New England Conference of Public Utilities Commissioners
necpuc

Concurrent Session

Innovations and Trends in Electric Vehicle Rate Design

Electric Vehicle Panel

J. Riley Allen

5/20/25

Projected Vermont Peak Load and Components

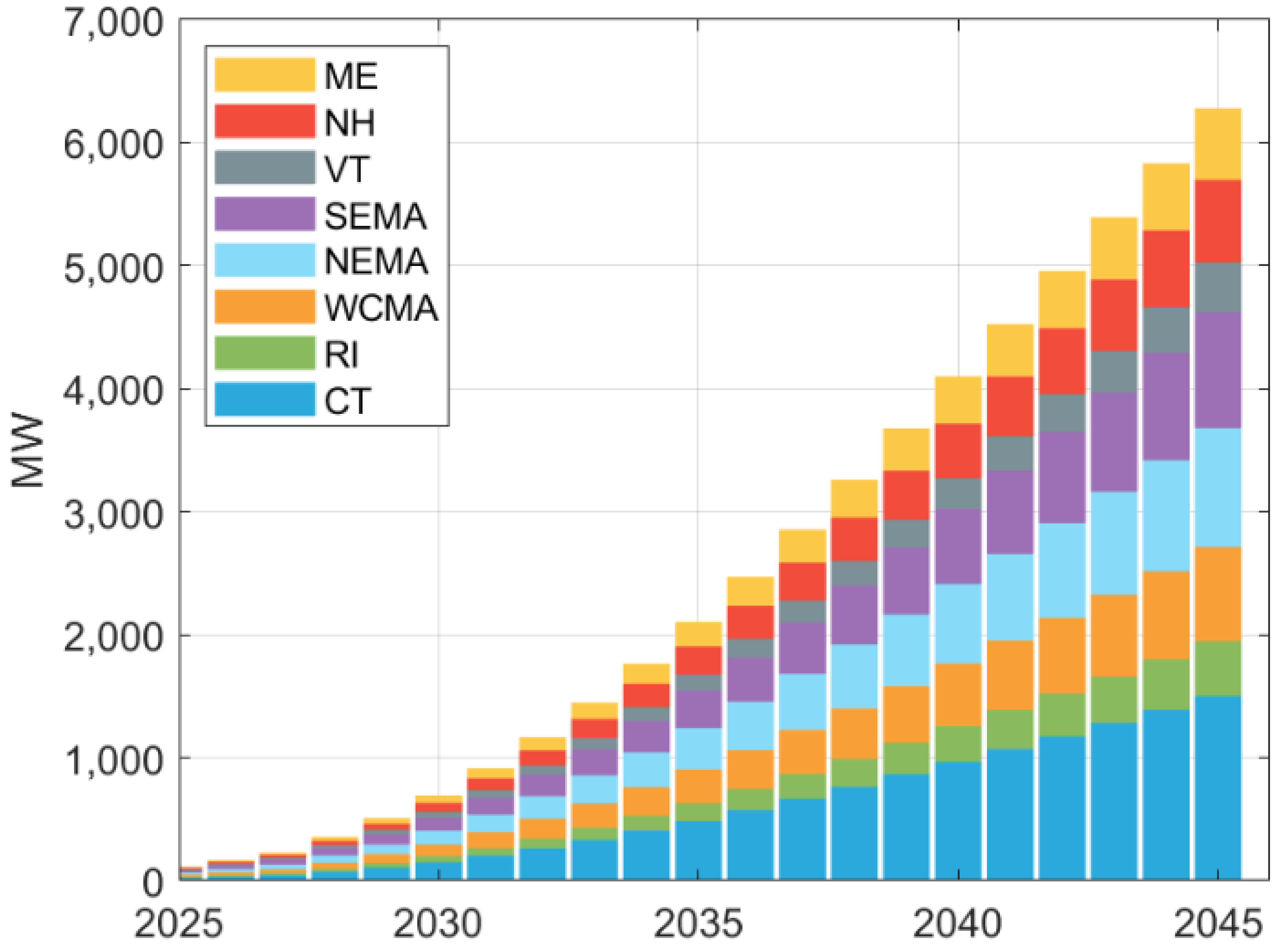
Source: VELCO 2024 Long-Range Transmission Plan

New England

2025 EV Winter Peak Demand Forecast

Winter 50/50 Peak Demand, by Load Zone

Winter Peak Demand (MW)									
Year	CT	ME	NEMA	NH	RI	SEMA	VT	WCMA	ISONE
2025	21	10	19	9	8	21	9	17	114
2026	31	14	28	15	11	30	13	25	168
2027	44	20	38	22	15	39	18	34	229
2028	72	32	57	35	24	58	27	51	356
2029	108	46	80	52	34	80	37	72	509
2030	151	63	110	72	46	105	49	98	694
2031	203	84	144	95	62	136	63	128	914
2032	263	107	183	123	79	171	78	162	1,166
2033	331	134	230	154	99	211	94	196	1,449
2034	405	165	282	190	121	255	112	235	1,764



Source: ISO-NE https://www.iso-ne.com/static-assets/documents/100023/trans_fx_2025_final.pdf

BERKELEY LAB

Electric Vehicle Rate Design

Peter Cappers

Berkeley Lab

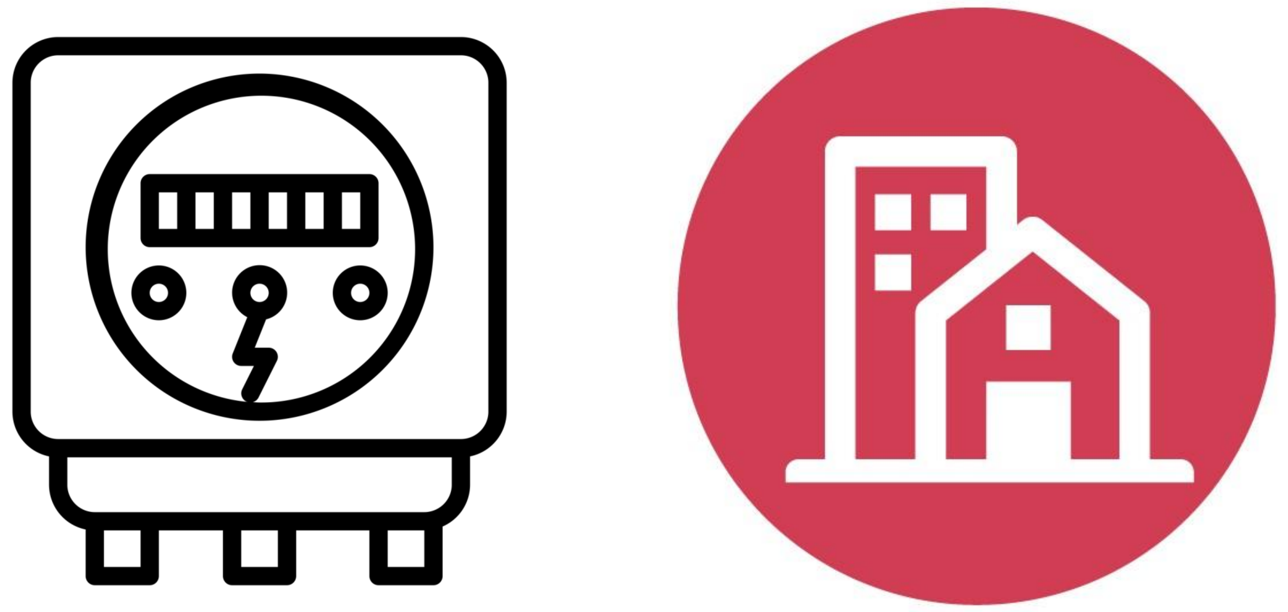
77th Annual NECPUC Symposium

May 20, 2025

State policy-driven objectives may serve as the basis for rate design for EV charging

- EV adoption
- Grid management
- System economic efficiency
- Decarbonization
- Equity

EV rate design is typically comprised of metering configurations



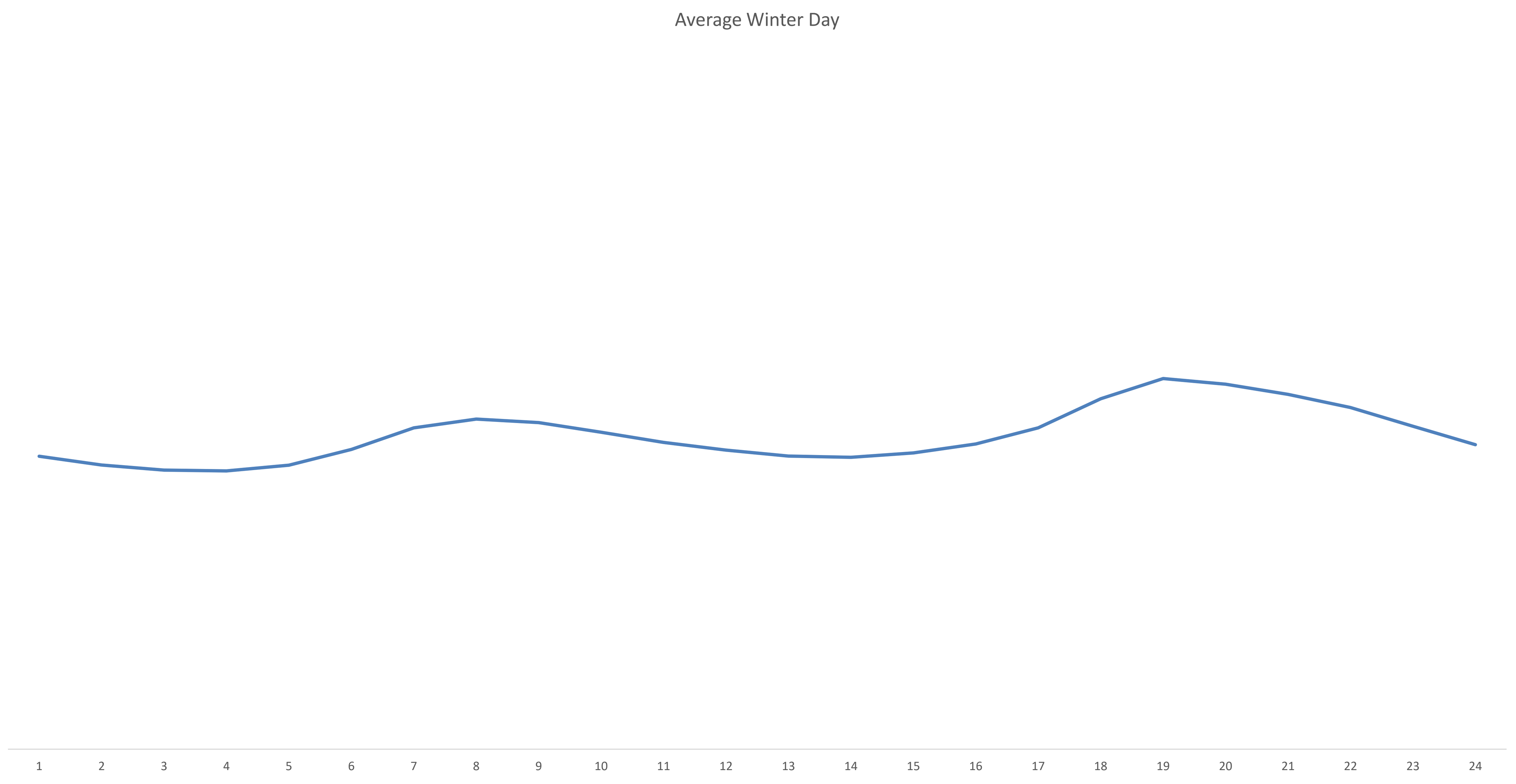
Whole home/facility consumption via account meter

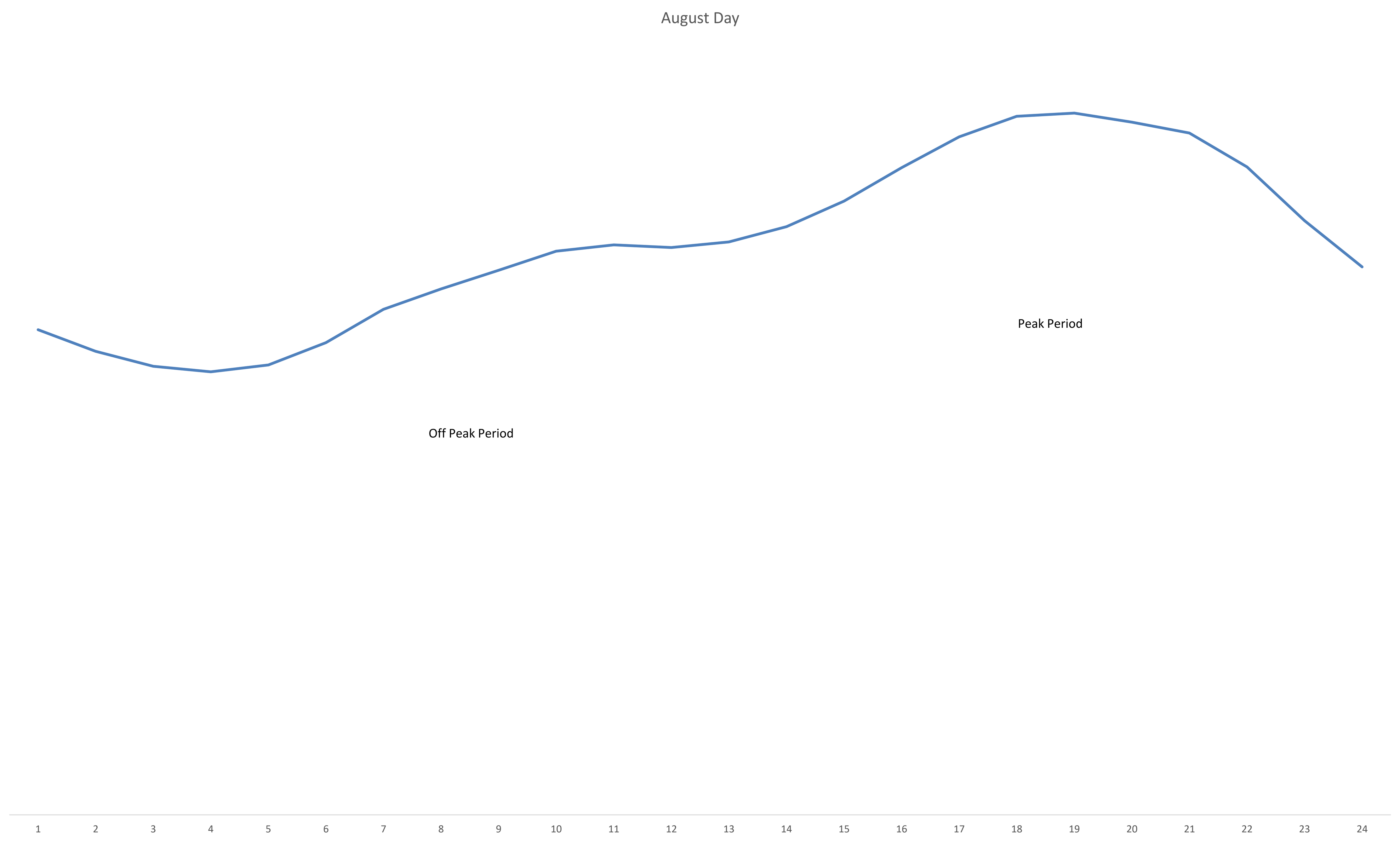
EV charging consumption via account meter

Submetering via EVSE or vehicle

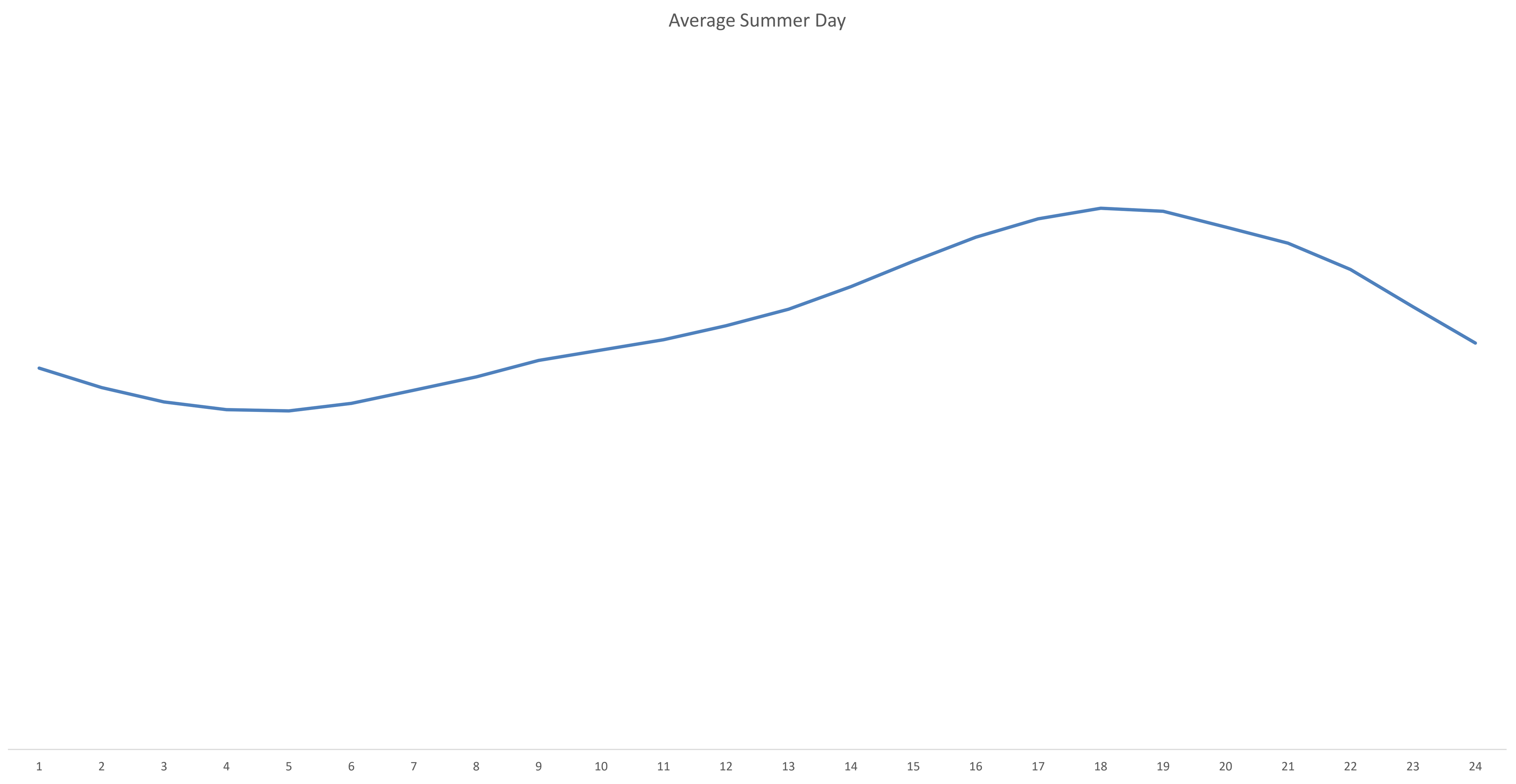
*EVSE = Electric Vehicle Supply Equipment

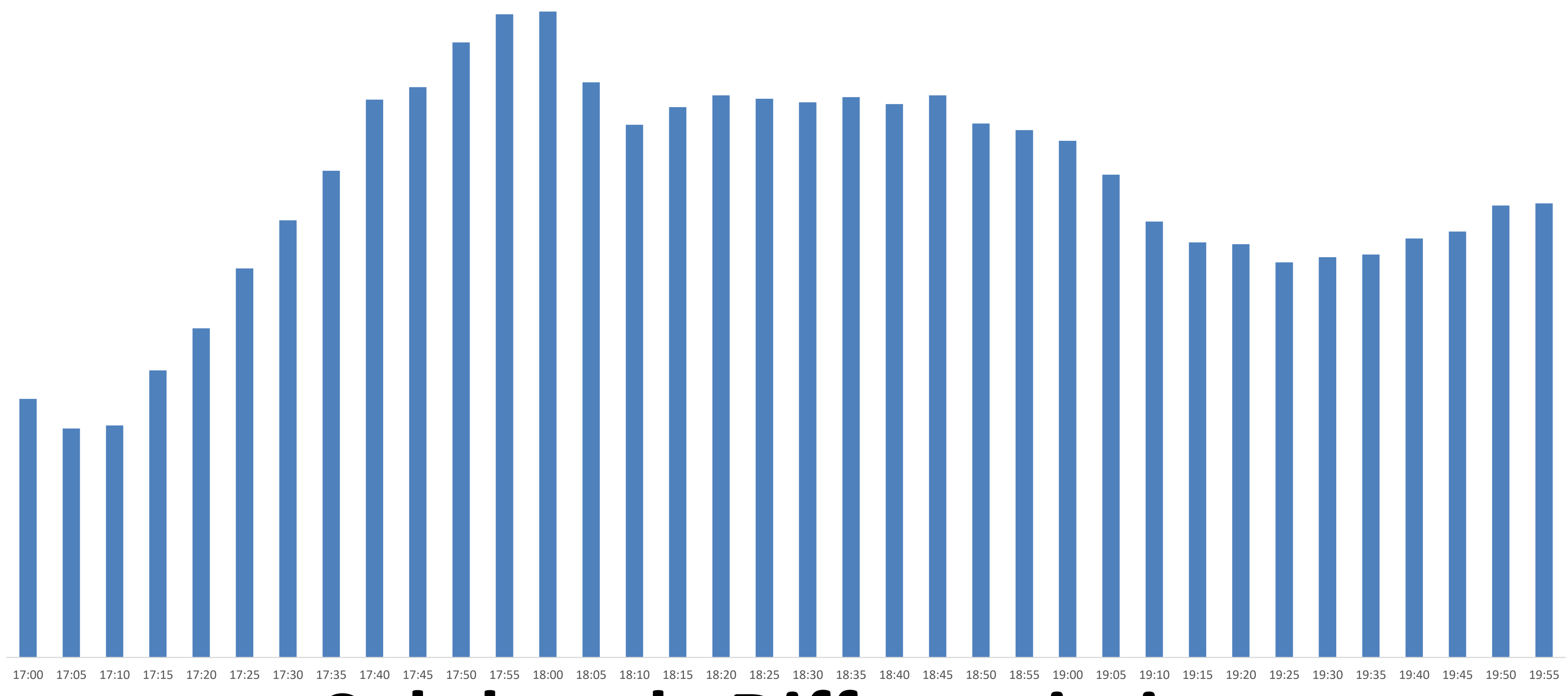
EV rate design is typically comprised of temporal differentiation





Hourly and Period Differentiation





Seasonal Differentiation

Sub-hourly Differentiation

Figures show temporal differentiation in *load,* but there is also temporal differentiation in system *costs* and *emissions* that could be used as the design basis

EV rate design is typically comprised of locational differentiation

Bulk power system

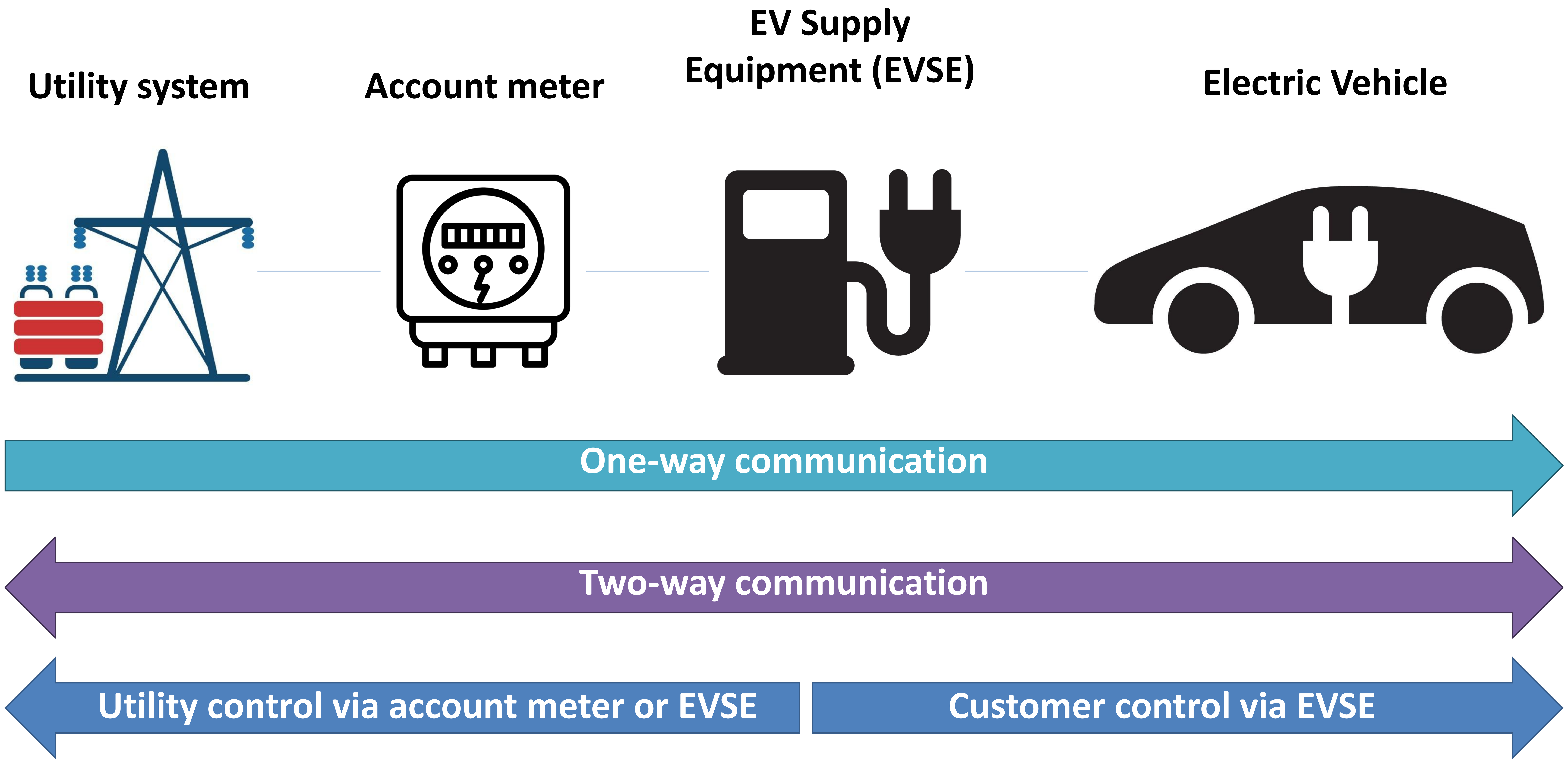
Distribution system

Site-specific

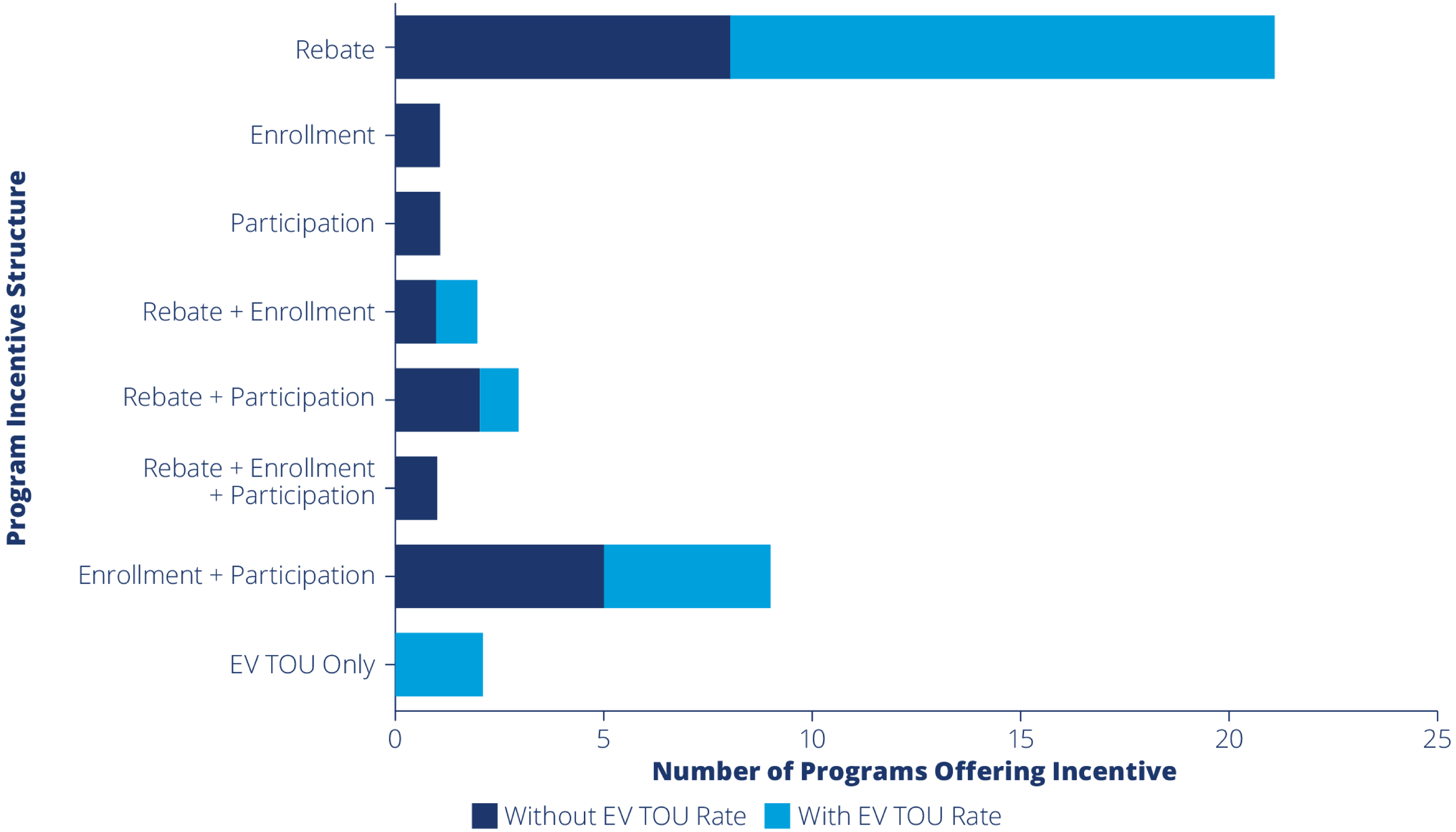
EV rate design is typically comprised of demand charges

- ✓Max demand period
- ✓Demand ratchet
- ✓Seasonal
- ✓Coincident peak
- ✓Non-coincident peak
- ✓Holidays/deferals

EV rate design is typically comprised of charging controls



EV program elements can further EV-related objectives



Source: Smart Electric Power Alliance, 2021.
Available at: https://sepapower.org/resource/managed-charging-incentive-design/

Most utilities appear to be focusing on meeting EV adoption objectives, with modest interest in promoting grid management and economic efficiency

	Residential		Commercial		Utility-Owned	
	1st Most Offered	2nd Most Offered	1st Most Offered	2nd Most Offered	1st Most Offered	2nd Most Offered
Whole Premise Metering	○	●	○	○	○	○
Dedicated EV Metering	●	○	●	●	○	○
Flat or Block Energy Charge	○	○	○	○	●	○
TOU Energy Charge	●	●	●	●	○	●
Traditional Demand Charge	○	○	○	○	○	○
Alternative Demand Charge	○	○	●	○	○	○
Geographic Differentiation	○	○	○	○	○	○
Control Tech Requirement	○	○	○	○	○	○
Count / % of Class Total	25 / 46%	16 / 30%	13 / 27%	13 / 27%	16 / 60%	8 / 30%

Based on a review of 136 EV-specific retail rates currently approved and/or offered to customers

Source: Cappers et al. (2023). A Snapshot of EV-Specific Rate Designs Among U.S. Investor-Owned Electric Utilities. Report and rates database available at: https://emp.lbl.gov/publications/snapshot-ev-specific-rate-designs

Resources for More Information

Alliance for Transportation Electrification. 2021. Electric Transportation Rate Design Principles for Regulated Utilities.

Ball, J., S. Forrester, A. Grayson, A. Satchwell. 2023. Electric Vehicle Program Designs and Strategies to Enhance Equitable Deployment.

Cappers, P. and A. Satchwell. 2022. EV Retail Rate Design 101.

Cappers, P., A. Satchwell, C. Brooks, S. Kozel. 2023. A Snapshot of EV-Specific Rate Designs Among U.S. Investor-Owned Electric Utilities.

Ryan, N. A. Burger, J. Bosco, J. Howat, M. Muller. 2022. Best Practices for Sustainable Commercial EV Rates and PURPA 111(d) Implementation.

Satchwell, A., P. Cappers, G. Barbose. 2019. Current Developments in Retail Rate Design: Implications for Solar and Other Distributed Energy Resources.

Schwartz, L., M. T. Collins, T. Wolf, C. Lane. 2024. Best Practices Guide for Benefit-Cost Analysis of Managed EV Charging.

Whited, M., A. Allison, R. Wilson. 2018. Driving Transportation Electrification Forward in New York: Considerations for Effective Transportation Electrification Rate Design.

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AN EXELON COMPANY

EVsmart® Programs

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Electric Vehicle Managed Charging

What is Active Managed Charging?

Allows utility to remotely control electric vehicle (EV) charging by curtailing charging to better correspond to electric grid needs, much like a demand response program.

VS.

What is Passive Managed Charging?

Enables EV charging to respond to grid needs through price signals or scheduled incentives, encouraging customers to shift charging to off-peak times without direct utility control.

Both are important!

With estimates of more than 20 million EVs expected on the road in the U.S. by 2030, EVs will represent the most significant new electric load since the rise of air conditioning in the 1950s.*

To manage this growing load effectively, utilities need a range of programs—like passive and active managed charging—that work for all types of customers. This is critical to ensuring a reliable, resilient, and balanced electric grid.

*Source: SEPA, A Comprehensive Guide to Electric Vehicle Managed Charging, May 2019

Vehicle Charging Rate

CUSTOMERS SAVE APPROX. $120 ANNUALLY BY CHARGING OFF-PEAK

Passive Managed Charging Program

Pilot Period

- 2020-2021: Research
- 2022-2023: Charging demonstration
- **2024 and beyond**: Full program implementation

What are the Benefits?

- Uses vehicle telematics or smart chargers (EVSEs), so there's no need to install a second electric meter—making enrollment simple and cost-effective.
- Customers decide when and how to charge, maintaining full control while still accessing lower off-peak rates.
- Charging during off-peak hours (typically nights and weekends) can significantly reduce electricity costs for EV owners.

Smart Charge Management

CUSTOMERS CAN EARN UP TO $120 A YEAR BY ENROLLING

Active Managed Charging Program

Pilot Period

- 2021-2022: Research
- 2023-2024: Charging demonstration
- **2025 and beyond**: full program implementation

What are the Benefits?

- Identify managed charging techniques that can be shared industry-wide
- Understand and reduce grid impacts of EV charging on the utility’s distribution and transmission systems
- Lessen Exelon customers’ capital investment required to manage EV charging demand as EV ownership grows
- Identify potential cybersecurity risks and vulnerabilities of EVSEs and vehicle telematics software

Residential Charging

Demonstration Phases

GOAL

METHOD

Identify EV Drivers

EV DETECTION

Identify EV customers for grid planning and targeted marketing

2022

Develop Optimization Strategy

TOU RATES

Incentivize beneficial charging habits

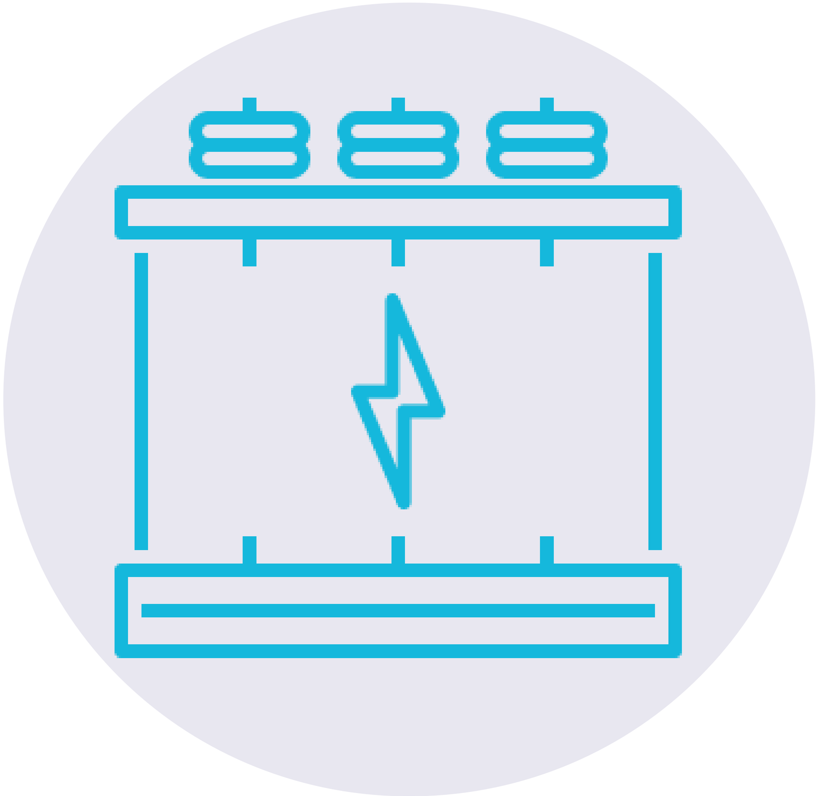
Capture Bulk System Benefits

PJM FORECAST

Align charging with the cost of electricity

June '23

Protect Distribution Assets



LOAD BALANCING

Optimize charging at the distribution level

Oct '23

Overall Goal: Avoid Infrastructure Costs

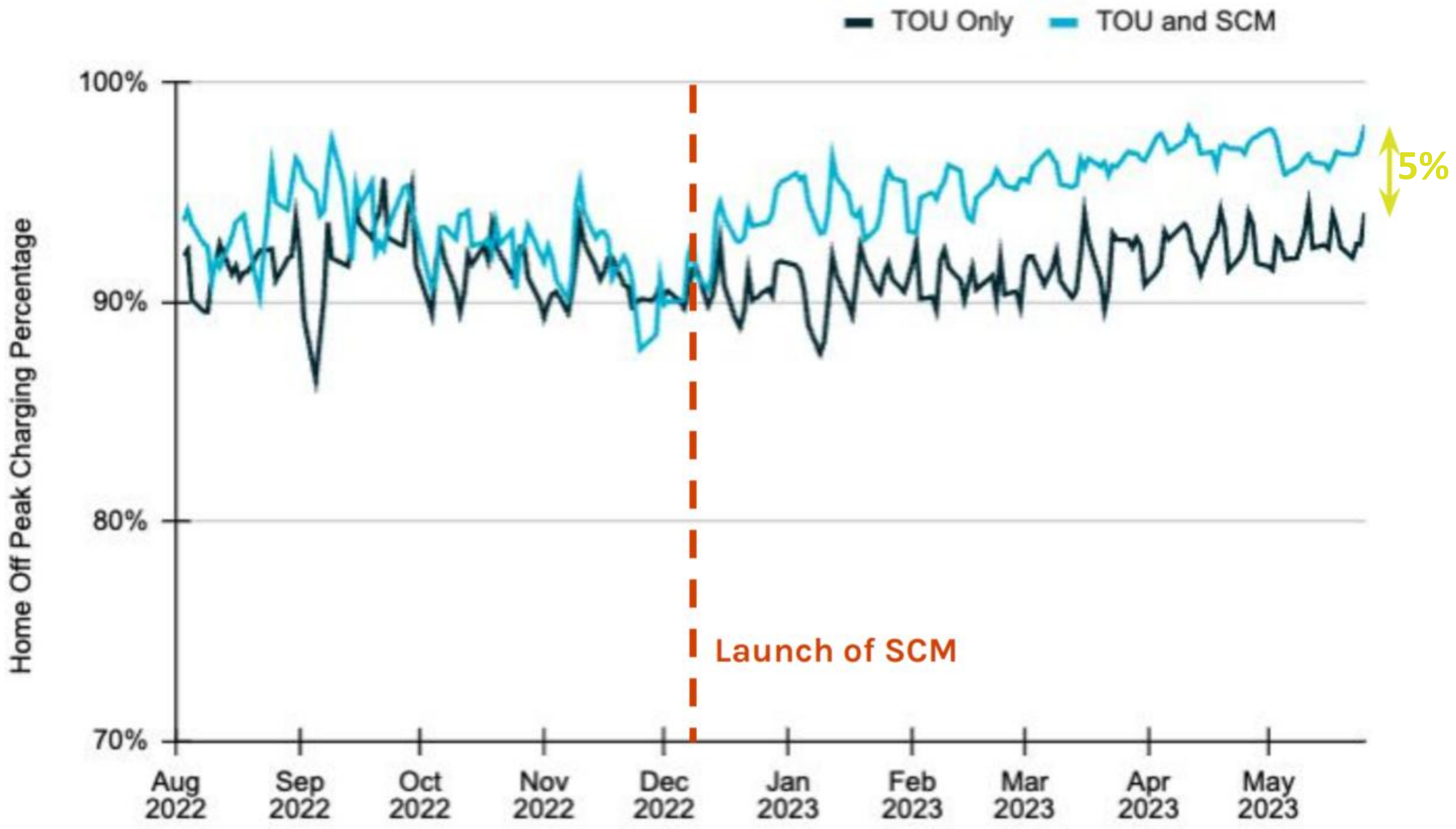
PREDICTIVE GRID MANAGEMENT

Predict infrastructure needs and defer investments

Future state

TOU Rate Management

Off-peak Charging Increased for TOU Customers

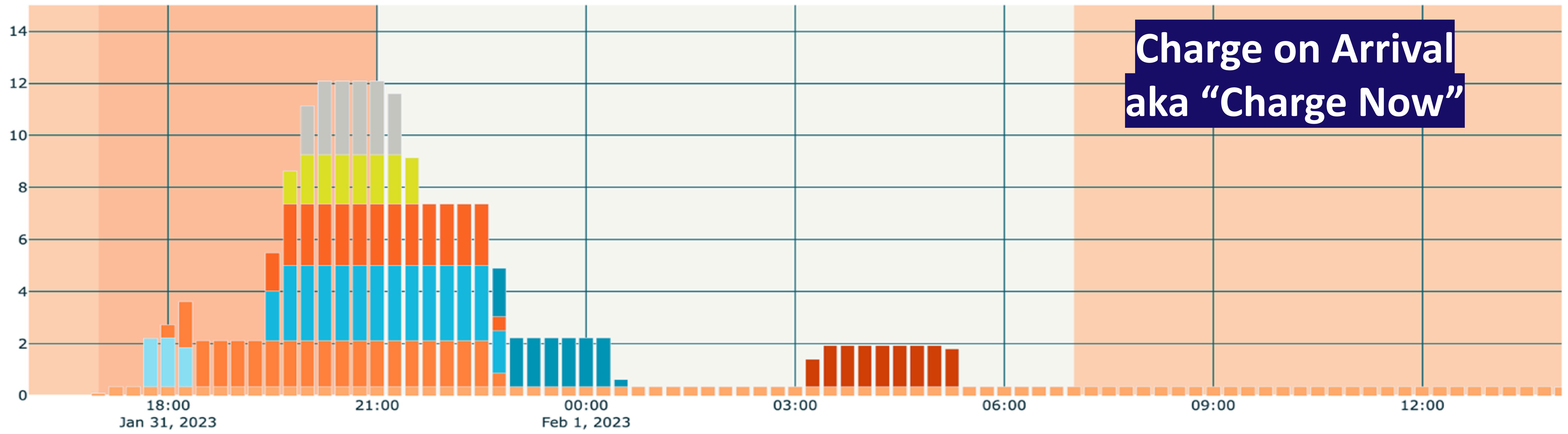


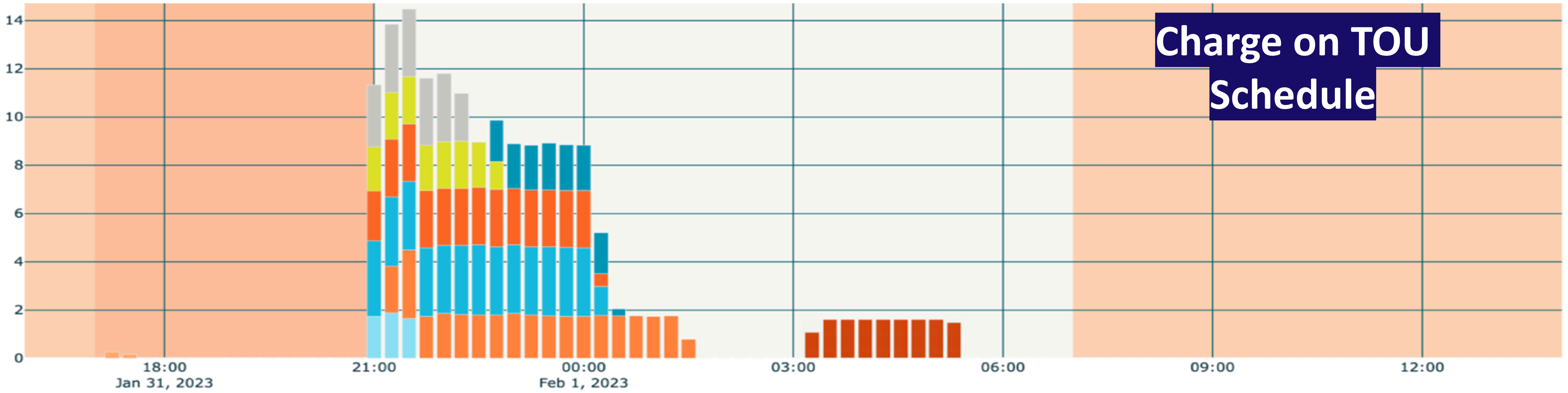
Data shared from WeaveGrid's evPulse insights

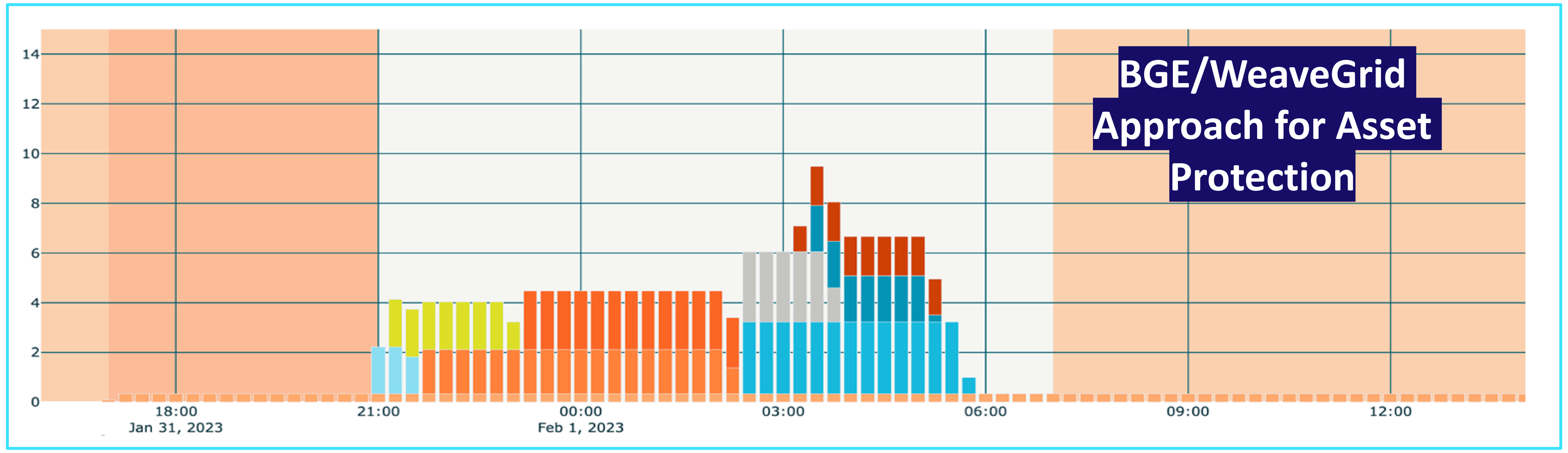
Load Balancing

Distribution Asset Protection

Design

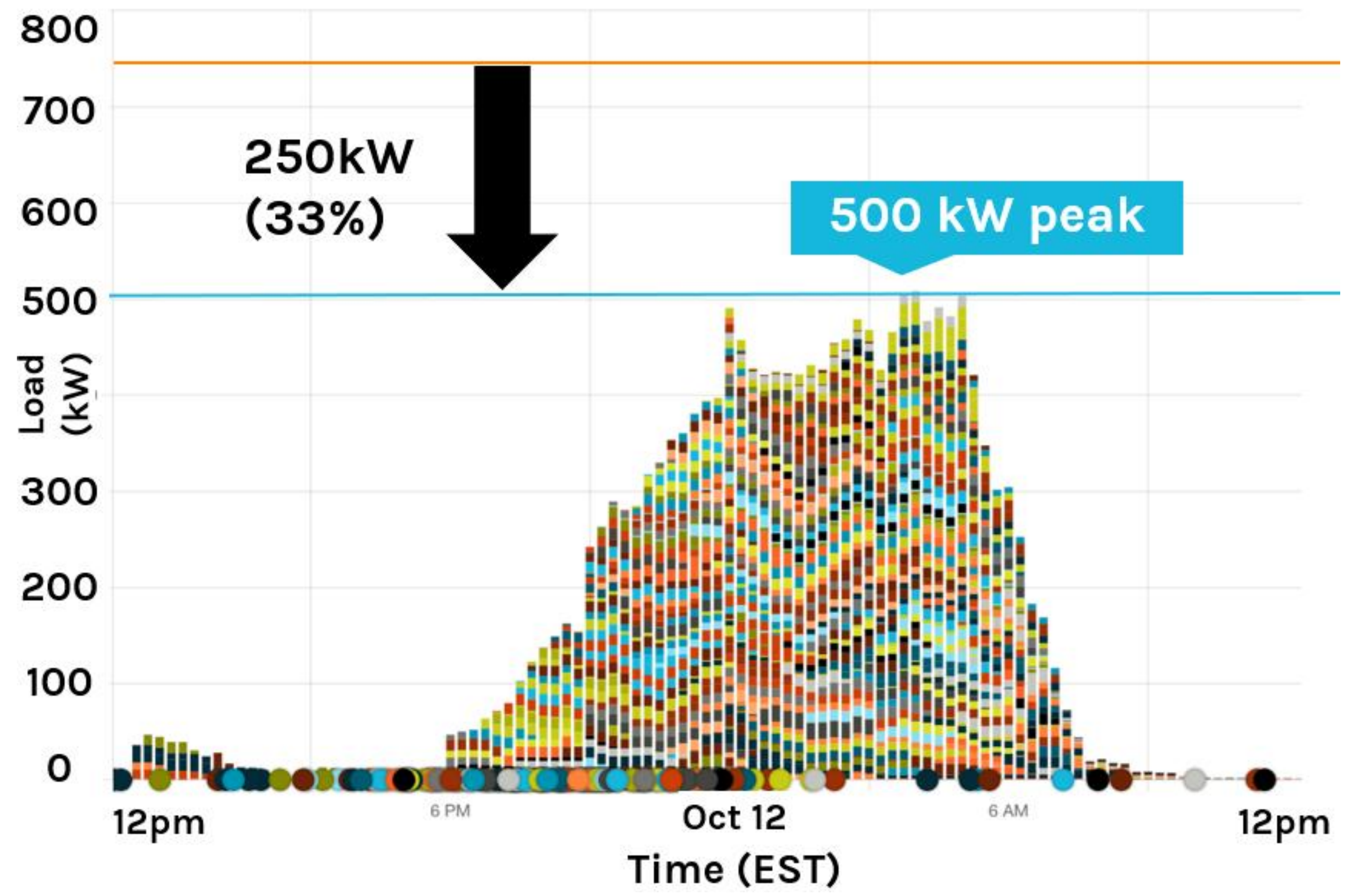




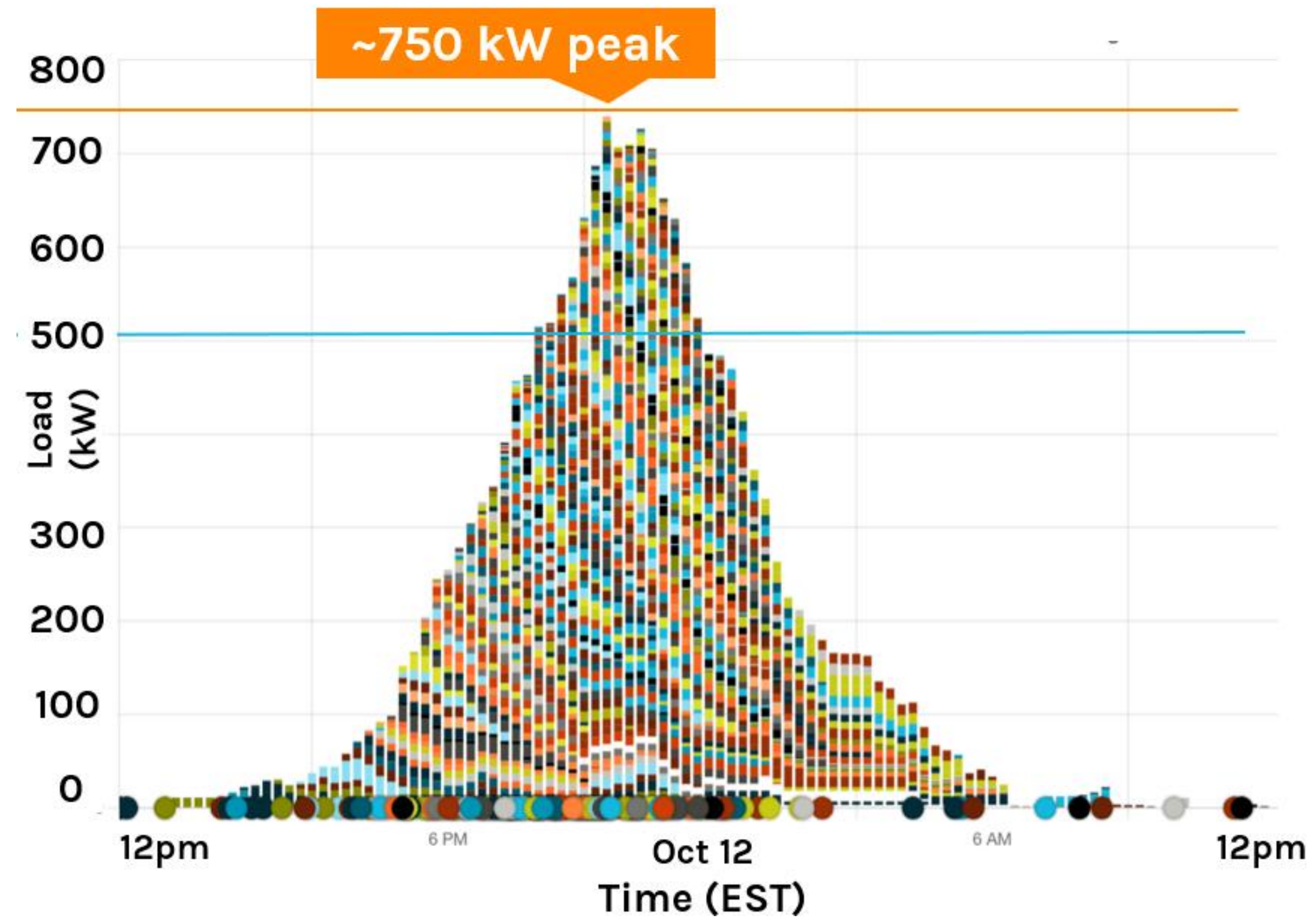


Results

Observed Load
What happened because of load balancing



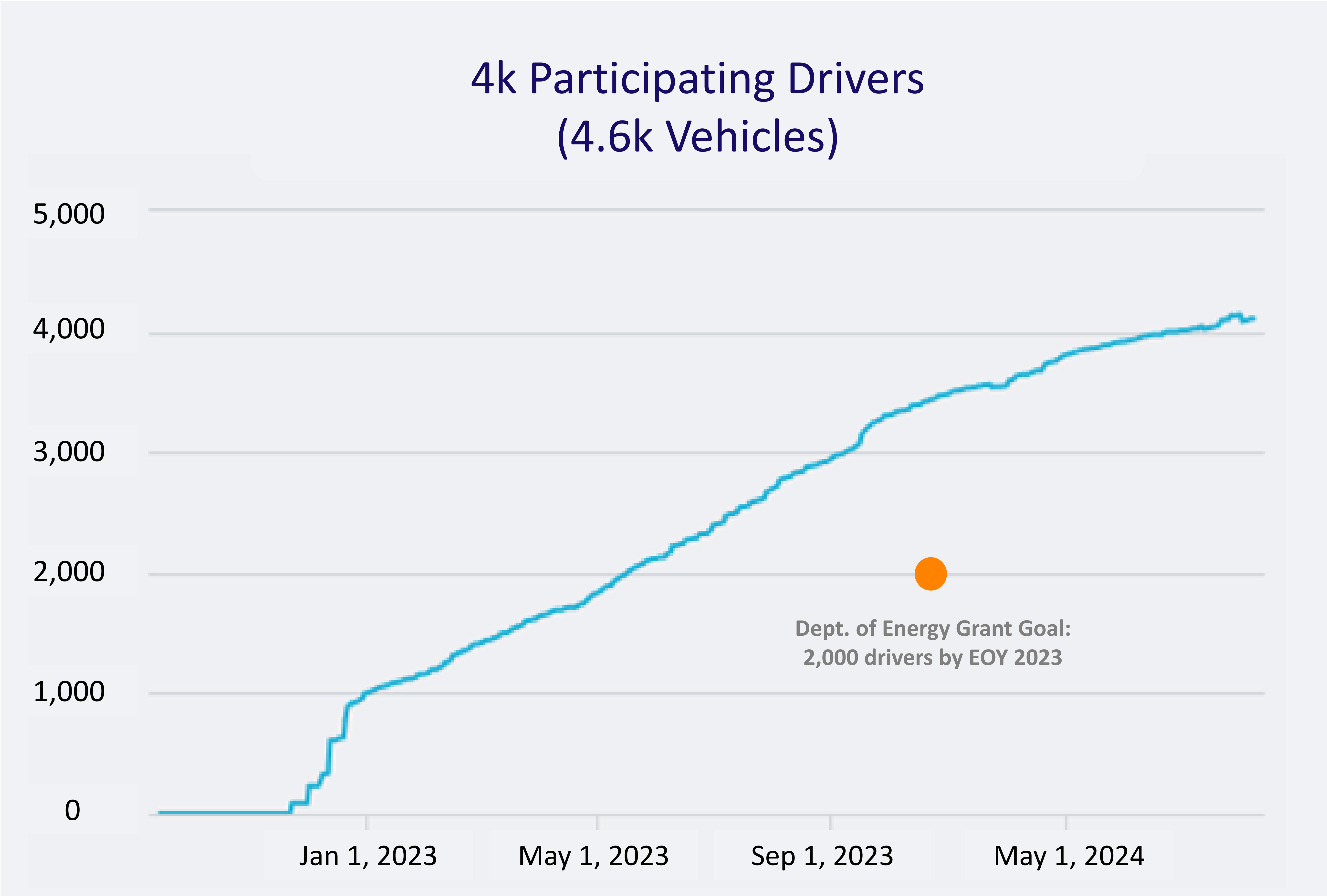
Charge Now Counterfactual
What would have happened if everyone started charging when they plugged in



Results provided by WeaveGrid

Customer Satisfaction Results

Interest is outpacing expectations



79%
Overall Satisfaction

83%
Likelihood To Recommend

56%
Likely To Remain If TOU Requirement

22%
Likely To Remain If $10 A Month Credit Discontinued

Electric Vehicle Rate Design

NECPUC Symposium

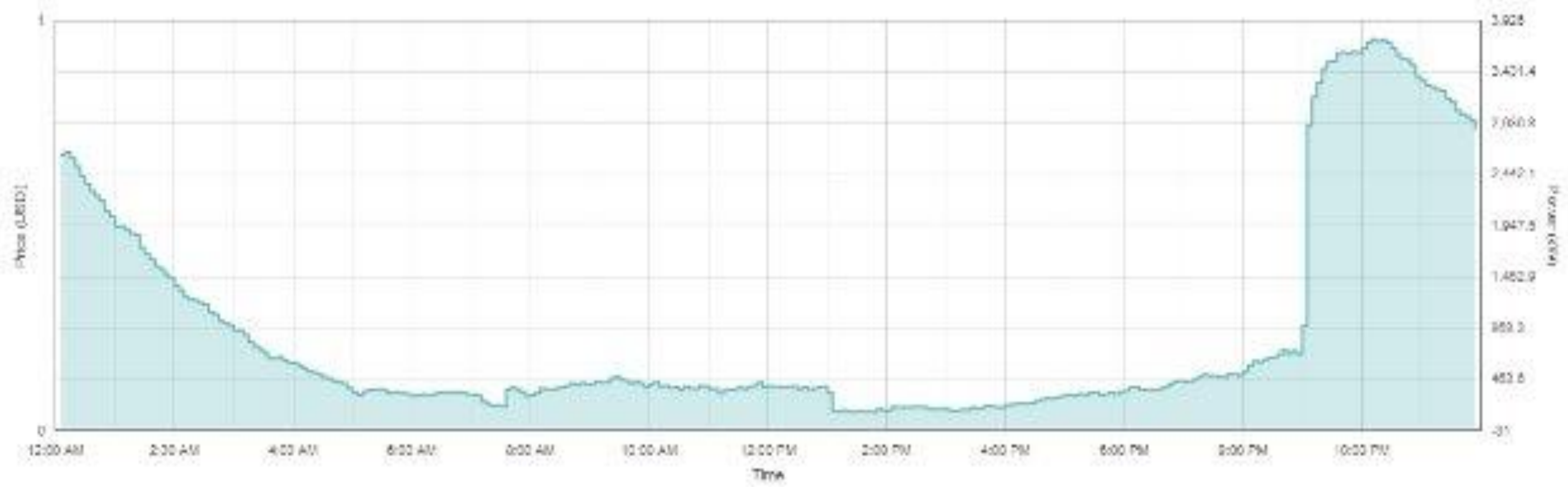
May 20, 2025

GREEN MOUNTAIN POWER
Generating Possibilities Together

Managing the Grid for Customers

Rate 72 Dispatch Event, September 2024

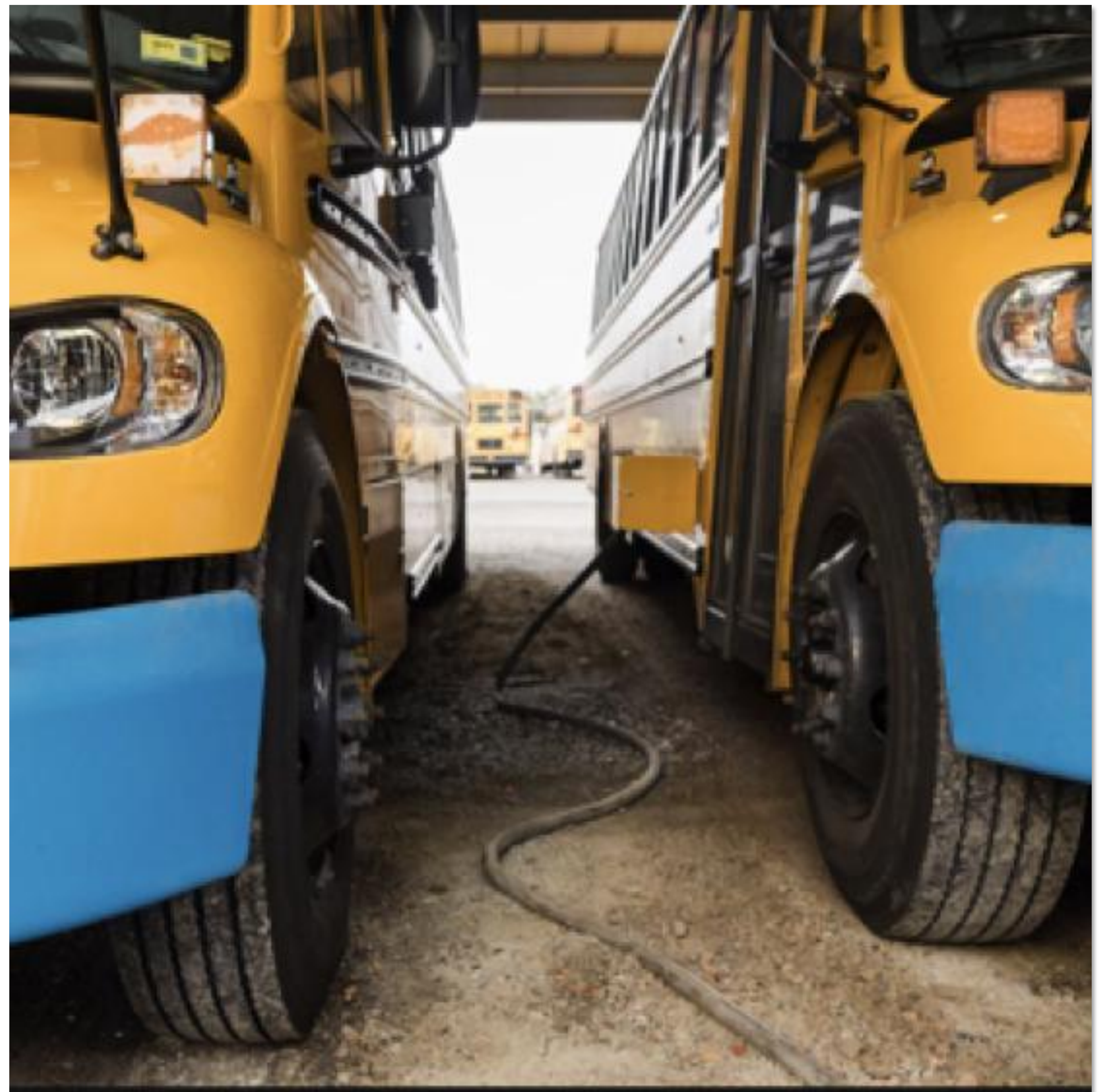
Rate 74 Charging Profiles, September 2024



- eCharger Innovative Pilot July 2017
  - Free level 2 charger
  - Peak pricing events
  - Unlimited off-peak charging for $29.99/month
- Residential Discount EV Rates launched August 2020
  - Free level 2 charger
  - Rate 72- Peak pricing events
  - Rate 74- TOU rate
  - Equivalent to $1.20/gallon
- Optimizing charge curve to smooth bounce back and maximize evening charging

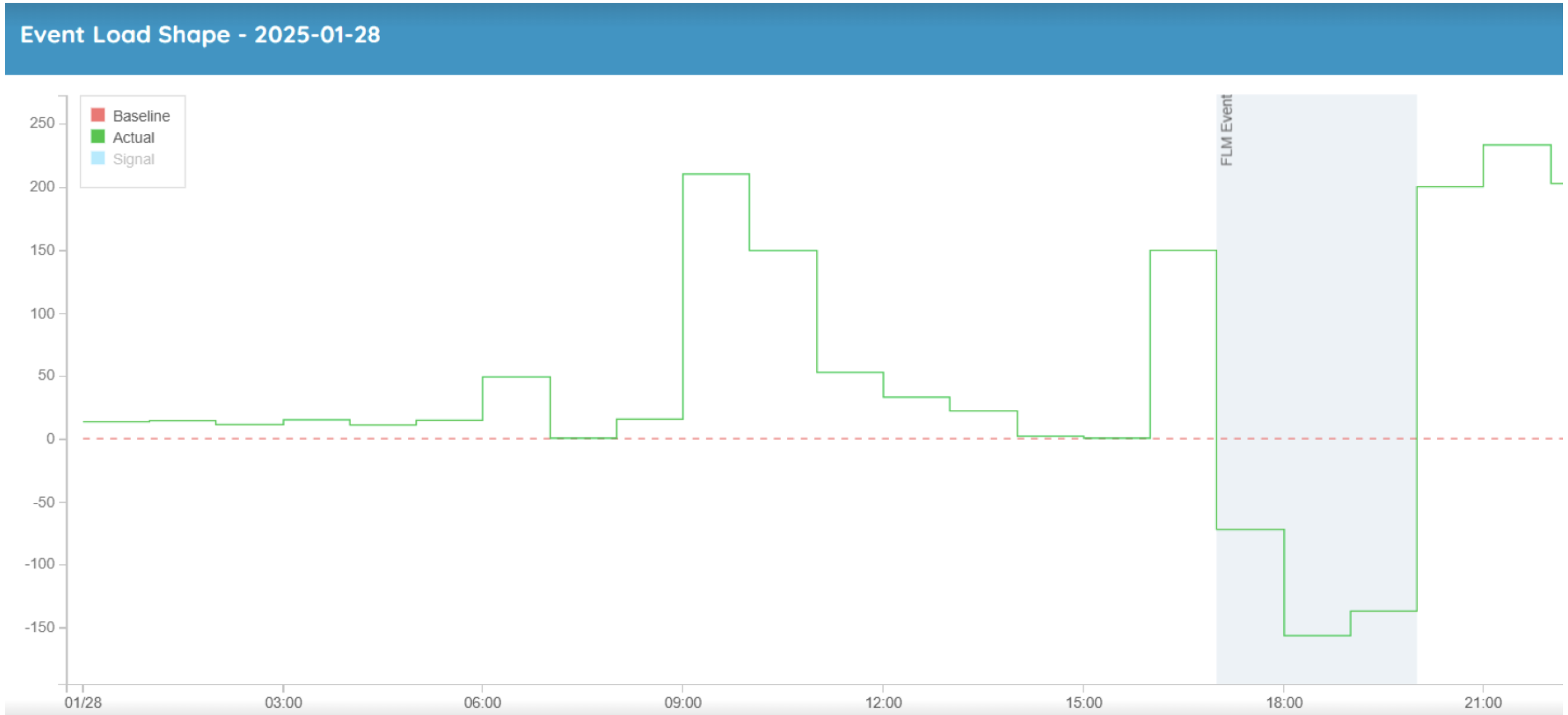
GREEN MOUNTAIN POWER
Generating Possibilities Together

Larger Scale EV Programs – School Bus


School buses in Vermont are part of an experiment to test the idea that electric vehicles could be vital in the transition to clean energy. Oliver Parini for The New York Times

How Your Child's School Bus Might Prevent Blackouts

When not driving around, electric buses and other vehicles could help utilities by storing their solar and wind energy and releasing it to meet surges in demand.

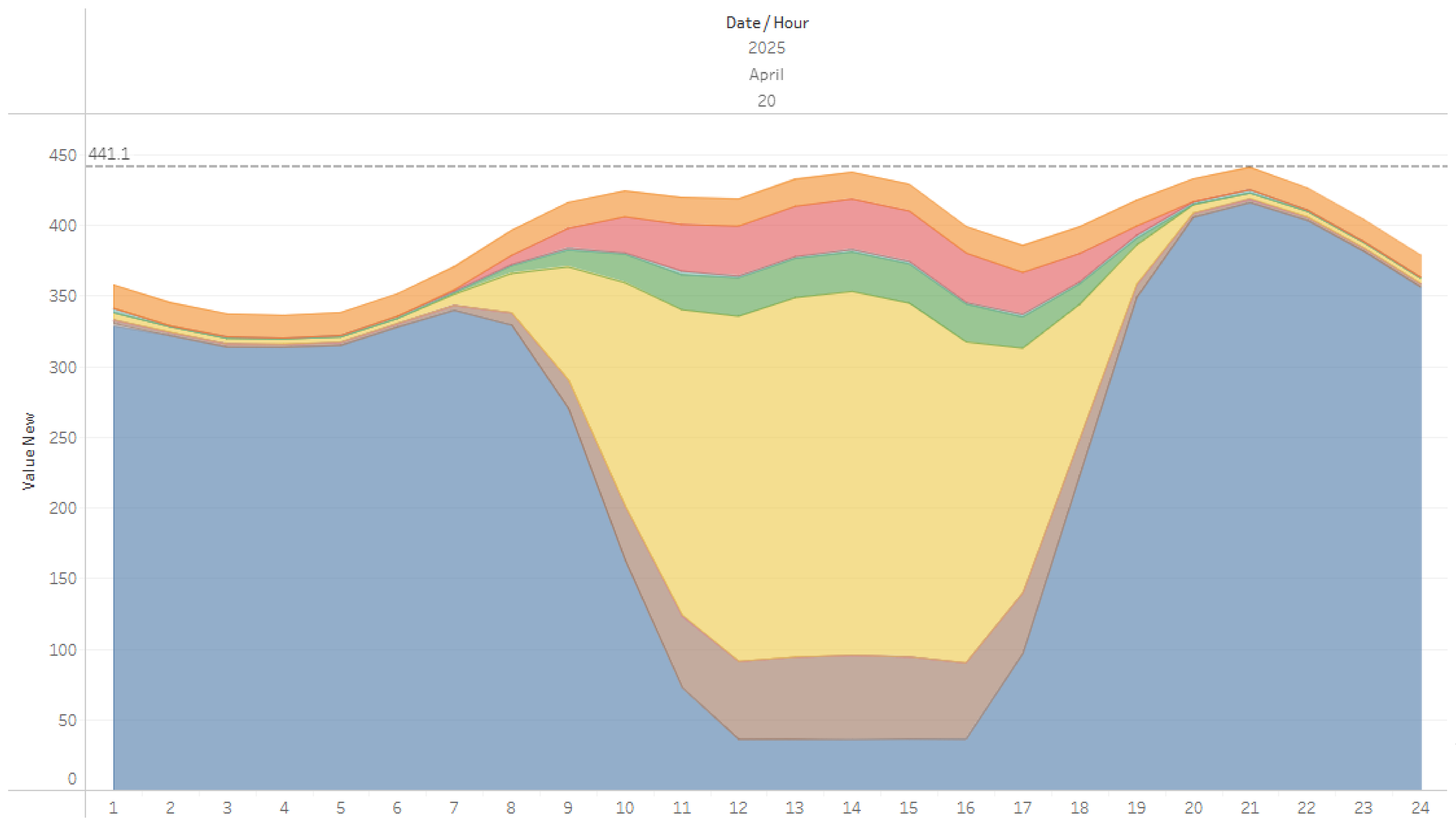


- GMP's Flex Load Management Bi-directional charging
  - Supports the grid
  - Reduces costs for all customers
  - Financial benefits for school districts
- How it works:
  - Buses charge overnight, do morning route, plug in to support morning peak
  - Buses charge mid-day absorbing solar, do afternoon route, plug in to support evening peak

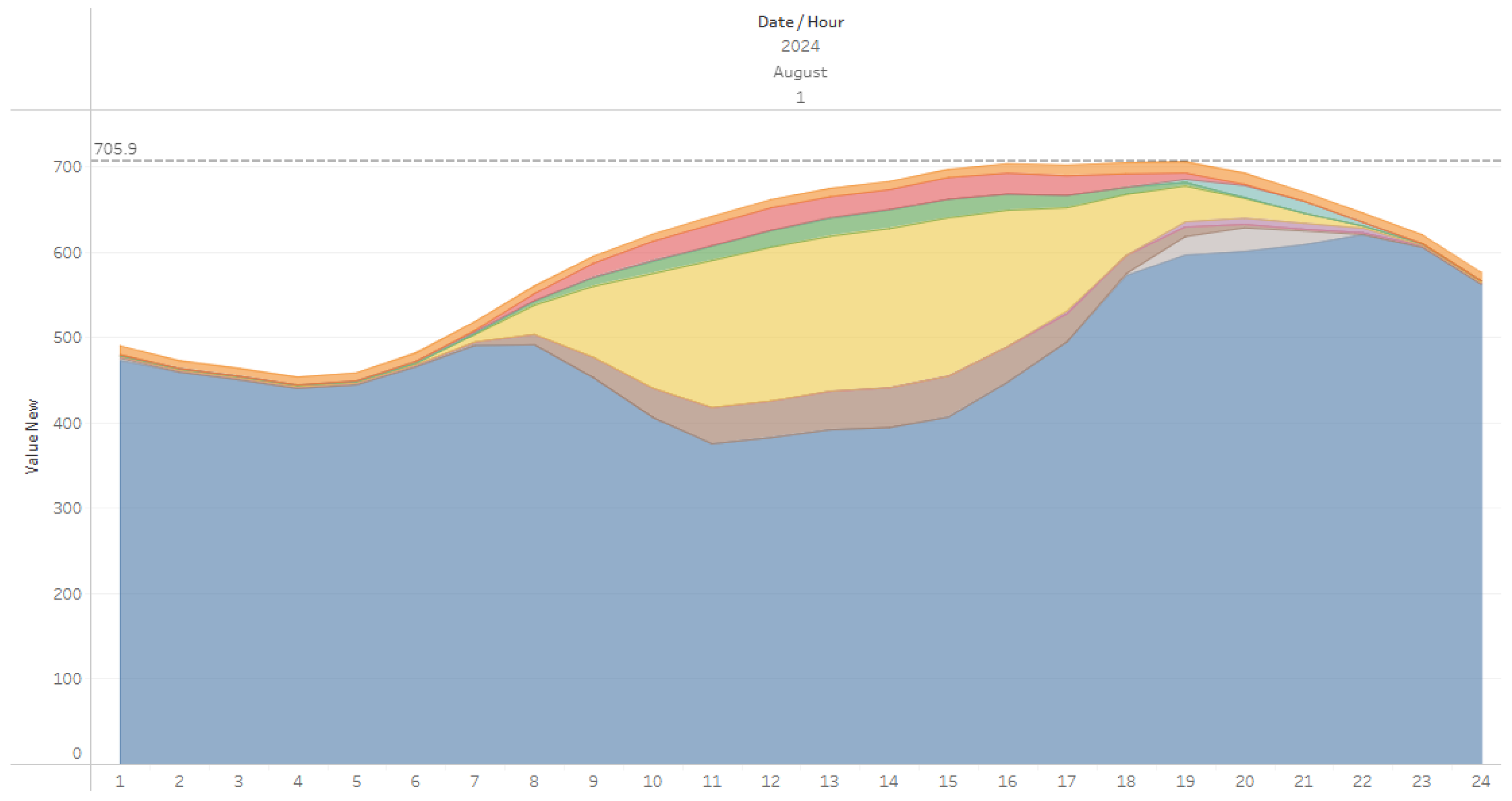
GREEN MOUNTAIN POWER
Generating Possibilities Together

What's Next

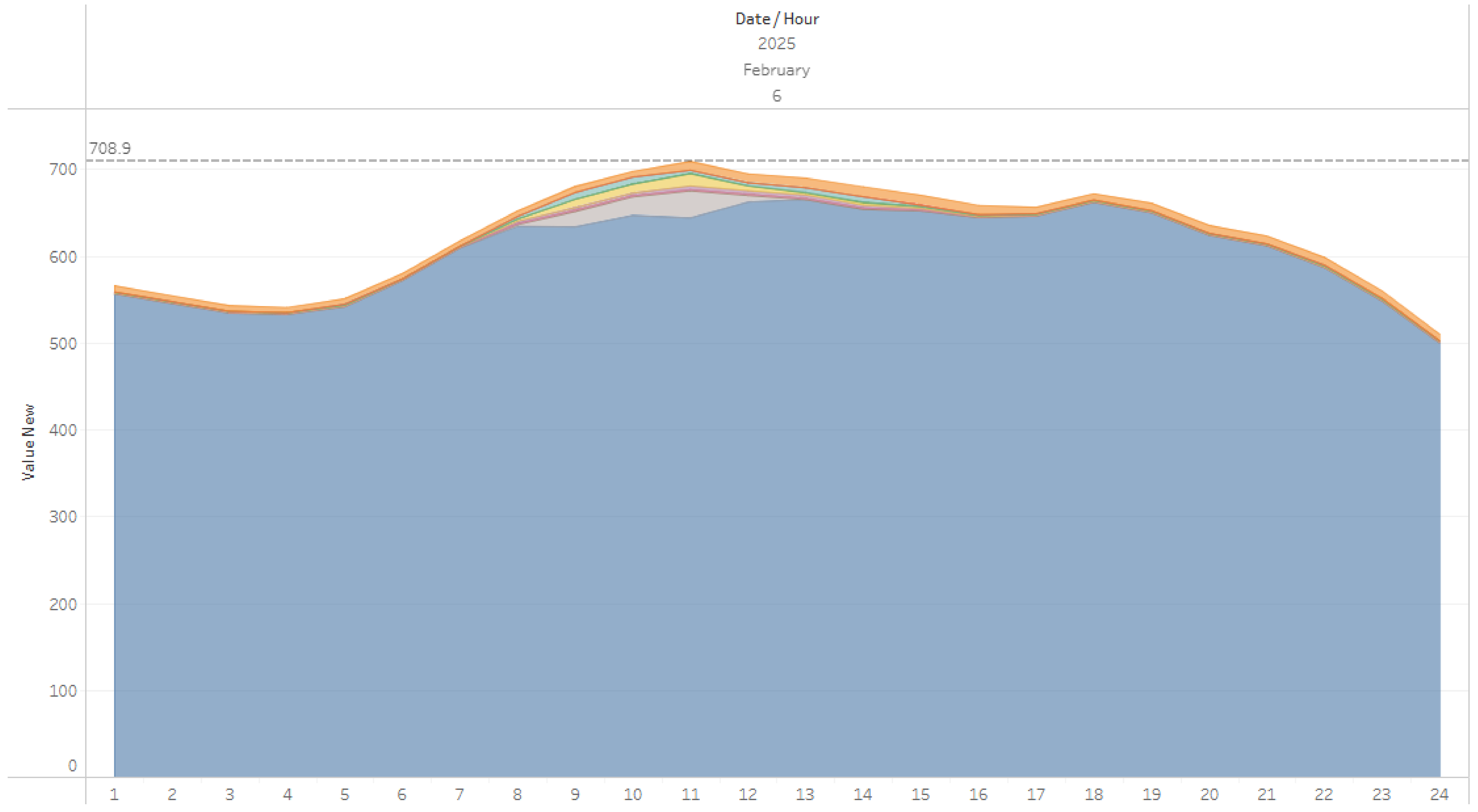
- The most optimal load shape paired with usage will look different at different times
- For example:
  - Optimized load shape for a cold February day with solar covered in snow is different than a sunny spring day with strong wind and hydro production
- An optimal load shape maximizes customer benefits:
  - Energy Arbitrage
  - Ancillary services and markets
  - Transmission deferral (happening now in VT)
  - Local distribution deferral
  - Increase DG hosting capacity (such as with encouraged daytime charging – workplace etc.)



April 20, 2025. Negative load HE 13-16



August 1, 2024. ISO-NE scarcity event. HE 19 LMP $2,113



February 6, 2025. VT network peak HE 13. Snow covered PV

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