2026 Long-Term Forecast
November 17th, 2025

Mike Russo and Eric Fox

Agenda

1. Forecast Status
2. Heat Pump Data and Forecast Update
3. EV Data and Forecast Update
4. Solar Capacity
5. Distribution Level Load Forecasting – Method and Demo
6. Questions and Discussion

Workplan and Schedule

Status

» Updated forecast database and model inputs

- Residential and customer sales data through July 2025
- Calibrated residential and commercial end-use intensities (waiting for upcoming EE projections)
- State and county economic forecasts (Moody's September 2025, Woods & Poole June 2025)
- EV and Heat Pump adoption data – by county and town (EVs through July, Heat Pumps through September)
- Daily historical temperature data – Burlington and Rutland
- Normal daily and trended monthly normal HDD and CDD (calculated through 2024)
- Installed behind the meter solar capacity

» Updated system and planning zone data

- System and zone level data through June 2025 reconstituted for solar generation
- Zonal weather response models, estimating with Artificial Neural Network (ANN) models
- Links/mapping to substations

» Preliminary Baseline Sales, Customer, and Energy Forecast

Forecast Inputs Status

Inputs	Complete	Comment
Historical VELCO system hourly load.	Yes	
Historical VELCO transmission zone hourly load data.	Yes	
Historical daily temperature data for Rutland and the Burlington International Airport.	Yes	
Historical monthly residential, commercial, and industrial customers and sales data.	Yes	
Customer class AMI hourly load data if available (in past forecasts both GMP and Burlington Electric have provided aggregated AMI data).	Yes	Updated GMP data
Historical and forecasted EE program end-use savings estimates.	Yes	Based on prior VEIC forecast
Calibrated residential and commercial end-use saturation estimates.	Yes	
End-use stock efficiency estimates.	Yes	
Historical solar and other distributed energy capacity.	Yes	
Historical and forecasted state-level demographic and economic data by county.	Yes	
Heat pump sales by month and county and heat pump load characteristics.	Yes	
Historical Substation winter and summer peak, hourly load data if available.	Yes	VELCO provided seasonal substation peaks. Hourly substation data provided by WEC.
Customer load control programs, e.g. EV charge control and battery storage	Partial	Request into GMP for hourly EV charging data. What about battery storage?

Schedule: November - December 2025

- **Preliminary System and Zonal Load Forecasts**

- **Technology Shapes and Impact**
  - EV Charging,
  - Update building electrification (heat pump and heat pump water heaters)
    - Unit, energy, location, heat pump and water heat load profiles
  - Update EV forecast
    - Units, location, charging profiles
  - Update utility scale and BTM solar generation forecast
  - New technology and load control forecasts
    - Utility scale and behind the meter utility scale battery storage
    - Load control programs and rate design
- **Focus on the planning zones and subregions**
  - Improve zone-level forecasts of heat pumps and EVs
  - Incorporate substation level load data – ideally hourly load

- **Presentation – Focus on technology forecasts**

Schedule: January - April 2026

» **Construct forecast scenarios**

- Extreme weather conditions
- Higher and lower technology adoption paths
- Alternative EV charging profiles
- Alternative battery storage and load control strategies
- High and low economic outlook

» **Presentation – Scenario results**

» **Complete project report**

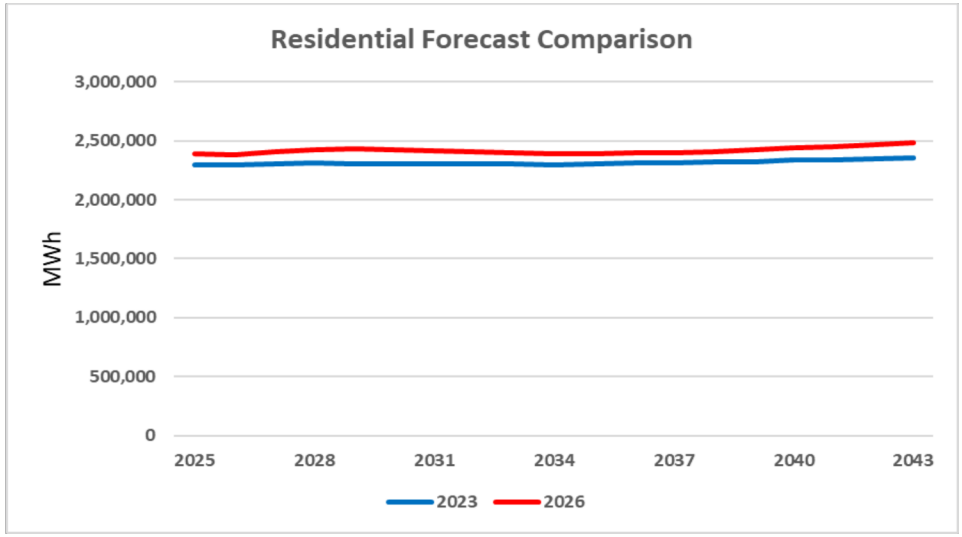
Tracking Prior LTLF

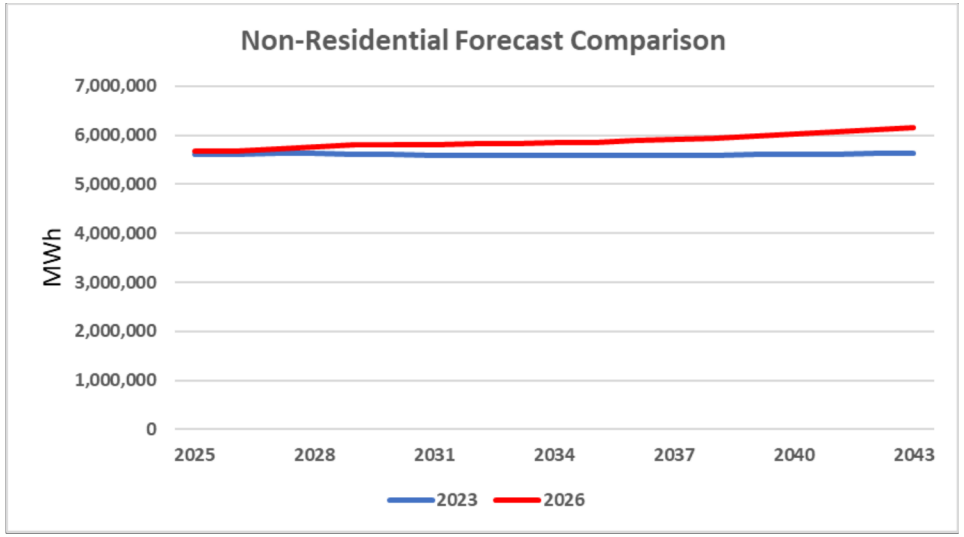
2023 vs 2026 Baseline Sales Forecast Comparison

» Higher baseline sales forecast (not adjusted for EV/PV)

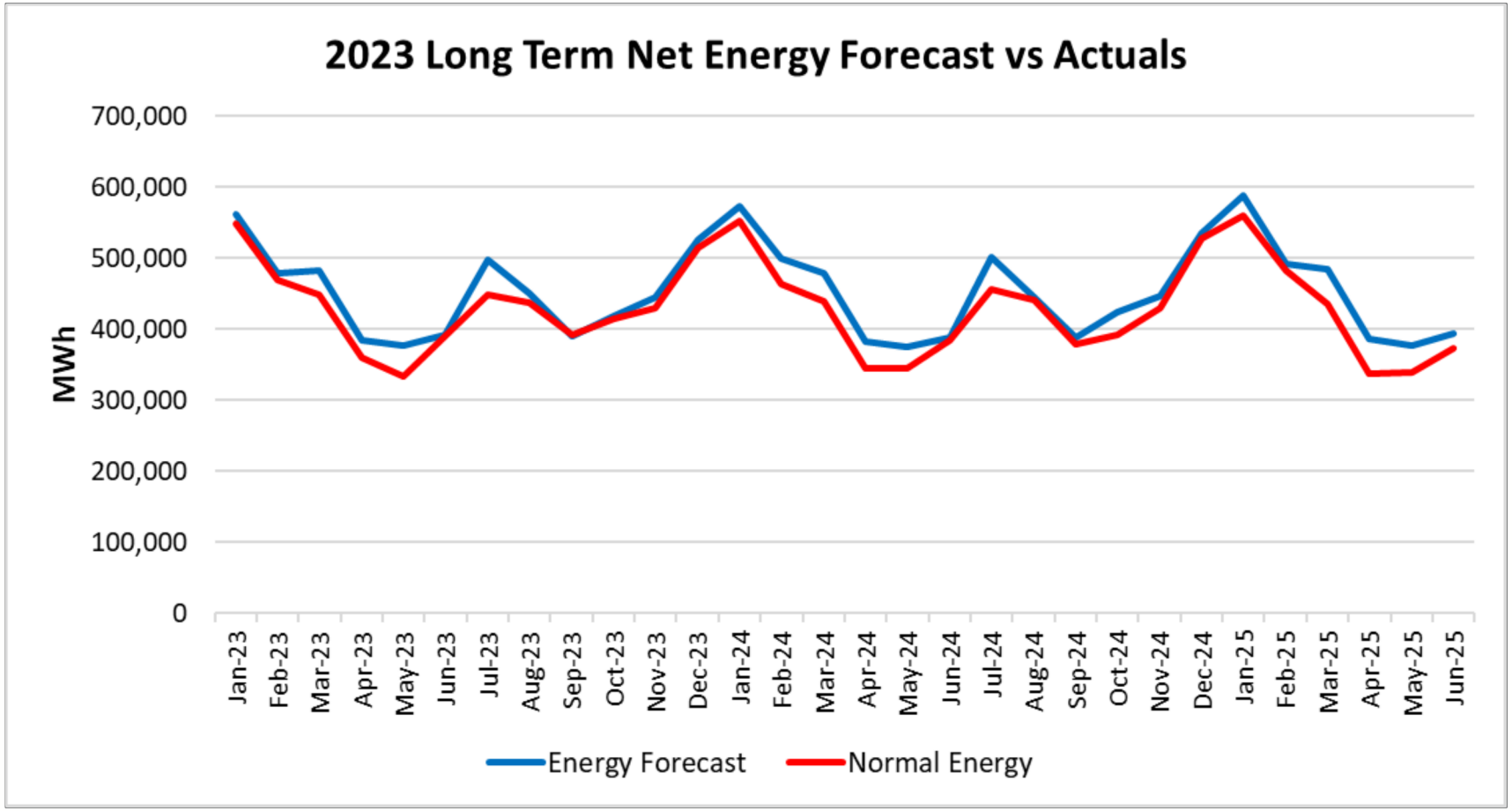
- Residential
  - Higher average use starting point
  - Largely due to heat pumps

- Non-Residential
  - Stronger end-use intensity projections
  - Ventilation that declines at a much slower rate
  - Computer loads – both on-premise and data centers





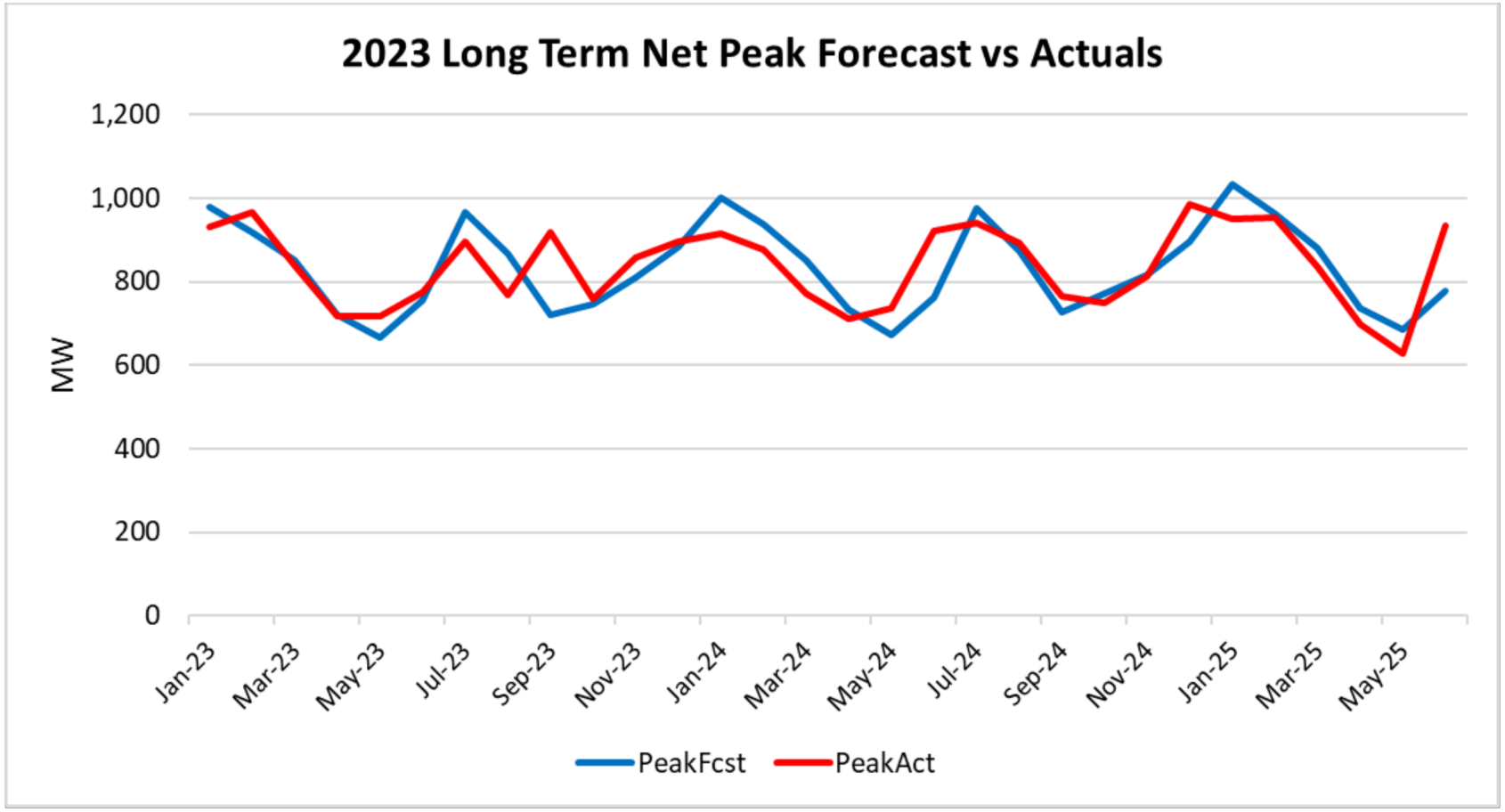
Energy Forecast Comparison



» 2023 forecast assumed 11,500 addition heat pumps in 2023 and 12,600 in 2024.

» 2023 forecast assumed 15,000 registered EV in 2023 and 25,000 in 2024.

Peak Forecast Comparison



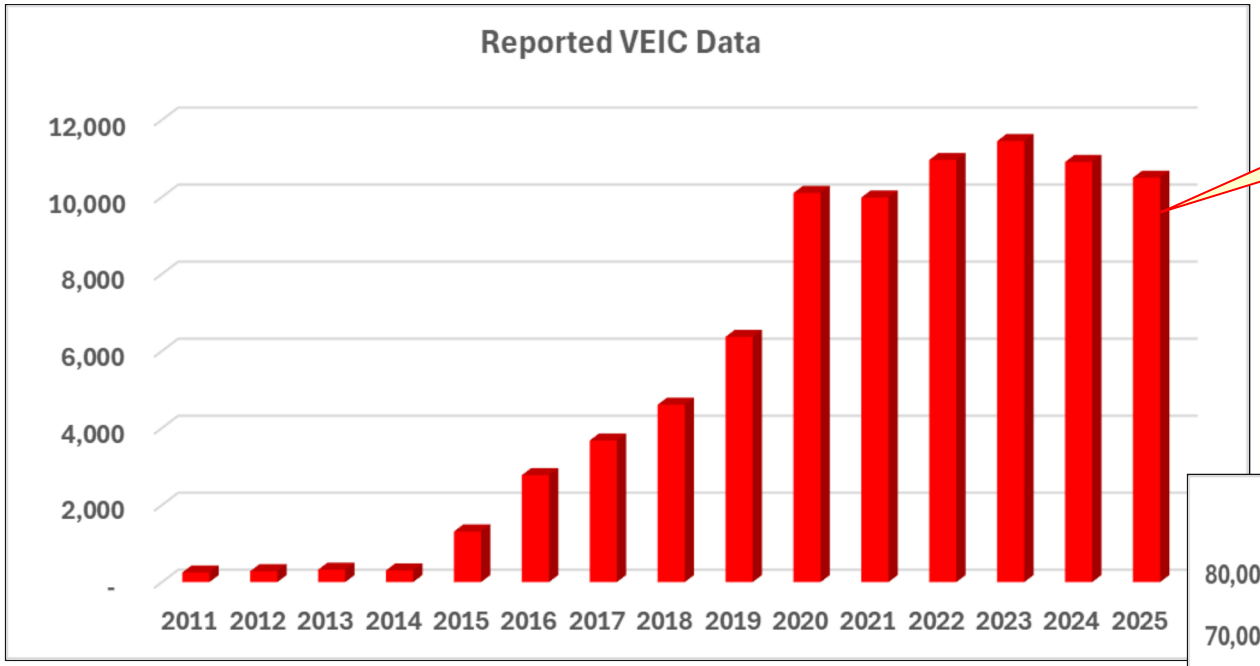
Heat Pumps

Heat Pump Forecast

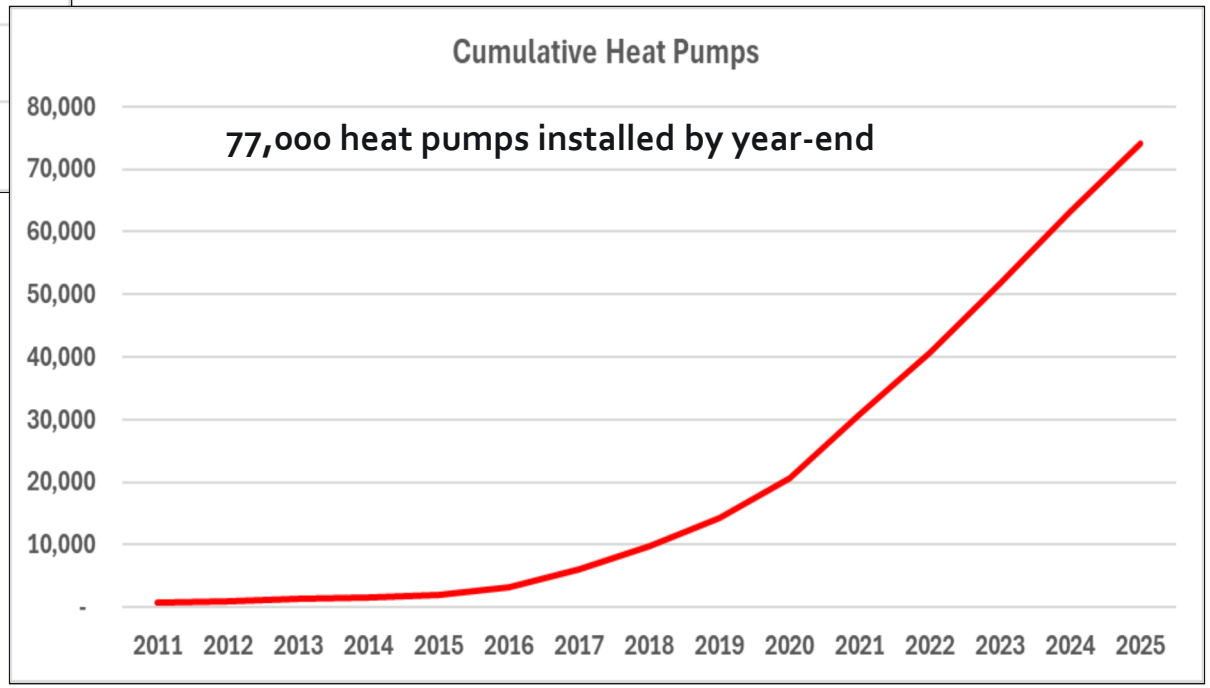
- **What Drives the Forecast**
  - Unit Sales
  - Unit Use (UEC)
  - Load Profile

- **Heat Pump Characteristics**
  - Purchase and Saturation Trends
  - Unit characteristics
  - Unit energy consumption
  - Heat pump load profile

Heat Pump Sales



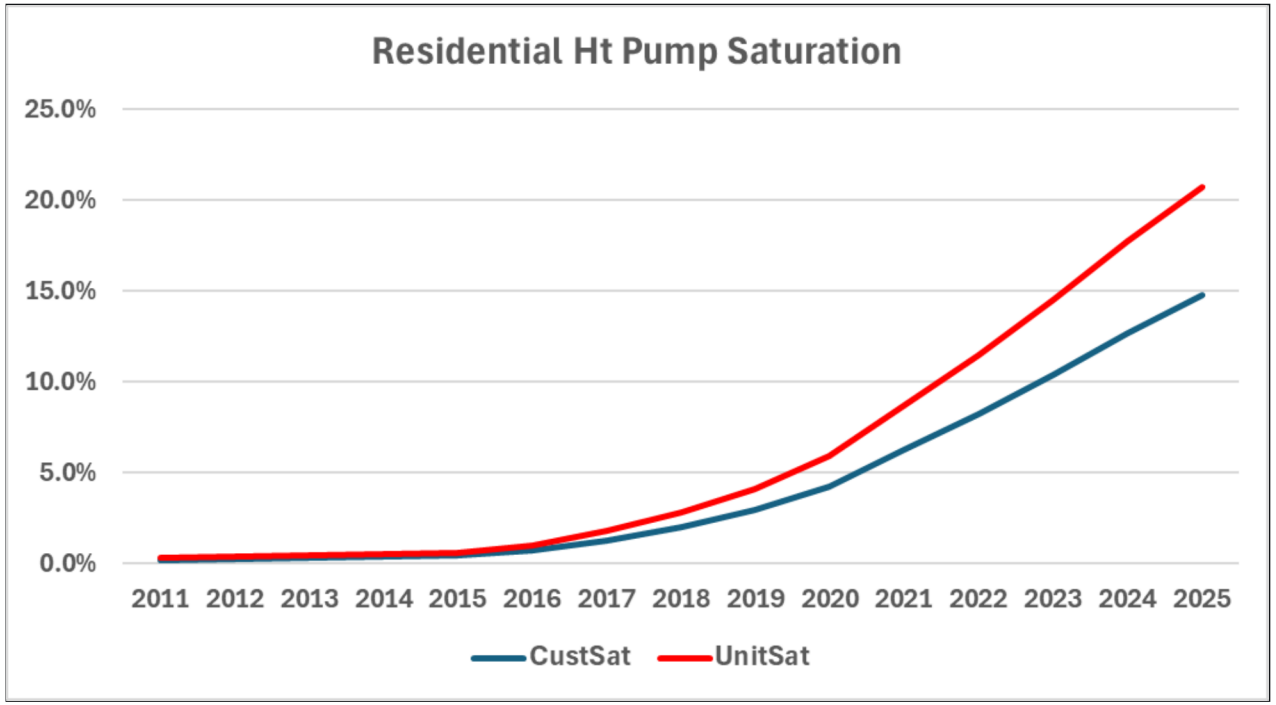
On track for 2025 year-end sales of 10,500 units

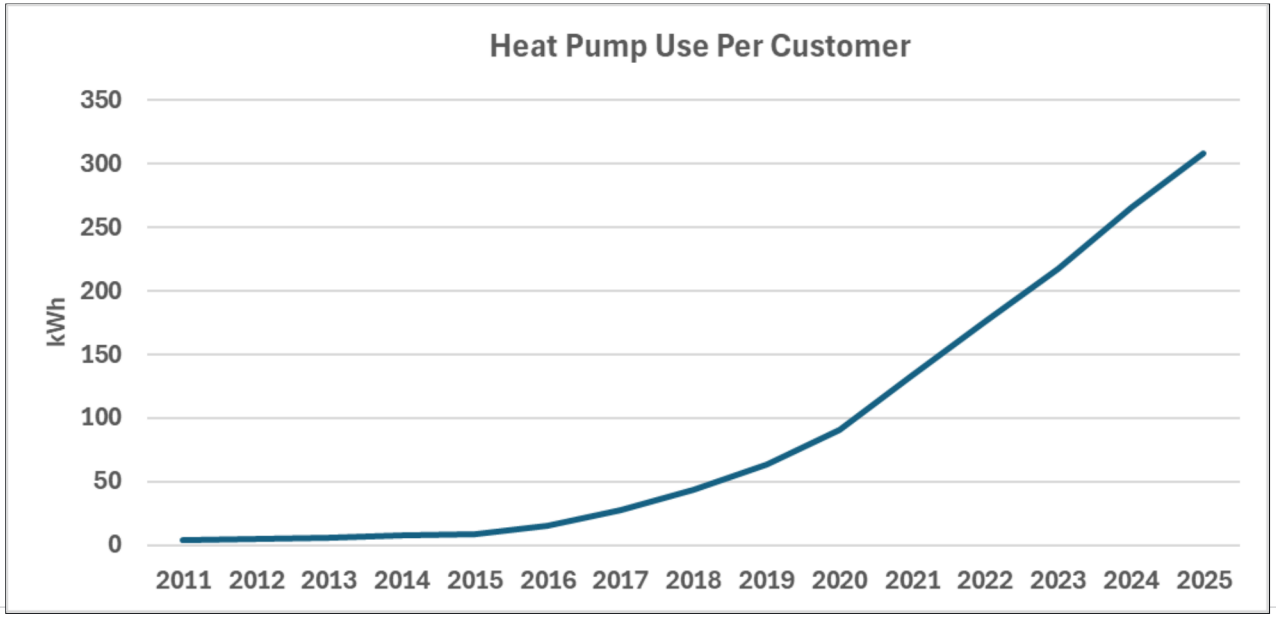


The heat pump program has had a significant impact on building electrification and in turn reducing CO2 emissions

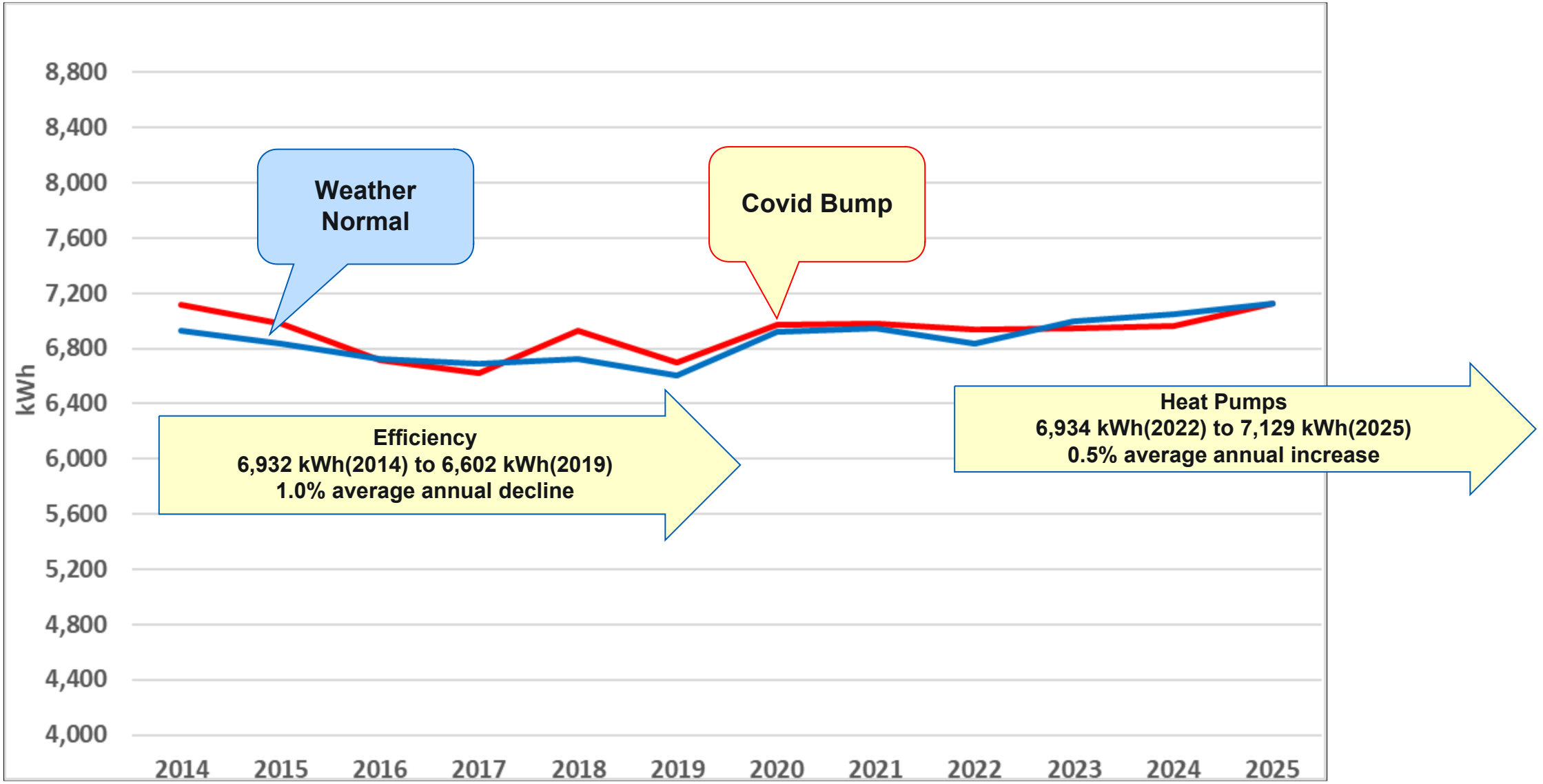
Heat Pump Saturation

- 15% of customers have heat pump systems (based on residential electric customer counts).
  - Compared with 1% in 2020
  - 1.4 heat pump units per customer (based on 2024 state heat pump study)
  - Translates into 300 kWh per customer and 90,000 MWh of electricity sales (based on 2024 study).



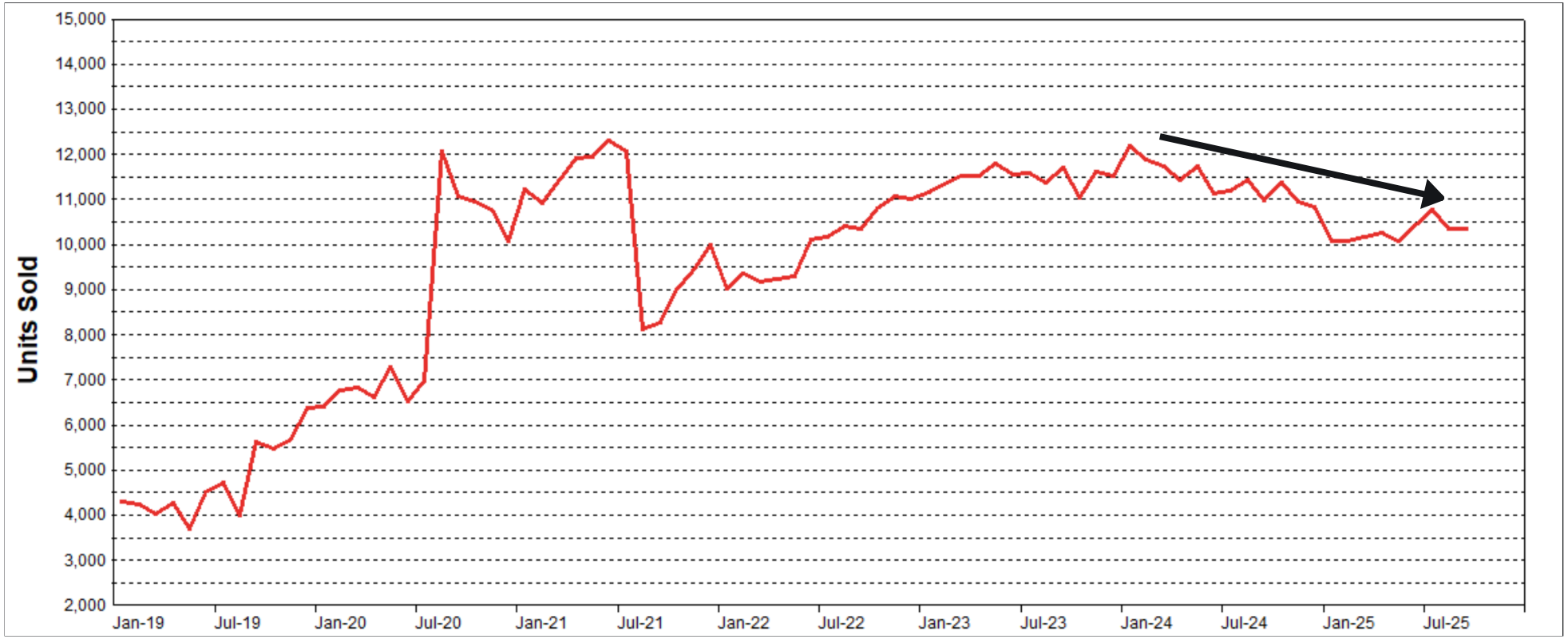


Increasing residential usage (with own use generation)



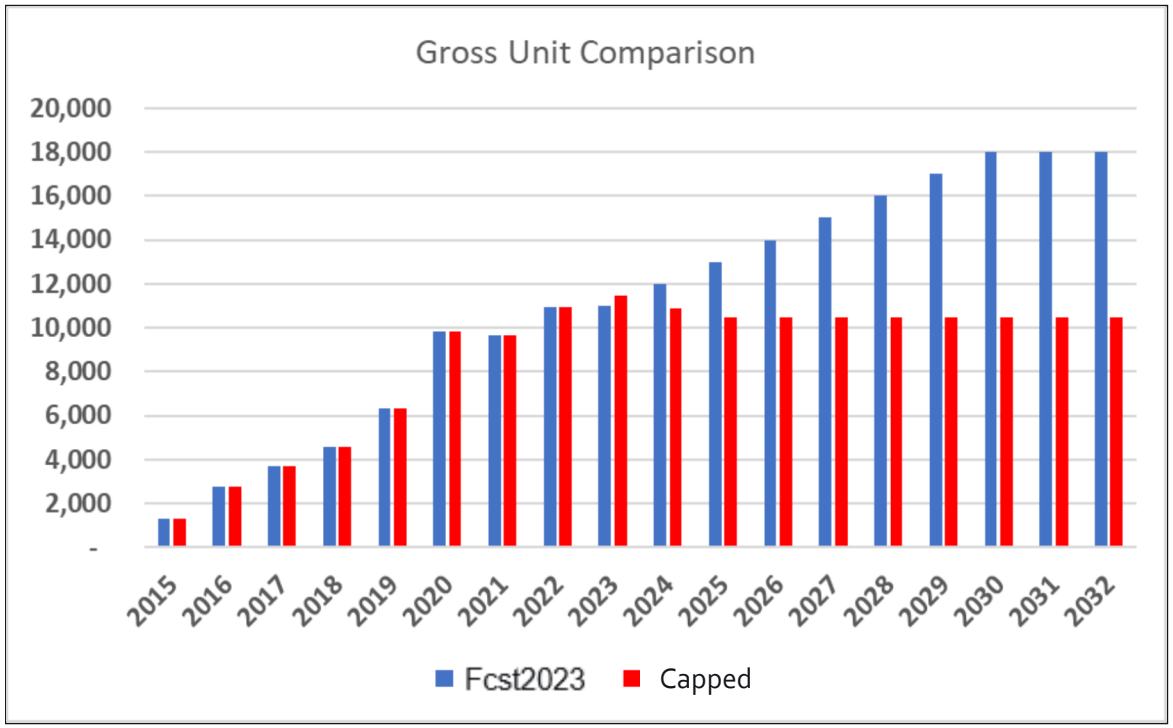
But Unit Sales are Slowing

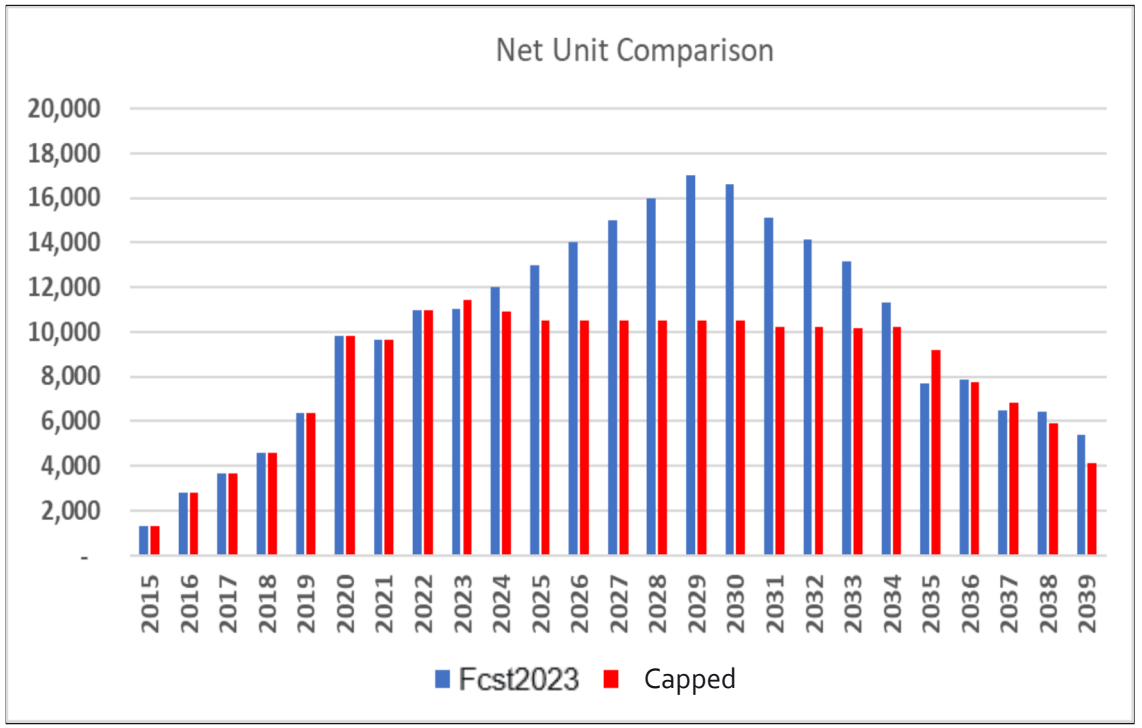
12-month moving average – through September 2025 (annualized)



Loss of federal tax credit likely to accelerate sales decline

Heat Pump Unit Forecast



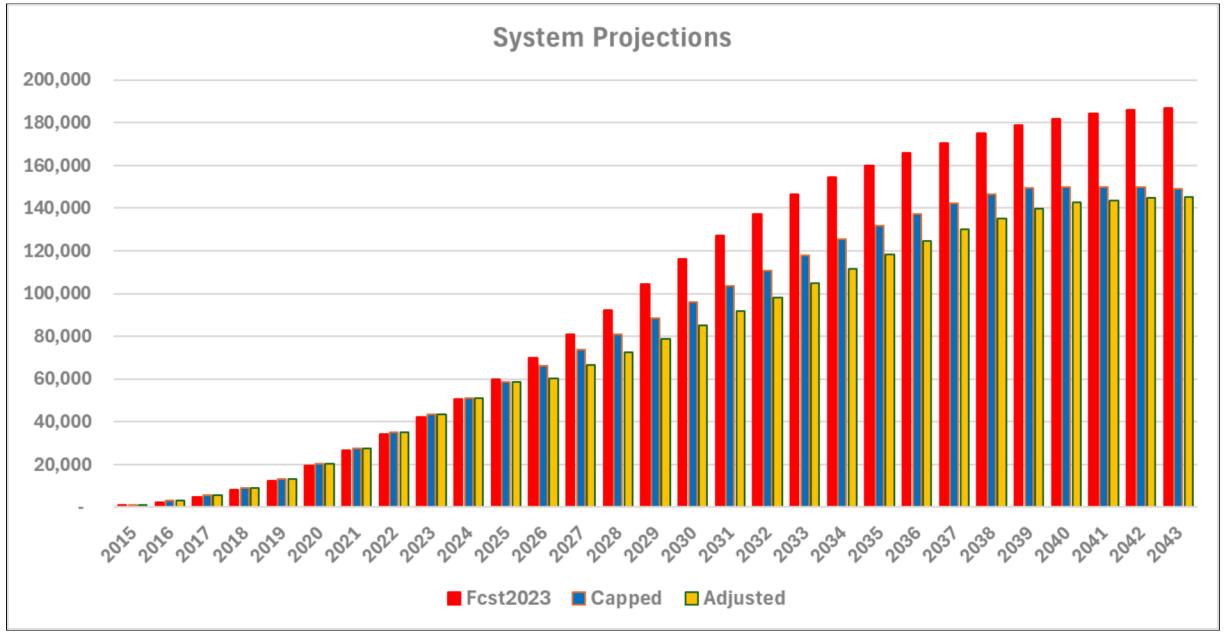


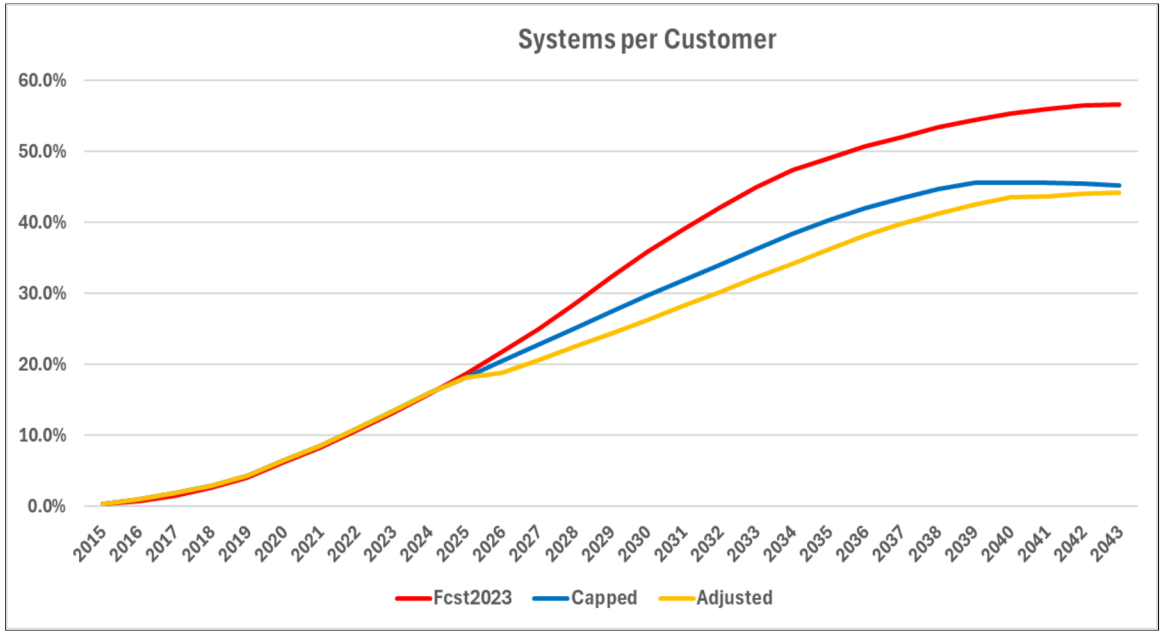
2023 Policy Forecast: Ramps up to 18,000 units per year
Capped: Levels off at 10,500 units per year (2025)

Net: Gross less Replacements

Adjusted Unit Forecast – Adding some levers

» Assumptions
- Loss of tax credits results in 20% drop in 2026 heat pump sales
- Unit sales then increase at the rate of customer growth
- Further growth (2%) driven by marketing and state incentives





31,000 fewer customers have heat pumps in 2030 and 39,000 fewer in 2040

What is Being Installed

» Based on VEIC Reported Unit Sales

System	Shrs	Avg BTU per Hour
Ducted	11%	33,858
Multi Ductless	32%	27,009
Single Ductless	57%	12,763

» Typical single-family home requires 80,000 BTU/hour to 100,000 BTU/hour heating capacity

» Partially meeting heating load requirements –

- For a significant share of the customers, sizing to meet air conditioning load

Typical mini split AC output by room size

- **Small rooms (150–400 sq ft):** 9,000 BTU (0.75 ton)
- **Medium rooms (400–600 sq ft):** 12,000 BTU (1 ton)
- **Larger rooms (600–1000 sq ft):** 18,000 BTU (1.5 ton)
- **Very large rooms (1000–1500 sq ft):** 24,000 BTU (2 ton)

Significant Reduction In Assumed Heat Pump Usage

2024 Vermont Heat Pump Study
Table 11

Annual Heating kWh - Reported by Study		
Study	Per House	Per Uni
Cadmus		**2,085**
Vt 2021 Study	1,531	
2024 Maine Study		1,887
2024 Vt Study	**1,885**	**1,347**
	Per House	Per Uni
GMP 2025 Sept Fcst 17% of homes ducted	2,224	1,589

Average Impacts Derived from Daily Modeling

Variable	Impact (kWh)		Impact (kWh/kBtu)	
	Point Estimate	90% CI	Point Estimate	90% CI
Annual Heating Impact	1,471	(1,418, 1,525)	52.7	(50.6, 54.8)
Annual Cooling Impact	-4	(-12, 5)	-0.1	(-0.4, 0.2)
Annual Base Impact	439	(391, 486)	15.7	(14.2, 18.5)
Annual Impact	**1,885**	**(1,817, 1,953)**	**67.5**	**(64.7, 70.9)**

AMI finds a **1,885 kWh increase** in annual electric use following heat pump installation.

The kBtu metric used to normalize results is the rated heating output of the program-supported heat pumps at 47 degrees (F) according to AHRI certification

9

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Some Questions

Table 9: Average Impacts Derived from Daily Modeling (n=7,058)

Variable	Impact (kWh)		Impact (kWh/kBtu)	
	Point Estimate	90% CI	Point Estimate	90% CI
Annual Heating Impact	1,471	(1,418, 1,525)	52.7	(50.6, 54.8)
Annual Cooling Impact	-4	(-12, 5)	-0.1	(-0.4, 0.2)
Annual Base Impact	439	(391, 486)	15.7	(14.2, 18.5)
Annual Impact	**1,885**	**(1,817, 1,953)**	**67.5**	**(64.7, 70.9)**

What is the base impact?

Ductless heating impact – larger than Ducted impact?

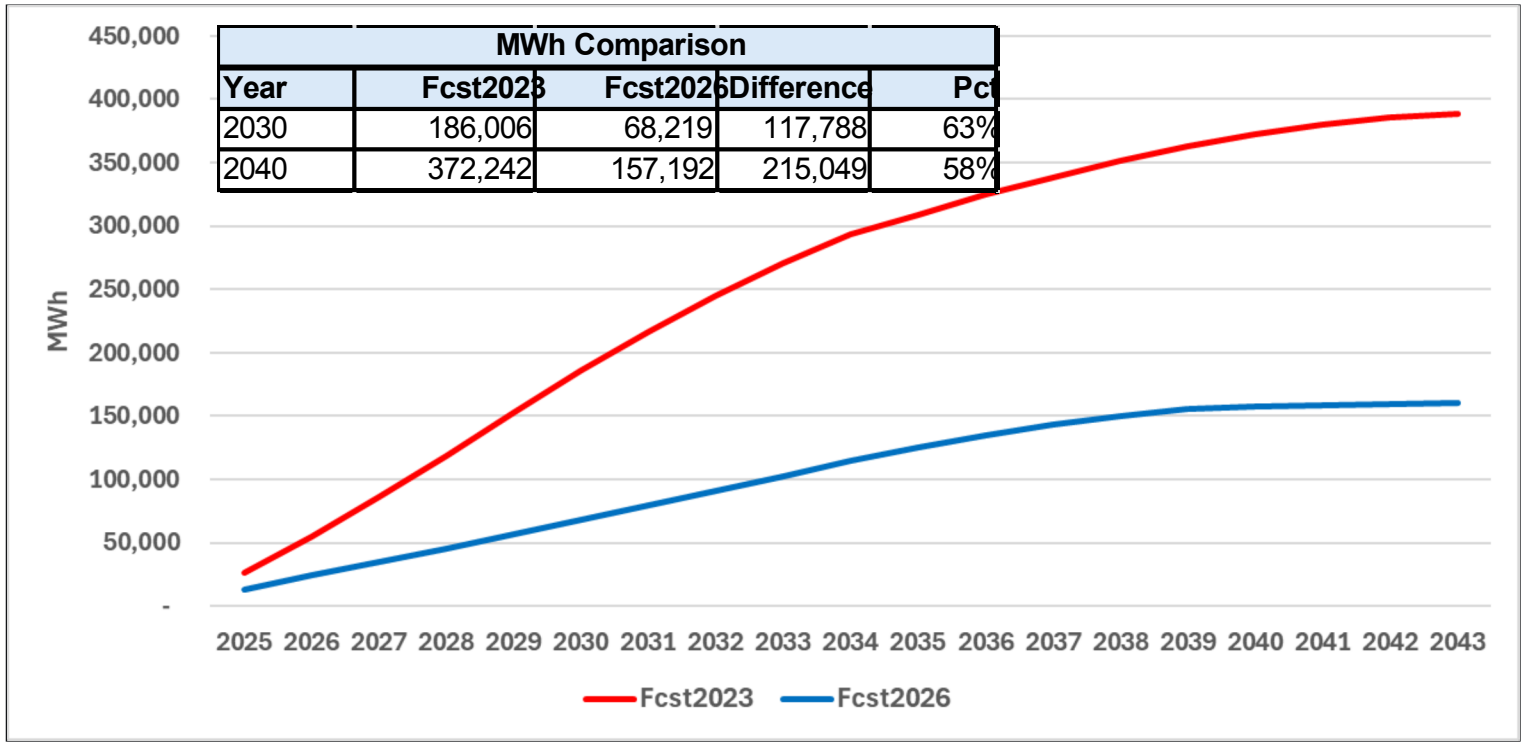
Table 17: Average Daily Impacts by Type (n= 6,957)

Metric	Units	Ducted (n=838)		Ductless (n=6,119)	
		Point Estimate	90% CI	Point Estimate	90% CI
Annual Impact	kWh	2,144	(1,926, 2,362)	1,816	(1,745, 1,888)
	kWh/kBtu	67.4	(59.7, 75.2)	67.0	(63.9, 70.0)
Annual Heating Impact	kWh	1,302	(1,135, 1,466)	1,479	(1,422, 1,535)
	kWh/kBtu	40.9	(35.4, 46.5)	54.5	(52.2, 56.8)
Annual Cooling Impact	kWh	11	(-42, 30)	-7	(-16, 1)
	kWh/kBtu	0.4	(-1.5, 0.7)	-0.3	(-0.7, 0.1)
Annual Base Impact	kWh	862	(708, 1,017)	364	(293, 436)
	kWh/kBtu	27.1	(21.8, 34.3)	13.4	(11.1, 15.7)

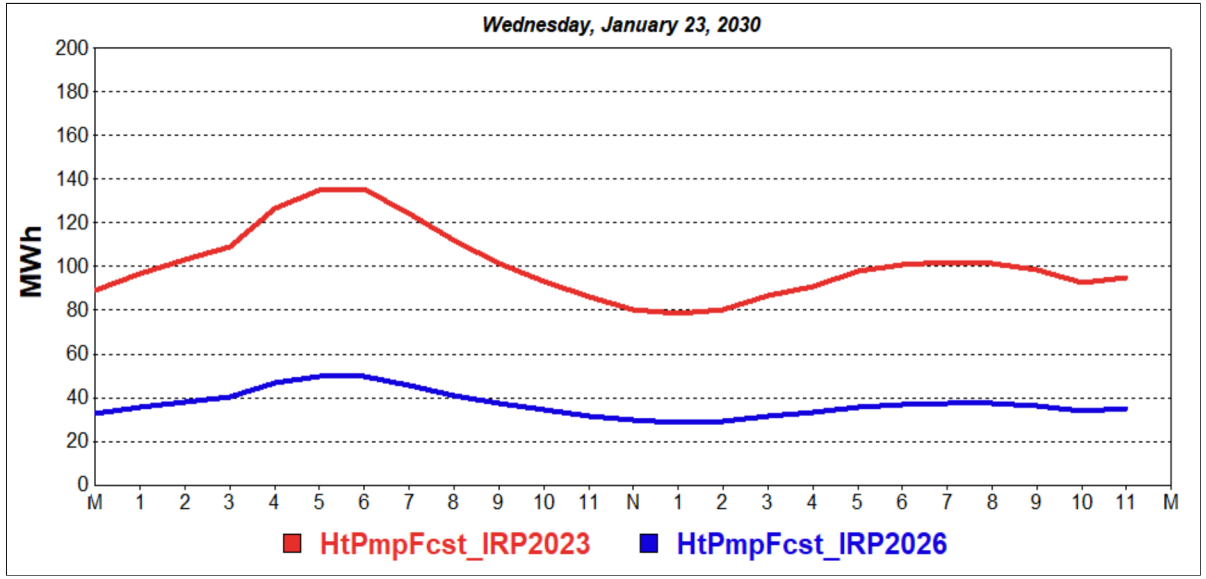
Heat Pump Sales Comparison – Starting 2024

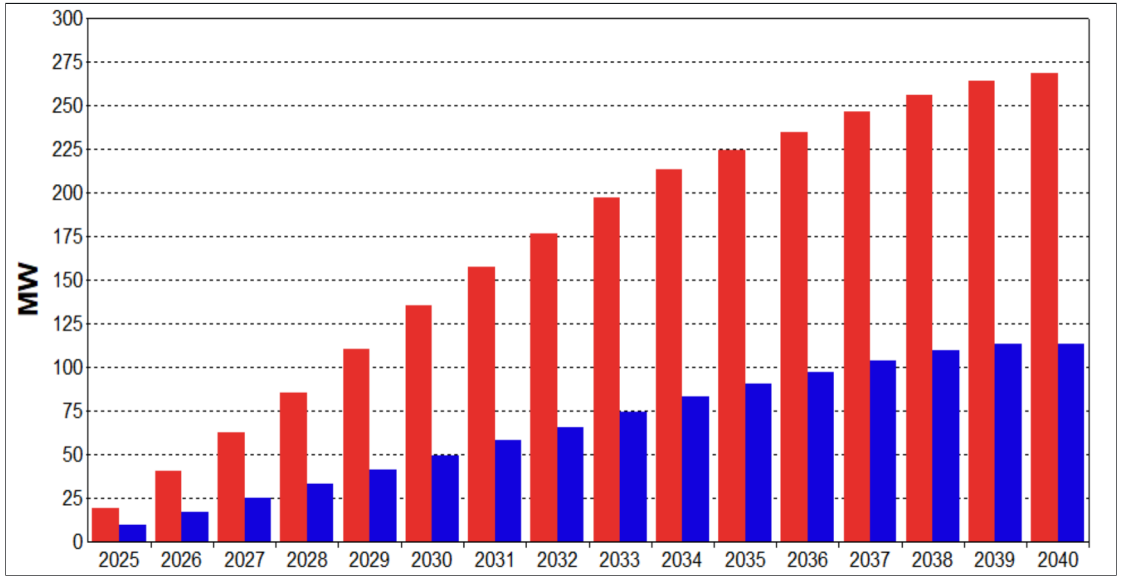
	Fcst2023	Fcst202
Units	Ramps up to 18,000	Capped at 10,50
2024 Heating UEC	2,035	1,347
2024 Cooling UEC	141	0

34% lower



System Peak Day





Significantly lower impact on peak demand

Demand Comparison (MW)		
Year	2023 Fcst	2026 Fcs
2030	135.4	49.6
2040	268.7	113.5

Significantly lower heating use where natural gas is available

» Basically, purchasing for air conditioning

Heating Utilization Results Differ in Homes with Access to Natural Gas

NG Territory (n=1,300)

Metric	Units	Point Estimate	90% CI
Annual Impact	kWh	989	(854, 1,124)
	kWh/kBtu	38.5	(32.8, 43.1)
Annual Heating Impact	kWh	577	(497, 658)
	kWh/kBtu	22.4	(14.8, 24.1)
Annual Cooling Impact	kWh	-120	(-144, -97)
	kWh/kBtu	-4.7	(-5.7, -3.7)
Annual Base Impact	kWh	533	(426, 640)
	kWh/kBtu	20.7	(15.3, 24.6)

Rest of State (n=5,758)

Metric	Units	Point Estimate	90% CI
Annual Impact	kWh	2,087	(2,010, 2,164)
	kWh/kBtu	73.5	(70.3, 76.7)
Annual Heating Impact	kWh	1,680	(1,606, 1,730)
	kWh/kBtu	59.1	(56.7, 61.5)
Annual Cooling Impact	kWh	15	(6, 24)
	kWh/kBtu	0.5	(0.1, 0.9)
Annual Base Impact	kWh	417	(364, 471)
	kWh/kBtu	14.7	(12.3, 17.1)

Homes in NG territory show approximately half the average heating utilization (kWh/kBtu) of homes in the rest of the state.

10

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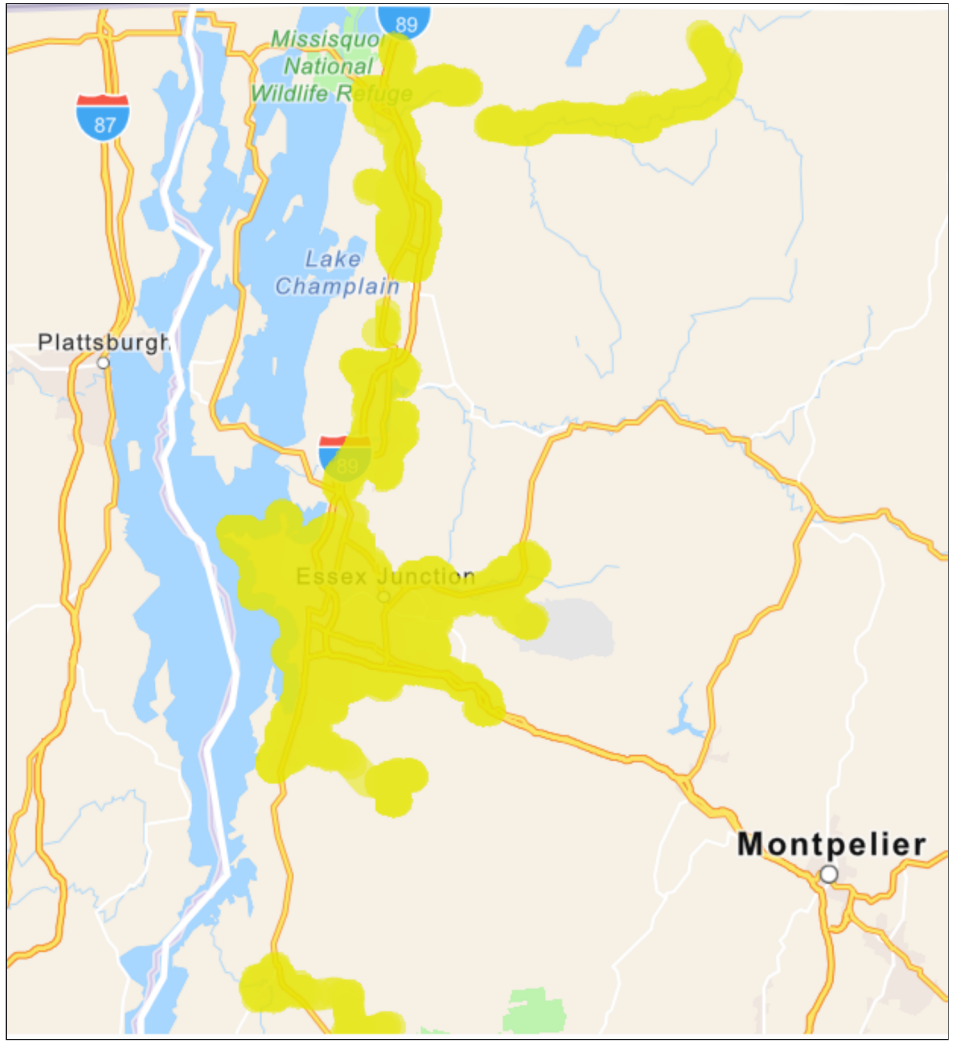
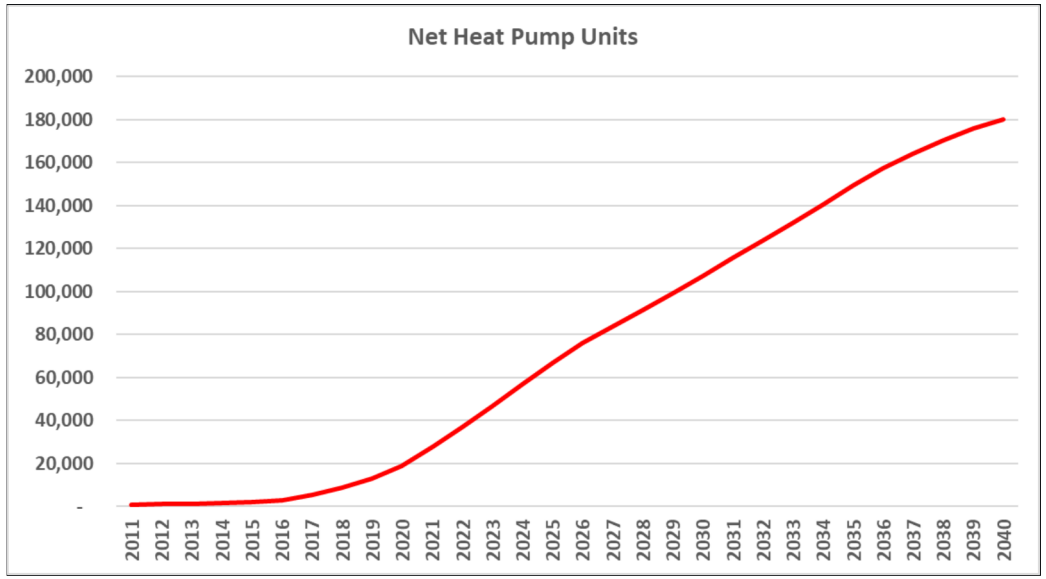
VGS Service Area



» VGS provides gas service to 56,500 customers (20% of the state residential customers):

- Addison: 1,500
- Chittenden: 48,000
- Franklin: 7,000

Heat Pump Model



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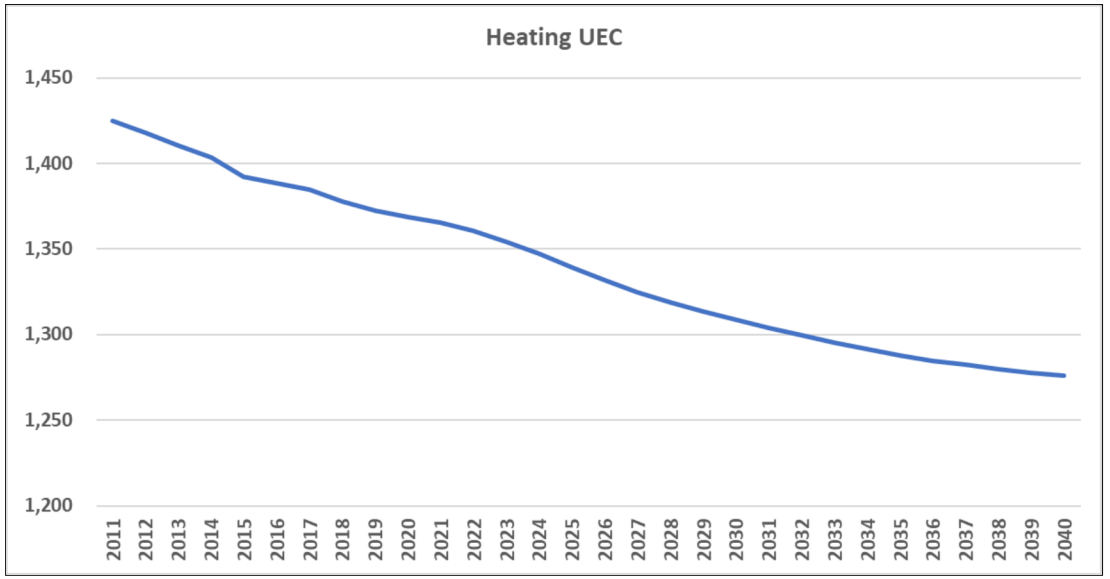

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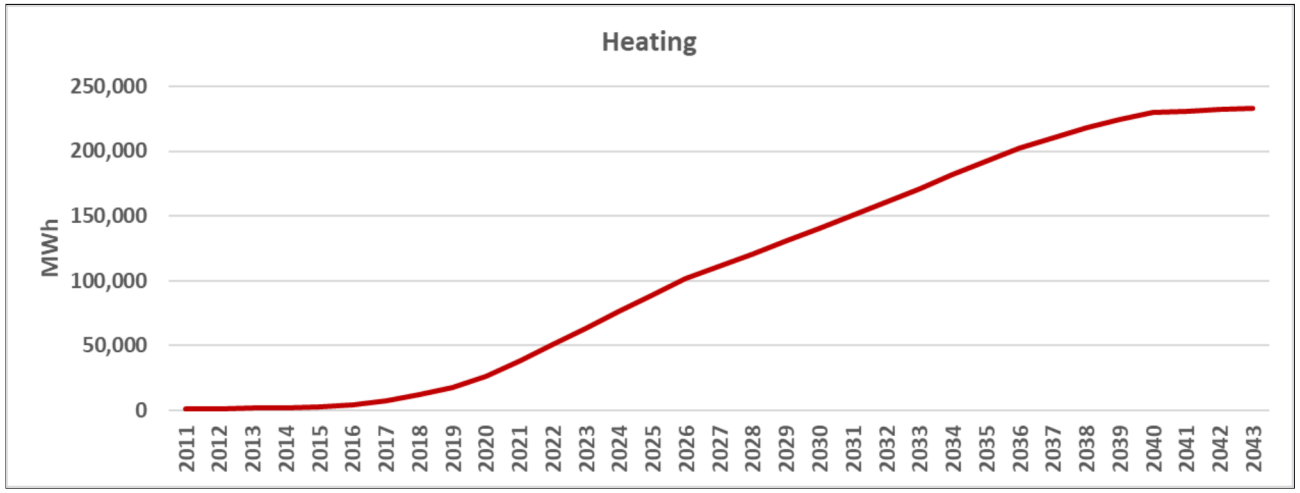
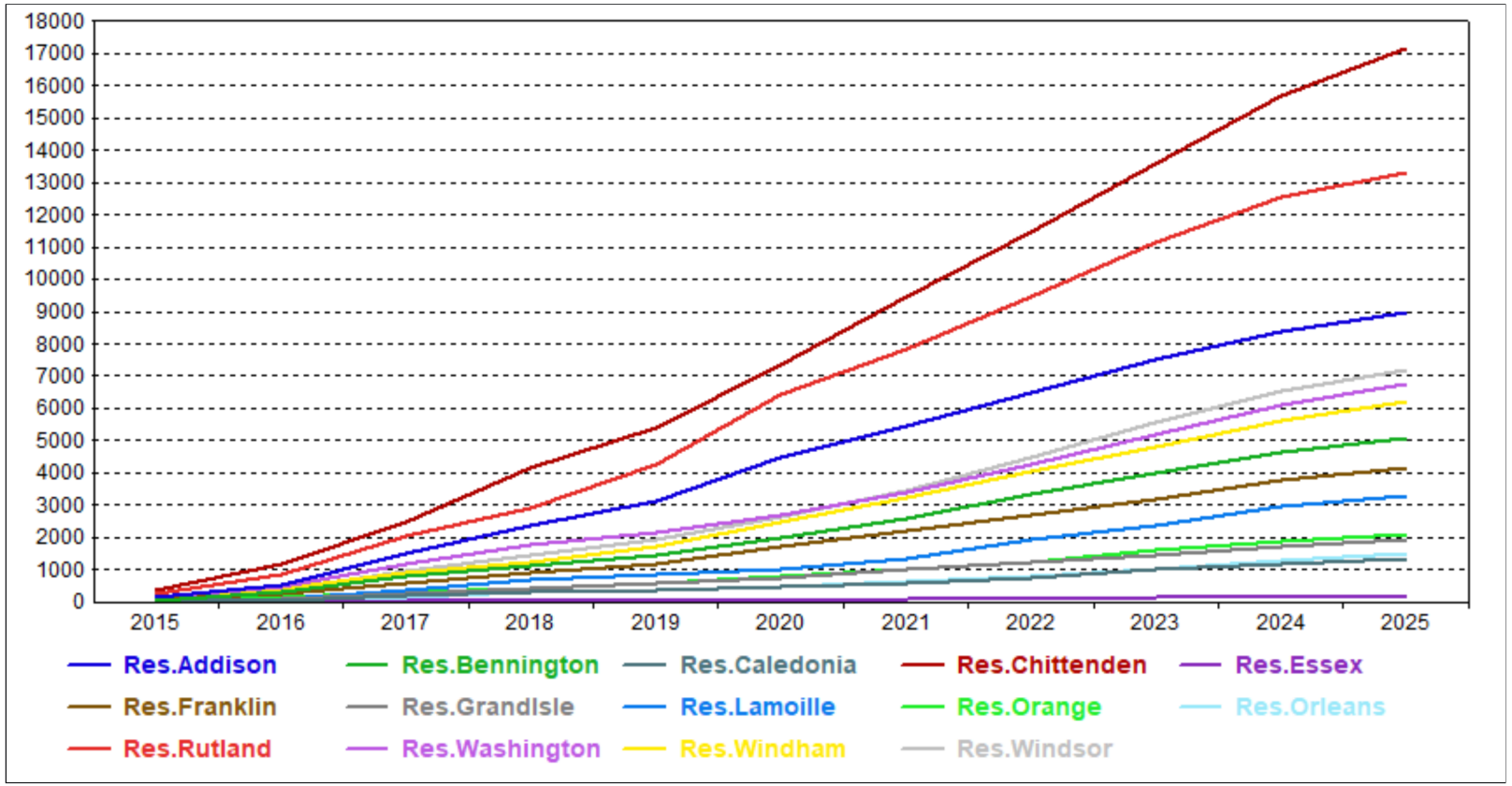


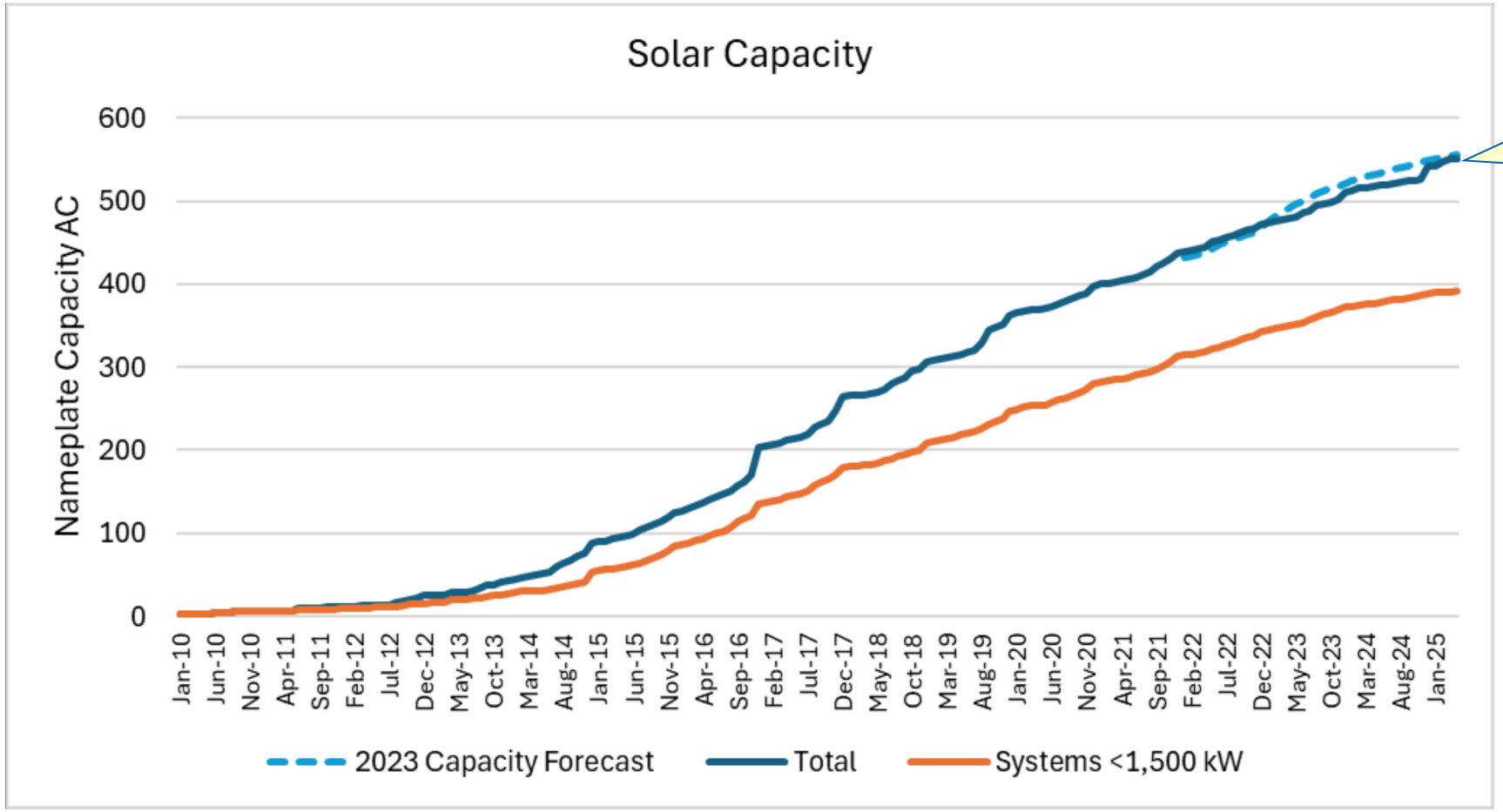
Zone Level Forecast

- Develop trend model based on county income projections
- Use model results to allocate state forecast to counties and zones
- Capture differences in heating UEC between zones where gas is available and where it is not.



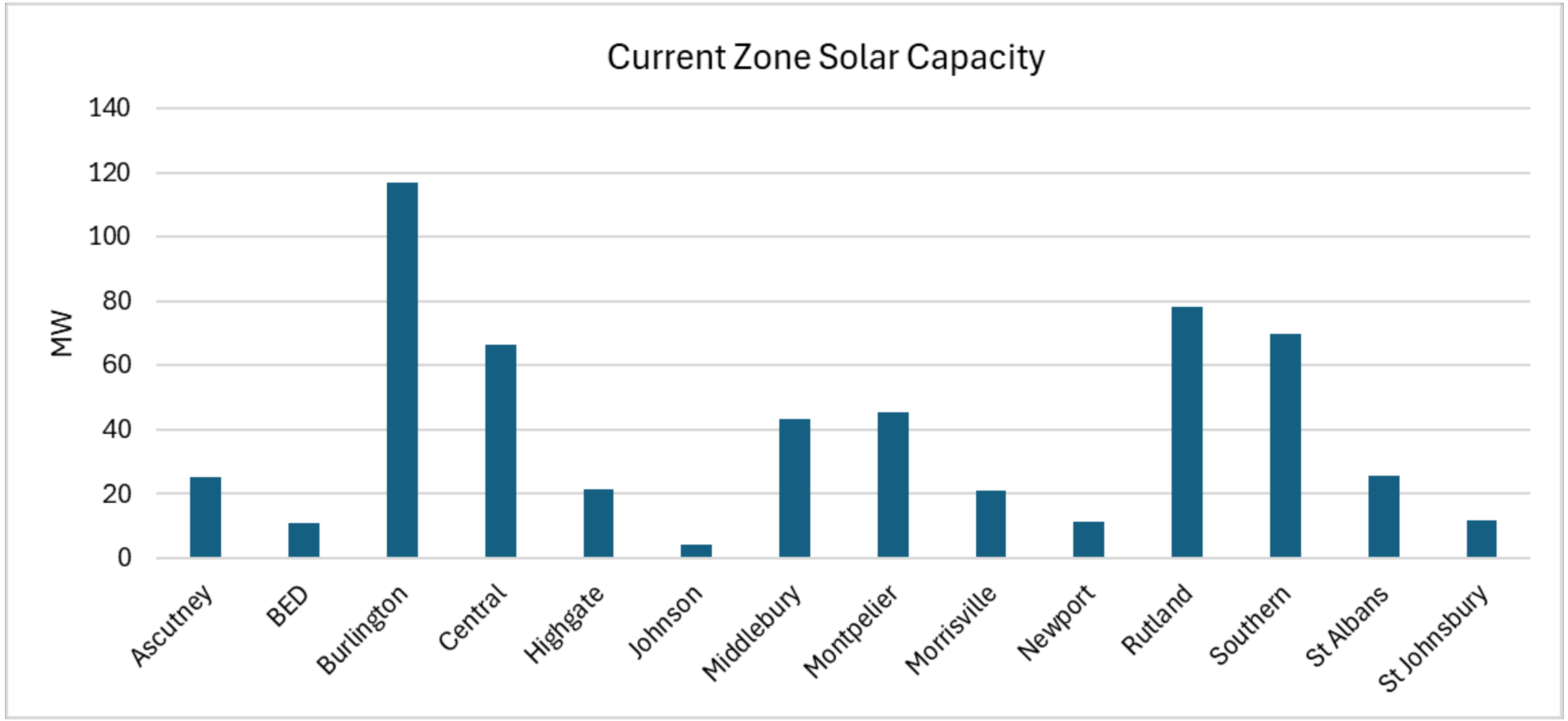
Solar Load

State Solar Capacity



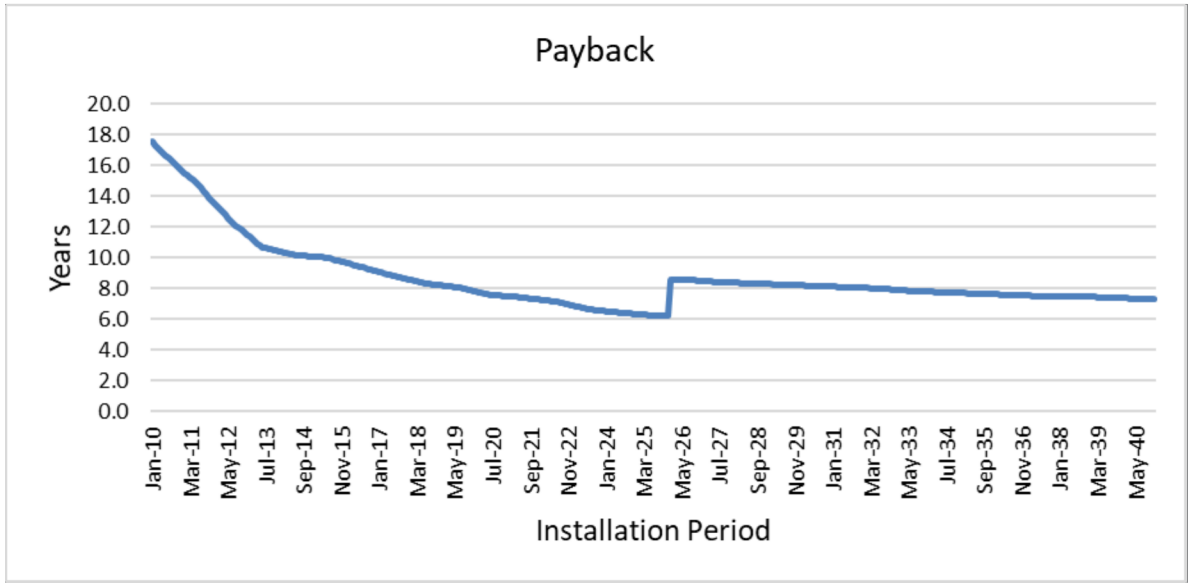
Forecasted 555 MW, actual was 551 MW

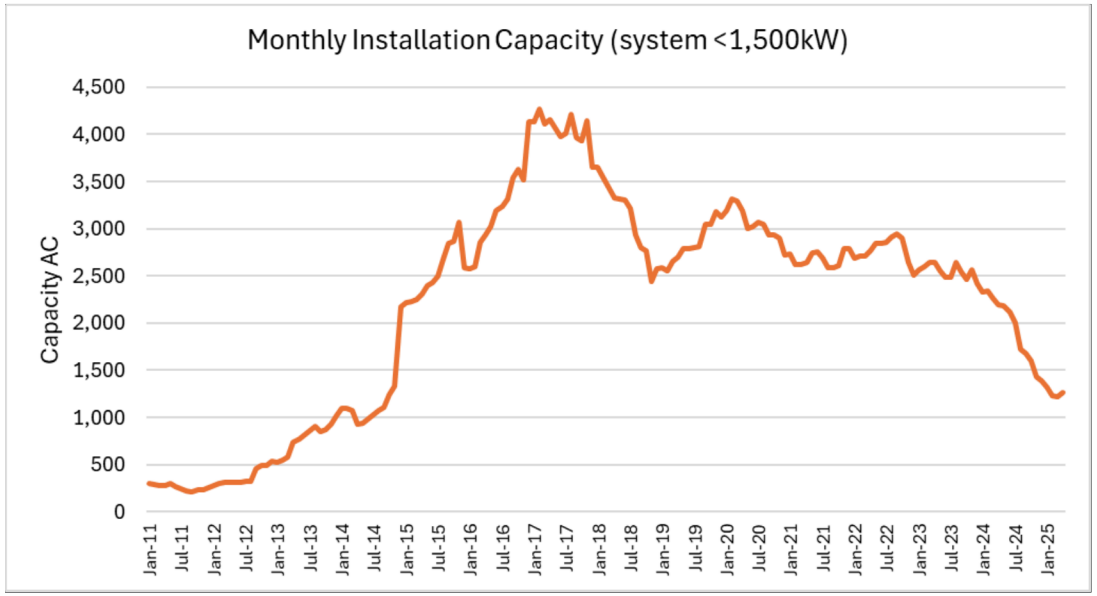
Historical Zonal Capacity



Prior Solar Capacity Forecasting Approach

» Capacity (excluding utility scale) modeled as a function of simple payback.
- Payback incorporates:
  - system costs, incentives (expiring tax credits), electric rates, and payments for excess generation.
- Cubic model specification used to impose S-shaped adoption curve.





» Expiration of federal tax credits increases the payback from 6 to 8 years.
- The payback model implies this could reduce adoption by 50%

Electric Vehicles

Current Electric Vehicle Market Information: Vermont

» As of October 2025, there were approximately 20,424 registered electric vehicles in the state, comprised of all electric (BEV) and plug-in hybrid electric (PHEV).
  • 60% BEV and 40% PHEV

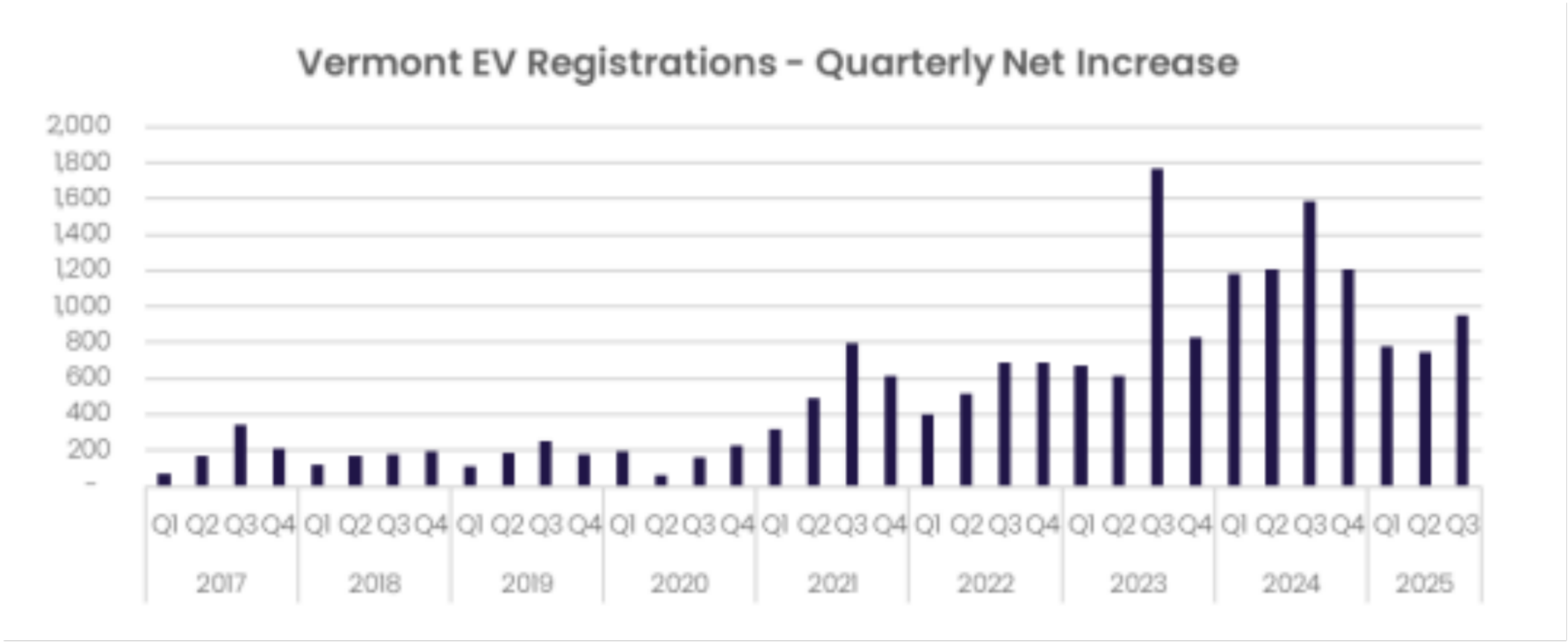
» 3,693 additional EV were added over the past year, a 22% increase, this is down from previous years.
  • 9.9% of light duty vehicle sales in the 3rd quarter of 2025. 12.4% of light-duty sales in the 4th quarter, 2024.
  • Most popular BEV registered vehicle is Tesla Model Y

» Top 5 most popular models sold in the 3rd quarter of 2025 were the Hyundai Ioniq 5, Tesla Model Y, Volkswagen ID.4, Chevrolet Equinox EV, and Toyota bZ4X

» Federal tax credits expired on Sept 30th, 2025. Will likely result in fewer EV sales.

Source: Drive Electric Vermont

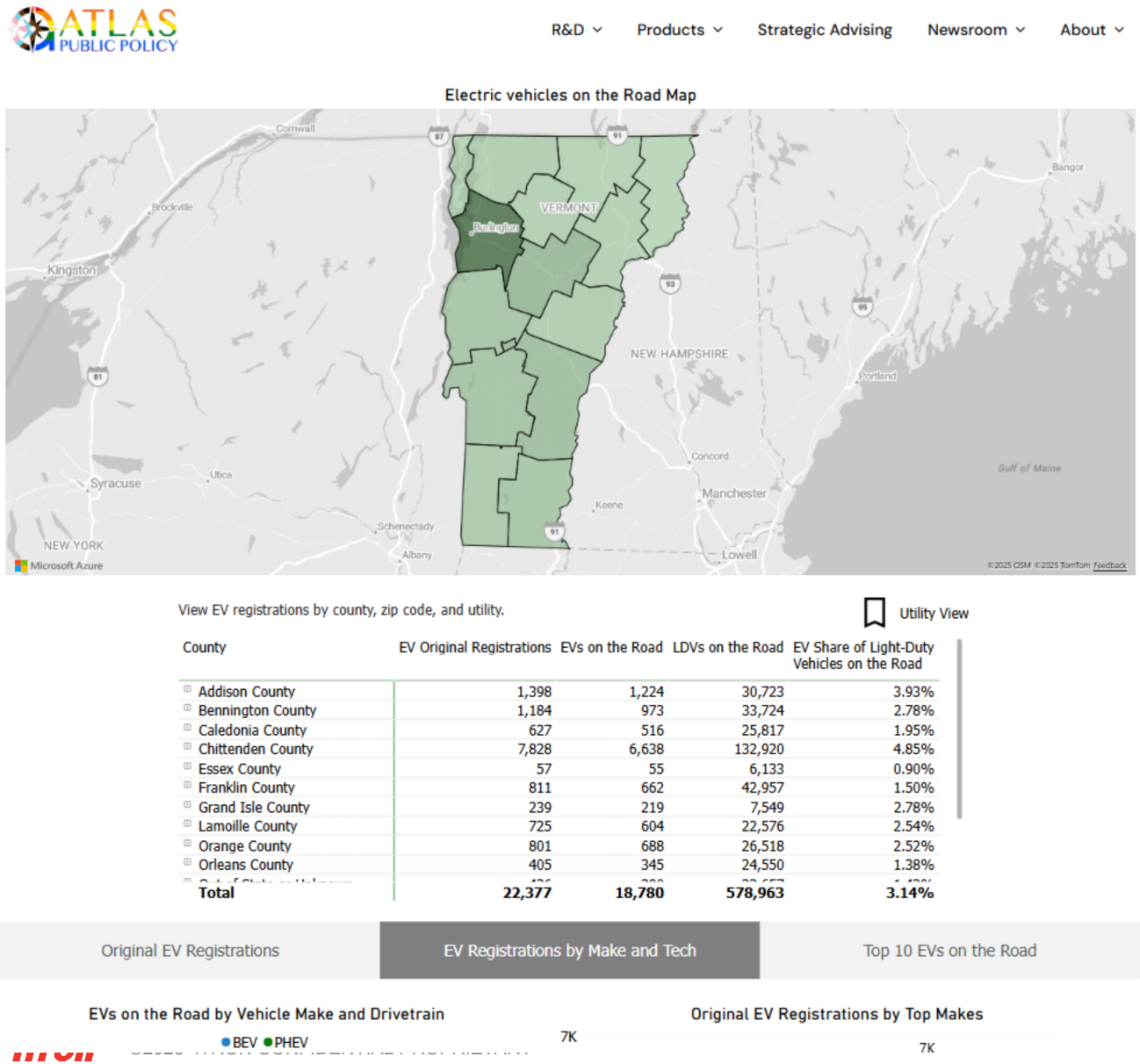
Quarterly Change in EV Registrations



» Q3 2025 uptick likely driven by rush to take advantage of expiring federal tax credits

Source: Drive Electric Vermont

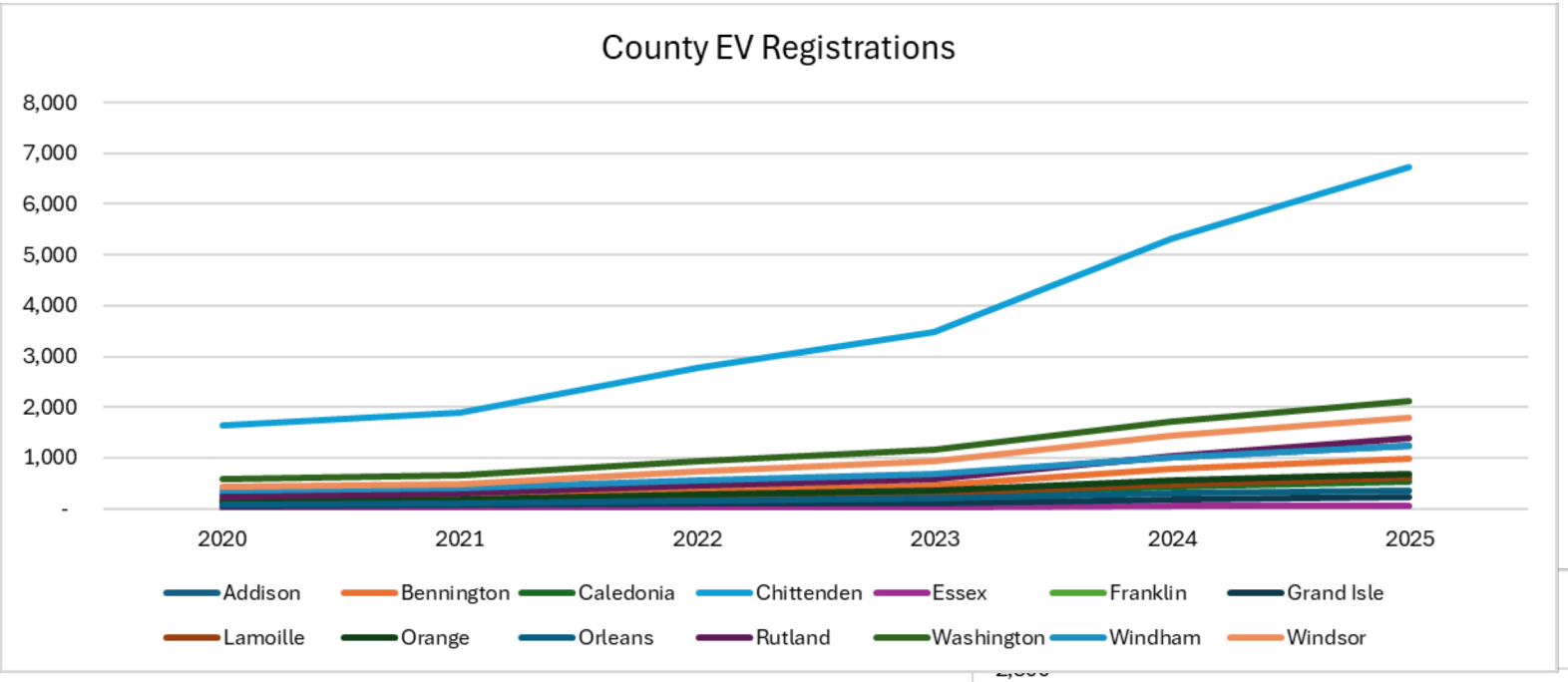
Additional Data Source: Atlas Public Policy EValuate



County	EV Original Registrations	EVs on the Road	LDVs on the Road	EV Share of Light-Duty Vehicles on the Road
Addison County	1,398	1,224	30,723	3.93%
Bennington County	1,184	973	33,724	2.78%
Caledonia County	627	516	25,817	1.95%
Chittenden County	7,828	6,638	132,920	4.85%
Essex County	57	55	6,133	0.90%
Franklin County	811	662	42,957	1.50%
Grand Isle County	239	219	7,549	2.78%
Lamoille County	725	604	22,576	2.54%
Orange County	801	688	26,518	2.52%
Orleans County	405	345	24,550	1.38%
Total	**22,377**	**18,780**	**578,963**	**3.14%**

- Detailing breakdown of registered EV by county and zip code
- Make and models
- Charging locations
- Regularly updated: last update July 2025
  - 19,345 registered EV
- Prior updates are available allowing the construction of a time series of EV adoption by county.
  - Enabling modeling of EV adoption at the county level

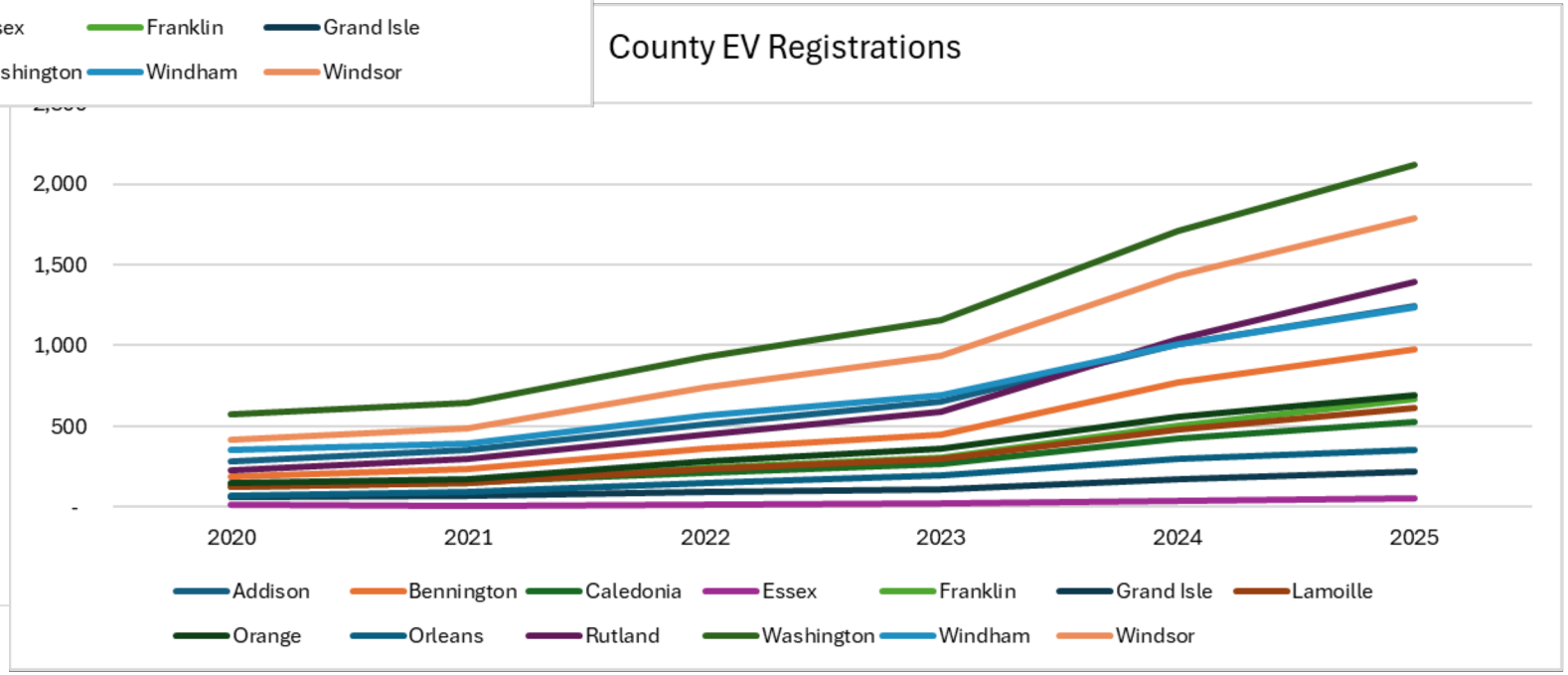
County EV Adoption



» Highest levels of EVs in Chittenden county

» Washington, Rutland, Windsor, and Addison also have large numbers of electric vehicles.

» Not surprisingly these are the more populated counties.



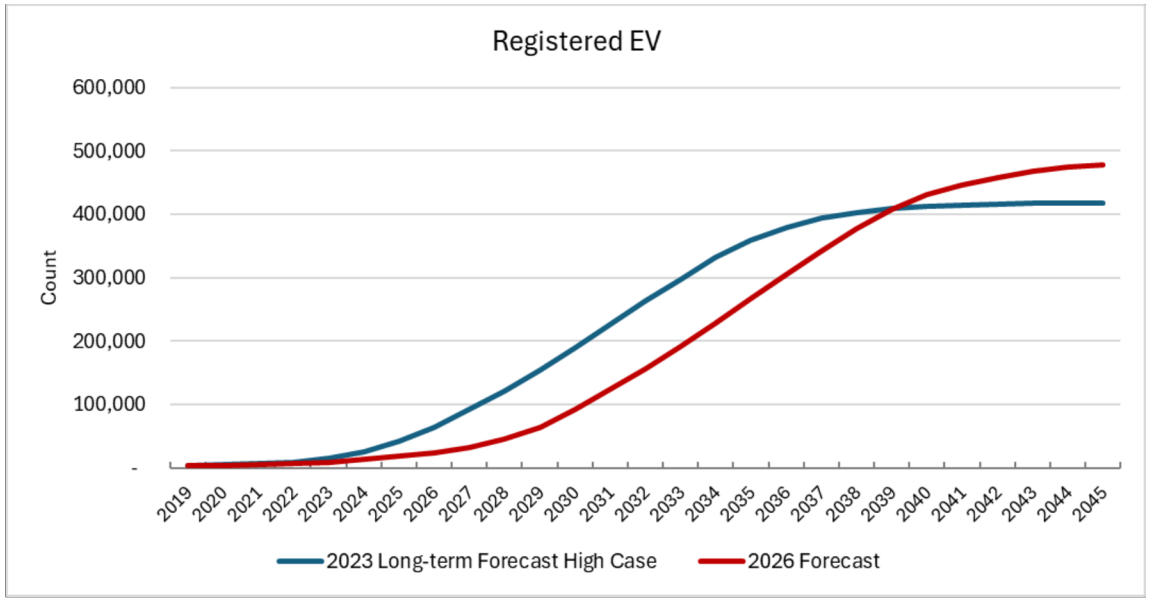
Electric Vehicle Forecast Model

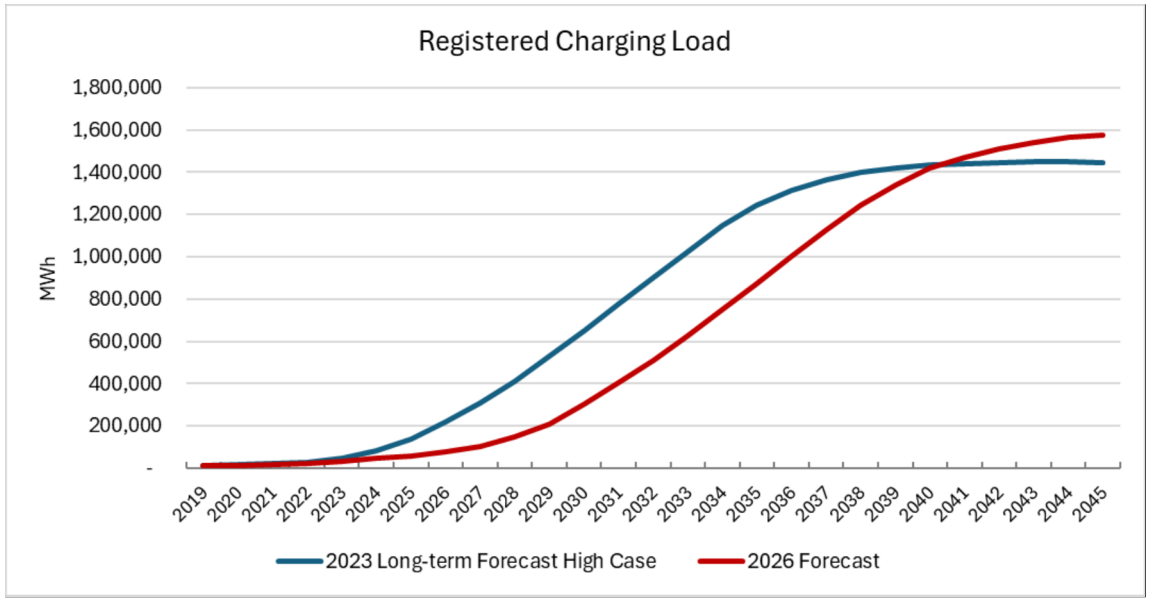
1. Develop a state-level EV forecast using a stock accounting model based on EV sales targets.
   I. Starting with the most recent EV sales and EV registrations
   II. EV sales targets based on state mandates; ~~35% by 2026~~, 68% by 2030, 100% by 2035
   III. Assumptions regarding BEV/PHEV splits, annual miles, kWh per mile, average vehicle life

2. Forecast county EV registrations as a function of county household income.
   i. Calibrate county EV forecast to state EV forecast
   ii. Validate reasonableness of county allocation

3. Combine EV MWh forecast with hourly charging profiles
   i. Home charging versus public charging
   ii. Uncontrolled home charging versus controlled or TOU rates

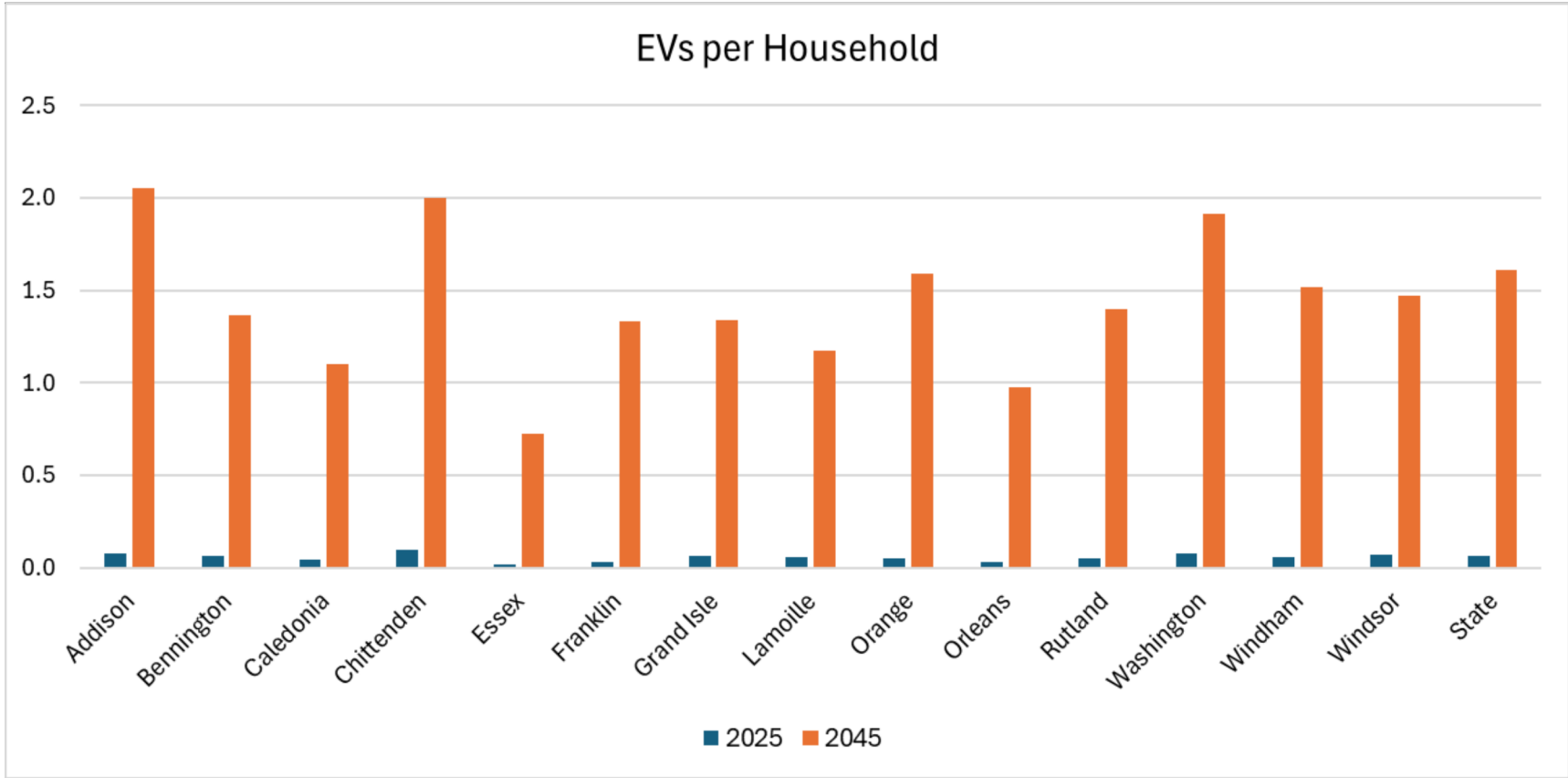
2026 Forecast Compared to the Prior Long-term Forecast





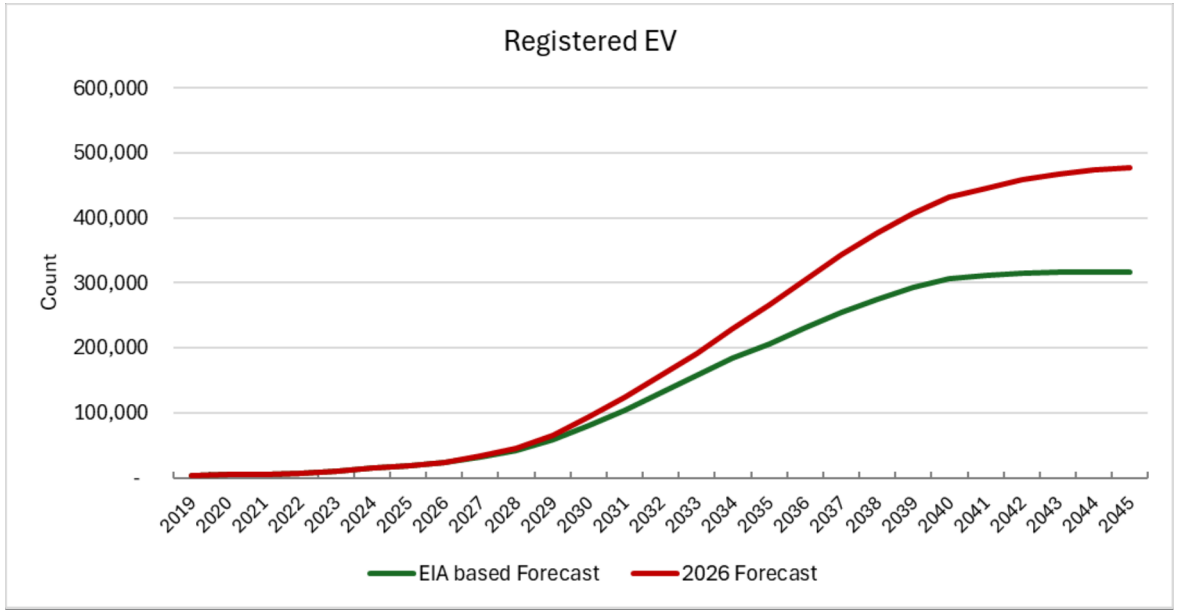
- Forecast assumes the 2030 and 2035 mandates stay in place
- Calibrated into the current mix of BEV and PHEV and their kWh per mile ratings
  - 3,630 kWh per year BEV, 2,430 kWh per year PHEV
- Assumes 12,000 miles per year, PHEV are assumed to meet 50% of travel using electricity
- 2023-2025 EV adoption is more in line with the medium EV forecast scenario
  - High cased forecasted 42,000 EVs in 2025, medium case forecasted 20,000

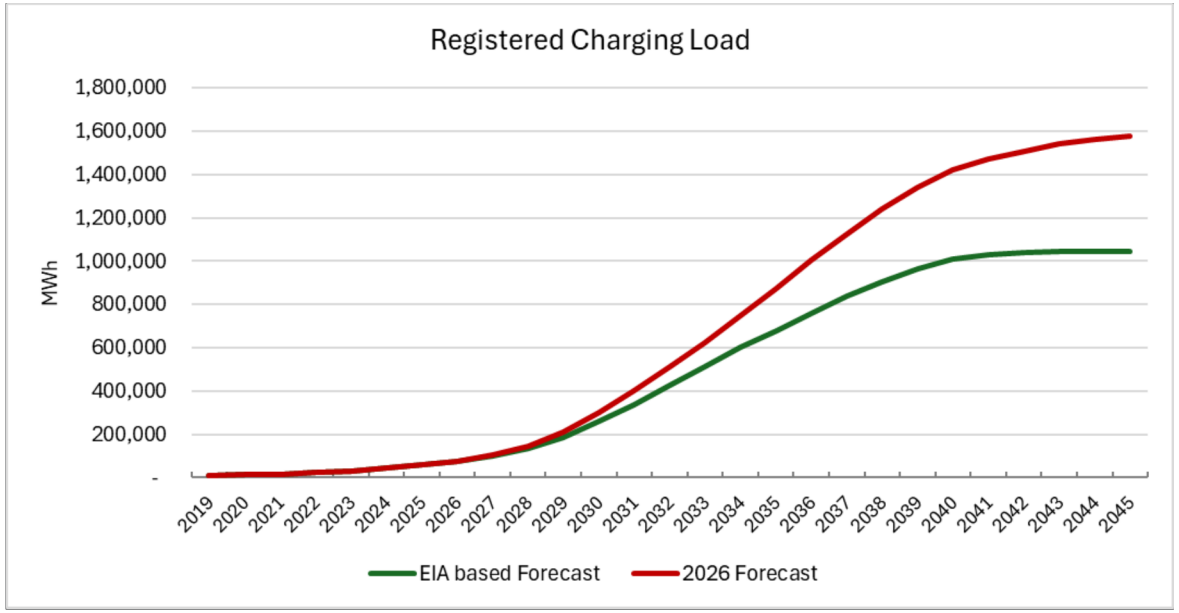
County EV Forecast (100% new car purchases are electric)



» Addison, Chittenden, and Washington county have rates of 2 EVs per household, which is slightly higher than the state average of 1.7 total vehicle per household. Reasonable given these are more populated and higher income counties.

Alternative EV Forecasts





- The Energy Information Administration's Annual Energy Outlook
- Does not adhere to the California Advanced Clean Cars II (ACC II)
- Cost based choice model
- 52% of new vehicle sales are electric by 2030, opposed to 68% in mandate forecast.
- 65% of new vehicle sales are electric by 2035, opposed to 100% in mandate forecast.

Hourly EV Charging Assumption

» The prior long-term forecast assumed unincentivized and uncontrolled EV charging. This resulted in significant EV charging coinciding with system peak times, 4-7pm.

» Many utilities in the state now offer controlled and/or time-of-use incentivized rates.

- GMP offers two EV rates; one which allows for control of the vehicle charger during certain hours to shave load. The other is a TOU rate with on and off-peak pricing, On-peak is from 1p.m. to 9p.m.
  - Approximately 2/3 of GMP customers on an EV rate opting for the TOU rate.
- BED has similar options for TOU and load control
- Other utilities offer similar options

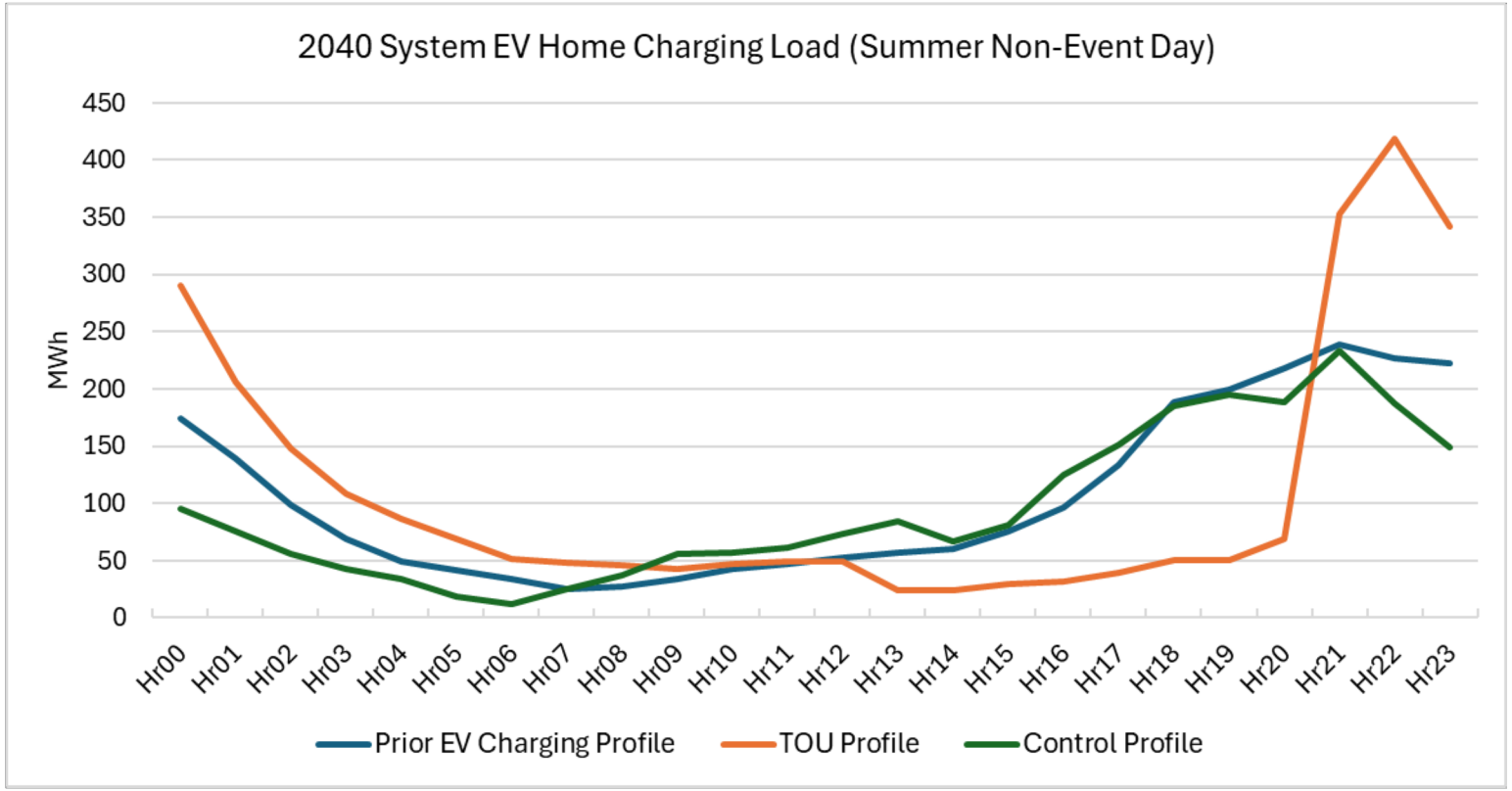
» The 2026 forecast will continue the assumption that 80% of charging occurs at home and 20% away from home at public or workplace chargers.

» **Demand impact will depend on TOU rate adoption assumption.**

- **Assume 50% of home charging occurs under a TOU rate, ramping up to 100%?**

» **Controlled charging to reduce peak treated as a resource and not included in the forecast.**

Potential Demand Impact

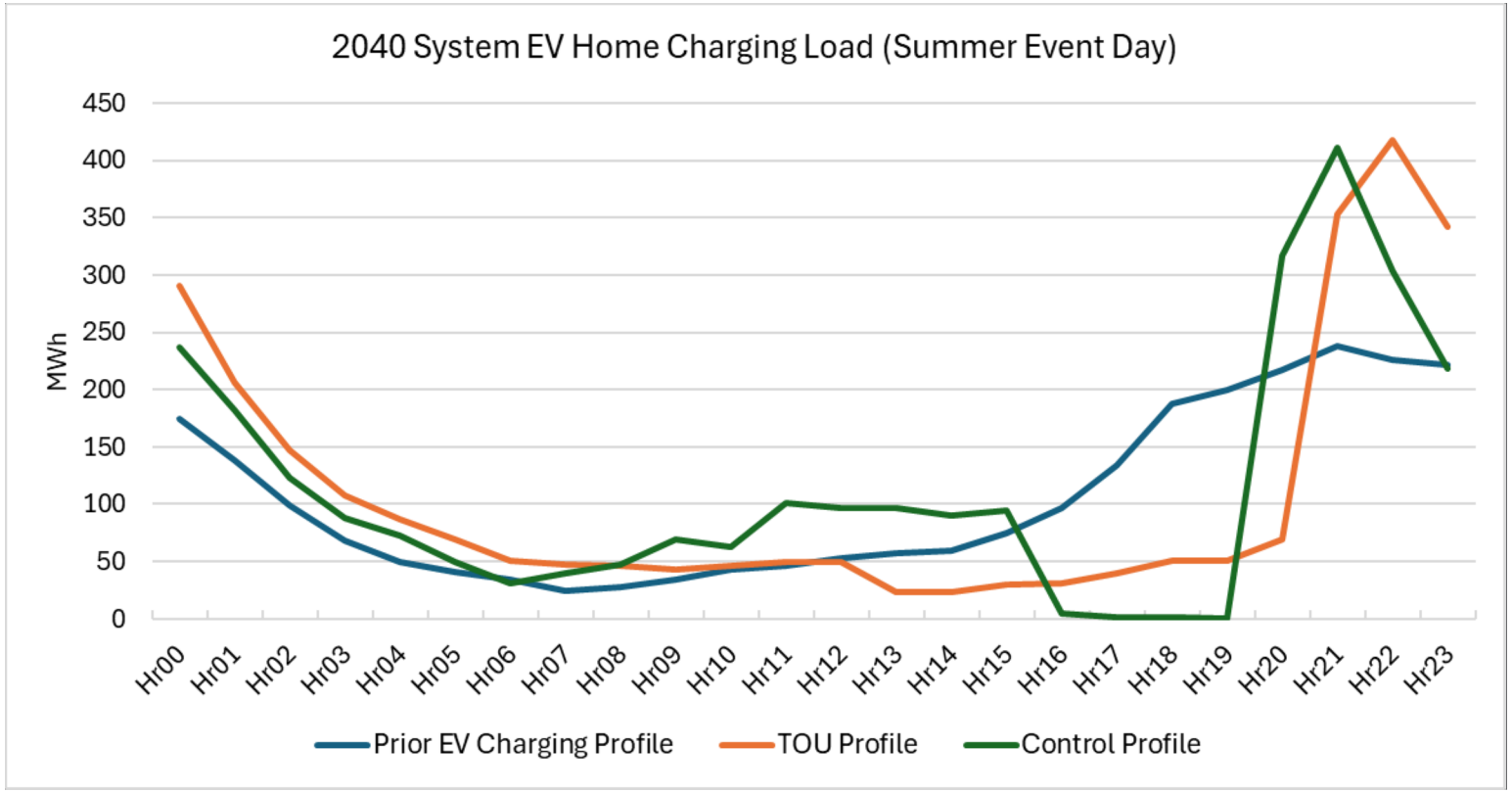


» By 2040 approximately 80% of the registered light-duty vehicles will be electric

» Demand impact at Hr19 is 200 MW using the prior charging or control rate profile (non-event day)

» Demand impact at Hr19 is 50 MW using the TOU profile

Potential Demand Impact



» By 2040 approximately 80% of the registered light-duty vehicles will be electric
» Demand impact at Hr19 is 200 MW using the prior charging
» Demand impact at Hr19 is 50 MW using the TOU profile
» Demand impact at Hr19 could be zero with control rate

Fleet/Commercial EV Forecast

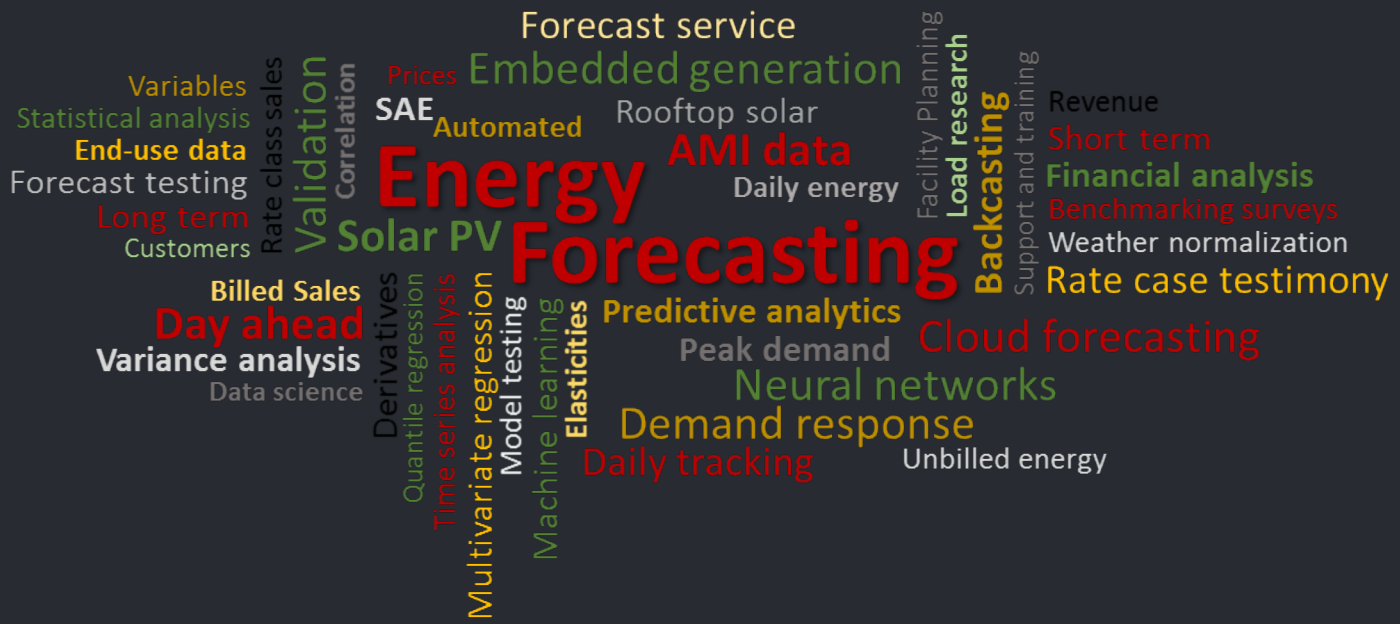
- Based on ISO New England's 2025 Transportation Electrification Forecast for Vermont, May 2025
- State-level forecast of light-duty fleet, medium-duty fleet, school bus, and transit bus

ISO new england

Final 2025 Electric Vehicle Forecast

Distribution Forecast Overview

Discussion



Thank You

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