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Final Draft 2020 Transportation Electrification Forecast

Load Forecast Committee

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Introduction

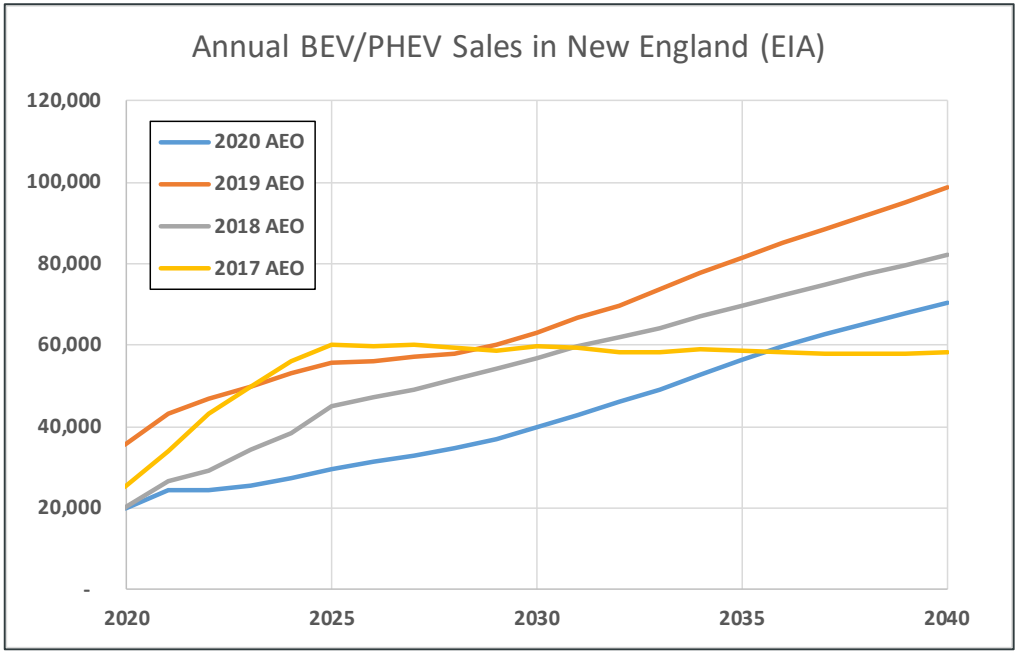
- ISO discussed methodology and assumptions used in the transportation electrification forecast at the September 27, 2019 and November 18, 2019 LFC meetings, and the draft 2020 forecast at the December 20, 2019 LFC meeting
- The 2020 transportation electrification forecast focuses on light-duty vehicles (LDV), including cars and light-duty trucks
  - Electrification of other, non-LDV vehicle classes (e.g., freight vehicles, electric buses, rail, trolley) may be considered in future forecasts
- There are two general components to the EV forecast:
  1. Forecast the adoption of electrified LDVs for each state and the region over the next ten years
     - Adoption values to include battery-electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV)
  2. Data-driven assumptions to convert the EV adoption forecast into estimated impacts on monthly energy and demand by state
     - Include monthly demand and energy impacts per EV based on recent historical EV charging data licensed from ChargePoint, Inc.

Stakeholder Comments on Draft Forecast

- VT Department of Public Service
  - The current forecast is a reasonable first iteration, but likely overstates demand impacts when considering load control strategies that may be implemented
- No changes were made to the 2020 forecast based on stakeholder comments

Update on EIA Annual Outlook Forecast

- EIA released the 2020 AEO on January 29, 2020
  - Forecast includes significantly lower BEV/PHEV sales projections
  - Change is primarily due to EIA's removal of California's zero emission vehicle (ZEV) Mandate from light-duty vehicle modeling
- Comparison of the past 4 AEO projections of New England BEV/PHEV sales is plotted to the right
  - 2020 AEO is lowest through year 2035
- The AEO 2019 forecast that previously discussed with stakeholders will be used as the final 2020 EV adoption forecast
  - Increased EV adoption better aligns with New England state policy objectives



Final Draft 2020 EV Adoption Forecast

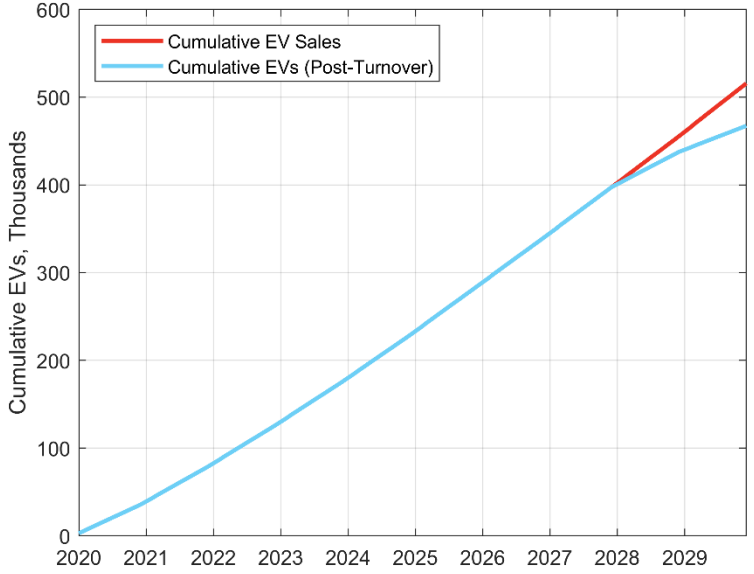
2019 Annual Energy Outlook Forecast (EIA Reference Case)

- Forecast of EV LDV sales for New England
- Incremental sales from 2020-2029 tabulated for use in 2020 draft forecast
- Allocated to states based on state shares of 2018 EV registrations

Year	NE	CT	MA	ME	NH	RI	VT
2020	35,653	8,449	18,329	2,181	2,672	1,499	2,523
2021	43,199	10,237	22,209	2,642	3,238	1,816	3,057
2022	47,020	11,143	24,173	2,876	3,524	1,976	3,327
2023	49,783	11,798	25,594	3,045	3,731	2,092	3,523
2024	53,005	12,561	27,250	3,242	3,973	2,228	3,751
2025	55,737	13,209	28,655	3,409	4,177	2,343	3,944
2026	55,921	13,252	28,750	3,420	4,191	2,351	3,957
2027	57,136	13,540	29,374	3,495	4,282	2,402	4,043
2028	58,032	13,753	29,835	3,549	4,349	2,439	4,107
2029	60,197	14,266	30,948	3,682	4,512	2,530	4,260
Estimated Total	**515,683**	**122,208**	**265,119**	**31,540**	**38,649**	**21,675**	**36,492**

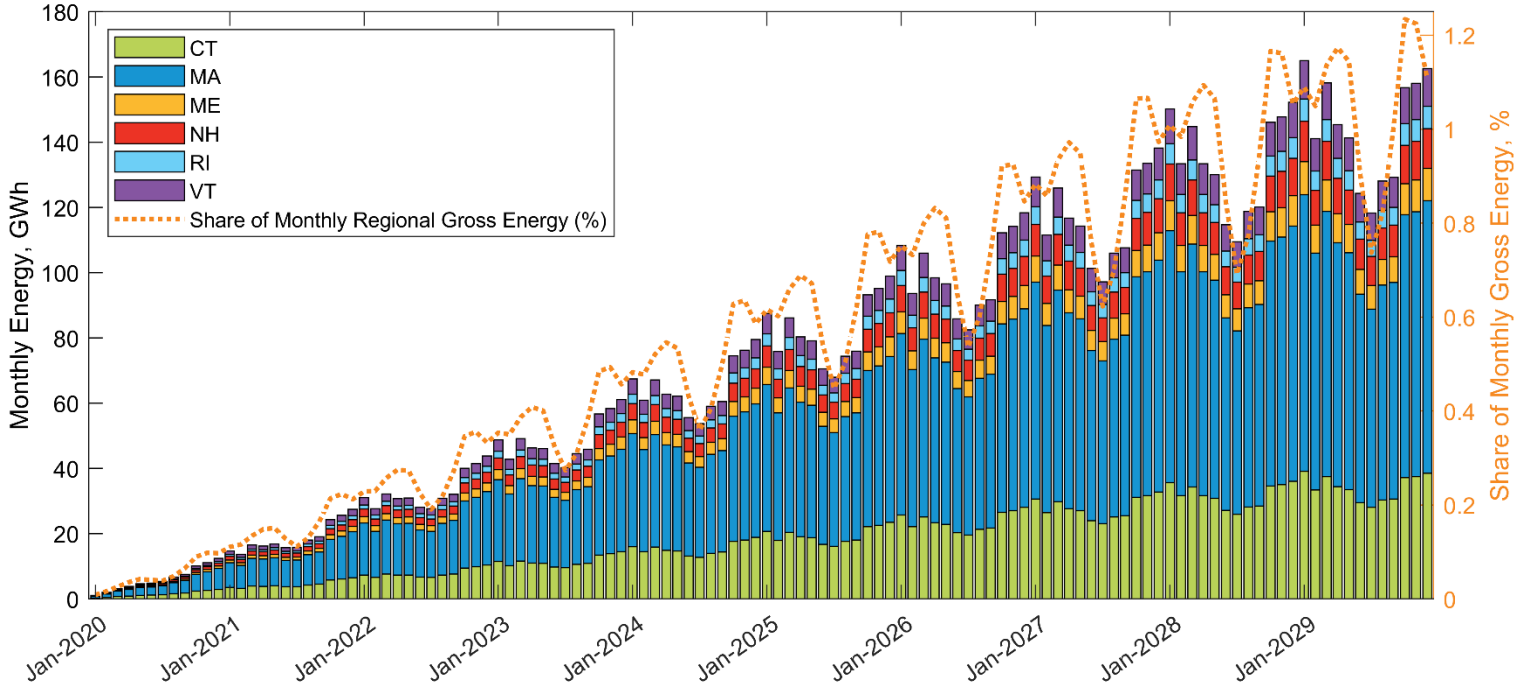
EV Fleet Turnover

- EV fleet turnover assumptions:
  - 50% of sales turn over after 8 years
  - 25% of sales turn over after 9 years
  - 25% of sales turn over after 10 years
- Effect of assumed turnover is illustrated for the draft 2020 New England EV forecast



Final Draft 2020 EV Forecast

Monthly Energy



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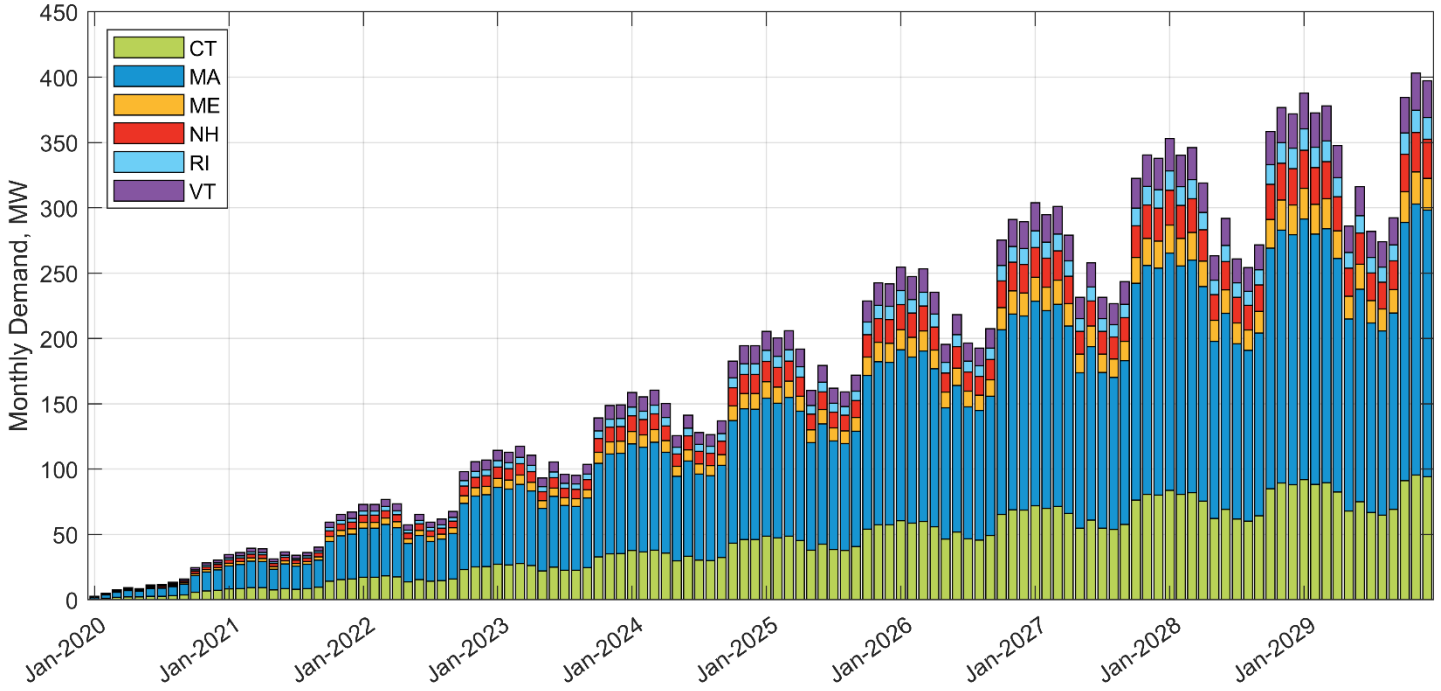
Monthly Demand



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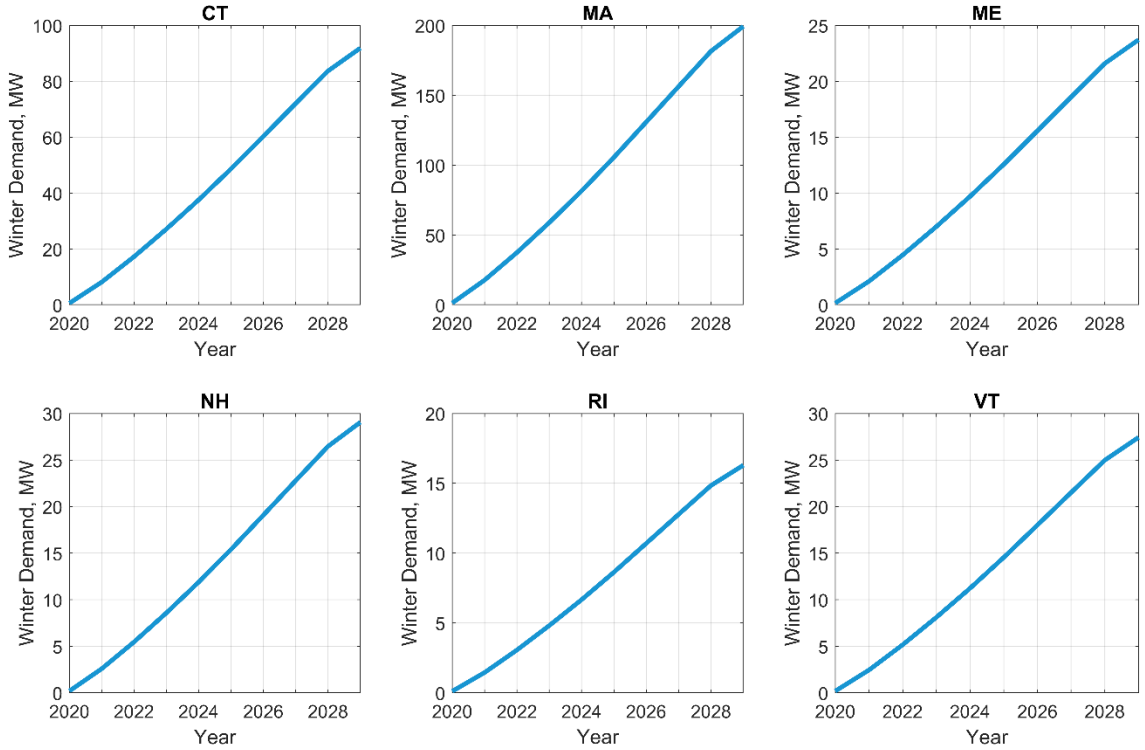
Winter Demand (January)



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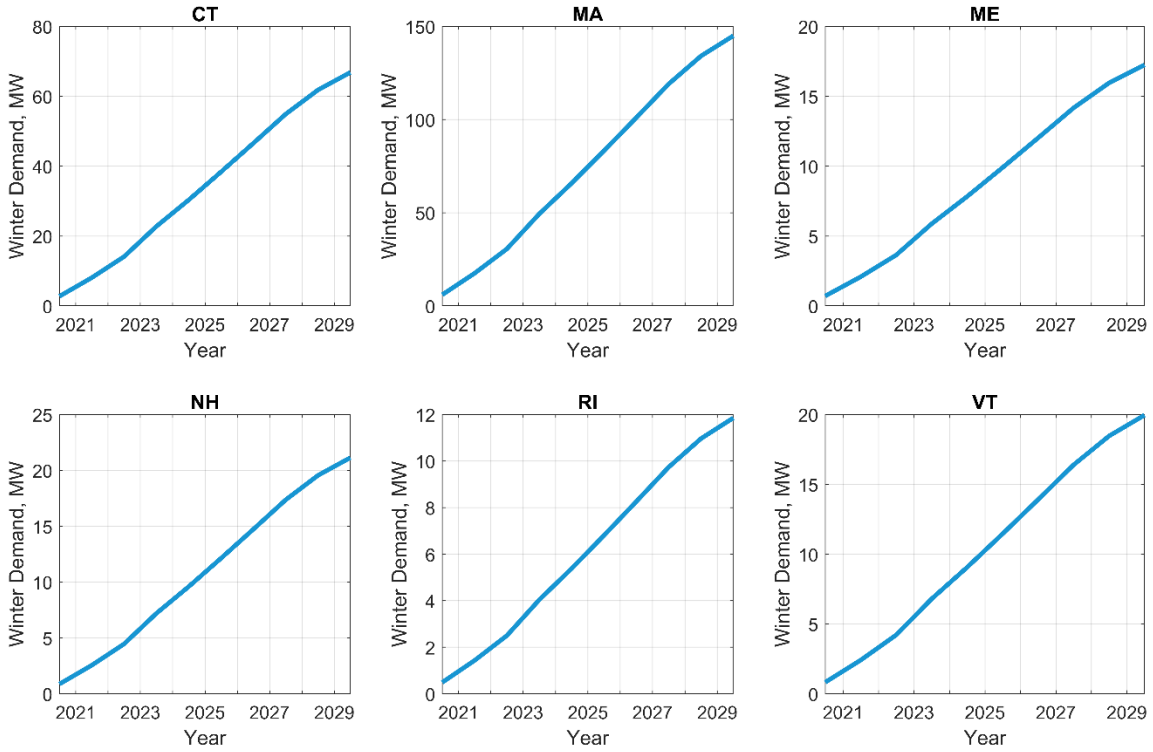
Summer Demand (July)



Next Steps

- ISO will publish the transportation electrification forecast as part of CELT 2020
  - Will be included in both the CELT report and the annual Forecast Data spreadsheet

APPENDIX

Information Supporting Assumptions Used in the 2020 Transportation Electrification Forecast

EV Adoption Forecast

Using Registration and New Sales Data in EV Adoption Forecast

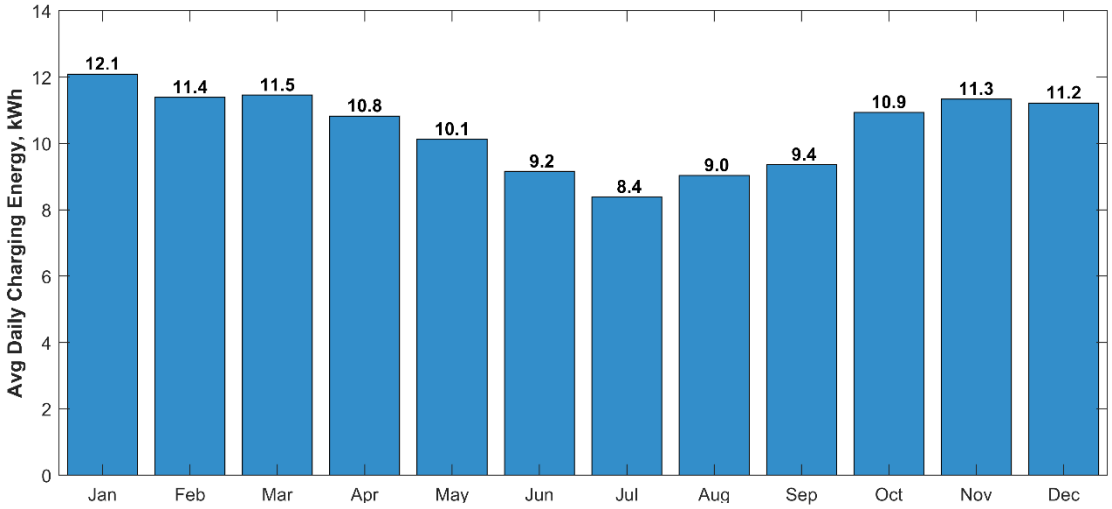
- Tabulated to the right are 2018 total LDV registrations and new LDV sales data from Alliance of Automobile Manufacturers
- Based on these data, below are related state-level statistics on BEV/PHEV registrations and new sales
  - Registration data/calculations is shaded blue
  - Sales data/calculations are shaded orange
- **State shares of regional BEV/PHEVs (in dashed red box) are used to convert regional EIA adoption forecast to state forecasts**

State	2018 Registrations			2018 New Purchases		
	BEV	PHEV	Total LDVs	BEV	PHEV	Total LDVs
CT	4,453	5,346	3,052,626	1,844	1,571	169,074
MA	9,763	11,495	5,382,570	4,959	4,031	355,731
ME	748	1,781	1,287,077	254	545	70,462
NH	1,125	1,974	1,306,353	579	544	97,069
RI	599	1,139	859,116	276	343	49,166
VT	1,057	1,869	564,886	355	469	42,913
NE	**17,745**	**23,604**	**12,452,628**	**8,267**	**7,503**	**784,415**

State	BEV+PHEV Registrations (2018)	State Share of Region	State Share of Total LDV Registrations	BEV+PHEV New Purchases (2018)	BEV+PHEV Share of Total New LDV Purchases
CT	9,799	23.7%	0.32%	3,415	2.0%
MA	21,258	51.4%	0.39%	8,990	2.5%
ME	2,529	6.1%	0.20%	799	1.1%
NH	3,099	7.5%	0.24%	1,123	1.2%
RI	1,738	4.2%	0.20%	619	1.3%
VT	2,926	7.1%	0.52%	824	1.9%
NE	41,349	100.0%	0.33%	15,770	2.0%

Estimating Energy Impacts of EV Adoption

- Monthly energy is based on results of the ChargePoint data analysis
- The adjacent bar chart illustrates monthly kWh/day per EV used to estimate monthly energy
- Values reflect a 6% gross-up for assumed transmission and distribution losses



Data source: ChargePoint, Inc.

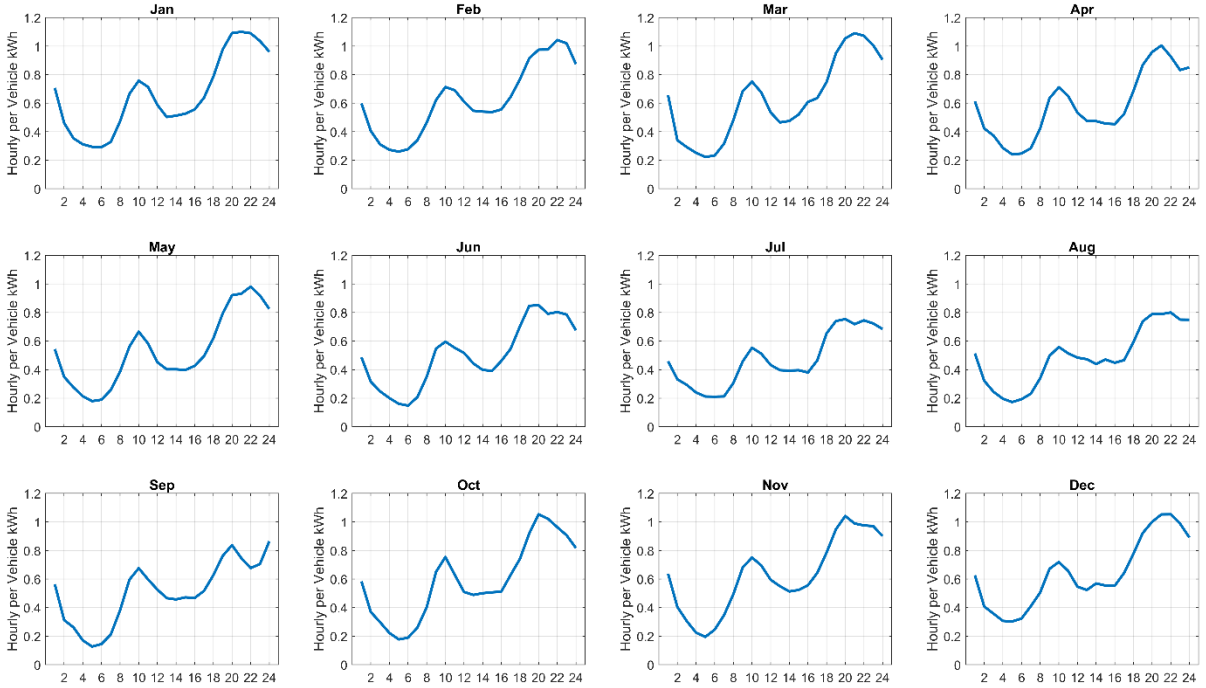
Estimating Demand Impacts of EV Adoption

- Hourly weekday EV demand profiles are used to estimate demand impacts
  - These values reflect the 75th percentile ("P75") of the aggregated hourly EV data discussed as part of the November 18, 2019 LFC (slides 11-19)
    - P75 values serve to capture more extreme values than averages (e.g., due to weather effects), but are not the most extreme data points, which could be more of an artifact of a relatively small EV sample size
- Demand estimates are grossed up by 8% for assumed transmission and distribution losses, consistent with other forecast processes
- Resulting weekday demand profiles are shown on the following slide (all values reflect 8% gross-up)

EV Hourly Demand

- For applications that include hourly analysis, EV demand will be modeled hourly
  - E.g., probabilistic ICR analysis
- Other forecast applications and reporting require a deterministic peak value (e.g., CELT report), and for which:
  - Winter peak demand:
    - Use the monthly average EV demand from HE 18-19
    - January-April, October-December
  - Summer demand impacts should reflect expectations of peak shifting due to increasing BTM PV penetrations (see next 2 slides)

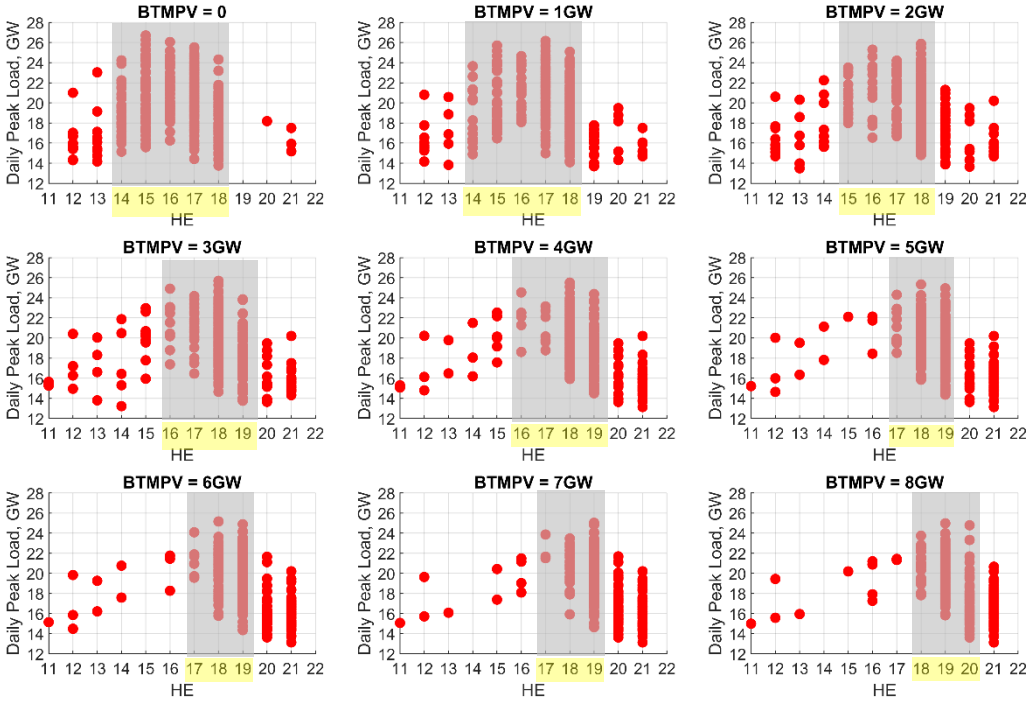
Weekday EV Profiles



Data source: ChargePoint, Inc.

Summer Peak Net Load as BTM PV Increases

- Hourly net load and BTM PV data from the summers (July/August) of 2014-2019 were analyzed to simulate net loads with increasing penetrations of BTM PV
- Scatter plot shows the hour ending (HE) and magnitude (in GW) of net peak load as BTM PV increases
- Gray areas reflect estimated window of hours peak load may occur
  - Yellow areas highlight peak hours



Interaction of EV Summer Demand and BTM PV

- For forecast applications and reporting that require a deterministic peak value, EV demand during the summer months is estimated as the average monthly EV demand during the summer peak hours tabulated to the right
  - May through September
  - Hours reflect effect of shifting peak demand due to BTM PV

Year	PV Nameplate Bin (GW) *	Summer Peak Hours
2020	3	16, 17, 18, 19
2021	4	16, 17, 18, 19
2022	4	16, 17, 18, 19
2023	5	17, 18, 19
2024	5	17, 18, 19
2025	5	17, 18, 19
2026	6	17, 18, 19
2027	6	17, 18, 19
2028	6	17, 18, 19
2029	7	17, 18, 19

* Based on 2019 PV Forecast values

Questions