Grid impacts of very high EV growth rate

Rate Design Initiative meeting

April 16 2020

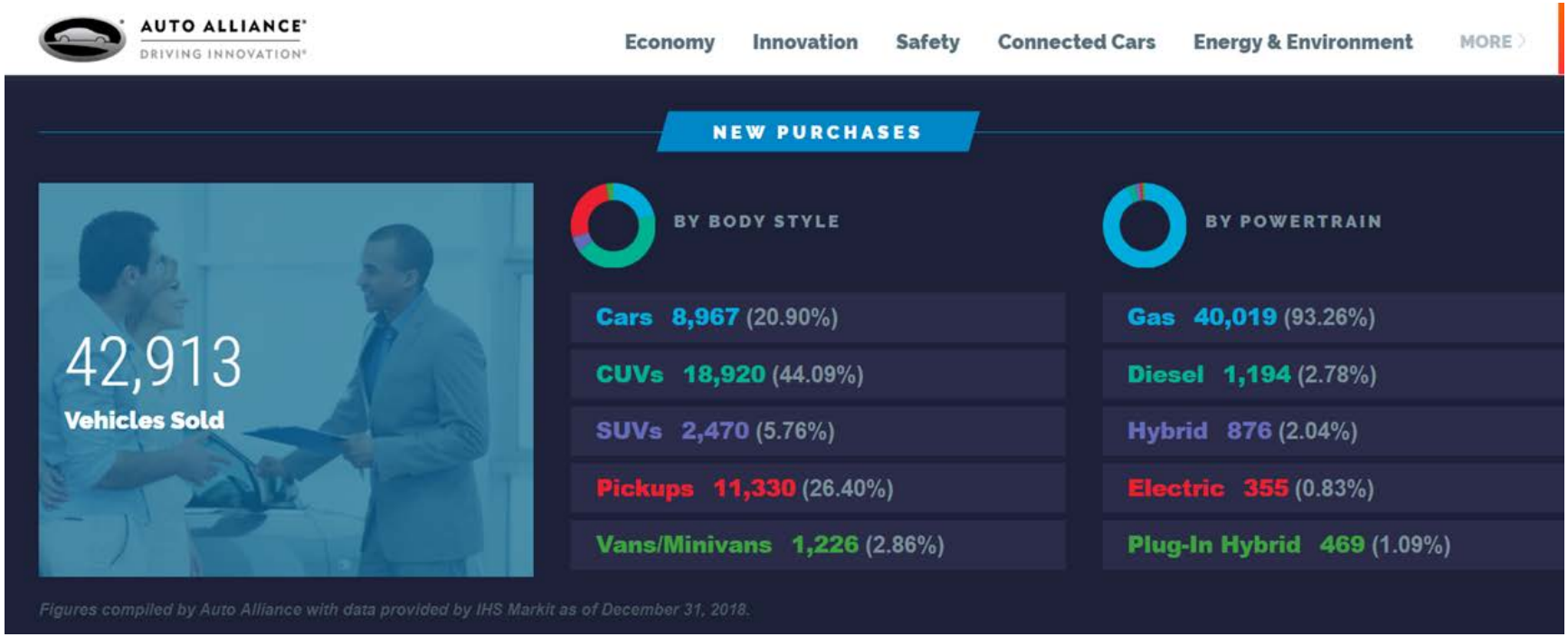
vermont electric power company

VELCO

Primary concern of high EV growth rate

- Accelerated adoption occurs suddenly
  - Not enough time to address criteria violations
  - Not enough time to resolve system concerns with non-transmission solutions
- Accelerated adoption enabled by
  - Prices drop sufficiently
  - Battery range increases sufficiently
  - Charging location available sufficiently
  - Manufacturers produce sufficiently
  - Available models match VT customer preference

We prefer utility vehicles and trucks



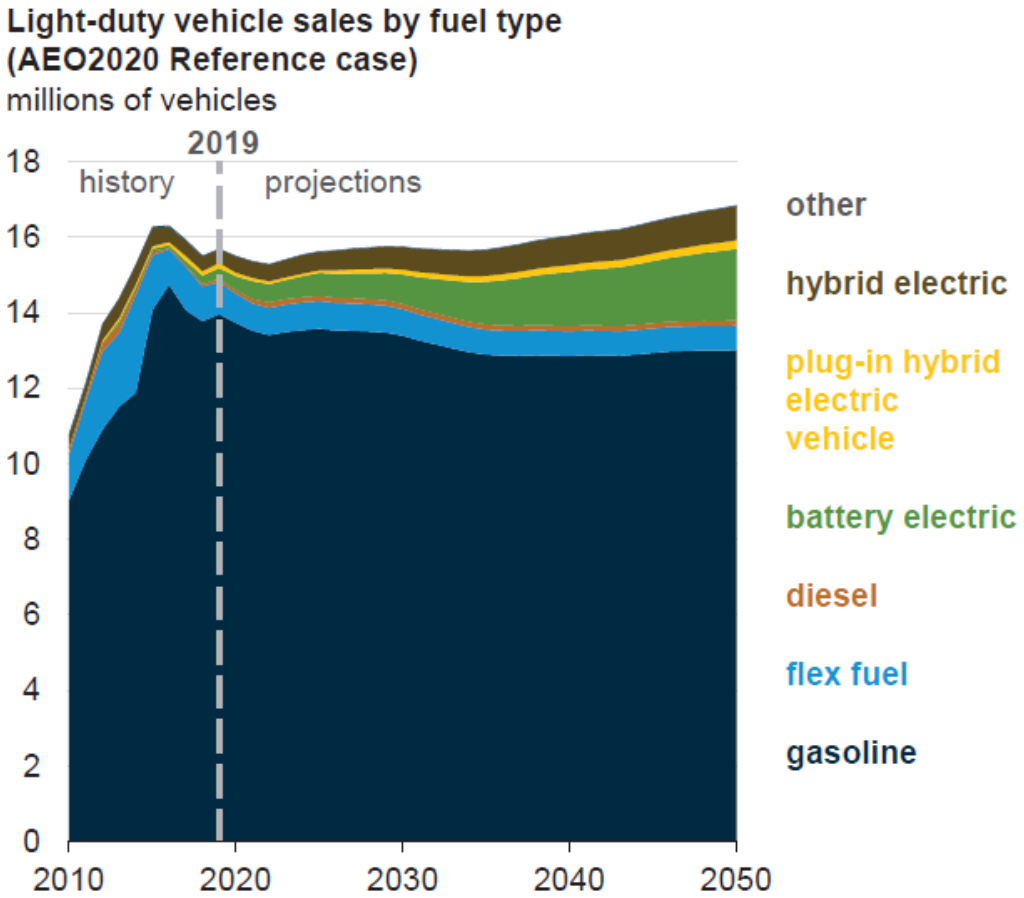
https://autoalliance.org/in-your-state/VT/

EIA projects modest EV growth through 2050

Battery Electric Vehicle (BEV) sales increase faster than any other type of vehicle sale, growing on average by 6% per year.

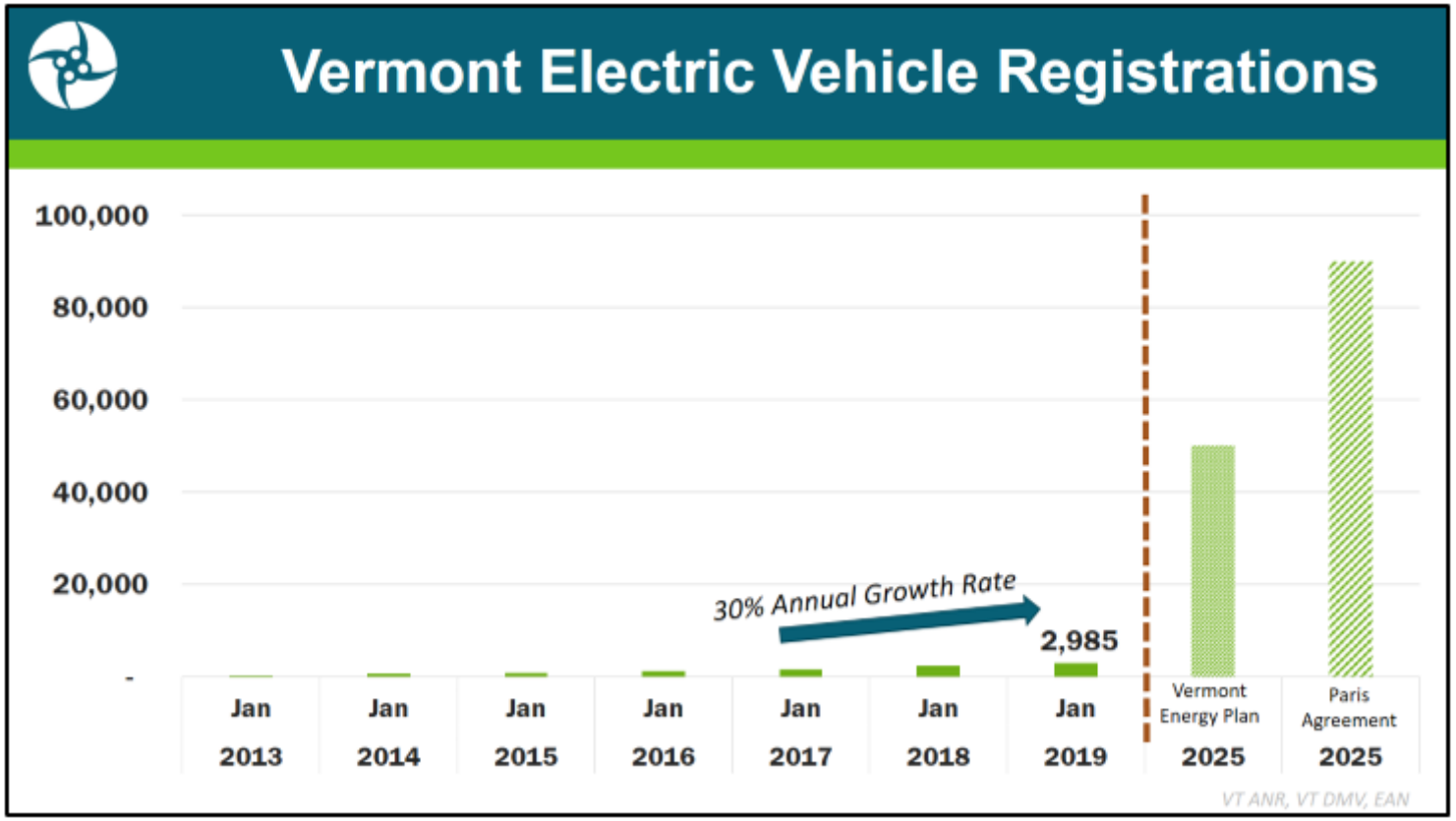
Sales for the 200- and 300-mile BEVs increase from 280,000 in 2019 to 1.9 million in 2050, while sales of PHEVs increase from 137,000 in 2019 to 230,000 in 2050.

Hybrid electric vehicle sales increase 3.1% per year, rising to more than 900,000 new vehicles sold by the end of the projection period.



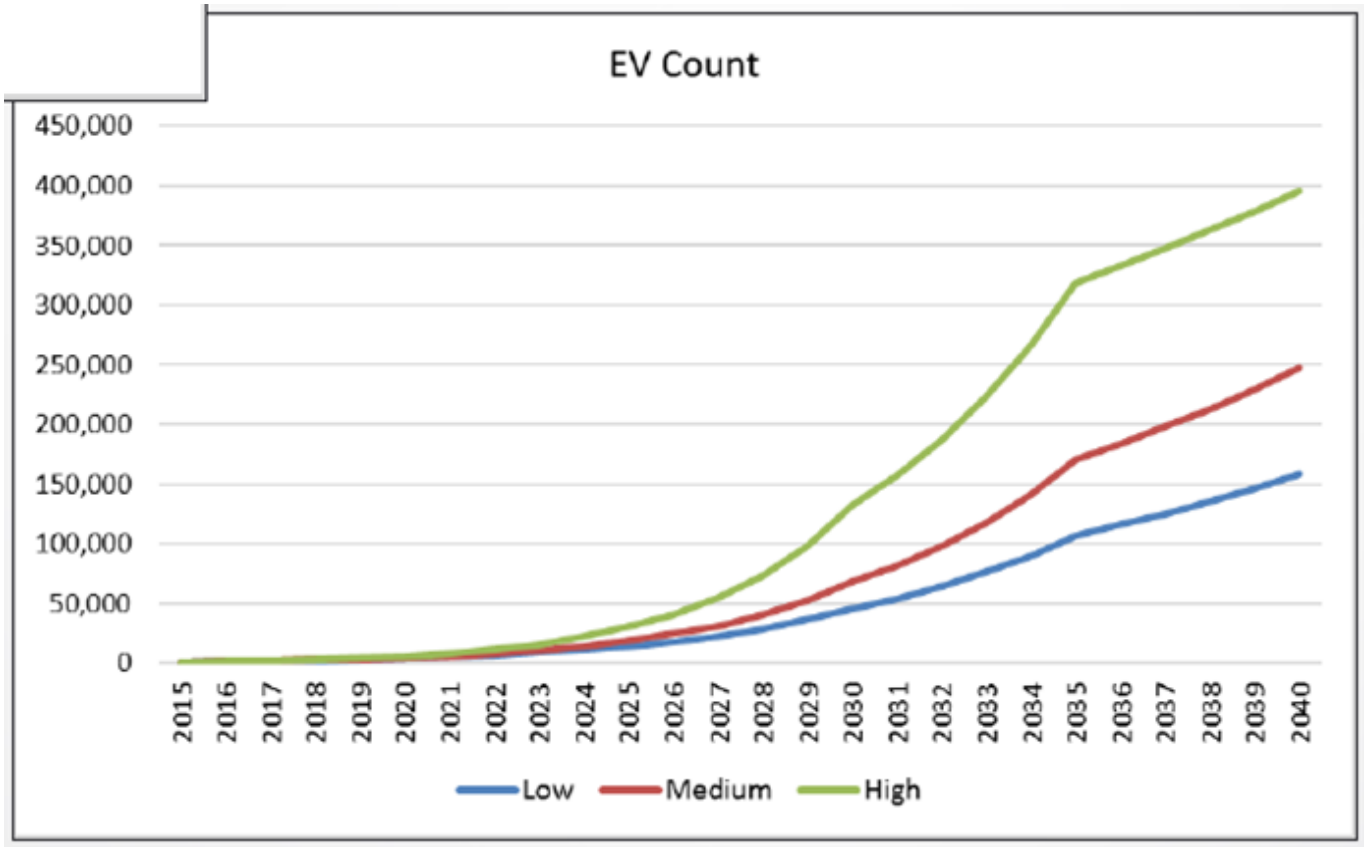
https://www.eia.gov/outlooks/aeo/

We desire faster EV growth



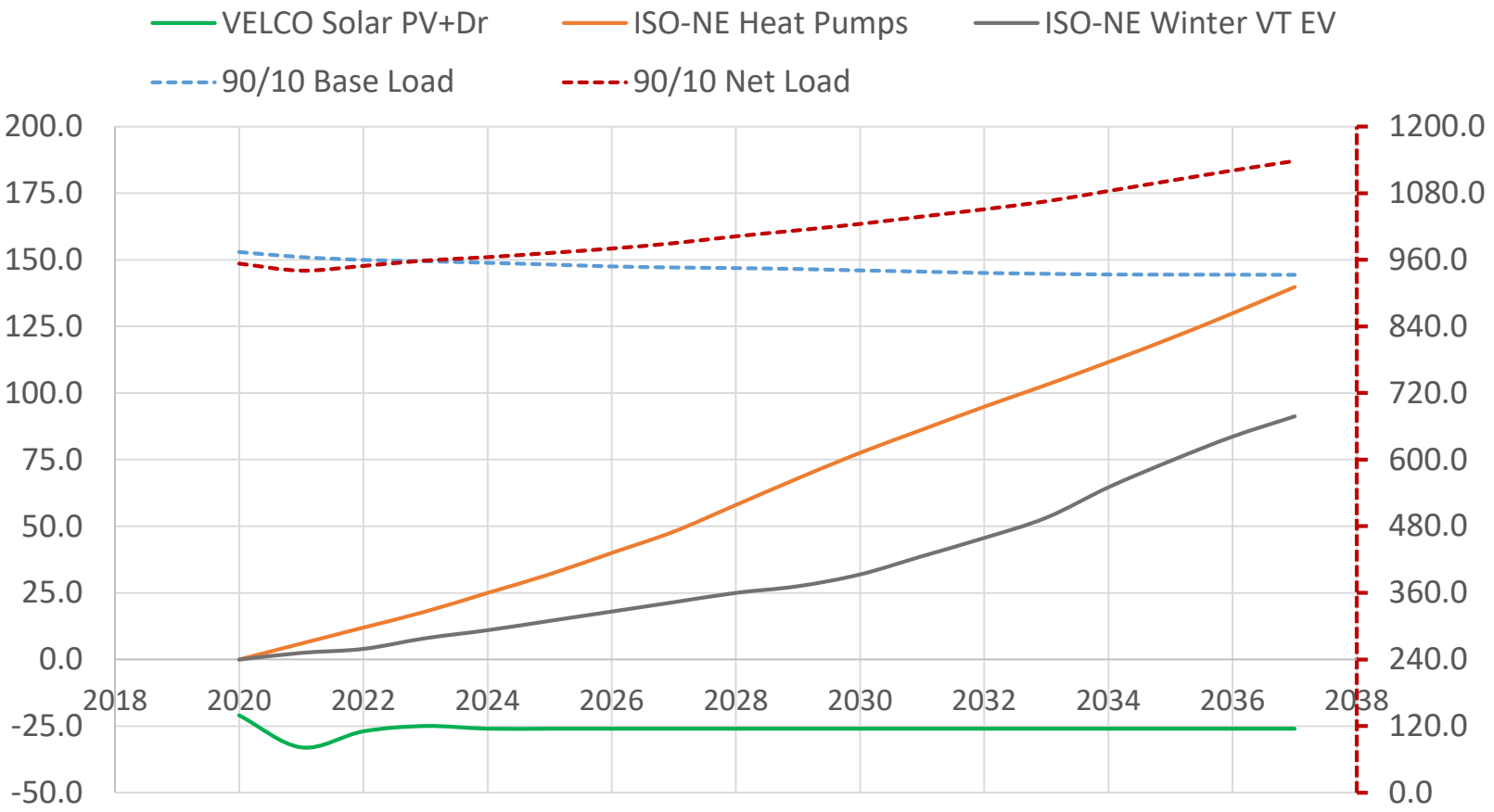
https://www.eanvt.org/wp-content/uploads/2019/08/EAN_VT-EnergyFutureInitiative_EV_presentation-Updated-08292019.pptx

The 2018 EV forecast scenarios



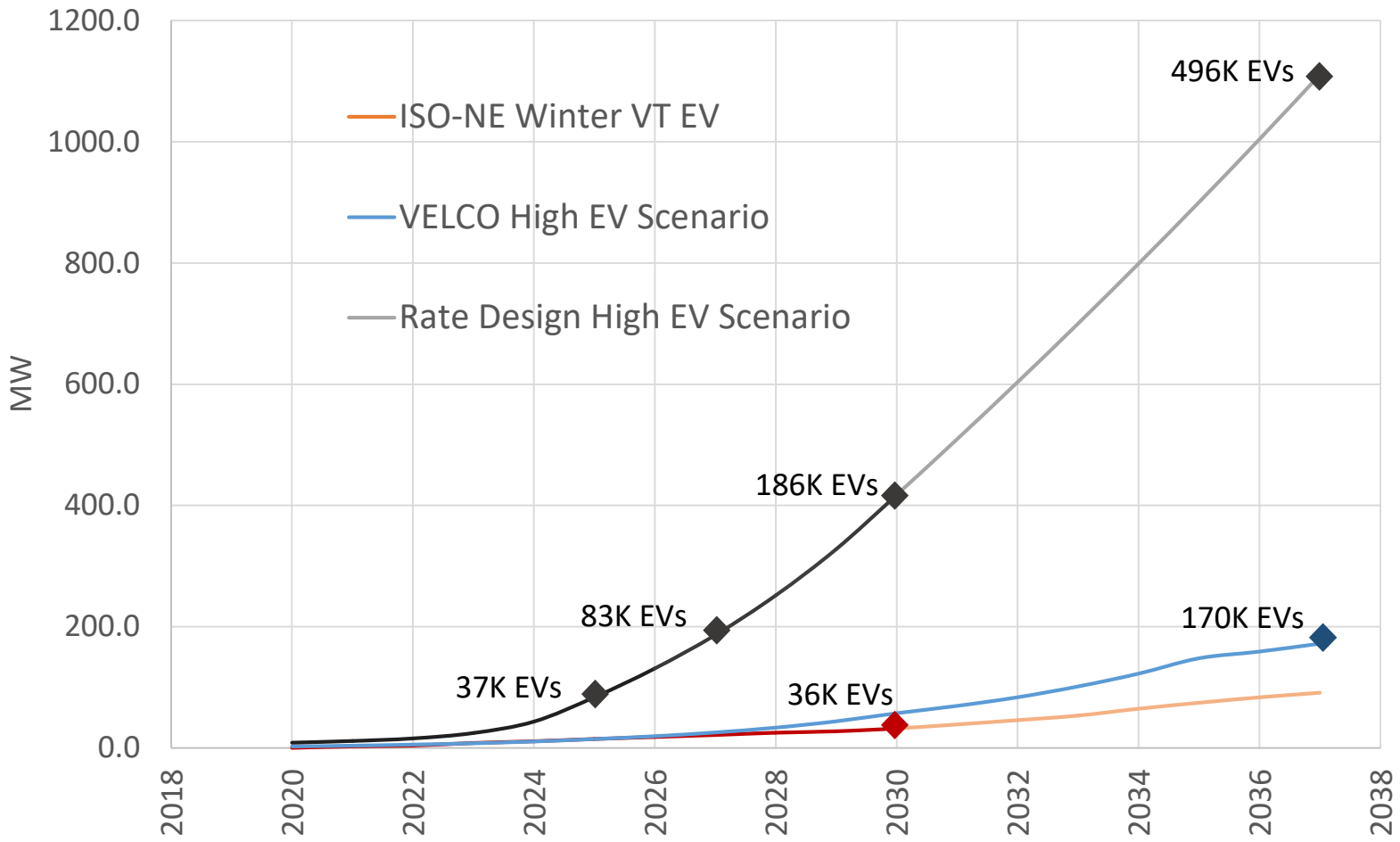
- The 2018 EV forecast utilized the low curve as the base forecast and the medium curve as the high penetration forecast scenario
  - The 2015 forecast exceeded the actuals, and was above the low curve for the first few years of the forecast

Adjusted 2018 long range plan winter peaks

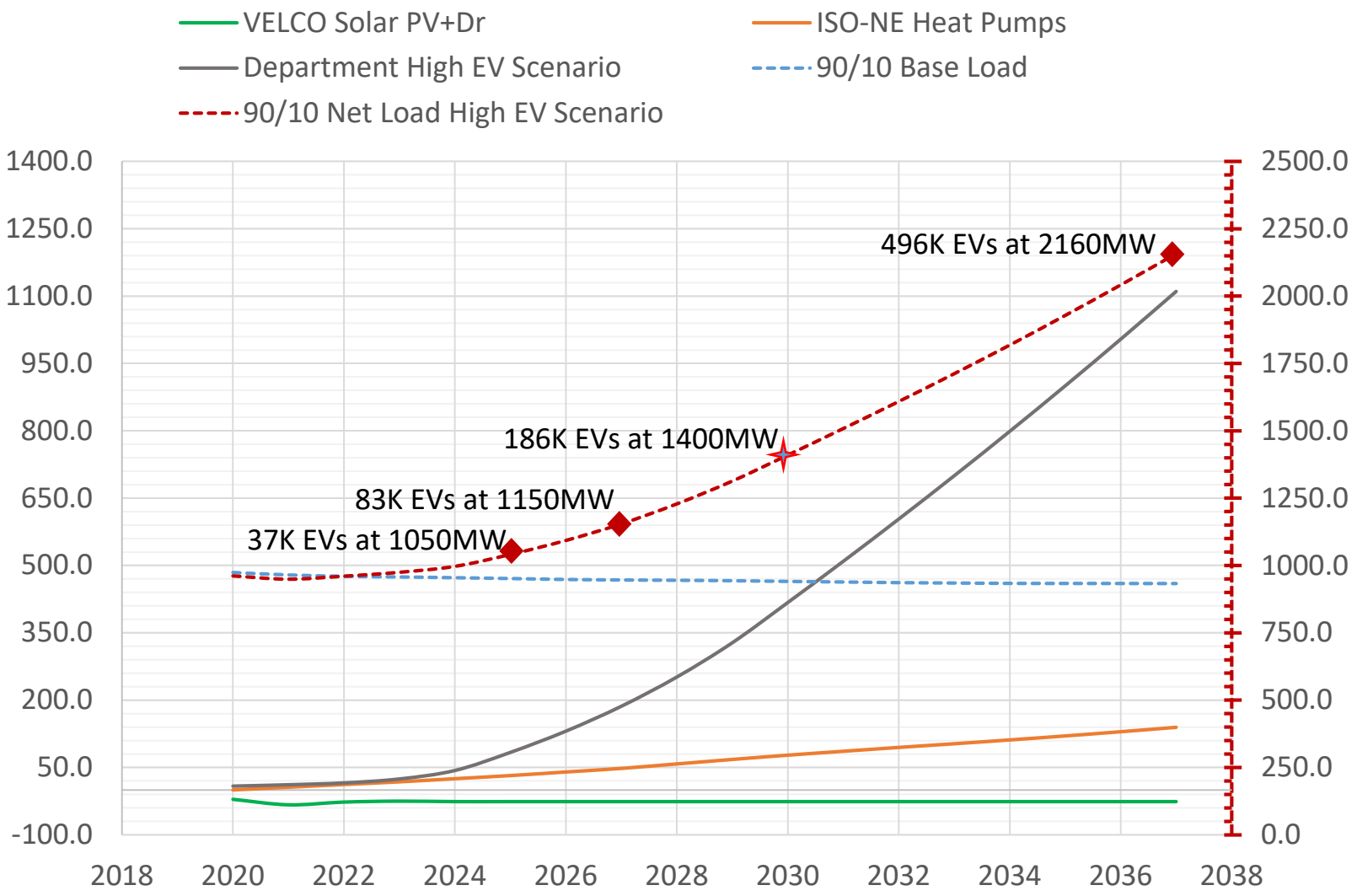


- 2018 forecast updated with most recent ISO-NE EV and HP forecasts extended beyond 10 years
  - Net load is just under 1200 MW in 2037

EV growth scenarios



Transmission capacity exceeded between 2027 and 2030

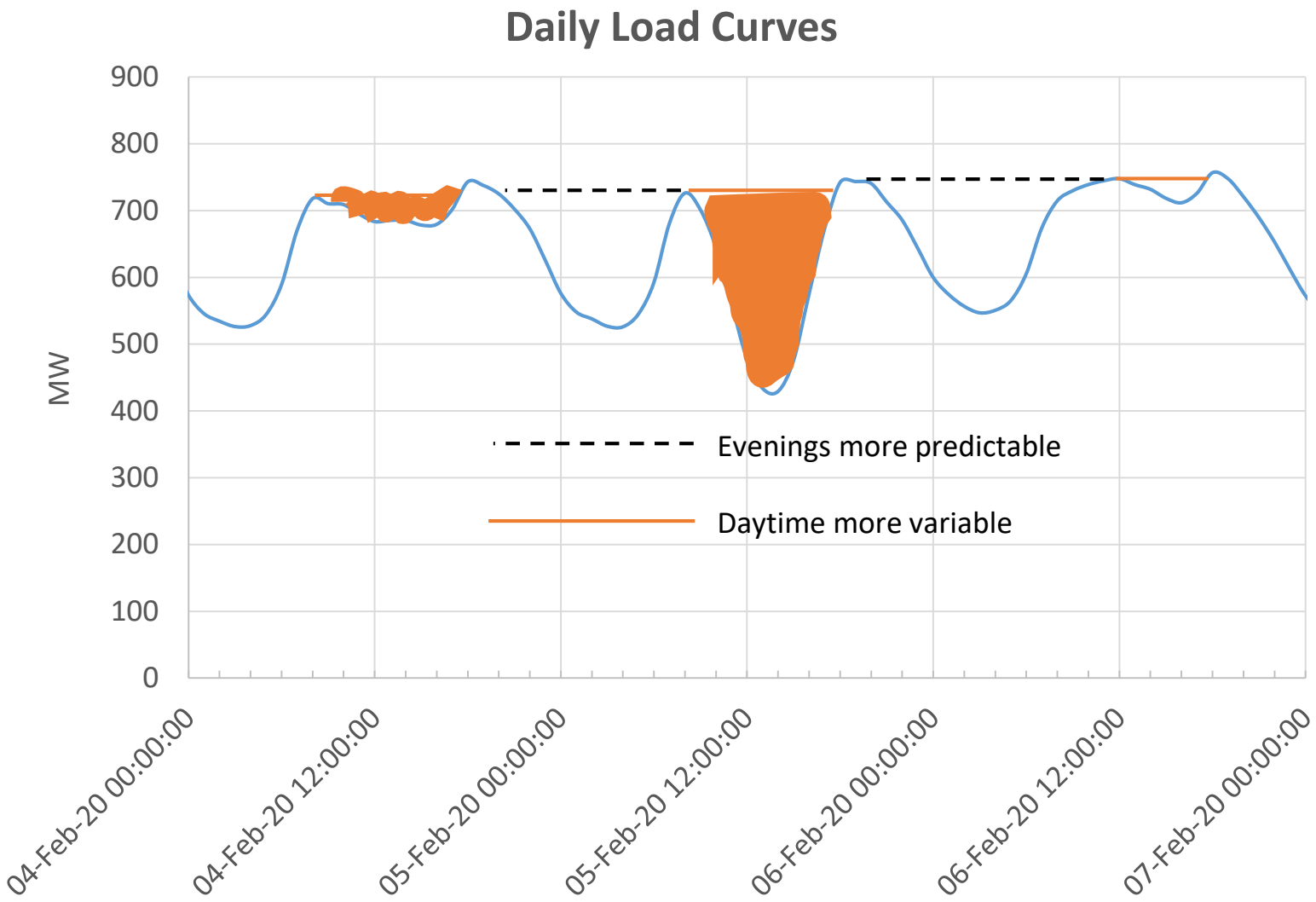


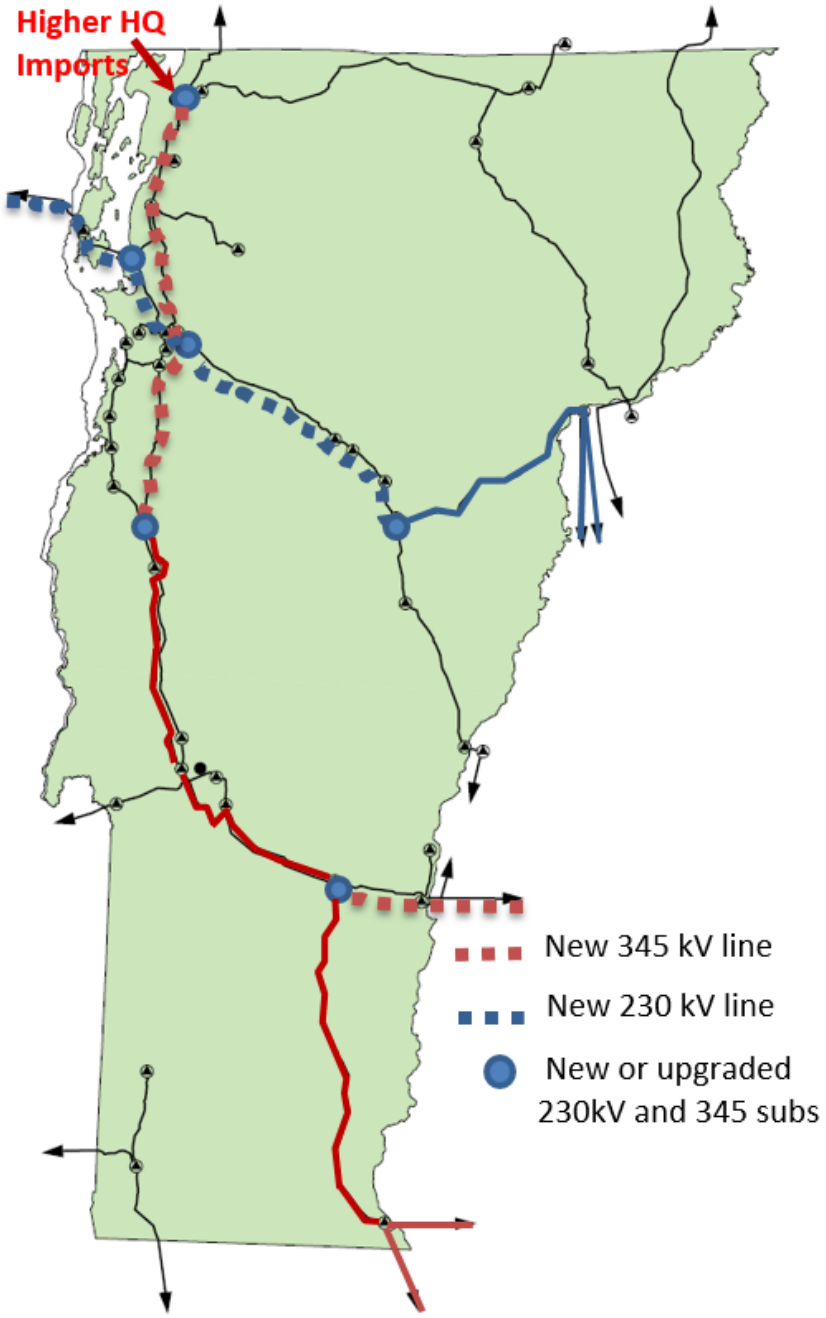
Grid reinforcements needed within 10 years

Assuming long term growth will flatten

Potential upgrades below 1400MW	Oder of magnitude cost estimates
Barre to Berlin 5.6 miles 954 ACSS	28
Cold River to N Rutland 5.6 miles reconductor 954 ACSS	28
Coolidge to Cold River 18.2 miles reconductor 954 ACSS	102
West Rutland to Florence 5.3 miles reconductor 1272 ACSR	27
New Haven to Williston 20.6 miles rebuild 2x954 ACSR 345kV built 115kV operated	125
Coolidge 345/115 kV transformer addition	10
Irasburg 50MVAr synchronous condenser	40
16.2 MVar at Blissville 46 kV	5
Irasburg 115/46 kV transformer replacement	5
Barre 115/35 kV transformer replacement	5
Berlin 115/35 kV transformer addition	15
Middlebury 115/46 kV transformer replacement	5
North Rutland 115/46 kV transformer addition	15
Cold River 115/46 kV transformer replacement	5
Hartford 115/46 kV transformer addition	15
Bennington 115/46 kV transformer replacement	10

Loads can be quite variable





Grid reinforcements needed

Assuming long term growth continues past 1400 MW

Forecasting discussion with VSPC

- Growth in number of vehicles
  - Drivers (price, incentives, mileage, availability,…)
    - When will growth accelerate
    - When will growth slow down and flatten
    - When will electrify trucks, tractor trailers, commercial vehicles
- Per vehicle demand
  - Coincidence of charger types and timing of charging activities
- Location of the growth
  - Utilization of public multiport charge stations, at work charging, at destination charging, at home charging
- Effects of Covid-19 on adoption rate
- Capabilities of dynamic load control