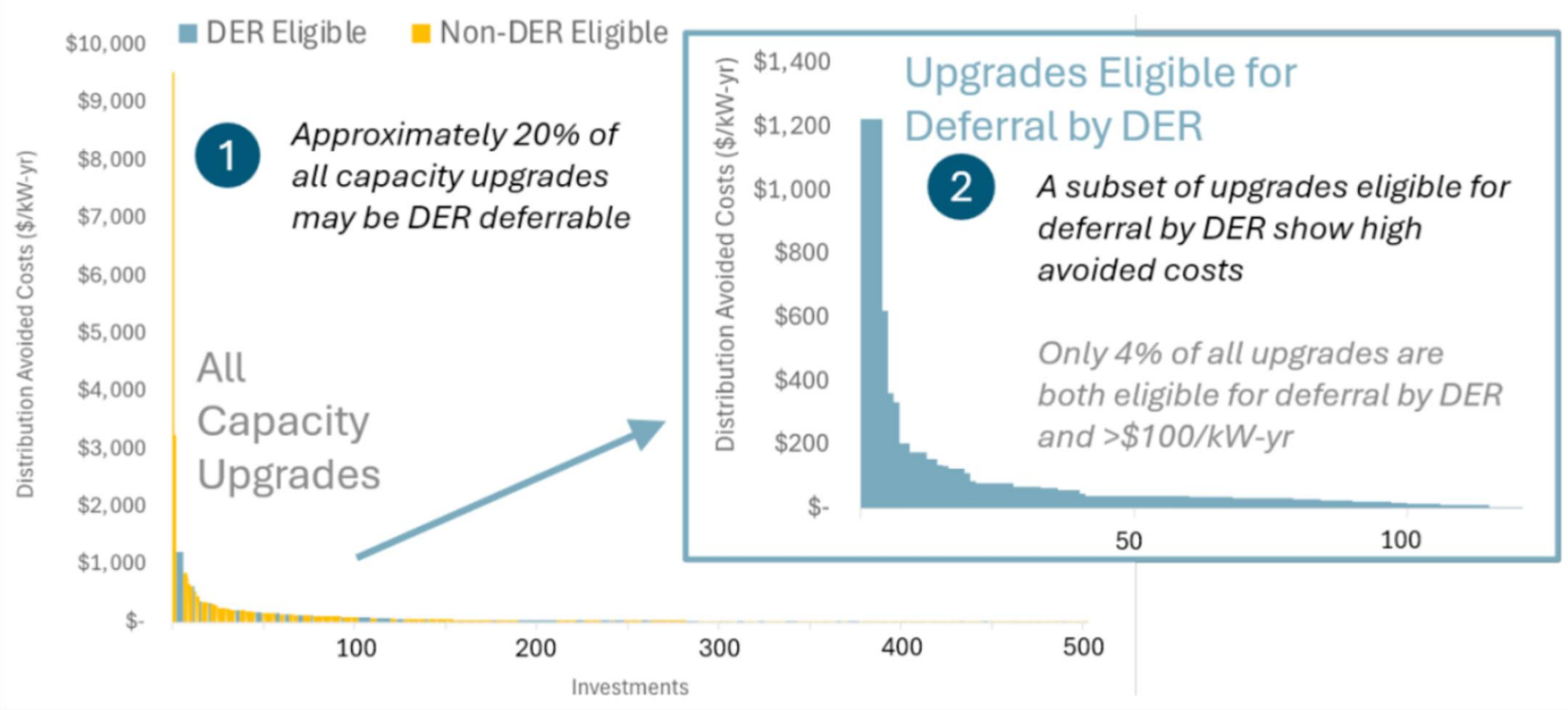
4.6%

from deferring distribution upgrades

Fleet today: 110 MW across 10,000+ batteries

Source: Utility regulatory filing

Distribution value is highly local



Source: E3, Compensating DER for Local Distribution Value While Protecting Affordability (July 2026)

EnergyHub

Unlocking capacity

REV conference

October 14, 2026

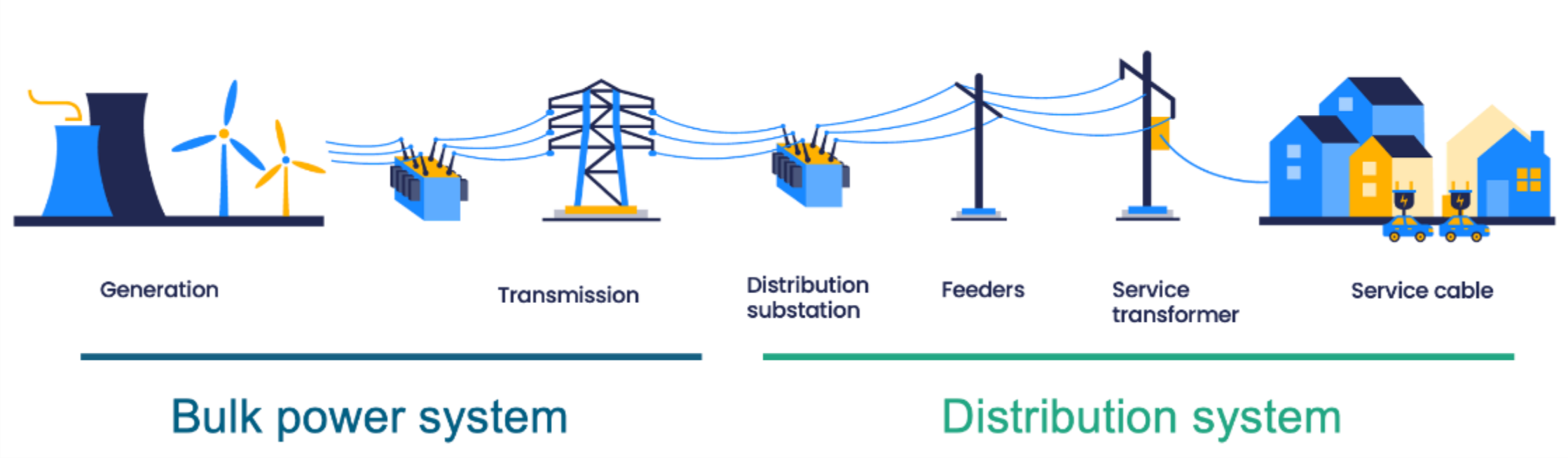
What do we mean by capacity?

01

EnergyHub

There are capacity limits across the grid

We design systems to be reliable, cost-effective and scalable... this means there are distinct limits



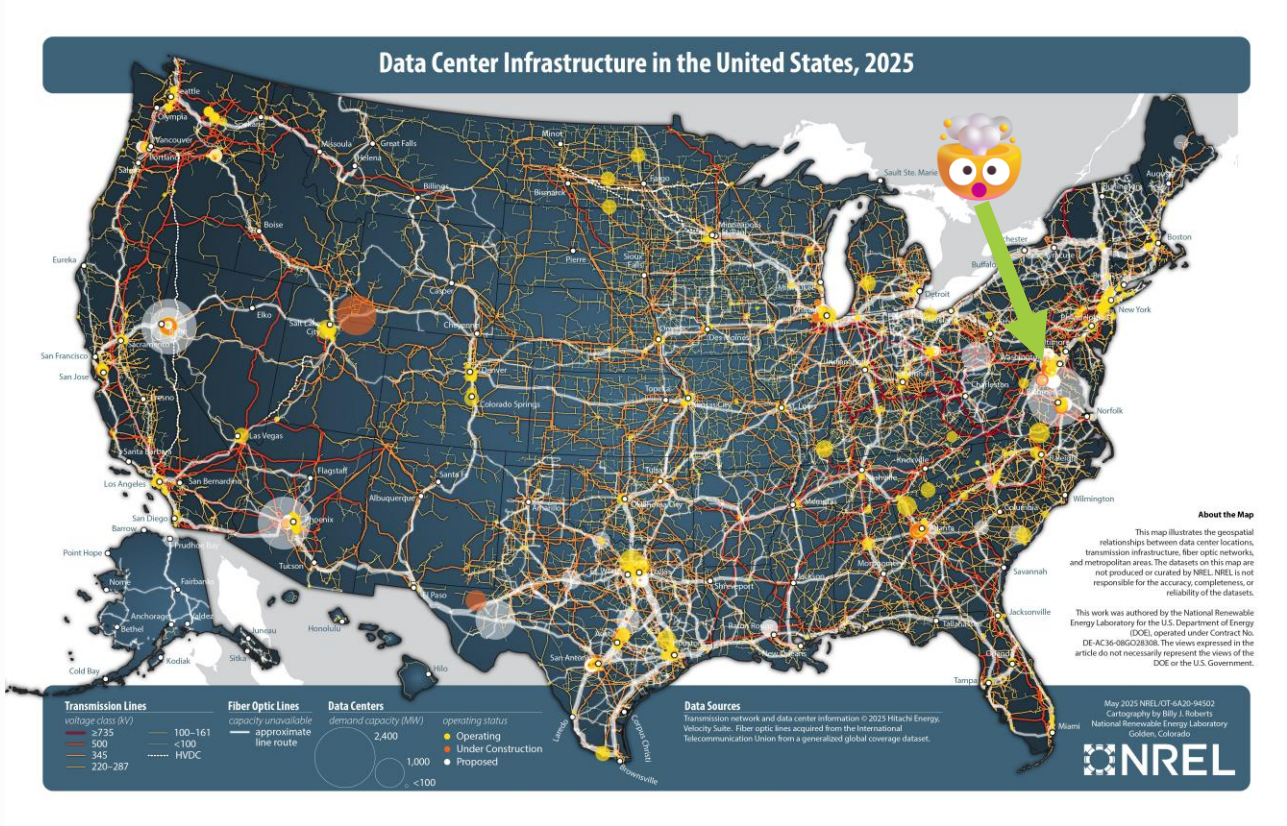
Limits are not constant but depend on your view of time:

time-of-day (ramping, peak capacity), season (winter energy constraints), and event-based (outages, switching).

SYSTEM CAPACITY

Exceeding limits comes at a cost

T&D represent +50% of utility capital expenditures



Approximate transformer failure rate is between 0.06% and 0.1% per service year. T&D World

The need for flexibility: a Vermont story

02

VERMONT FLEXIBILITY DATA STORY

VT's Renewable Energy Standard

Two primary goals for VT electric utilities

1. Add more renewable energy (Tiers 1+2)
2. Electrify demand for energy (Tier 3)

What does this look like?

- Majority of new generation will come from wind + solar
- Majority of electrification will be EVs and heat pumps

Tier 1

Big renewables
100% by 2030

Tier 2

Small renewables
20% by 2032

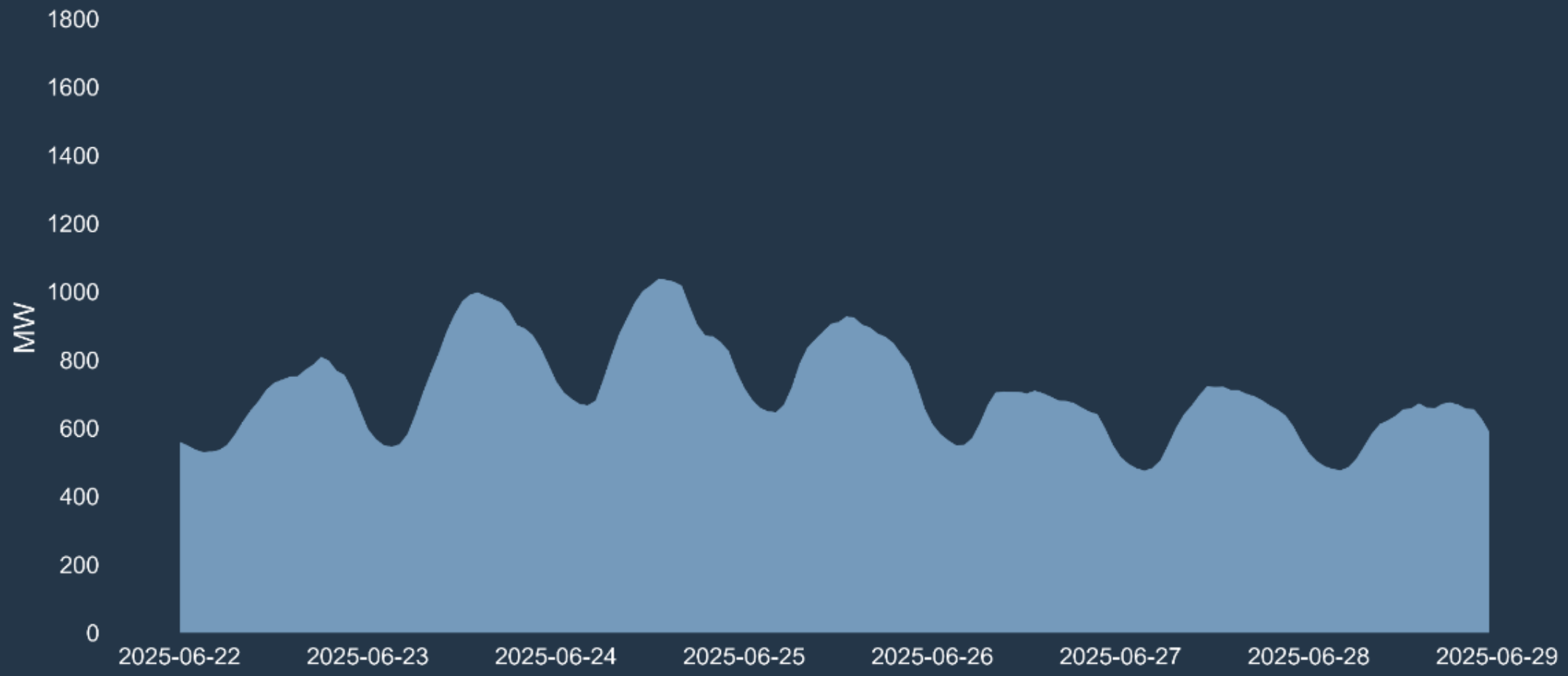
Tier 3

Electrification
12% by 2032

VERMONT FLEXIBILITY DATA STORY

A typical summer week in Vermont

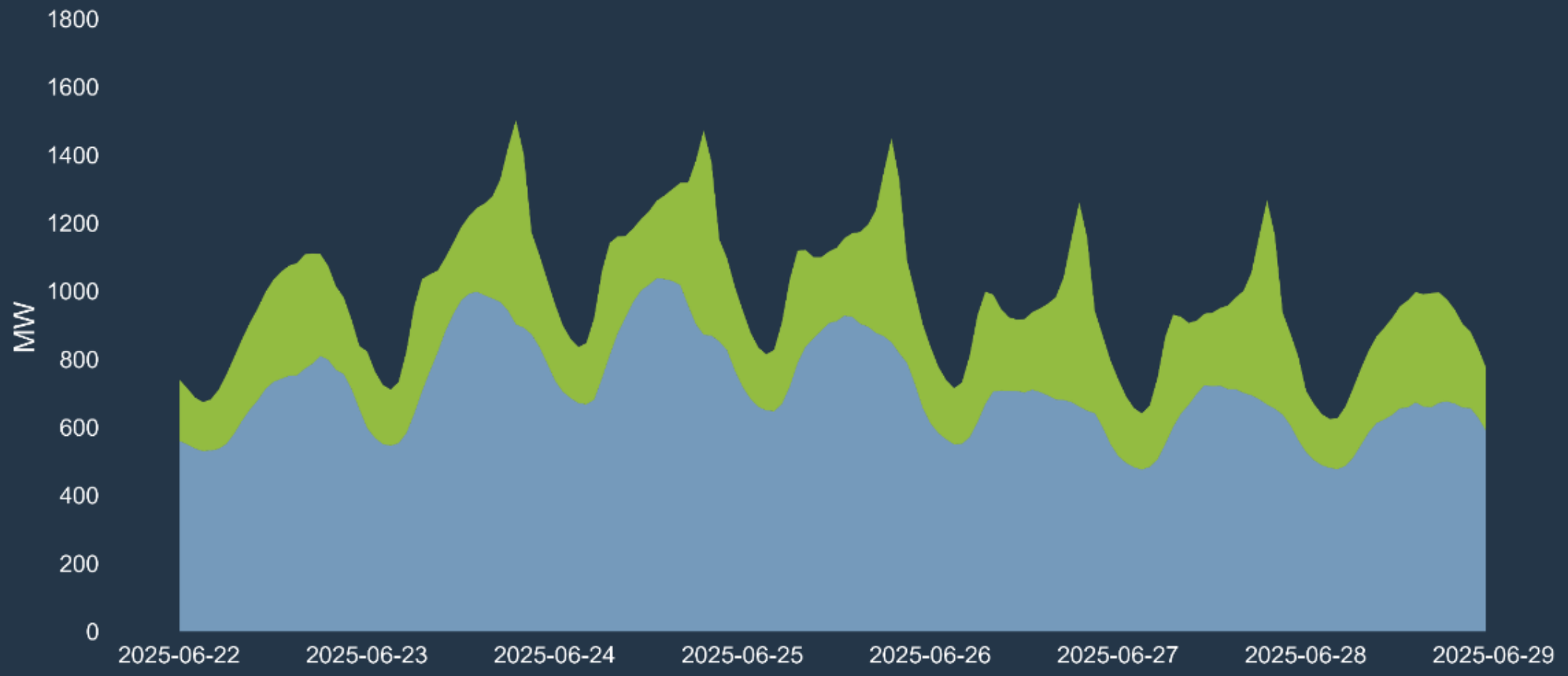
Before adding in behind the meter solar



VERMONT FLEXIBILITY DATA STORY

Electrify half of Vermont's vehicles

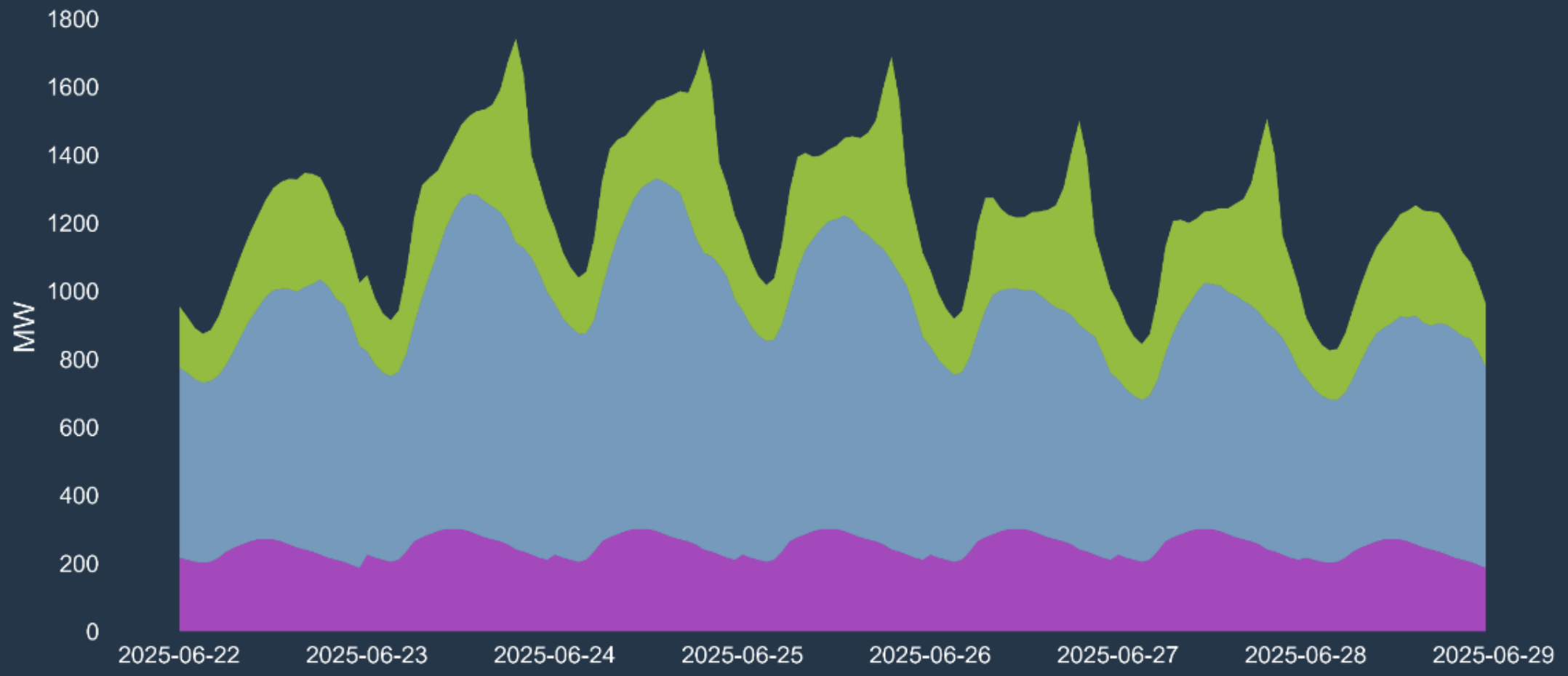
Adding ~250k EVs



VERMONT FLEXIBILITY DATA STORY

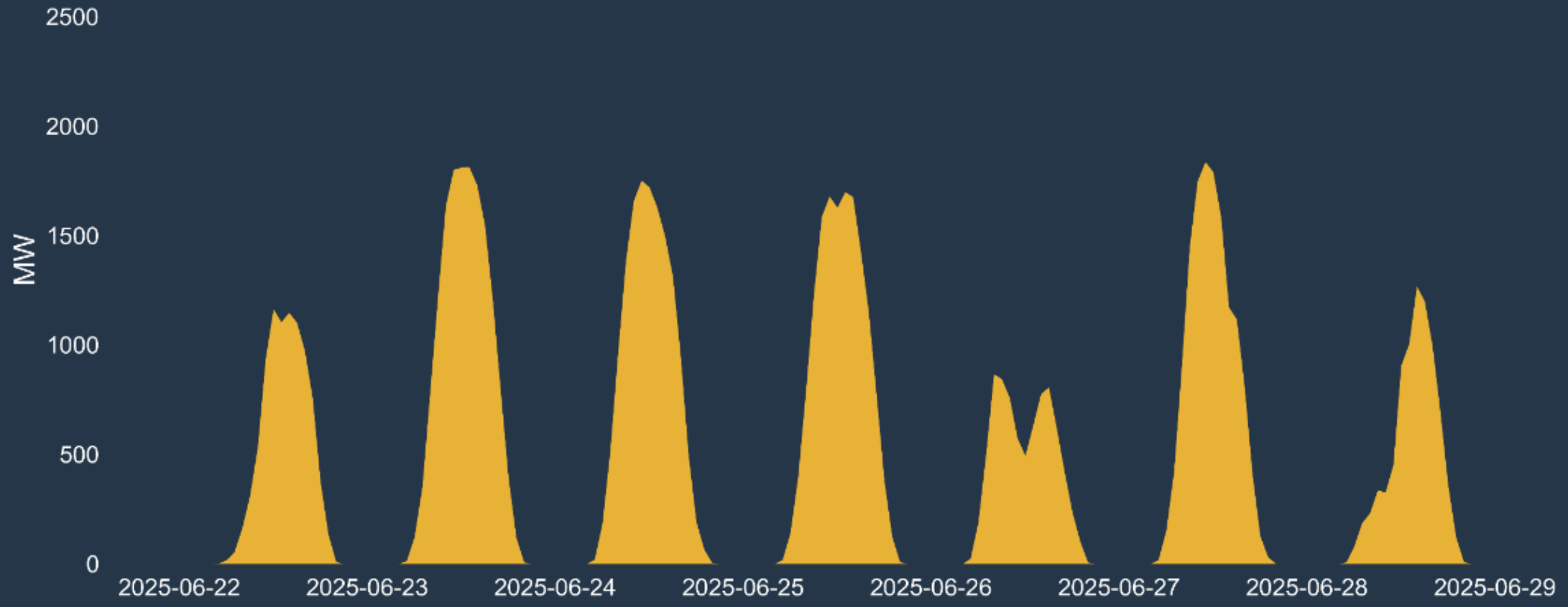
A data center comes to VT

Adding a relatively flat ~300 MW of demand



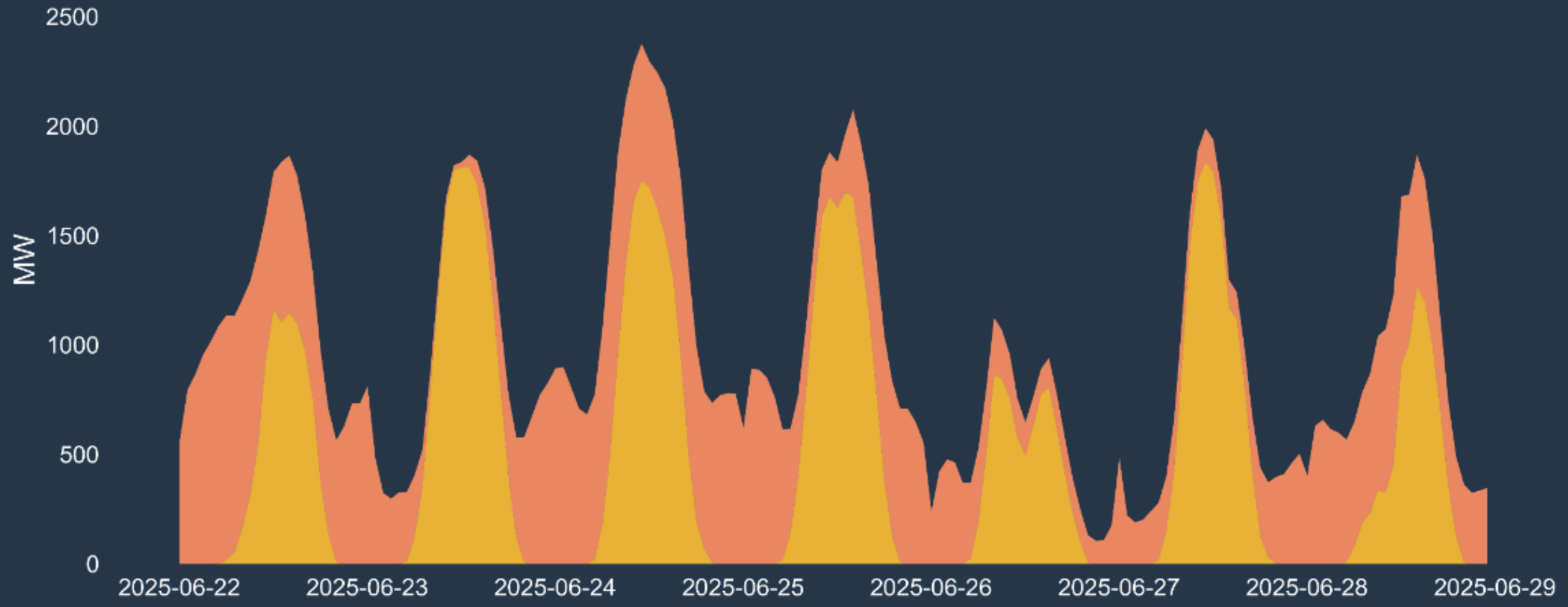
VERMONT FLEXIBILITY DATA STORY

Generate 40% of energy from solar



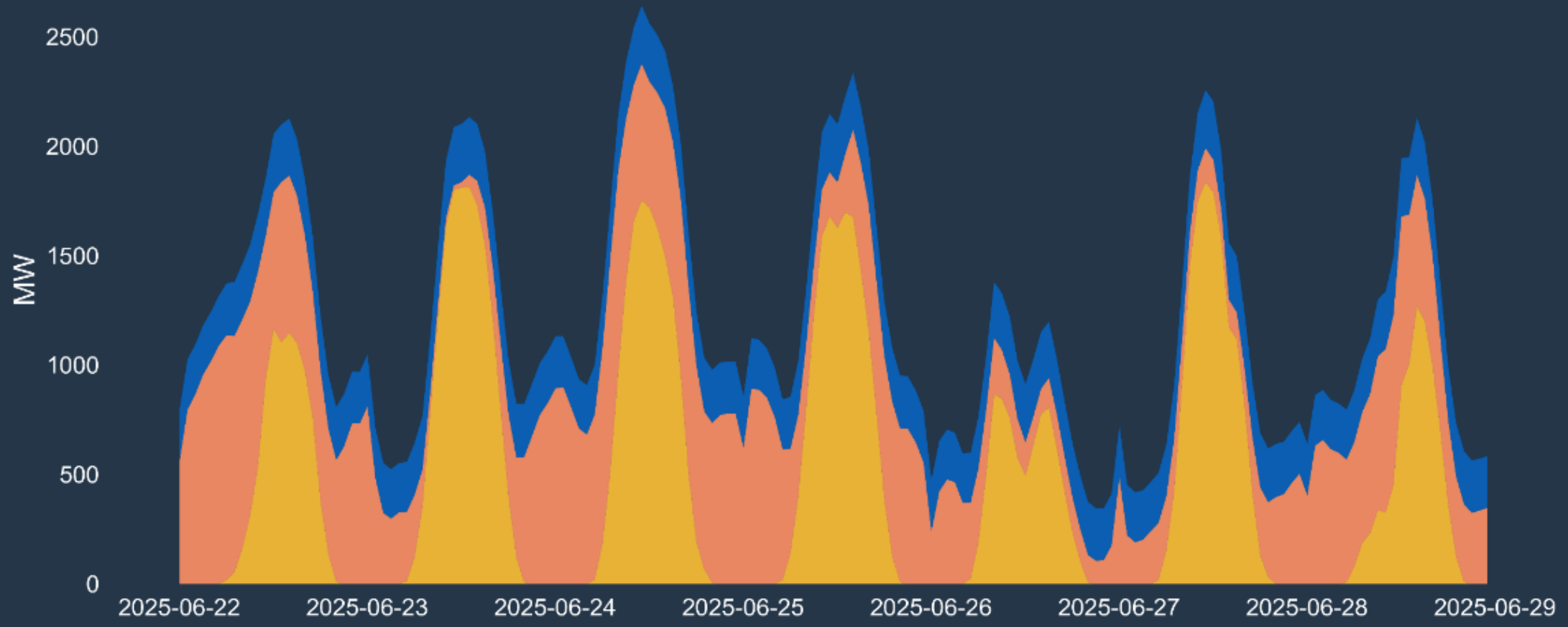
VERMONT FLEXIBILITY DATA STORY

Another 40% from wind



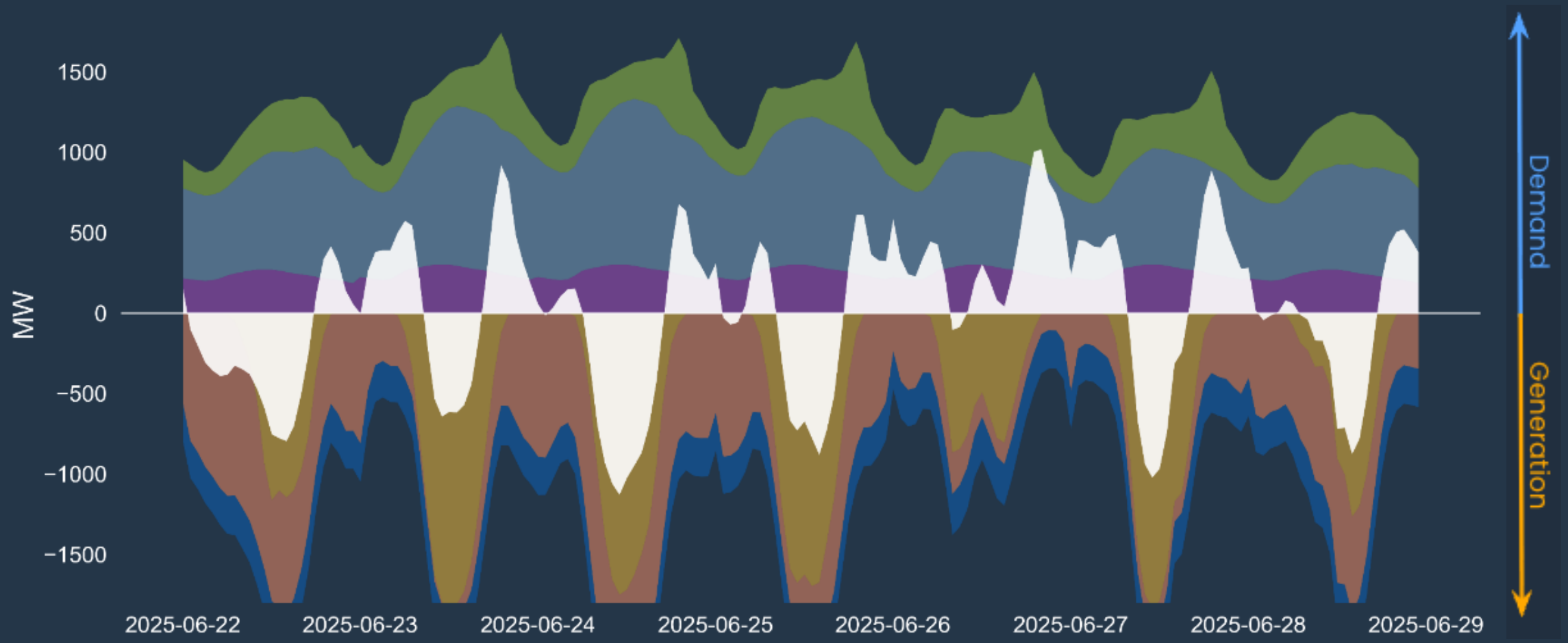
VERMONT FLEXIBILITY DATA STORY

And 20% from hydro



VERMONT FLEXIBILITY DATA STORY

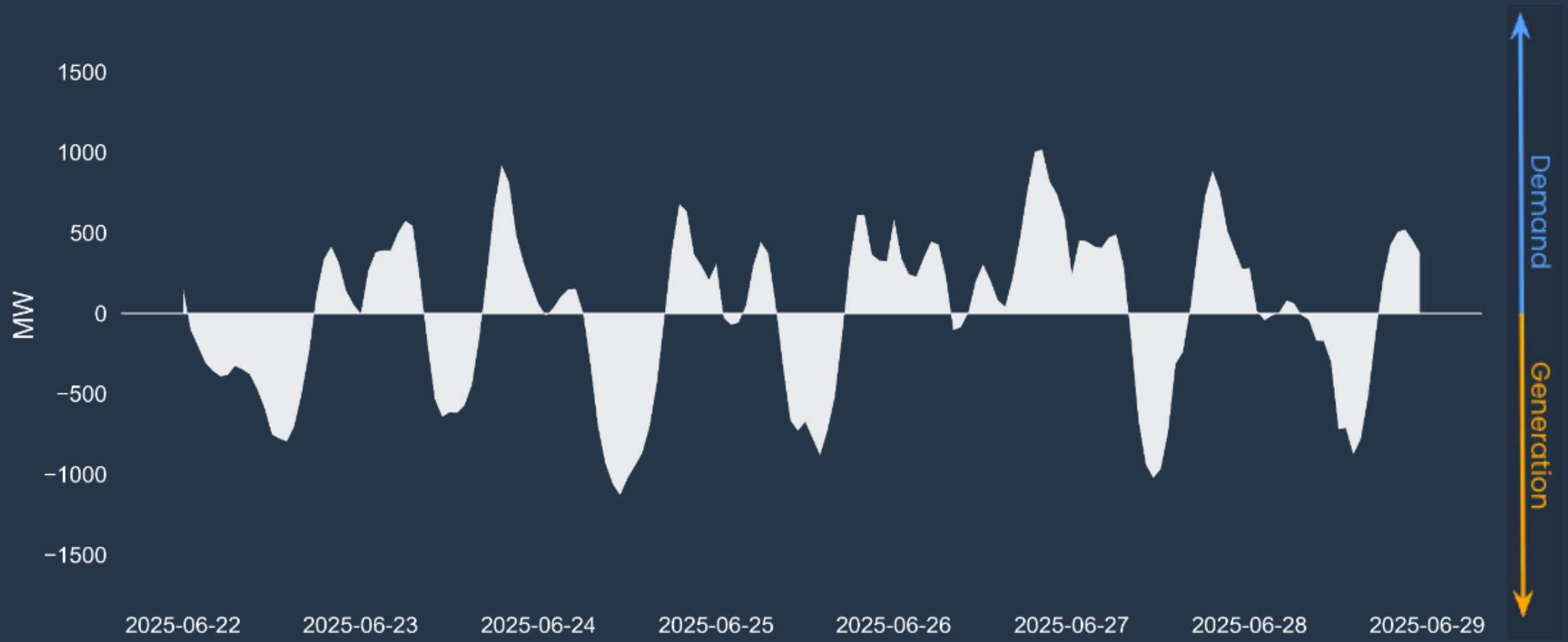
Now put it all together



VERMONT FLEXIBILITY DATA STORY

This is the problem we're solving

Distributed energy resources (DERs) can help free up capacity across the grid



How EnergyHub unlocks capacity

03

THE ENERGYHUB PLATFORM

Flexibility platform for the modern grid

EnergyHub DERMS

Grid services

- DER visibility
- Peak load reduction
- Load shaping and shifting
- Distribution asset protection
- Multi-DER event calling
- Consistent capacity

Platform services

Device and aggregator integrations | Enrollment and verification | Attribute management | Incentive management | Reporting and analytics

DERs

Thermostat | Battery | EV | C&I | Solar | Aggregations

Utility systems

CIS

CRM

MDMS

Grid DERMS

ADMS

PARTNERS

Industry-leading DER and aggregator integrations

Electric vehicles

TOYOTA · STELLANTIS · Ford · gm · TESLA · VOLVO · FIAT · RAM · DODGE · HUMMER · RIVIAN · LINCOLN · CHRYSLER · Audi · CHEVROLET · Jeep · Maserati · GMC

Battery storage

TESLA · GENERAC · sunnova · qcells · Cadenza INNOVATION · SUNRUN · ENPHASE · CanadianSolar · FORTRESS POWER · FRANKLINWH · emporia energy · sonnen · solaredge · Fermata Energy · Sol-Ark · LUXPOWER TEK · EGUANA · Schneider Electric · gm · goodleap

Thermostats

Nest · ecobee · Honeywell Home · vivint · sensi · resideo · ALARM.COM · amazon smart thermostat · Carrier · Building36 AN ALARM.COM COMPANY · TRANE · Pelican Wireless Systems

EVSEs

Synop · chargepoint · AUTEL · ENPHASE · flo · TESLA · emporia energy

Aggregators

SUNRUN · CPower · leap · voltus · nrg · IPKEYS POWER PARTNERS · enersense · qcells · Highland · NEXTGEN · enel x · IceTec · ChargeScape · FLIP

EnergyHub

~240
Utility and LPC implementations

3.6+ GW
Dispatchable flexible capacity

74+
DER vendors integrated

74+
DER vendors integrated

DISTRIBUTION CAPACITY

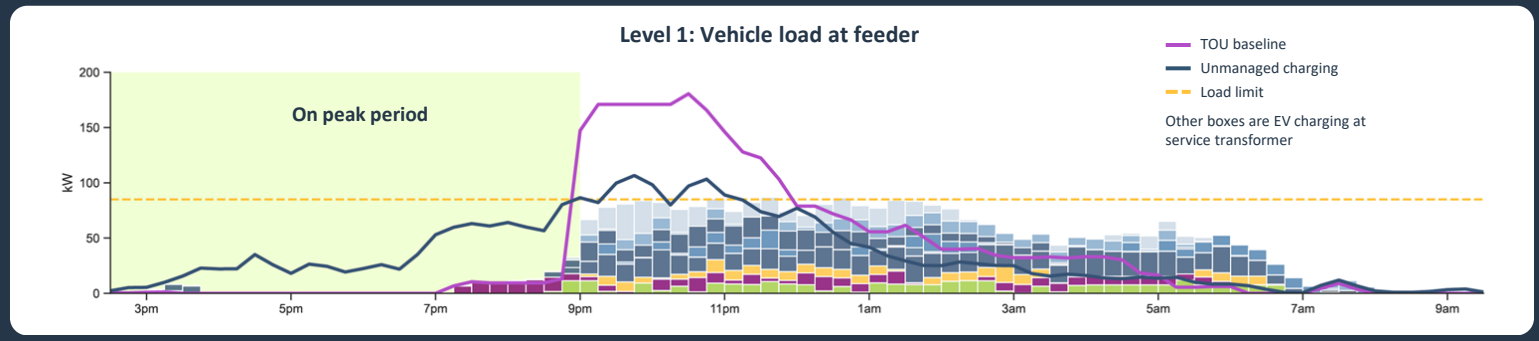
Multi-level distribution load optimization

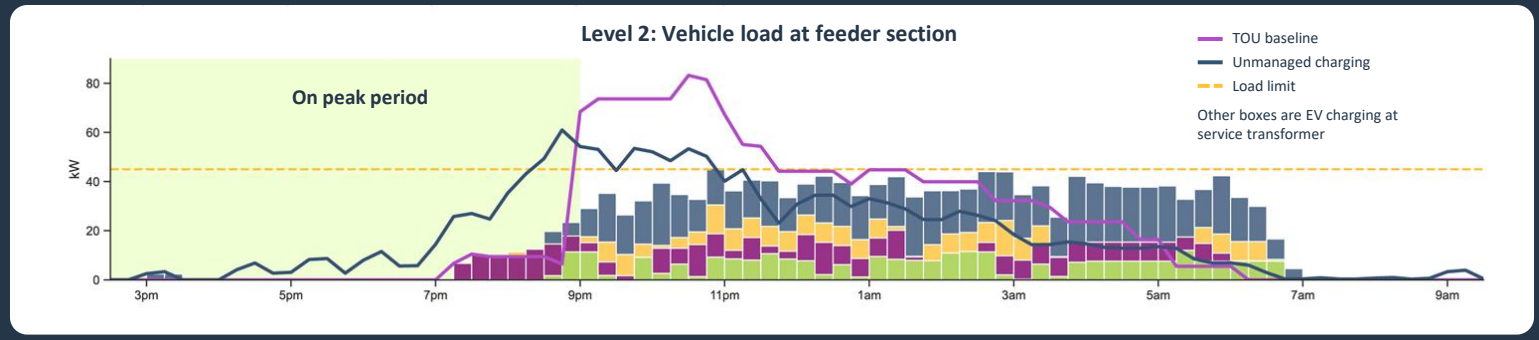
95%
Off-peak charging

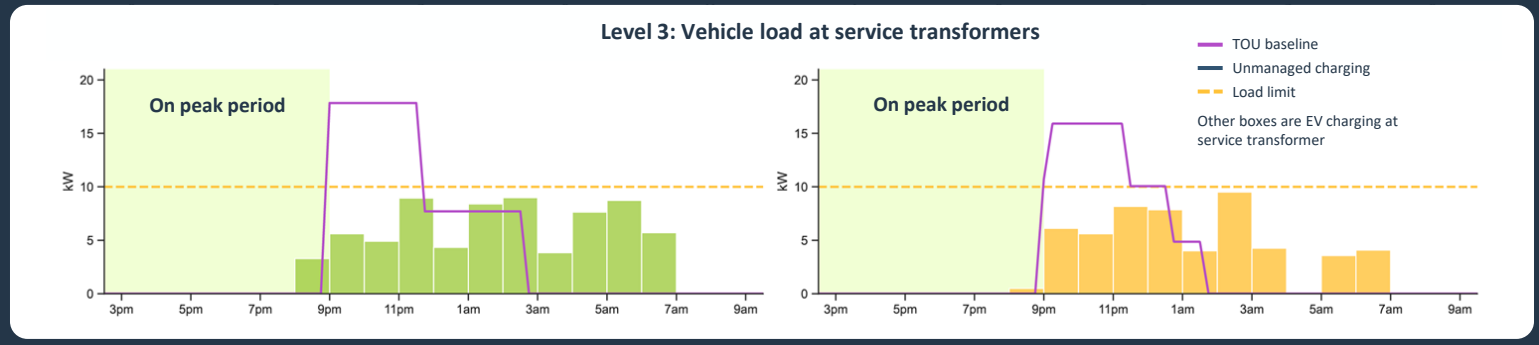
<10%
Opt-outs

100%
of charging sessions reach the target charge

50%+
Reduction in EV charging overloading grid assets

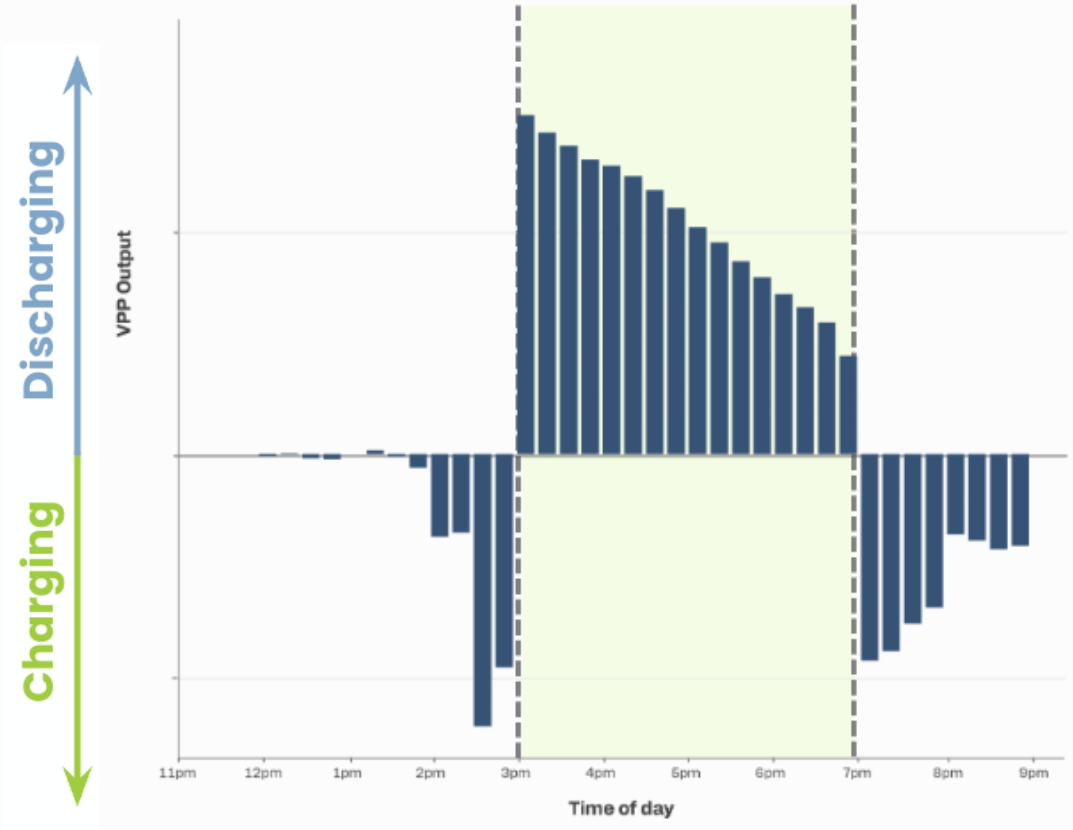




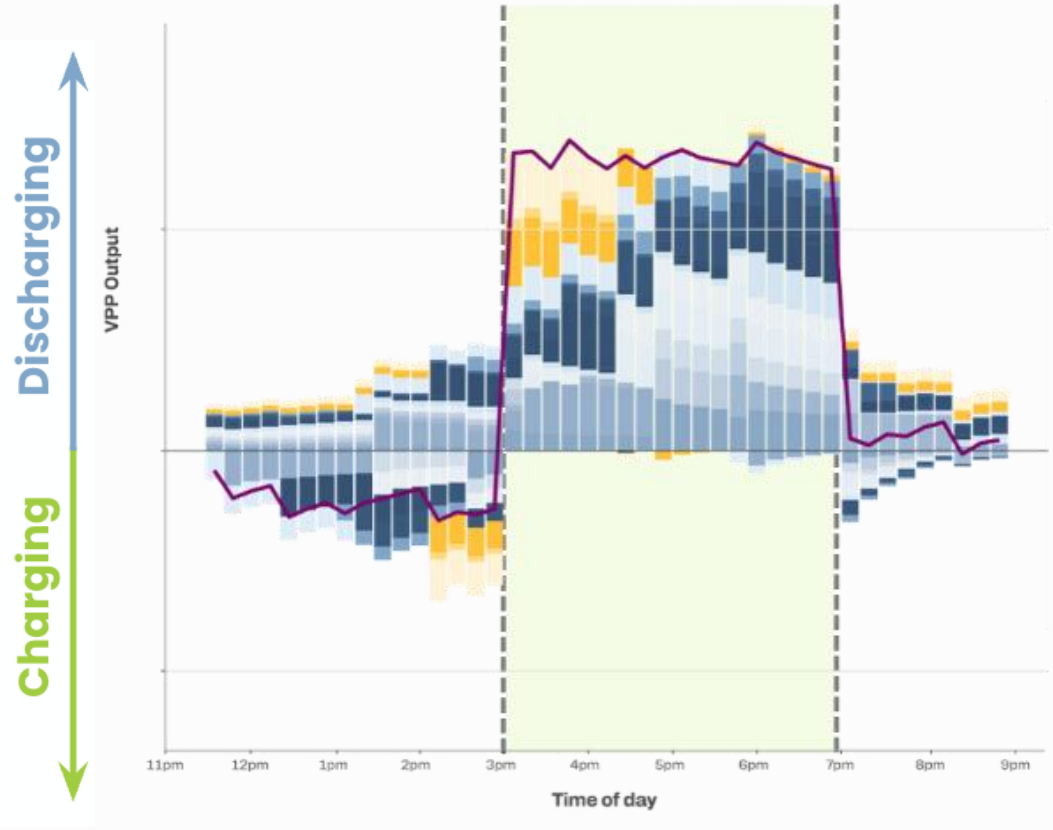


BULK SYSTEM CAPACITY

2x more consistent load shed than standard DR across ~70 events and +700k devices



Standard demand response



Dynamic load shaping

EnergyHub

FUTURE ROADMAP

Visibility and automation will unlock even more capacity across the grid

LEVEL 00

Basic DR

Manually reduce peak loads without insights into performance

LEVEL 01

DR + data

Demand response with connected devices that provide bi-directional data

LEVEL 02

Enhanced DR

Multi-season demand flexibility with flat load shapes and some locational control

LEVEL 03

Automated VPP

Dynamically shape load based on system needs and integrate into grid-management systems

LEVEL 04

Grid-adaptive VPP

Respond to grid needs continuously by autonomously optimizing for multiple customer, bulk grid, and distribution system objectives

EnergyHub

Thank you

frederick.hall@energyhub.net | Senior Data Scientist

EnergyHub

System requirements for VPP maturity

	Availability	Scheduling	Telemetry	Accuracy	Grid Impact	Autonomy
LEVEL 00	Summer season	None	None	No guarantees	Bulk grid	Manual events
LEVEL 01	Summer season	Start and stop times	>1 hour	No guarantees	Bulk grid	Manual events
LEVEL 02	Multiple seasons	Flat load shed for 4-hours	15 minute	<10-15% error	Reliable locational targeting	Some human oversight
LEVEL 03	Year-round	Follow daily, hourly schedules	5 minute	<5-10% error	Mapped to distribution grid	Minimal human oversight
LEVEL 04	24 hours /365 days	Real-time response	~2-6 second	<2-5% error	Fully locational grid service	Fully autonomous across systems

THANK YOU REV2026 SPONSORS