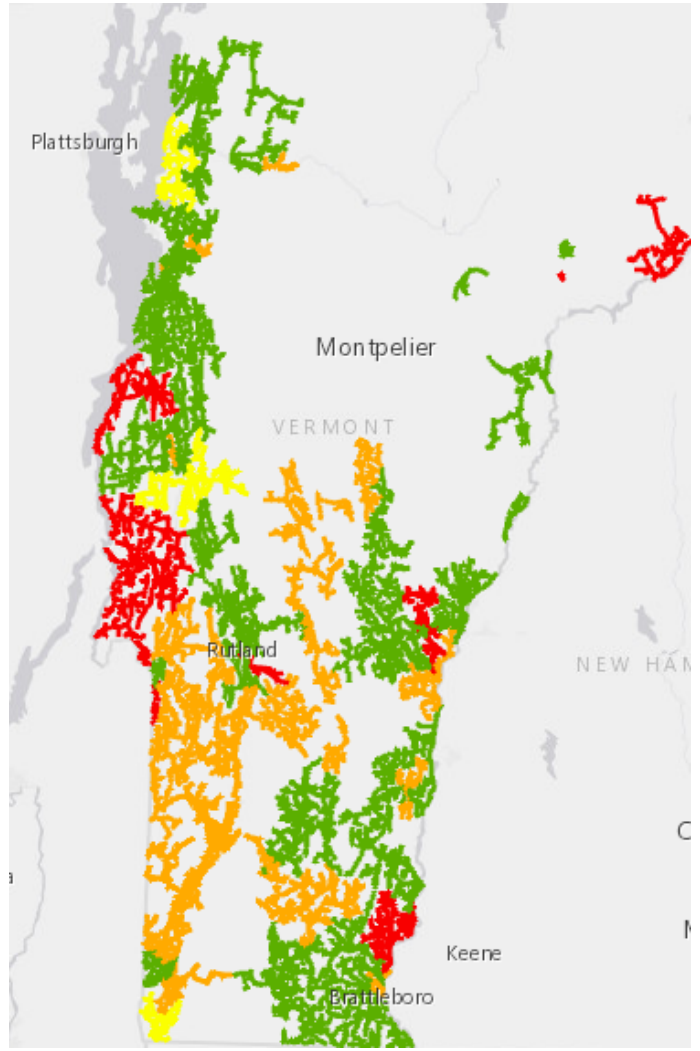
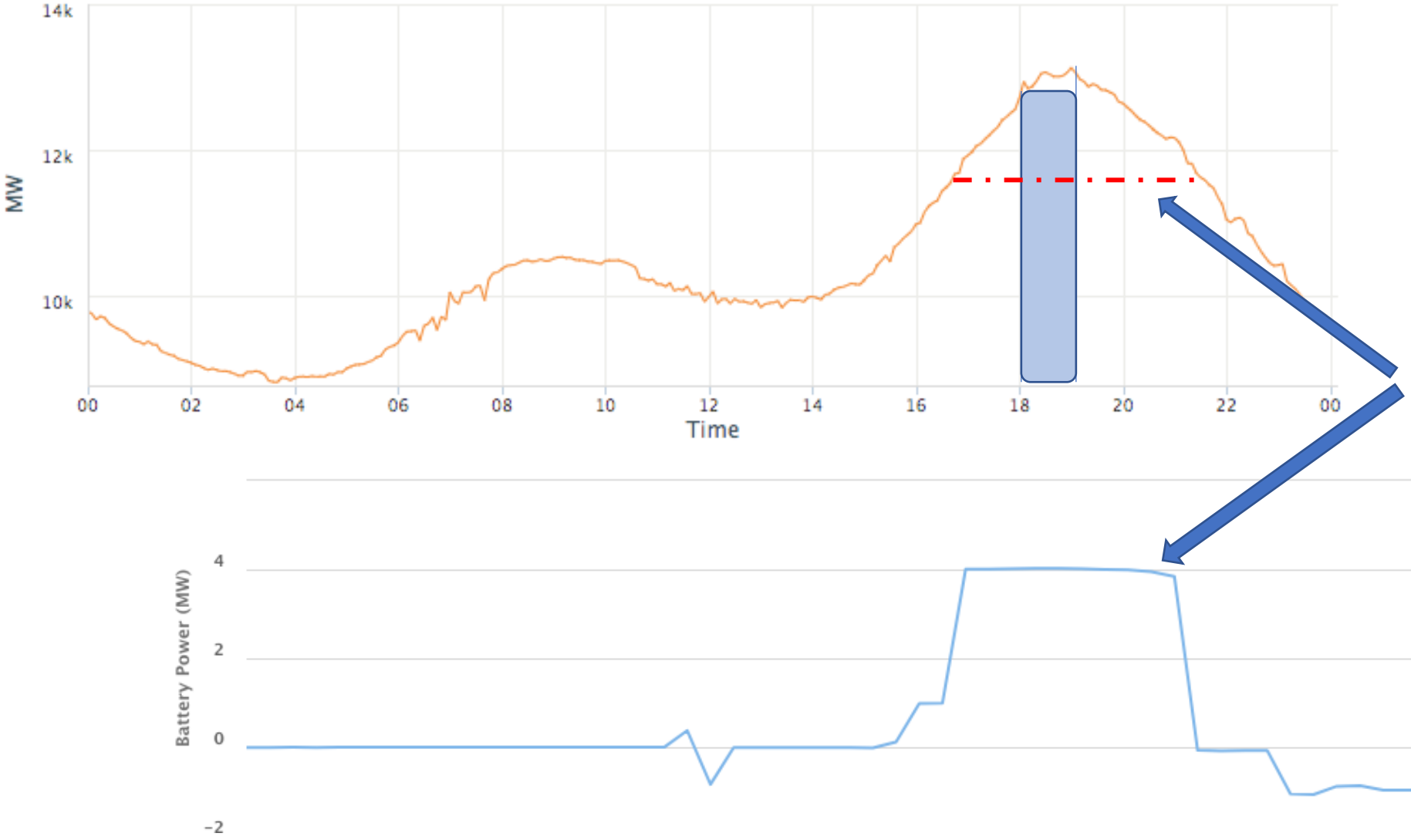
WHY ENERGY STORAGE IS IMPORTANT IN VERMONT

- **Resilience:** stay up and running during storms, which have become more frequent & severe in Vermont due to climate change
- **Affordability:** cost-effective, seamless backup power, plus peak shaving drives down costs for all customers
- **Grid flexibility:** provides GMP new tools to manage an increasingly distributed grid & support more renewables
- **Carbon reduction:** batteries charge off low-emission supply and displace dirty peaks



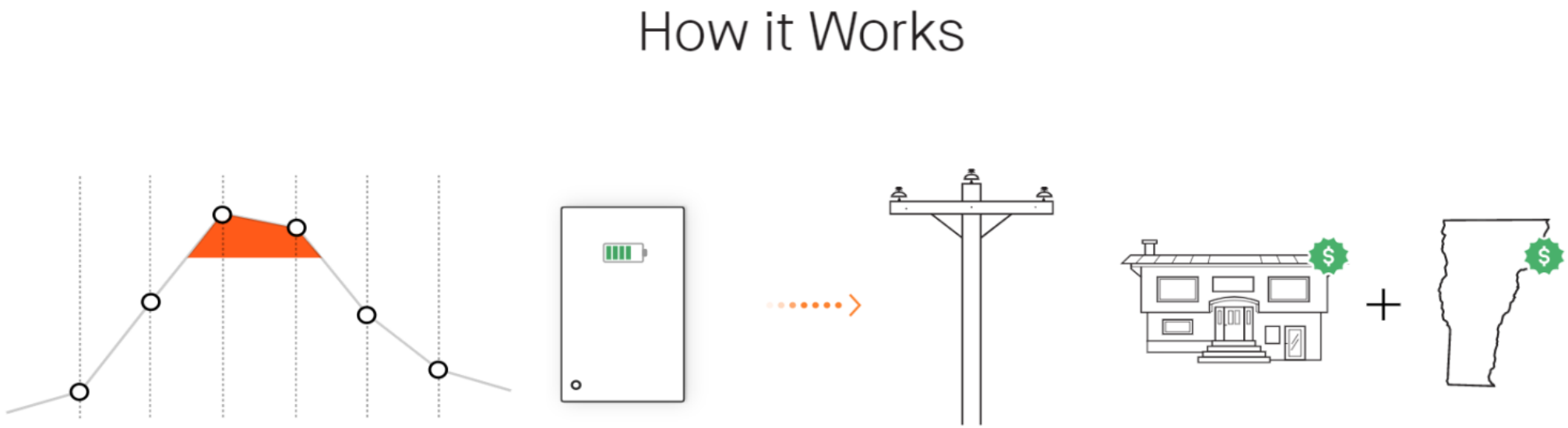
PEAK SHAVING 101: GENERATE SAVINGS FOR ALL CUSTOMERS



- GMP power supply costs driven by single hour of highest demand each month
- Batteries clip or lower the peaks by discharging

GMP ENERGY STORAGE PILOT

Battery storage at home for $15/month



2000 units = 10 MW Virtual Power Plant = 7,500 homes off the grid during a peak

HOW ARE WE DOING?

Tesla batteries save $500K for Green Mountain Power through hot-weather peak shaving

2018 article in Utility Dive, savings for single peak event

July 30th Peak

9.25MW curtailed

2019 Greentech Media article after Halloween wind storm

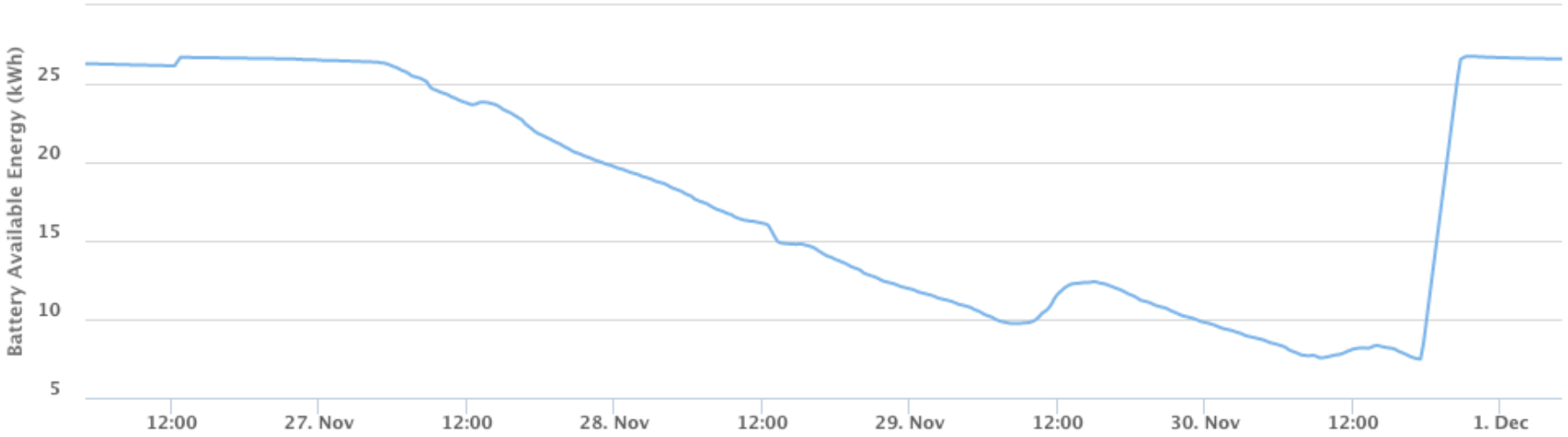
Batteries vs. Blackouts: 1,100 Homes Powered Through Vermont Outage With Storage

Utility Green Mountain Power's pilot programs paid off with clean, distributed backup power amid a statewide outage.

CUSTOMER STORIES

"The batteries pumped our water, ran our lights, appliances, TV, and computers, and even powered our electric snowblower, just as seamlessly as if we were connected to the grid"

- GMP customer who used storage and solar to stay powered during a 4-day outage



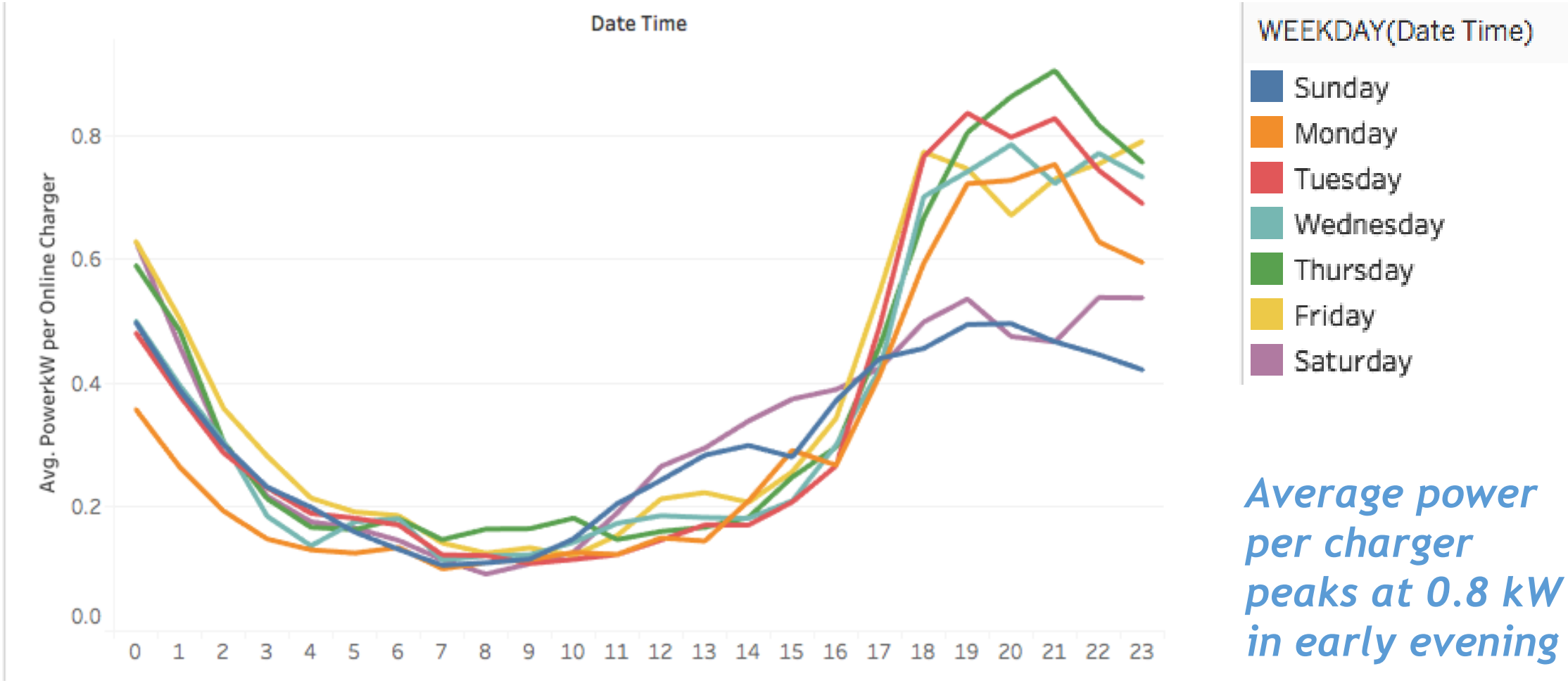
BATTERIES IN ACTION

ECHARGER PILOT

Pilot Details

- $29.99/month for unlimited off-peak home charging
- Customer shares access with GMP to manage during peak events, default opt-in
- 4-6 peak events per month based on forecasts

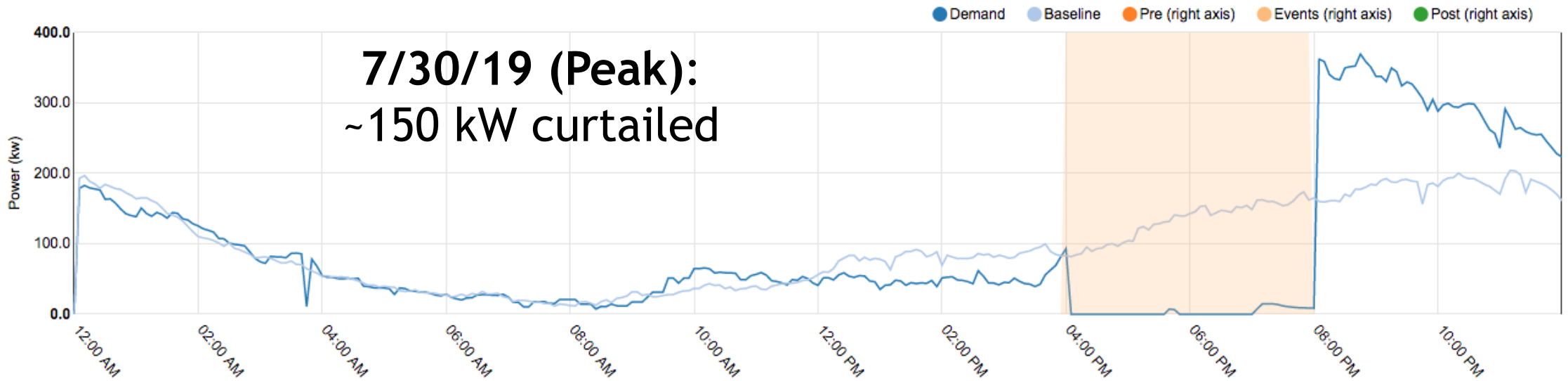
EV DATA FROM UNCONTROLLED DAYS



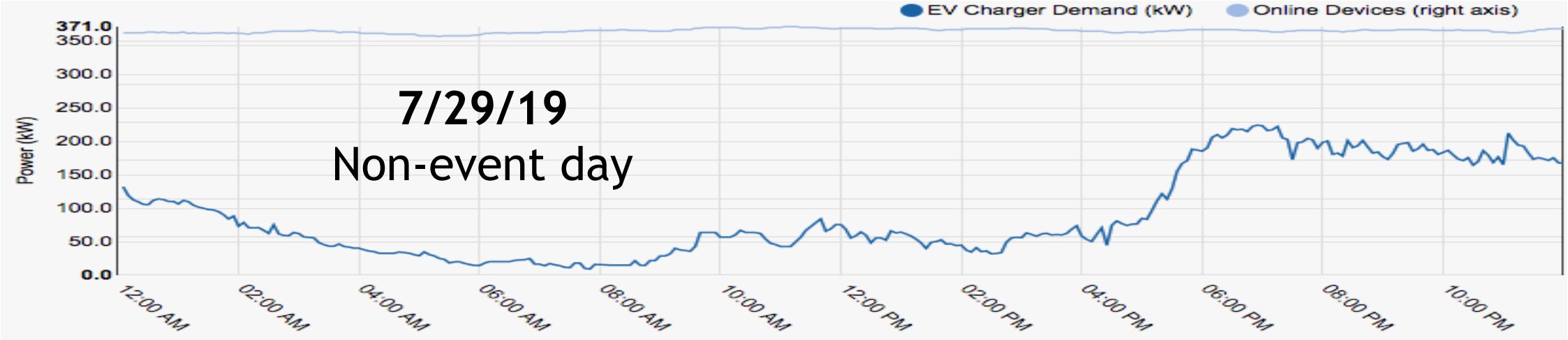
Average power per charger peaks at 0.8 kW in early evening

PEAK MANAGEMENT RESULTS

~300 total EVs



7/30/19 (Peak):
~150 kW curtailed



7/29/19
Non-event day

EV SATURATION TESTING

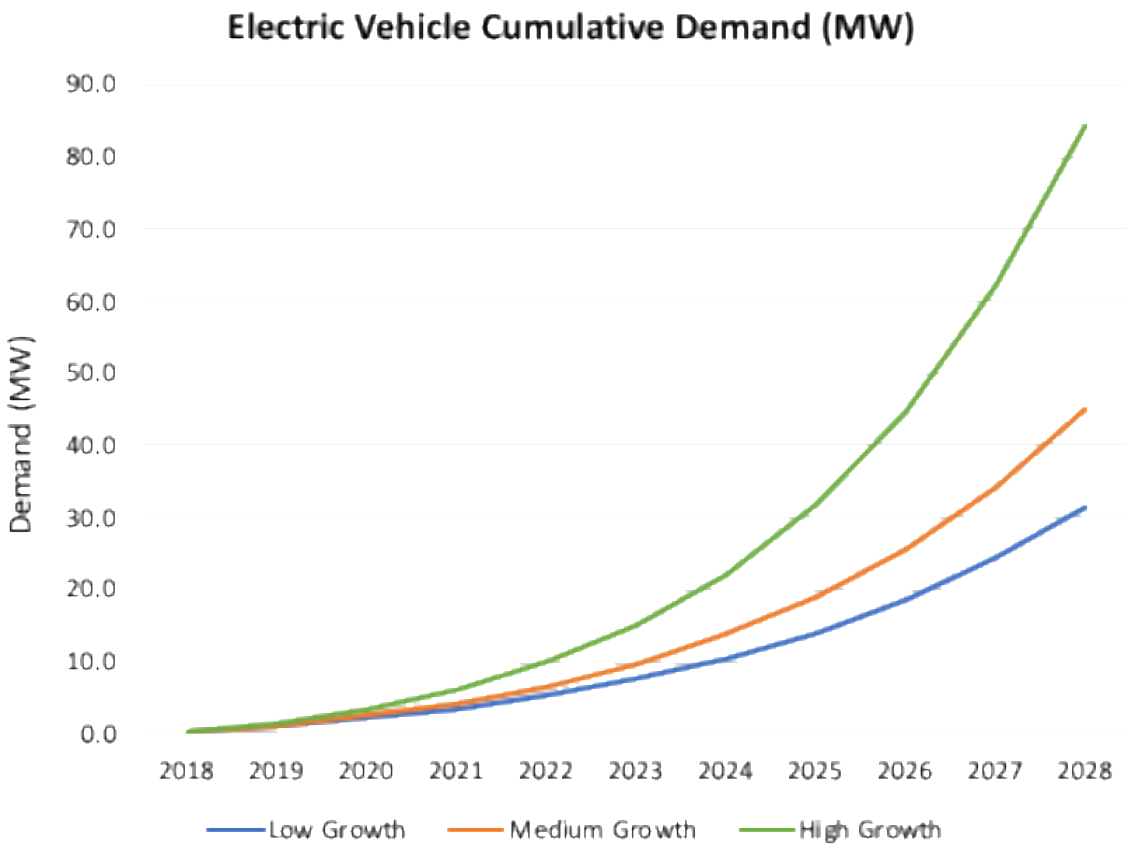
Circuit	Residential Customers	5 KVA Transformers	7.5 KVA Transformers	10 KVA Transformers	15 KVA Transformers	Case	Overloaded Fuses	Overloaded Sections of Conductors and Cables	Overloaded Regulators	Overloaded Reclosers
5F-G20	1626	166	4	375	362	Base	0	0	0	0
						Add EV to 50% of residences	4	1	0	0
						Add EV to 100% of residences	6	3	2	4

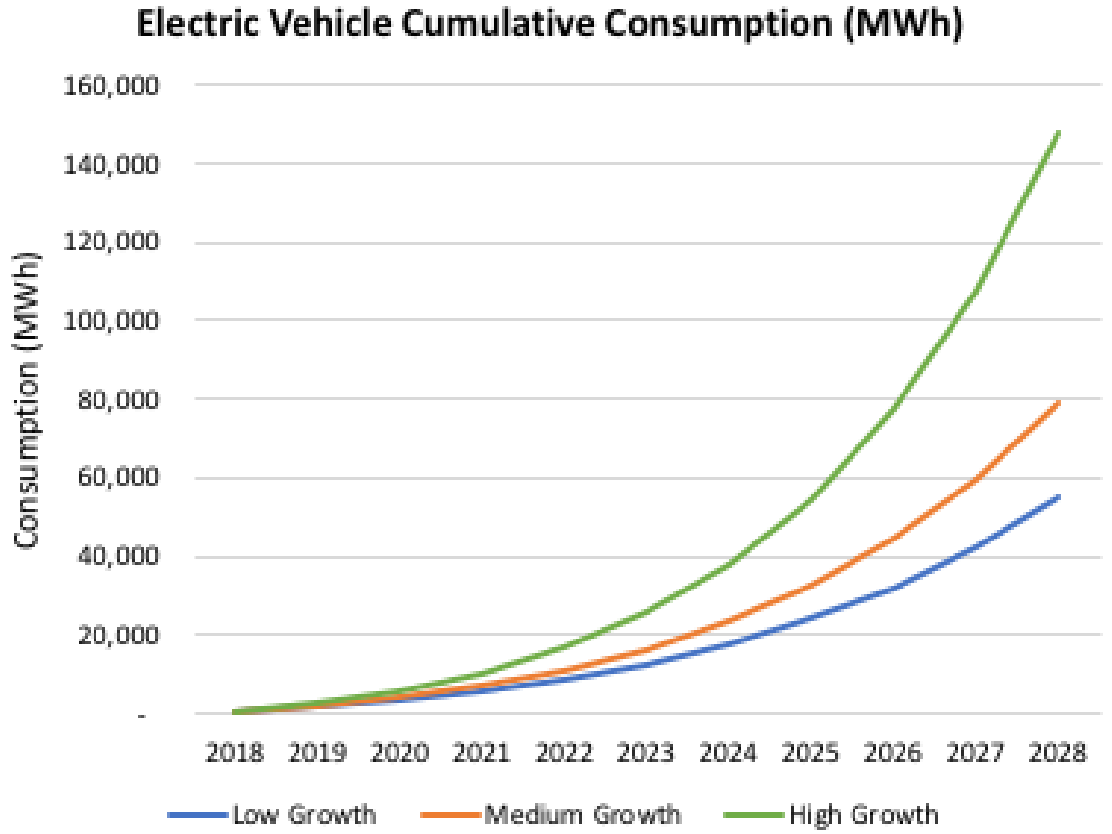
*Example from Circuit Saturation Run

- We took 10 circuits spread out across the State, applied a 50% and 100% residential uptake of EV's, and ran loadflows
- We assumed NO load control in this modeling
- Results show that we do not run into significant distribution limitations beyond some specific device changeouts.

ADDED EV CHARGING LOAD

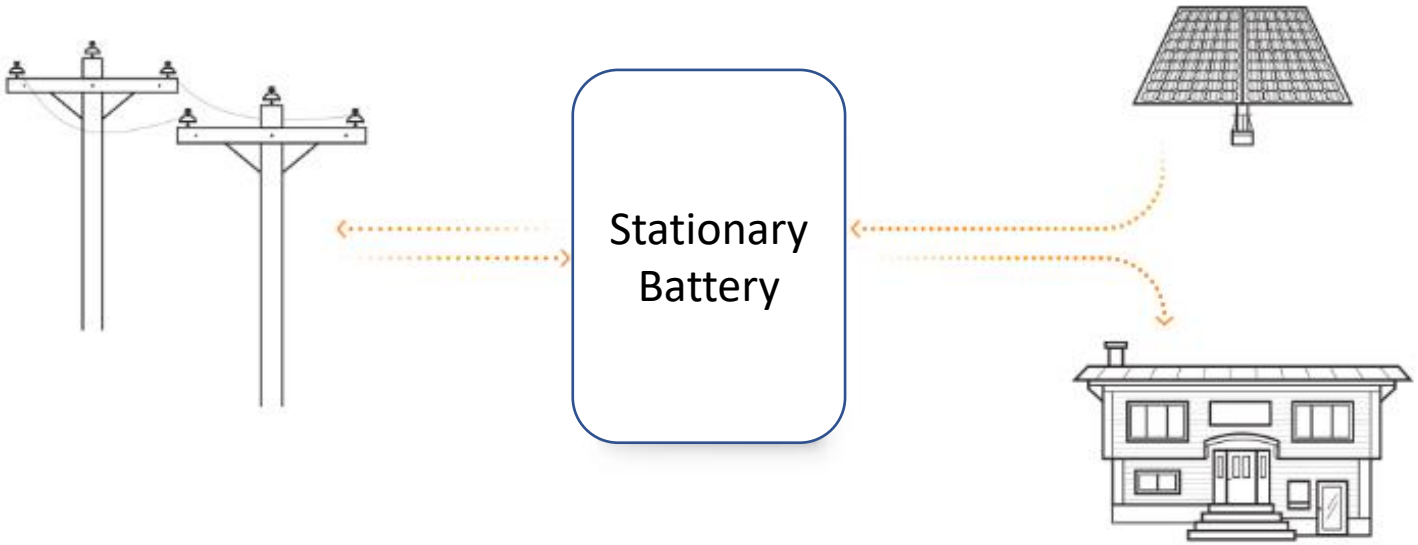
Conducted sensitivity analysis in 2018 Integrated Resource Plan (IRP)

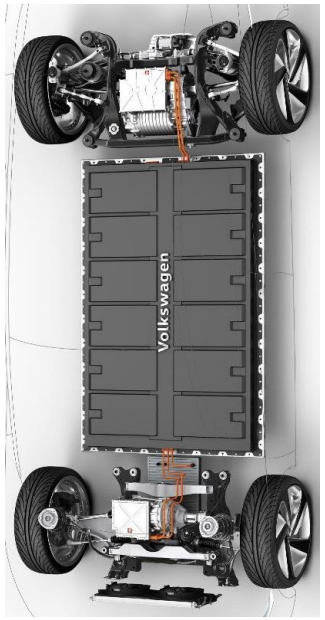


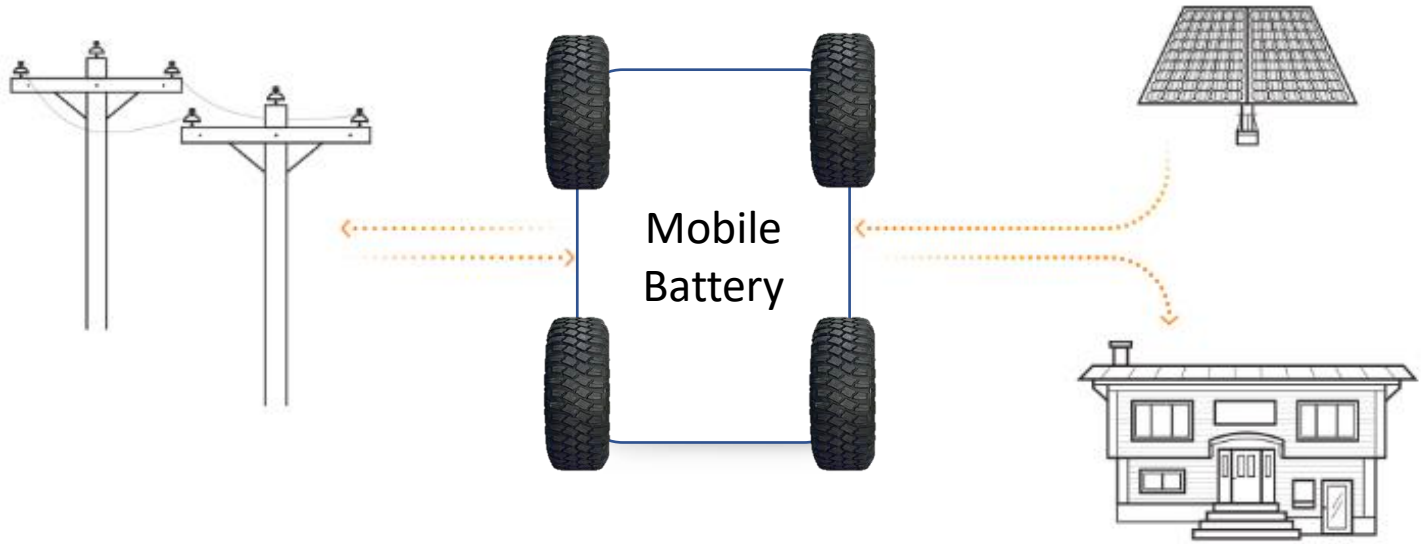


In medium growth scenario, EVs represent a ~5% increase in peak demand* and ~2% increase in overall consumption

* Peak coincidence assumes **no management** in place


Stationary
Battery


Volkswagen


Mobile
Battery

GREEN MOUNTAIN POWER
Generating Possibilities Together

Thank you and stay safe!

Questions?

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