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Green Mountain Power
FY 2022 Budget Forecast Report

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2022 FISCAL YEAR BUDGET FORECAST: SUMMARY

The FY2022 budget sales includes monthly customer, sales, and revenue projections through 2041. The forecast process starts with estimating linear regression sales and customer models for residential, small commercial & industrial (C&I), and large C&I revenue classes. Models are estimated with monthly billed sales and customer data from January 2011 through February 2021. Once estimated models are used to forecast sales for projected household and economic growth, end-use intensity trends (reflecting both change in end-use ownership and efficiency improvement), and trended temperature projections. The model-based forecast is referred to as the *baseline* sales forecast.

Expected sales impact from large customer expansion and new technologies are layered on the baseline forecast. Baseline forecast is adjusted for:

- Large customer expansion activity
- Tier 3 customer electrification activity
- Behind the meter solar (BTM)
- Heat pump incentive program
- Electric vehicle projections

Forecast and associated sales impact of customer activity (both own and program-related) and new technologies are based on discussions with GMP's largest customers, expected sales gain from electrification program activity, GMP's solar capacity forecast, and heat-pump and electric vehicle forecasts developed as part of the recent VELCO long-term state energy and demand forecast.

Revenue Forecast. Sales forecasts are generated at the customer class level for residential, small C&I, large C&I, and street lighting. To develop the revenue forecast, class-level sales forecasts are allocated to rate schedules and then to billing determinants based on historical rate-schedule allocation trends, on and off-peak sales and billing demand trends.

COVID-19 had a significant impact on 2020 electric sales and revenues and are expected to carry over into 2021. There has been a significant increase in residential sales and drop in C&I sales. Work has shifted from offices to homes and education from on-campus to remote learning. Businesses have reduced operations or closed. Our expectation is that we get close to pre COVID-19 business and personal activity by the end of calendar 2022. We still expect small, but permanent structural change with some people continuing to work at home and correspondingly fewer people in the office; some businesses are likely permanently closed.

Residential sales drop in FY 2022 and C&I sales increase as we transition back to something closer to the pre COVID-19 economy. Large C&I sales show a large drop in 2027 as a result of loss of GlobalFoundries as an all requirements customer. The forecast assumes that GlobalFoundries' pending petition to become a Self-Managed Utility (SMU) is approved and GlobalFoundries takes limited distribution service on a portion of their campus starting in FY 2027. Revenues are priced at current tariffs with residential contributing nearly all the revenue growth over the next five years. The state heat pump incentive program is expected to be a major contributor to this growth.

Table 1 and Table 2 show expected annual sales and revenue through 2041.

Table 1: Fiscal Year Booked Sales Forecast (MWh)

Year	Residential	Chg	Small C&I	Chg	Large C&I	Chg	Other	Chg	Total	Chg
2021	1,576,267		1,395,990		1,109,851		3,749		4,085,856	
2022	1,495,382	-5.1%	1,438,553	3.0%	1,125,773	1.4%	3,789	1.1%	4,063,498	-0.5%
2023	1,495,711	0.0%	1,457,984	1.4%	1,135,102	0.8%	3,789	0.0%	4,092,586	0.7%
2024	1,511,244	1.0%	1,459,925	0.1%	1,136,704	0.1%	3,789	0.0%	4,111,661	0.5%
2025	1,533,313	1.5%	1,459,248	0.0%	1,132,783	-0.3%	3,789	0.0%	4,129,134	0.4%
2026	1,559,530	1.7%	1,457,185	-0.1%	1,129,994	-0.2%	3,789	0.0%	4,150,498	0.5%
2027	1,592,376	2.1%	1,454,093	-0.2%	735,224	-34.9%	3,789	0.0%	3,785,482	-8.8%
2028	1,629,560	2.3%	1,451,897	-0.2%	733,319	-0.3%	3,789	0.0%	3,818,565	0.9%
2029	1,673,836	2.7%	1,450,435	-0.1%	730,650	-0.4%	3,789	0.0%	3,858,710	1.1%
2030	1,721,559	2.9%	1,449,287	-0.1%	728,305	-0.3%	3,789	0.0%	3,902,941	1.1%
2031	1,771,574	2.9%	1,445,007	-0.3%	724,816	-0.5%	3,789	0.0%	3,945,187	1.1%
2032	1,823,351	2.9%	1,441,394	-0.3%	721,330	-0.5%	3,789	0.0%	3,989,864	1.1%
2033	1,877,208	3.0%	1,437,233	-0.3%	717,168	-0.6%	3,789	0.0%	4,035,399	1.1%
2034	1,929,436	2.8%	1,433,740	-0.2%	713,564	-0.5%	3,789	0.0%	4,080,530	1.1%
2035	1,979,791	2.6%	1,430,313	-0.2%	709,963	-0.5%	3,789	0.0%	4,123,856	1.1%
2036	2,024,969	2.3%	1,428,999	-0.1%	706,759	-0.5%	3,789	0.0%	4,164,517	1.0%
2037	2,064,401	1.9%	1,426,933	-0.1%	702,500	-0.6%	3,789	0.0%	4,197,623	0.8%
2038	2,095,445	1.5%	1,425,268	-0.1%	698,783	-0.5%	3,789	0.0%	4,223,285	0.6%
2039	2,119,135	1.1%	1,423,146	-0.1%	695,223	-0.5%	3,789	0.0%	4,241,293	0.4%
2040	2,135,224	0.8%	1,419,689	-0.2%	692,341	-0.4%	3,789	0.0%	4,251,043	0.2%
2041	2,149,688	0.7%	1,416,202	-0.2%	689,099	-0.5%	3,789	0.0%	4,258,778	0.2%
21-26		-0.2%		0.9%		0.4%		0.2%		0.3%
26-31		2.6%		-0.2%		-7.3%		0.0%		-0.9%
31-41		2.0%		-0.2%		-0.5%		0.0%		0.8%

Note: Unless otherwise specified, table summaries represent data on calendar-year billed basis.

Table 2: Fiscal Year Booked Revenue Forecast ($)

Year	Residential	Chg	Small C&I	Chg	Large C&I	Chg	Other	Chg	Total	Chg
2021	302,814,103		233,038,924		122,435,010		2,557,788		660,845,825	
2022	289,350,719	-4.4%	237,568,124	1.9%	122,371,657	-0.1%	2,585,565	1.1%	651,876,064	-1.4%
2023	289,503,944	0.1%	240,783,668	1.4%	106,587,954	-12.9%	2,585,565	0.0%	639,461,130	-1.9%
2024	292,327,171	1.0%	241,178,785	0.2%	106,708,646	0.1%	2,585,565	0.0%	642,800,166	0.5%
2025	296,001,461	1.3%	241,423,438	0.1%	107,230,936	0.5%	2,585,565	0.0%	647,241,400	0.7%
2026	300,472,741	1.5%	241,329,717	0.0%	107,671,553	0.4%	2,585,565	0.0%	652,059,576	0.7%
2027	306,020,092	1.8%	241,077,838	-0.1%	86,786,323	-19.4%	2,585,565	0.0%	636,469,818	-2.4%
2028	312,388,423	2.1%	240,845,408	-0.1%	86,488,588	-0.3%	2,585,565	0.0%	642,307,984	0.9%
2029	319,689,371	2.3%	240,965,719	0.0%	86,248,273	-0.3%	2,585,565	0.0%	649,488,927	1.1%
2030	327,671,214	2.5%	241,014,568	0.0%	85,972,304	-0.3%	2,585,565	0.0%	657,243,651	1.2%
2031	336,021,082	2.5%	240,578,908	-0.2%	85,560,685	-0.5%	2,585,565	0.0%	664,746,240	1.1%
2032	344,767,608	2.6%	240,132,766	-0.2%	85,077,553	-0.6%	2,585,565	0.0%	672,563,492	1.2%
2033	353,610,467	2.6%	239,831,199	-0.1%	84,659,880	-0.5%	2,585,565	0.0%	680,687,110	1.2%
2034	362,282,085	2.5%	239,517,918	-0.1%	84,235,373	-0.5%	2,585,565	0.0%	688,620,940	1.2%
2035	370,640,187	2.3%	239,215,124	-0.1%	83,811,244	-0.5%	2,585,565	0.0%	696,252,120	1.1%
2036	378,260,499	2.1%	239,131,032	0.0%	83,363,096	-0.5%	2,585,565	0.0%	703,340,191	1.0%
2037	384,681,164	1.7%	239,148,897	0.0%	82,932,103	-0.5%	2,585,565	0.0%	709,347,728	0.9%
2038	389,817,870	1.3%	239,119,971	0.0%	82,494,400	-0.5%	2,585,565	0.0%	714,017,805	0.7%
2039	393,731,055	1.0%	239,020,313	0.0%	82,075,257	-0.5%	2,585,565	0.0%	717,412,189	0.5%
2040	396,501,370	0.7%	238,608,642	-0.2%	81,666,829	-0.5%	2,585,565	0.0%	719,362,406	0.3%
2041	398,759,083	0.6%	238,400,882	-0.1%	81,355,297	-0.4%	2,585,565	0.0%	721,100,826	0.2%
21-26		-0.1%		0.7%		-2.4%		0.2%		-0.3%
26-31		2.3%		-0.1%		-4.2%		0.0%		0.4%
31-41		1.7%		-0.1%		-0.5%		0.0%		0.8%

I. Forecast Summary

Baseline Sale Forecast. The customer class sales and customer forecasts are derived from linear regression models that relate monthly sales to household projections, economic activity as measured by real GDP, employment, household income, expected weather, price, and changes in end-use energy ownership and efficiency (both standards and state efficiency programs). Models are estimated with monthly billed sales and customer data from January 2011 to February 2021. The forecast is extended through 2041 and is used developing the long-term system energy and demand forecast.

Sales Trend. Residential and Small C&I sales have been declining since 2014. Increase in customers and business activity have been countered by efficiency improvements (both market and program driven) and strong solar market penetration. The 2020 uptick in residential sales and decline in C&I sales is largely due to the impact of COVID-19 on businesses and residences. Large C&I sales have largely been flat with a slight decline starting in 2019 and continuing this trend into 2020 as a result of COVID-19. Figure 1 captures class sales trends over the last decade.

Figure 1: Sales Trend (12-month moving sum)

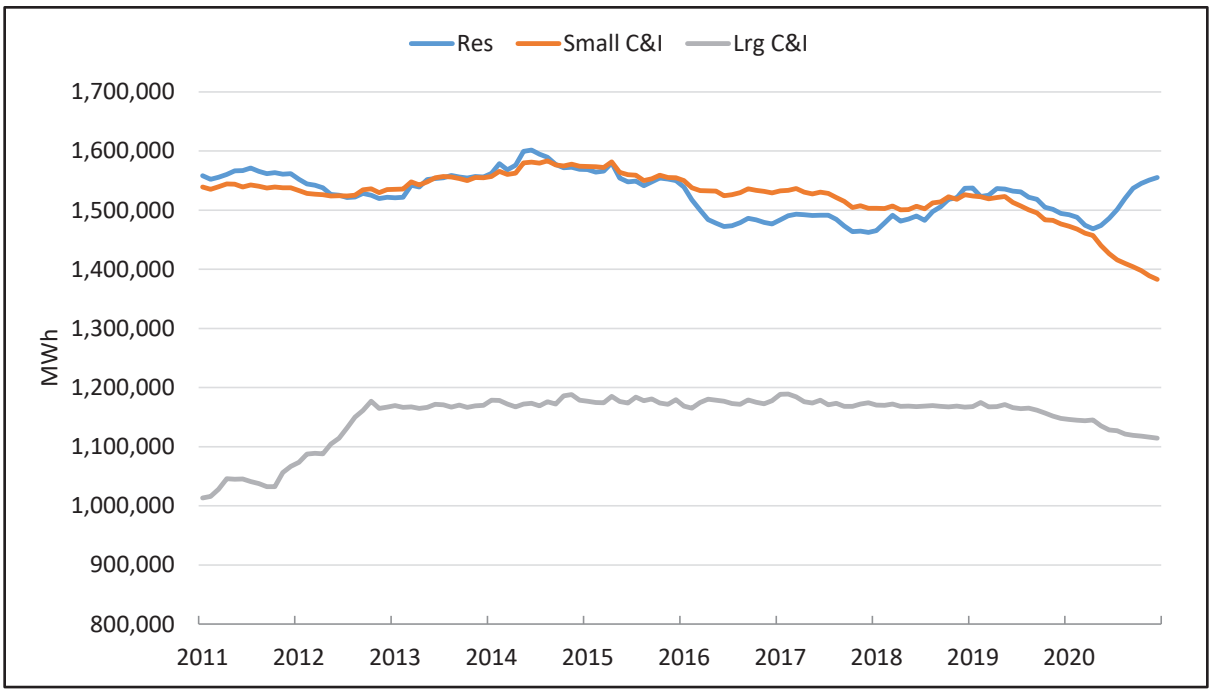
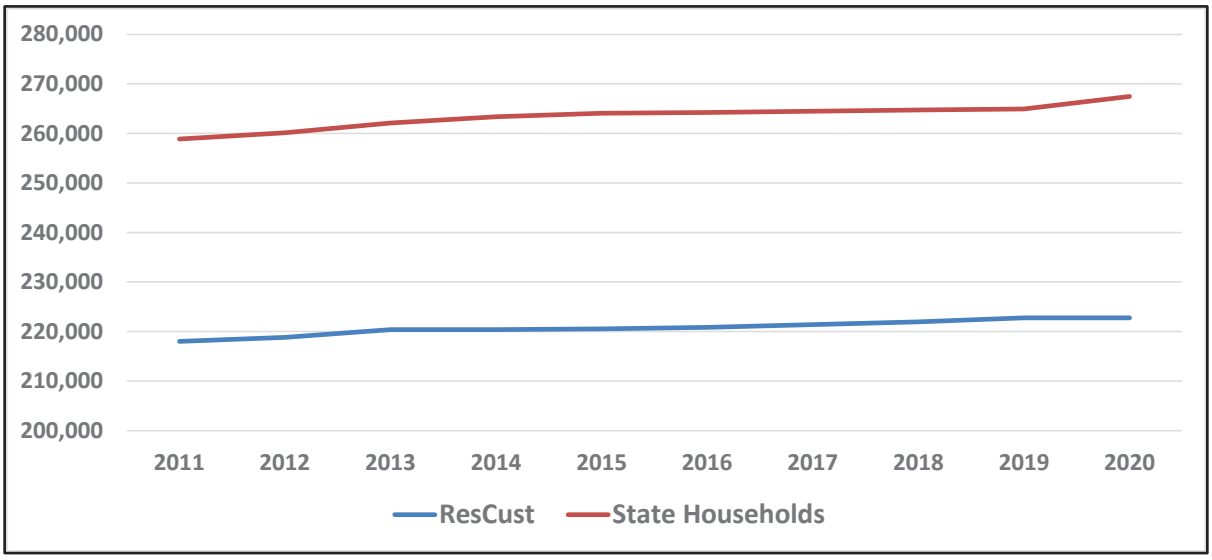


Figure 2 shows historical residential customers and number of state households.

Figure 2: Residential Customers and State Households

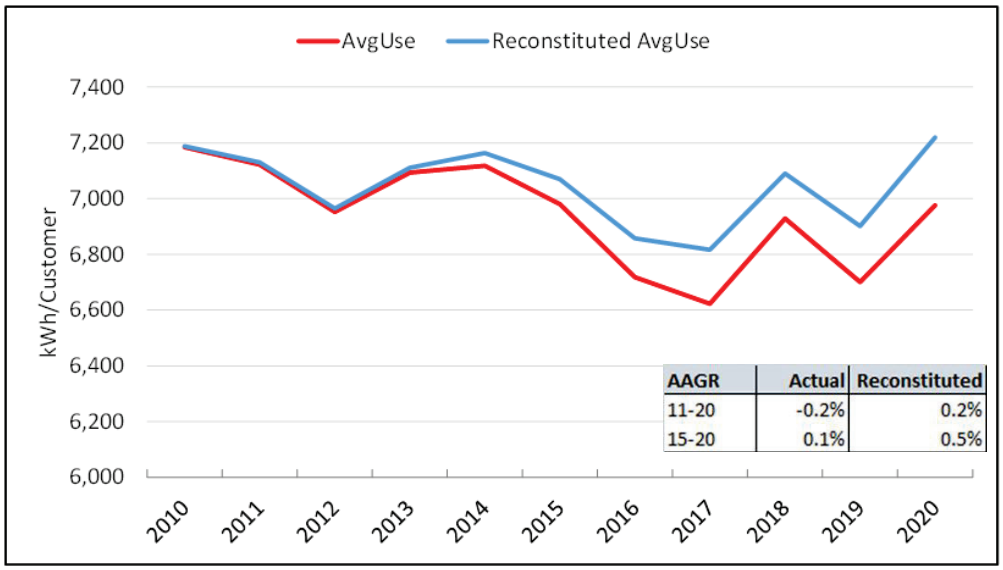


Customer growth has been relatively slow. Since 2011, GMP has added roughly 5,000 customers. Customer growth has tracked state household growth with both customers and number of households averaging 0.3% annual growth through 2019. GMP accounts for approximately 84% of state households. The state saw a 1.0% gain in households in 2020 while GMP customer counts were

flat. The household gains may reflect people moving into Vermont in response to COVID-19, but we would have expected to have seen similar customer growth in the GMP service area. Moody's Analytics will likely adjust 2020 household counts down in later forecast releases.

Behind the meter (BTM) solar has had significant impact on customer usage. Figure 3 compares residential average use against reconstituted average use (with own-use solar added back).

Figure 3: Residential Solar Load Impact



BTM solar penetration has had a meaningful impact starting 2014. By 2020, the cumulative impact reached approximately 240 kWh per customer with a total sales impact of over 54,000 MWh – close to 3.5% reduction in residential sales. While BTM solar also impacts small C&I usage, very little is reflected in the billed sales data; most of the solar usage is treated as a power purchase cost and registers on the C&I customer bill as a dollar credit.

COVID-19 added a new twist to this year's forecast contributing to a large increase in residential sales and decline in C&I sales. Figure 4 and Figure 5 show COVID sales impact.

Figure 4: Residential COVID Sales Impact

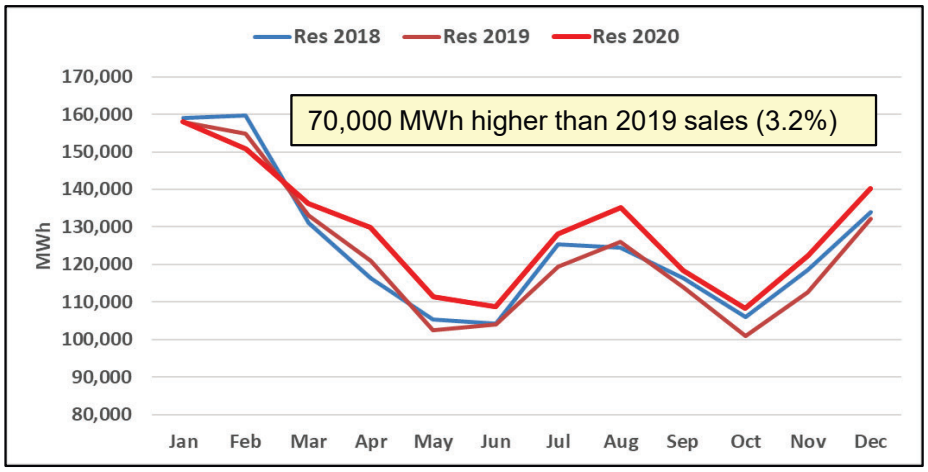
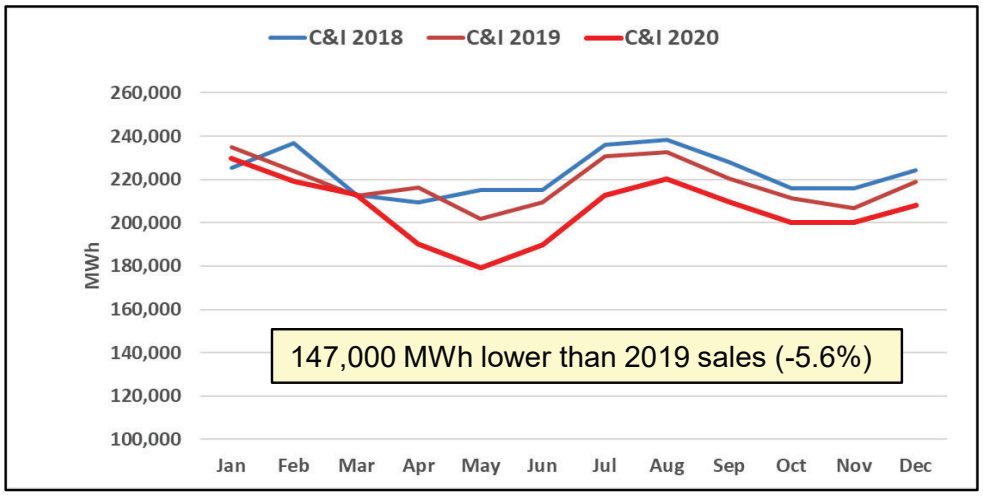


Figure 5: COVID Impact on C&I Sales



Net loss due to COVID is 77,000 MWh representing a 1.9% drop in 2020 sales. With vaccinations beginning to slow COVID-19 spread, we expect to reach a more normalized sales level by October, the start of Fiscal Year 2022.

The baseline forecast incorporates Moody's Analytics January 2021 state economic forecast and the Energy Information Administration (EIA) 2020 end-use energy intensity projections for New England. End-use intensity projections are adjusted to reflect end-use saturations for Vermont and VEIC's energy efficiency (EE) program savings projections.

Baseline Forecast Adjustments. The baseline forecast is adjusted for factors not captured in historical sales data. This includes adjustments for:

- New solar capacity and generation projections.

- Expected Tier 3 electrification impacts (heat pumps and custom projects).
- Electric vehicle sales.
- Spot load adjustments for expected large load additions (and losses).

Residential Sales Forecast

Since 2010, residential average use has declined from 7,200 kWh per customer to 6,700 kWh per customer, averaging 0.8% annual usage decline. Solar adoption has accounted for approximately half the decline with improvements in end-use efficiency from standards and state-sponsored energy efficiency programs the other half.

Over the next couple of years, solar adoption, natural occurring efficiency, and EE programs savings will continue to contribute to declining average use. By 2023, average use begins to turn positive with increase in electric sales from state heat pump program and beginning of measurable impact from electric vehicle adoption. After 2025, we expect to see even stronger growth in residential electric usage with increasing EV market penetration.

The residential sales forecast is derived by combining average use forecast with customer forecast. The customer forecast is based on state-level household projections. Table 3 shows the forecast results.

Table 3: Residential Sales Forecast

Year	Average Use (kWh)	Chg	Customers	Chg	Sales (MWh)	Chg
2021	6,963		223,656		1,557,294	
2022	6,661	-4.3%	224,290	0.3%	1,493,910	-4.1%
2023	6,684	0.4%	225,084	0.4%	1,504,541	0.7%
2024	6,730	0.7%	225,860	0.3%	1,519,962	1.0%
2025	6,805	1.1%	226,637	0.3%	1,542,341	1.5%
2026	6,907	1.5%	227,370	0.3%	1,570,492	1.8%
2027	7,036	1.9%	227,982	0.3%	1,604,114	2.1%
2028	7,188	2.2%	228,533	0.2%	1,642,768	2.4%
2029	7,370	2.5%	229,044	0.2%	1,688,119	2.8%
2030	7,568	2.7%	229,516	0.2%	1,736,965	2.9%
2031	7,770	2.7%	229,917	0.2%	1,786,496	2.9%
2032	7,986	2.8%	230,249	0.1%	1,838,887	2.9%
2033	8,210	2.8%	230,504	0.1%	1,892,501	2.9%
2034	8,430	2.7%	230,656	0.1%	1,944,326	2.7%
2035	8,637	2.5%	230,809	0.1%	1,993,601	2.5%
2036	8,821	2.1%	230,952	0.1%	2,037,207	2.2%
2037	8,980	1.8%	231,009	0.0%	2,074,429	1.8%
2038	9,105	1.4%	230,997	0.0%	2,103,125	1.4%
2039	9,199	1.0%	230,956	0.0%	2,124,588	1.0%
2040	9,262	0.7%	230,893	0.0%	2,138,607	0.7%
2041	9,328	0.7%	230,781	0.0%	2,152,742	0.7%
21-26		-0.1%		0.3%		0.2%
26-31		2.4%		0.2%		2.6%
31-41		1.8%		0.0%		1.9%

Table 4 shows the cumulative forecast adjustments. Energy efficiency and own-use solar impacts are part of the baseline forecast as both efficiency and solar are embedded in the historical data. Embedded efficiency and solar are isolated by holding the model end-use intensities, EE savings, and solar own-use generation constant through the forecast period.

Table 4: Residential Sales Forecast Disaggregation (MWh)

Year	NoEE(1)	EE(2)	Solar(3)	Baseline(4)	Tier3(5)	EV(6)	Forecast
2021	1,559,846	-5,152	-6,410	1,548,285	7,450	1,558	1,557,293
2022	1,505,055	-29,371	-14,025	1,461,659	26,043	6,208	1,493,910
2023	1,517,325	-43,910	-21,426	1,451,989	40,628	11,924	1,504,541
2024	1,530,556	-57,396	-29,031	1,444,130	56,378	19,455	1,519,962
2025	1,546,347	-70,709	-35,861	1,439,777	73,212	29,353	1,542,341
2026	1,562,623	-83,472	-42,087	1,437,064	91,158	42,270	1,570,492
2027	1,578,999	-95,838	-48,315	1,434,846	110,294	58,974	1,604,114
2028	1,595,420	-106,635	-54,781	1,434,004	128,449	80,315	1,642,768
2029	1,611,398	-115,369	-60,768	1,435,261	145,693	107,165	1,688,119
2030	1,626,717	-125,269	-66,850	1,434,598	162,084	140,283	1,736,965
2031	1,641,591	-134,163	-70,732	1,436,695	177,638	172,163	1,786,496
2032	1,656,081	-142,423	-74,227	1,439,431	192,414	207,041	1,838,887
2033	1,670,140	-150,417	-77,151	1,442,572	206,452	243,477	1,892,501
2034	1,683,644	-158,215	-80,361	1,445,067	219,788	279,471	1,944,326
2035	1,697,100	-165,126	-83,571	1,448,404	232,452	312,745	1,993,601
2036	1,710,360	-171,729	-87,094	1,451,536	244,481	341,190	2,037,207
2037	1,723,394	-178,253	-89,990	1,455,151	255,954	363,325	2,074,429
2038	1,736,055	-185,172	-93,200	1,457,683	266,862	378,580	2,103,125
2039	1,748,519	-192,014	-96,410	1,460,095	277,228	387,265	2,124,588
2040	1,760,710	-199,525	-99,962	1,461,224	287,080	390,303	2,138,607
2041	1,772,507	-206,709	-102,829	1,462,969	296,432	393,341	2,152,742
21-26	0.0%			-1.5%			0.2%
26-31	1.0%			0.0%			2.6%
31-41	0.8%			0.2%			1.9%

1. No EE forecast assumes no efficiency improvements after 2020.
2. Efficiency includes impacts of new standards, naturally occurring, and EE program-based efficiency improvements.
3. Solar is derived from GMP solar capacity forecast and is allocated to classes.
4. Baseline forecast are derived from the estimated forecast models.
5. Tier 3 heat pump forecast is derived by adjusting VEIC projections for Vermont for the share of GMP sales.
6. VEIC forecast adjusted for GMP share.

The baseline forecast is consistent with historical sales trend. With the combination of solar and efficiency reducing sales growth by 1.5% over the next five years (0.6% if 2021 is excluded). The primary contributor to residential sales growth is expected strong penetration of heat pumps through incentives designed to promote Tier 3 electrification goals and projected EV market growth.

C&I Sales Forecast

Separate forecast models are estimated for the small and large commercial and industrial (C&I) customer classes. The Large C&I model excludes GlobalFoundries which is forecasted separately. Over the long-term, C&I sales are expected to continue to decline approximately 0.2% per year. GlobalFoundries remains a retail customer at a negotiated price per MWh starting in October 2022 and is removed from the forecast altogether beginning in October 2026. Baseline C&I sales forecasts are derived using linear regression models that relate monthly billed sales to state GDP, population, employment, small C&I end-use intensity trends, state DSM savings projections, and weather conditions (heating and cooling degree-days). The modeled-base or baseline forecasts are adjusted for solar own-use (excess generation is treated as power purchase cost), Tier 3 electrification projects, and large load additions (and losses) associated with specific customer activity that would not be captured in the baseline models. Table 5 shows the C&I sales forecast.

Table 5: C&I Sales Forecast

Year	Small C&I (MWh)	Chg	Large C&I (MWh)	Chg	Other (MWh)	Chg	Total (MWh)	Chg
2021	1,409,011		1,112,082		3,769		2,524,861	
2022	1,444,220	2.5%	1,128,376	1.5%	3,786	0.5%	2,576,382	2.0%
2023	1,461,232	1.2%	1,135,185	0.6%	3,786	0.0%	2,600,203	0.9%
2024	1,459,662	-0.1%	1,135,459	0.0%	3,786	0.0%	2,598,907	0.0%
2025	1,459,370	0.0%	1,131,451	-0.4%	3,786	0.0%	2,594,607	-0.2%
2026	1,456,146	-0.2%	1,033,293	-8.7%	3,786	0.0%	2,493,225	-3.9%
2027	1,453,581	-0.2%	733,976	-29.0%	3,786	0.0%	2,191,343	-12.1%
2028	1,451,090	-0.2%	732,094	-0.3%	3,786	0.0%	2,186,970	-0.2%
2029	1,450,426	0.0%	729,441	-0.4%	3,786	0.0%	2,183,653	-0.2%
2030	1,448,471	-0.1%	727,018	-0.3%	3,786	0.0%	2,179,276	-0.2%
2031	1,443,916	-0.3%	723,196	-0.5%	3,786	0.0%	2,170,899	-0.4%
2032	1,440,250	-0.3%	719,718	-0.5%	3,786	0.0%	2,163,755	-0.3%
2033	1,436,198	-0.3%	715,624	-0.6%	3,786	0.0%	2,155,608	-0.4%
2034	1,432,662	-0.2%	712,007	-0.5%	3,786	0.0%	2,148,455	-0.3%
2035	1,429,556	-0.2%	708,413	-0.5%	3,786	0.0%	2,141,755	-0.3%
2036	1,428,418	-0.1%	705,166	-0.5%	3,786	0.0%	2,137,370	-0.2%
2037	1,426,305	-0.1%	700,896	-0.6%	3,786	0.0%	2,130,987	-0.3%
2038	1,424,586	-0.1%	697,215	-0.5%	3,786	0.0%	2,125,588	-0.3%
2039	1,422,513	-0.1%	693,712	-0.5%	3,786	0.0%	2,120,011	-0.3%
2040	1,418,457	-0.3%	690,867	-0.4%	3,786	0.0%	2,113,110	-0.3%
2041	1,415,210	-0.2%	687,626	-0.5%	3,786	0.0%	2,106,622	-0.3%
21-26		0.7%		-1.4%		0.1%		-0.2%
26-31		-0.2%		-6.1%		0.0%		-2.6%
31-41		-0.2%		-0.5%		0.0%		-0.3%

Table 6 shows the C&I sales disaggregation. As with residential sector, historical efficiency savings are embedded in the billing data and as a result are part of the baseline forecast. Own-use solar is only partially embedded in billed sales as the larger share of own-use sales is received as a bill credit. The larger part of solar load impact flows through as a reduction in system energy requirements. Spot loads and Tier 3 projections include customer-specific activity not captured in the historical data.

Table 6: C&I Sales Forecast Disaggregation (MWh)

Year	NoEE(1)	EE(2)	Solar(3)	Baseline(4)	Spot(5)	Tier3(6)	Forecast
2021	2,529,088	-14,439	-24	2,514,625	9,108	1,129	2,524,861
2022	2,594,811	-33,369	-53	2,561,389	10,929	4,064	2,576,382
2023	2,632,313	-49,733	-80	2,582,501	10,929	6,773	2,600,203
2024	2,644,905	-66,303	-106	2,578,496	10,929	9,482	2,598,907
2025	2,654,460	-82,843	-130	2,571,487	10,929	12,191	2,594,607
2026	2,569,362	-101,813	-153	2,467,396	10,929	14,900	2,493,225
2027	2,283,032	-120,051	-176	2,162,805	10,929	17,609	2,191,343
2028	2,293,825	-137,905	-197	2,155,723	10,929	20,318	2,186,970
2029	2,303,703	-153,785	-221	2,149,697	10,929	23,027	2,183,653
2030	2,313,389	-170,527	-251	2,142,611	10,929	25,736	2,179,276
2031	2,322,493	-188,003	-256	2,134,234	10,929	25,736	2,170,899
2032	2,331,610	-204,255	-266	2,127,090	10,929	25,736	2,163,754
2033	2,340,131	-220,909	-279	2,118,943	10,929	25,736	2,155,608
2034	2,348,848	-236,767	-291	2,111,790	10,929	25,736	2,148,455
2035	2,357,706	-252,313	-303	2,105,090	10,929	25,736	2,141,755
2036	2,366,707	-265,690	-312	2,100,705	10,929	25,736	2,137,370
2037	2,374,183	-279,535	-326	2,094,322	10,929	25,736	2,130,987
2038	2,381,943	-292,683	-338	2,088,923	10,929	25,736	2,125,588
2039	2,389,906	-306,211	-349	2,083,346	10,929	25,736	2,120,011
2040	2,398,613	-321,809	-358	2,076,445	10,929	25,736	2,113,110
2041	2,406,735	-336,405	-373	2,069,957	10,929	25,736	2,106,622
21-26	0.3%			-0.4%			-0.3%
26-31	-2.0%			-2.9%			-2.7%
31-41	0.4%			-0.3%			-0.3%

1. No EE forecast assumes no efficiency improvements after 2020.
2. Efficiency includes impacts of new standards, naturally occurring, and program-based efficiency improvements.
3. Solar is derived from GMP solar capacity forecast and is allocated to classes.
4. Baseline forecast is derived from the estimated forecast models.
5. Spot loads for small C&I are based on projections provided by GMP.
6. Electrification is based on expected gains from class-specific Tier 3 electrification projects.

Table 7 shows the breakdown of total billed sales forecast.

Table 7: Forecast Disaggregation (MWh)

Year	NoEE(1)	EE(2)	Solar(3)	Baseline(4)	Tier3(5)	EV(6)	Spot(7)	Forecast
2021	4,088,935	-19,591	-6,434	4,062,910	8,579	1,558	9,108	4,082,155
2022	4,099,866	-62,740	-14,078	4,023,049	30,107	6,208	10,929	4,070,292
2023	4,149,638	-93,643	-21,506	4,034,490	47,401	11,924	10,929	4,104,744
2024	4,175,462	-123,699	-29,137	4,022,626	65,859	19,455	10,929	4,118,869
2025	4,200,807	-153,552	-35,991	4,011,264	85,402	29,353	10,929	4,136,948
2026	4,131,985	-185,284	-42,240	3,904,460	106,057	42,270	10,929	4,063,717
2027	3,862,031	-215,889	-48,490	3,597,652	127,903	58,974	10,929	3,795,458
2028	3,889,245	-244,540	-54,978	3,589,727	148,766	80,315	10,929	3,829,738
2029	3,915,101	-269,153	-60,989	3,584,958	168,719	107,165	10,929	3,871,772
2030	3,940,106	-295,797	-67,100	3,577,209	187,819	140,283	10,929	3,916,241
2031	3,964,083	-322,167	-70,988	3,570,929	203,373	172,163	10,929	3,957,395
2032	3,987,691	-346,678	-74,492	3,566,521	218,150	207,041	10,929	4,002,641
2033	4,010,271	-371,326	-77,431	3,561,515	232,187	243,477	10,929	4,048,109
2034	4,032,492	-394,983	-80,652	3,556,857	245,523	279,471	10,929	4,092,781
2035	4,054,806	-417,439	-83,874	3,553,494	258,188	312,745	10,929	4,135,357
2036	4,077,067	-437,419	-87,406	3,552,242	270,216	341,190	10,929	4,174,577
2037	4,097,577	-457,788	-90,316	3,549,473	281,689	363,325	10,929	4,205,416
2038	4,117,998	-477,855	-93,538	3,546,605	292,598	378,580	10,929	4,228,713
2039	4,138,425	-498,225	-96,759	3,543,441	302,963	387,265	10,929	4,244,599
2040	4,159,323	-521,334	-100,320	3,537,669	312,815	390,303	10,929	4,251,718
2041	4,179,242	-543,114	-103,202	3,532,926	322,168	393,341	10,929	4,259,364
21-26	0.2%			-0.8%				-0.1%
26-31	-0.8%			-1.8%				-0.5%
31-41	0.5%			-0.1%				0.7%

II. Forecast Drivers

There are several factors that impact the sales and customer forecast. Forecast drivers include:

- Moody Analytics January 2021 Vermont economic forecast.
- AEO 2020 end-use efficiency estimates for the New England Census Division (modified for Vermont end-use information).
- VEIC current energy efficiency savings projections, cold-climate heat pumps forecast, electric vehicle forecast.
- GMP's updated solar capacity forecast.
- GMP adjustments for C&I Tier 3 electrification efforts and large load adjustments that would not be reflected in the historical billing data.
- Updated trended normal HDD and CDD with data through 2020.
- State response to COVID-19

2.1 Economic Forecast

The FY22 forecast is based on Moody's January 2021 state economic projections. The primary economic drivers include number of state households, state real personal income, employment, and real state economic output (GDP). Table 8 shows historical and projected economic outlook.

Table 8: State Economic Projections

Year	Households (Thou)	Chg	RPI (Mil $)	Chg	GDP (Mil $)	Chg	Emp (Thou)	Chg
2011	258.9		27,901		28,694		300.9	
2012	260.2	0.5%	28,337	1.6%	28,951	0.9%	304.5	1.2%
2013	262.1	0.7%	28,434	0.3%	28,345	-2.1%	306.7	0.7%
2014	263.4	0.5%	29,026	2.1%	28,480	0.5%	309.6	0.9%
2015	264.1	0.3%	29,944	3.2%	28,913	1.5%	312.1	0.8%
2016	264.2	0.1%	30,203	0.9%	29,164	0.9%	313.3	0.4%
2017	264.5	0.1%	30,428	0.7%	29,320	0.5%	315.0	0.5%
2018	264.7	0.1%	30,900	1.6%	29,584	0.9%	316.0	0.3%
2019	265.0	0.1%	31,439	1.7%	29,670	0.3%	315.1	-0.3%
2020	267.5	1.0%	33,492	6.5%	28,367	-4.4%	288.4	-8.5%
2021	268.3	0.3%	33,827	1.0%	29,471	3.9%	292.0	1.2%
2022	269.7	0.5%	33,248	-1.7%	30,867	4.7%	300.2	2.8%
2023	271.1	0.5%	34,197	2.9%	31,921	3.4%	306.1	2.0%
2024	272.5	0.5%	34,929	2.1%	32,543	1.9%	308.6	0.8%
2025	273.9	0.5%	35,601	1.9%	33,137	1.8%	309.8	0.4%
2026	275.2	0.5%	36,360	2.1%	33,708	1.7%	310.9	0.4%
2027	276.4	0.4%	37,204	2.3%	34,322	1.8%	311.9	0.3%
2028	277.3	0.4%	38,081	2.4%	34,943	1.8%	312.9	0.3%
2029	278.3	0.3%	38,938	2.3%	35,553	1.7%	314.0	0.4%
2030	279.1	0.3%	39,755	2.1%	36,133	1.6%	315.2	0.4%
2031	279.8	0.3%	40,537	2.0%	36,702	1.6%	316.2	0.3%
2032	280.4	0.2%	41,302	1.9%	37,276	1.6%	317.1	0.3%
2033	280.9	0.2%	42,034	1.8%	37,878	1.6%	318.1	0.3%
2034	281.2	0.1%	42,733	1.7%	38,498	1.6%	319.2	0.3%
2035	281.5	0.1%	43,414	1.6%	39,124	1.6%	320.3	0.3%
2036	281.7	0.1%	44,071	1.5%	39,739	1.6%	321.3	0.3%
2037	281.8	0.0%	44,734	1.5%	40,341	1.5%	322.3	0.3%
2038	281.8	0.0%	45,391	1.5%	40,943	1.5%	323.3	0.3%
2039	281.7	0.0%	46,039	1.4%	41,558	1.5%	324.4	0.3%
2040	281.6	0.0%	46,671	1.4%	42,190	1.5%	325.6	0.4%
2041	281.4	-0.1%	47,275	1.3%	42,822	1.5%	326.8	0.4%
11-20		0.4%		2.1%		-0.1%		-0.4%
21-31		0.4%		1.8%		2.2%		0.8%
31-41		0.1%		1.5%		1.6%		0.3%

COVID-19 economic impact is highlighted in the data. In 2020, state output (GDP) dropped 4.4% and employment declined 8.5% while personal income increased 6.5%. The large increase in real income is a result of government financial stimulus designed to counter the COVID employment impact. Moody's projects economic recovery to pre-pandemic levels by 2022 in terms of state-level output, employment however does not return to pre-pandemic levels until 2030.

Long-term, number of state households is expected to increase 0.4%; number of households drives residential customer forecast which historically and through the forecast period increases at a slightly lower rate. Economic growth recovers from the COVID-induced recession quickly with GPD jumping 3.9% in 2021 and an even stronger 4.7% in 2022. By 2023 GDP trends back to a long-term average annual growth of 1.8% per year.

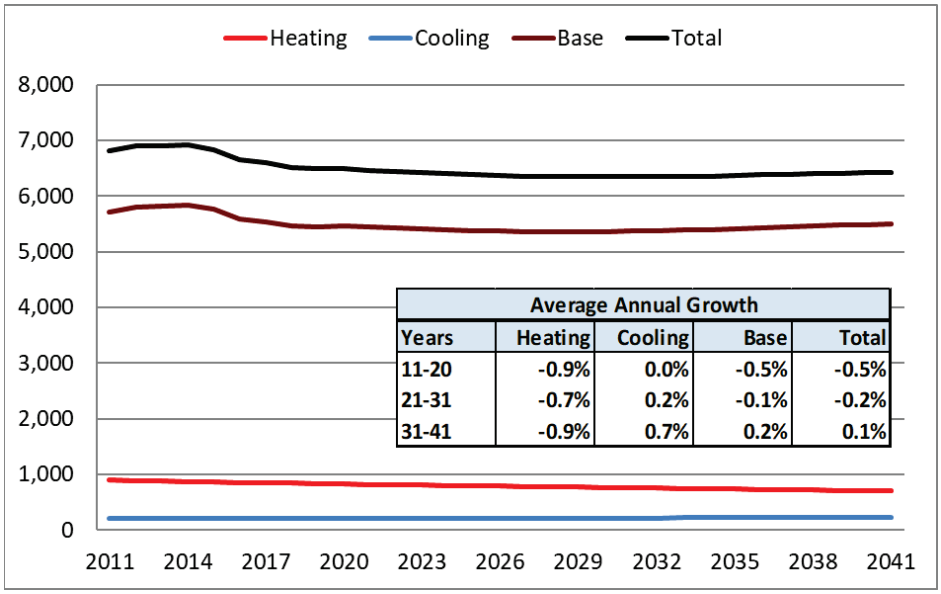
2.2 Energy Efficiency Impact

Efficiency gains continue to counter sales growth from customer and economic growth. Efficiency gains are captured two ways – through (1) end-use energy intensity projections and (2) expected state-sponsored EE program savings.

End-Use Model Intensities. End-use intensities are derived for ten residential and nine small C&I end-uses. End-use intensities reflect both increase in appliance ownership (saturation) and change in stock efficiency. In the residential sector, intensities are measured on a kWh per household basis and in the small C&I sector on a kWh per square-foot basis. End-use intensities are based on EIA 2020 Annual Energy Outlook for New England. Residential end-use saturations are calibrated to Vermont-specific end-use saturations where this data is available.

For most end-uses increasing efficiency outweighs increase in saturation; this results in declining end-use intensities. The exception is residential cooling where saturations continue to trend positive at a rate slightly faster than air conditioning stock efficiency. While cooling intensity is increasing, aggregate cooling consumption is still relatively small given the temperate summer weather conditions. Figure 6 shows residential end-use intensities aggregated into heating, cooling, base, and total intensity.

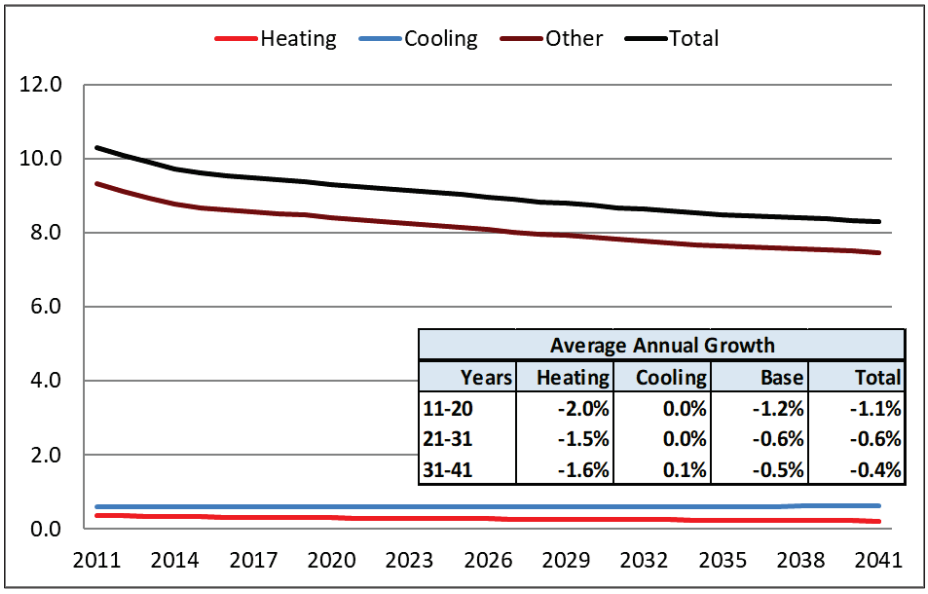
Figure 6: Residential End-Use Indices (kWh per Household)



Average Annual Growth				
Years	Heating	Cooling	Base	Total
11-20	-0.9%	0.0%	-0.5%	-0.5%
21-31	-0.7%	0.2%	-0.1%	-0.2%
31-41	-0.9%	0.7%	0.2%	0.1%

Figure 7 shows small C&I heating, cooling, and other use intensity trends. Intensities are expressed on a kWh per square foot basis. Small C&I heating and cooling intensities are relatively small in New England. Other use is composed of seven end-uses where the largest end-uses include ventilation, lighting, refrigeration, and miscellaneous use.

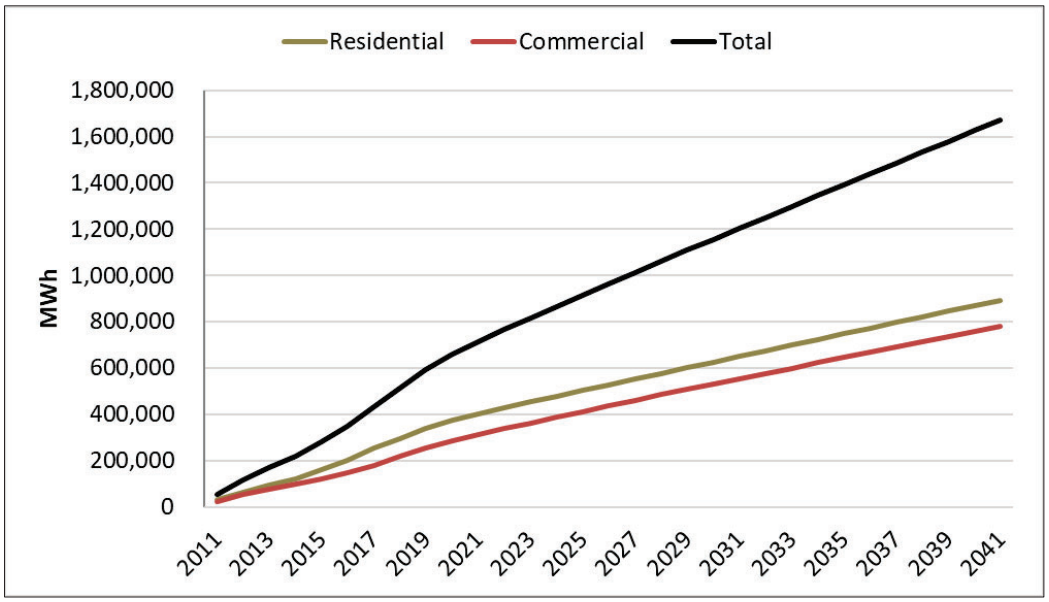
Figure 7: Small C&I End-Use Intensities (kWh/sqft)



Average Annual Growth				
Years	Heating	Cooling	Base	Total
11-20	-2.0%	0.0%	-1.2%	-1.1%
21-31	-1.5%	0.0%	-0.6%	-0.6%
31-41	-1.6%	0.1%	-0.5%	-0.4%

Energy Efficiency Program Savings. EIA incorporates the impact of regional (New England) energy efficiency (EE) programs by incentivizing the adoption of more efficient technologies in the end-use choice models. Additional savings from Vermont EE program activity are captured by incorporating historical and projected DSM savings as model variables. The DSM variables are constructed by cumulating EE savings over the historical and into the forecast period. Historical program savings are derived from Efficiency Vermont's *Savings Claim Summary* reports, and future savings provided by Efficiency Vermont reflect the state's most recently approved efficiency program budget. Historical and forecasted savings are scaled down to reflect GMP's share of state electric sales. Figure 8 shows the DSM model inputs.

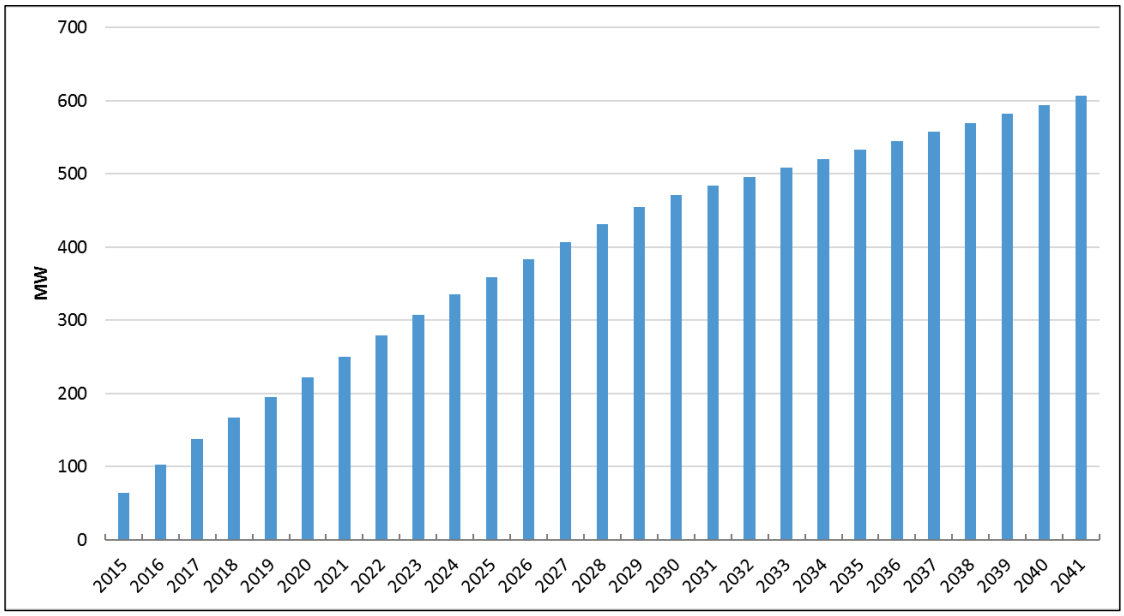
Figure 8: Cumulative EE Savings



2.3 Solar Load Impact

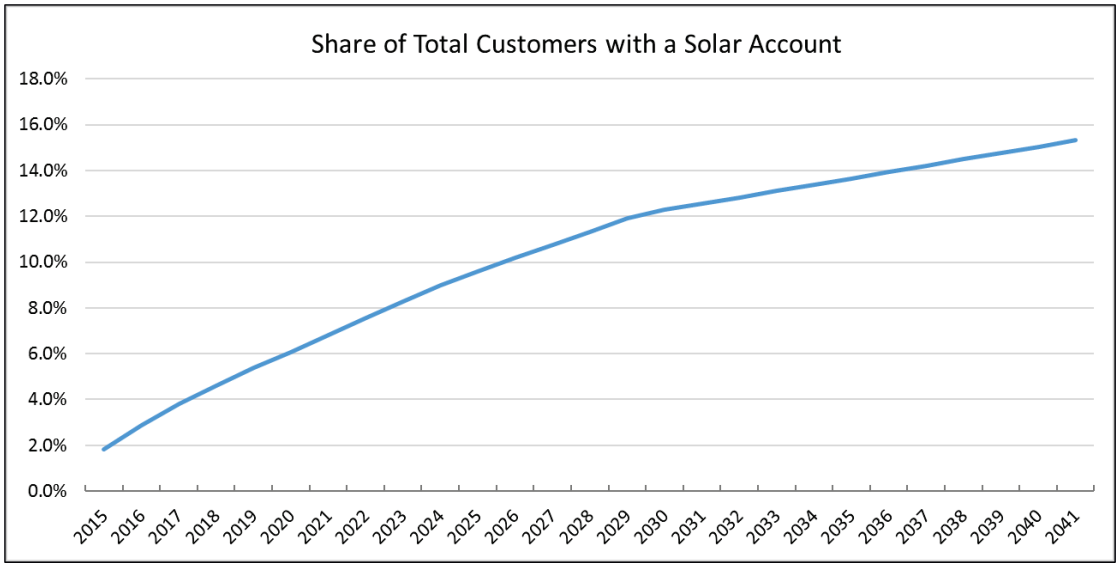
Solar Capacity Forecast. The behind the meter (BTM) solar capacity forecast is developed by GMP. At the end of 2020, an estimated 220 MW of BTM solar has been installed; this includes traditional, customer owned or leased roof-top systems, and larger community/group-based systems. GMP expects BTM solar to continue to increase at a strong pace adding 24 MW per year through 2030. Capacity growth slows after 2030 increasing at half the rate at 12 MW per year. By 2041 GMP projects over 600 MW of BTM solar capacity. Figure 9 shows the year-end capacity forecast.

Figure 9: Year-End Solar Capacity Forecast



Using current average installed capacity 13.7 kW per account (both residential and C&I), solar saturation increases from 6% of all customers in 2020 to over 15% by 2041. Figure 10 shows estimated BTM solar saturation projection.

Figure 10: BTM Solar Saturation



Capacity Class Allocation. The capacity forecast is allocated to the residential, small C&I, and large C&I classes based on the previous 12 months of billed solar generation data. Table 9 shows the allocation factors.

Table 9: Capacity Allocation Factors

Class	Previous 12 Mnth Generation (MWh)	Share of Total
Residential	84,977	31.7%
Commerical	151,173	56.3%
Industrial	32,282	12.0%
Total	268,431	

Solar Generation. Solar output is derived by applying monthly solar load factors to the capacity forecast; load factors are based on typical solar generation patterns developed by GMP. Table 10 shows the solar generation load factors.

Table 10: Solar Load Factors

Month	Load Factor
Jan	7.7%
Feb	10.8%
Mar	14.1%
Apr	18.8%
May	19.5%
Jun	20.6%
Jul	20.3%
Aug	19.5%
Sep	15.7%
Oct	12.5%
Nov	8.4%
Dec	5.7%

Solar Own-Use. Solar generation is either consumed onsite (*own-use*) or returned to the connected power-grid (*excess*); own-use reduces billed revenues, while excess is treated as power purchase cost. Solar billing data are used to determine the own-use and excess allocations. The split between own-use and excess varies by revenue class and month; own-use share is typically smaller in the summer months with a larger percentage of the generation sent to the grid. Figure 11 shows total, own use, and excess solar generation. Excess is significantly higher than own use. One reason is that most of small C&I solar

generation are purchases from large offsite solar installations that do not directly impact the customer's usage.

Figure 11: BTM Solar Generation

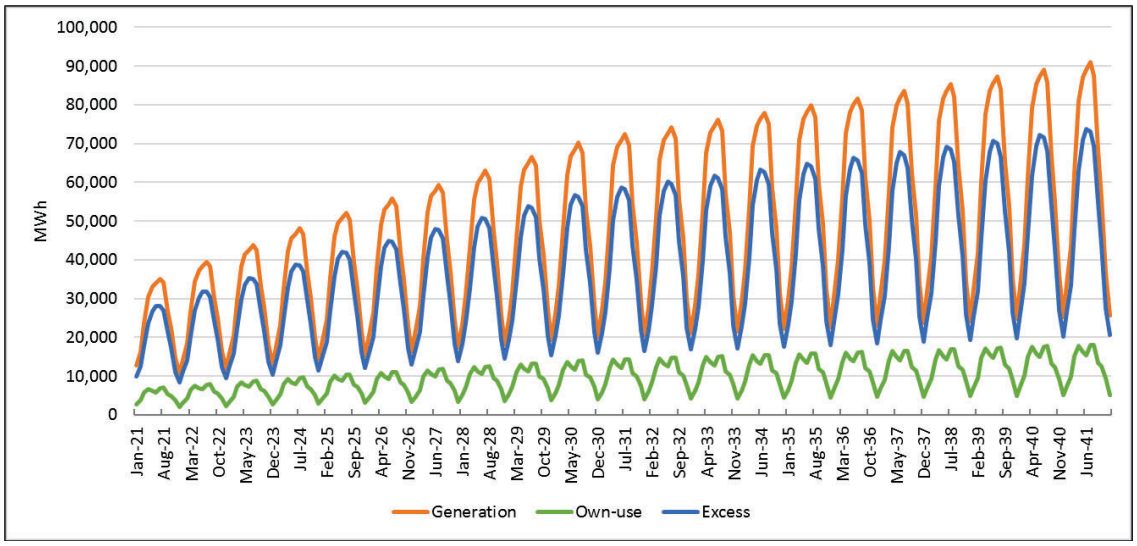


Table 11 shows the forecasted capacity and solar generation by rate case.

Table 11: Solar Generation

		Total			Residential			Commercial & Industrial		
Year	Year End Capacity (MW)	MWh Generation	MWh Excess	MWh Own Use	MWh Generation	MWh Excess	MWh Own Use	MWh Generation	MWh Excess	MWh Own Use
2021	250.5	293,733	232,668	61,065	94,826	33,343	61,483	198,907	199,324	-417
2022	278.9	330,753	261,996	68,757	106,777	37,549	69,228	223,976	224,447	-471
2023	307.3	366,688	290,461	76,227	118,378	41,626	76,752	248,310	248,835	-525
2024	335.7	403,540	319,636	83,905	130,275	45,787	84,488	273,265	273,849	-583
2025	359.5	436,889	346,071	90,818	141,041	49,591	91,450	295,848	296,480	-632
2026	383.3	467,121	370,019	97,103	150,801	53,021	97,779	316,320	316,997	-677
2027	407.1	497,360	393,972	103,388	160,563	56,453	104,110	336,797	337,519	-722
2028	431.0	528,658	418,741	109,917	170,667	59,976	110,690	357,991	358,764	-773
2029	454.8	557,828	441,871	115,958	180,084	63,314	116,769	377,745	378,556	-812
2030	471.5	587,500	465,381	122,119	189,663	66,694	122,968	397,838	398,687	-849
2031	483.7	606,538	480,466	126,072	195,809	68,849	126,959	410,729	411,617	-887
2032	496.0	623,386	493,785	129,601	201,248	70,728	130,520	422,138	423,056	-918
2033	508.3	637,708	505,157	132,551	205,871	72,386	133,485	431,836	432,770	-934
2034	520.6	653,293	517,502	135,791	210,903	74,155	136,748	442,390	443,347	-957
2035	532.8	668,878	529,847	139,030	215,934	75,923	140,011	452,944	453,924	-980
2036	545.1	685,854	543,264	142,589	221,414	77,813	143,601	464,439	465,451	-1,012
2037	557.4	700,048	554,538	145,510	225,997	79,460	146,536	474,051	475,078	-1,026
2038	569.7	715,633	566,883	148,749	231,028	81,229	149,799	484,605	485,654	-1,050
2039	582.0	731,217	579,229	151,989	236,059	82,997	153,062	495,158	496,231	-1,073
2040	594.2	748,321	592,744	155,577	241,581	84,899	156,682	506,740	507,846	-1,105
2041	606.5	762,387	603,919	158,468	246,122	86,534	159,587	516,266	517,385	-1,119

The sales forecast is adjusted for solar load impacts by subtracting cumulative new solar own-use generation from the appropriate class sales forecasts. By 2030, solar generation reduces residential sales by an additional 122,968 MWh,

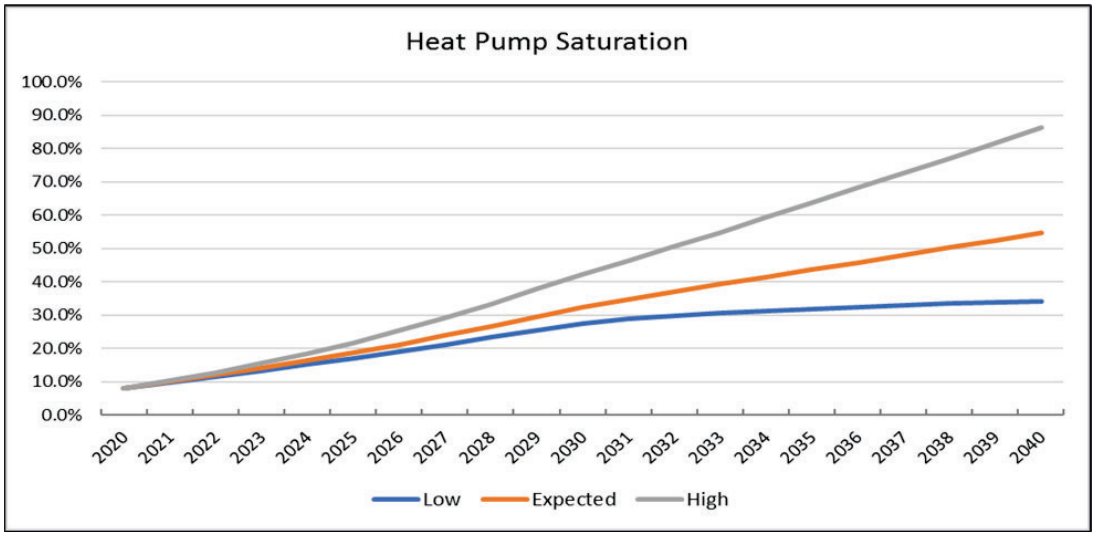
which represents a reduction of 536 kWh per customer. C&I solar impacts are relatively small as most of the C&I solar generation is treated as excess generation that shows up as a reduction in system energy requirements.

2.4 Tier 3 Electrification Impacts

State Tier 3 objectives are designed to reduce greenhouse gases with a large part of that effort through statewide electrification programs. The largest program is an incentive program promoting adoption of cold-climate heat pumps.

The heat pump forecast is based on the state-level forecast developed by Vermont Efficiency Investment Corporation (VEIC) and Department of Public Service (DPS) staff. VEIC and DPS developed low, medium, and high case projections; these forecasts are incorporated in the 2020 Vermont Electric Power Company (VELCO) IRP forecast. Figure 12 show saturation projections.

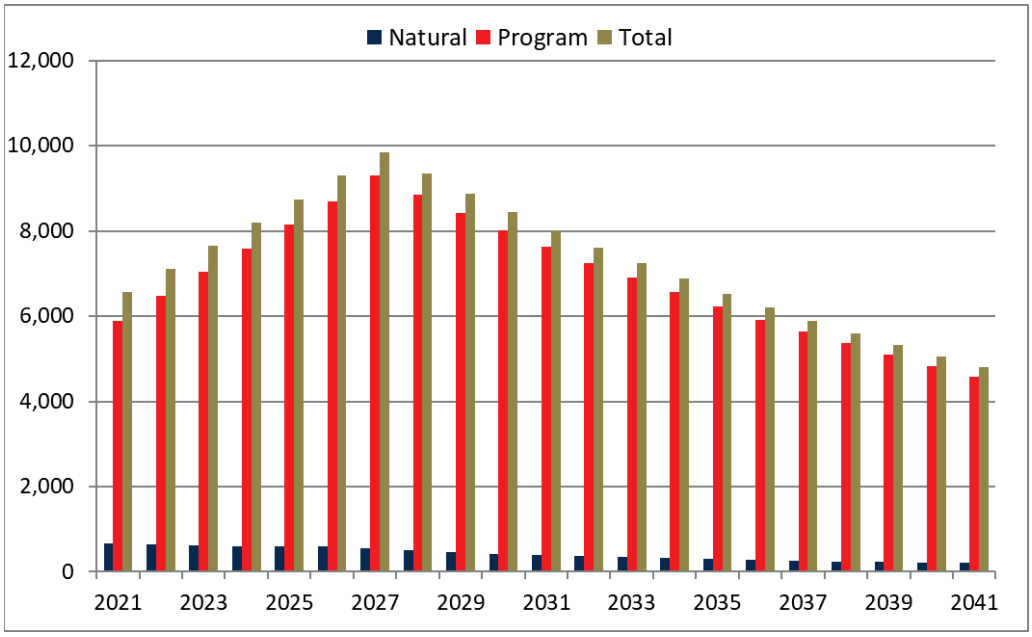
Figure 12: Heat Pump Program Forecast



The GMP forecast is based on the *expected* case. In the expected case, 30% of residential customers have heat pumps by 2030 and 50% of households by 2040 have either whole-house or auxiliary heat-pump units.

A small share of the heat pump program forecast is already captured in the end-use model. To avoid double counting, units sold through the heat-pump program are reduced by the number of units captured in the forecast model. Figure 13 shows net unit heat pump adoptions.

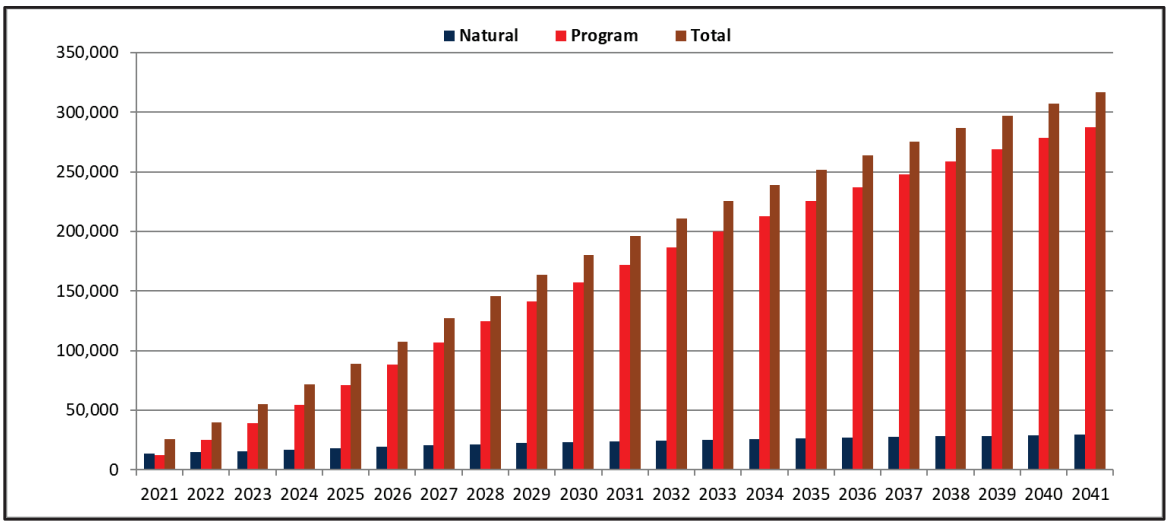
Figure 13: Cold-Climate Heat Pump Net Unit Adoption (units)



Net units decline in the out years, as by this point some heat pump unit sales are replacing older, less efficient heat pumps.

Annual heat pump energy projections are based on the GMP input based in turn on 2017 Cadmus heat pump study for Vermont. Cadmus estimated heat pumps on average use 2,085 kWh per year for heating and 146 kWh per year for cooling. Heat pump use declines over the forecast period with improvements in heat pump efficiency. Heat pump electricity sales are derived by multiplying the net heat pump unit forecast with the winter and summer heat-pump annual usage. Electricity use from market-driven heat pump adoption are captured in the baseline forecast models. Figure 14 shows projected heat pump sales.

Figure 14: Heat Pump Sales (MWh)



Based on unit projections and heat pump annual average use, the heat pump program is expected to add 150,000 MWh in sales by 2030 and over 300,000 MWh by 2040.

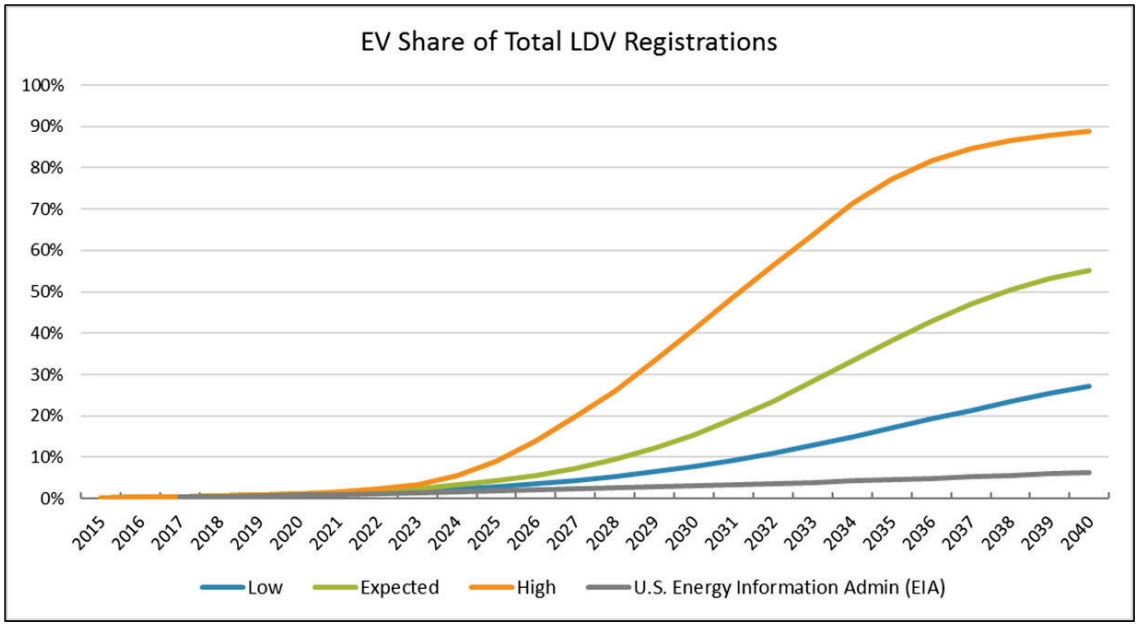
The C&I Tier 3 sales are relatively small. Total Tier 3 sales reach 25,736 MWh by 2030 and is kept at the same level through 2041. Tier 3 C&I sales include a small amount of program-related heat-pump sales and several customer-specific electrification projects.

2.5 Electric Vehicle Forecast

As of July 2020, Vermont had approximately 4,000 registered plug-in hybrid (PHEV) and all battery electric (BEV) vehicles. While still relatively low percent of new car sales, demand is expected to significantly increase over the next five years with declining vehicle costs, longer lasting batteries, improving infrastructure, and new vehicle models. EV investment commitments from GM, Volkswagen, Ford, and other major vehicle manufacturers along with new federal policy promoting electric vehicles all but guarantee strong growth in electric vehicle sales. There are dozens of new models coming into the market including this year's Ford Mustang, GMC Hummer, and Volkswagen's new ID.4 SUV.

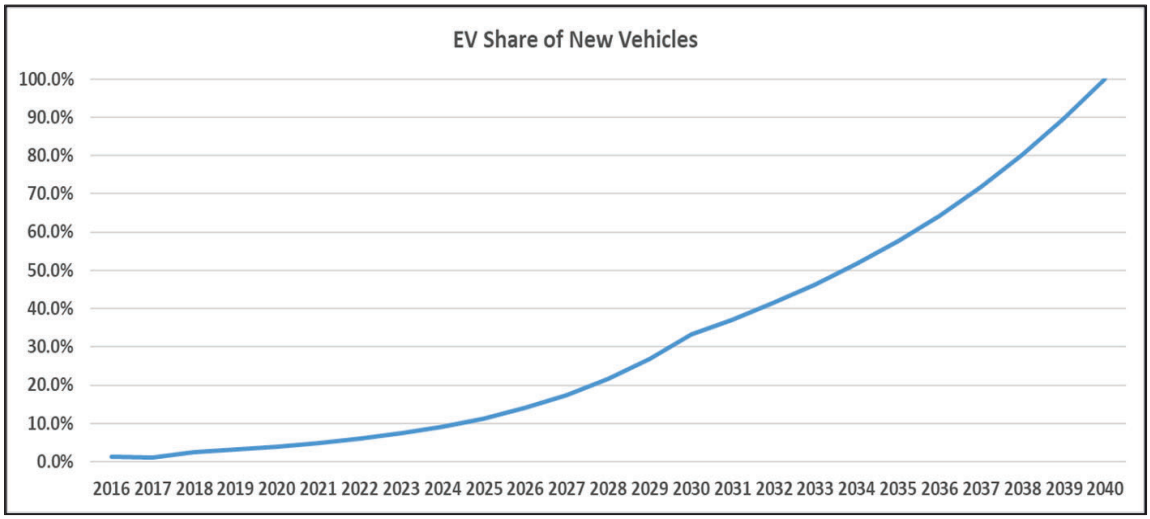
The EV sales forecast is based on VEICs most current EV projections. The VEIC forecast was updated as part of VELCO's 2020 IRP forecast. Figure 15 shows EV share of total vehicle stock.

Figure 15: EV Saturation Forecast



Projections show low, expected, and high saturation scenarios and in addition, EIA's saturation projections. EIA's current projection is significantly more conservative than nearly all other EV projections. The GMP forecast is based on VEIC's expected saturation path. Figure 16 shows how the saturation projection translates into share of new purchases.

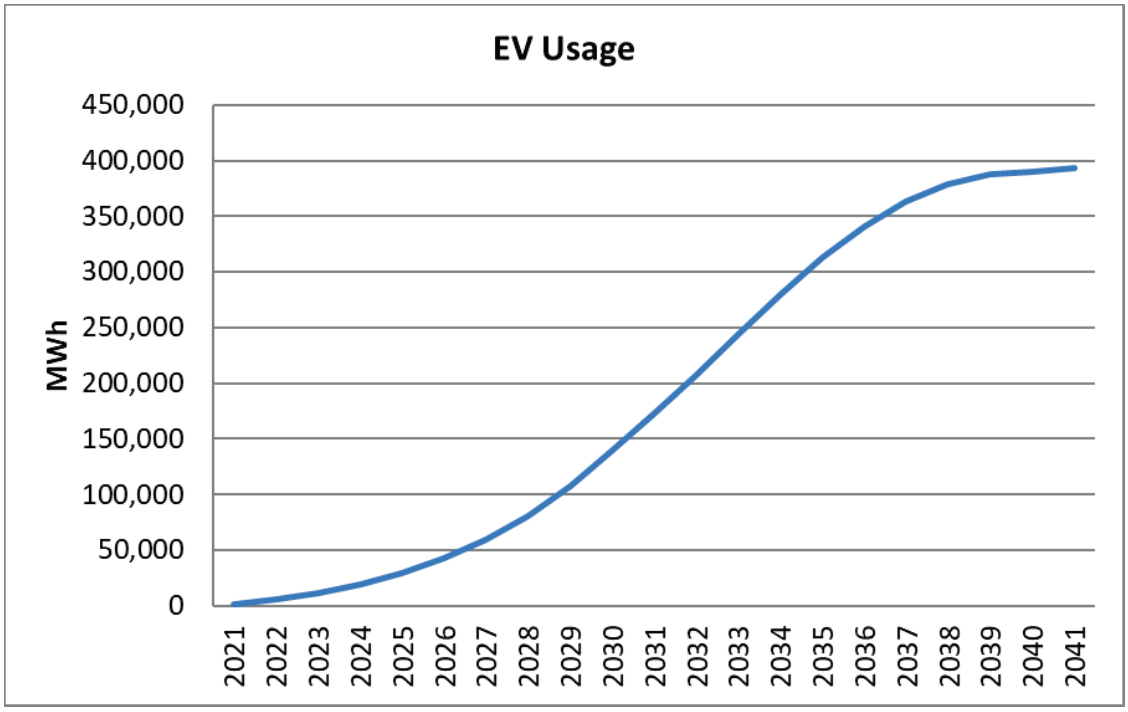
Figure 16: New Vehicle Purchases



By 2030, one in three vehicle purchases are expected to be electric. This is consistent with the most recent BloombergNEF forecast. By 2041, nearly all new vehicle purchases are electric.

Figure 17 shows the GMP electric vehicle sales forecast. Inputs include number of EVs, average annual miles driven, and miles per kWh.

Figure 17: Electric Vehicle Sales



2.6 Customer Specific Load Adjustments

Forecasts are adjusted for specific customer business activity that result in large changes in load; this load change would not be captured in historical data series, and as a result not captured in the forecast models. The spot load adjustment is relatively small at 10,929 MWh.

The largest load adjustment is for the loss of GlobalFoundries as a retail customer; their sales are a third of Large C&I class sales. GlobalFoundries is dropped from the retail sales forecast beginning October 2026.

2.7 Baseline Forecast Models

Baseline sales forecasts are derived from estimated linear regression models that relate monthly historical sales to economic conditions, price, weather conditions, end-use energy intensity trends, and EE program savings.

Separate forecast models are estimated for the primary revenue classes. Models are estimated for the following:

- Residential
- Small C&I
- Large C&I
- Other

Residential and small C&I models are constructed using an SAE modeling framework. This approach entails constructing generalized end-use variables (Heating, Cooling, and Other Use) that incorporate expected end-use saturation and efficiency projections as well as price, economic drivers, and weather. The SAE specification allows us to directly capture the impact of improving end-use efficiency and end-use saturation trends on class sales.

2.7.1 Residential Sales Model

The residential forecast is generated using separate average use and customer forecast models. The average use model is estimated using an SAE specification where monthly average use is estimated as a function of a heating variable (*XHeat*), cooling variable (*XCool*) and other use variable (*XOther*) as shown below:

$$AvgUse_m = a + b_1 \times XHeat_m + b_2 \times XCool_m + b_3 \times XOther_m + b_4 \times DSM + \varepsilon_m$$

XHeat is calculated as a product of a variable that captures changes in heating end-use saturation and efficiency (HeatIndex), economic and other factors that impact stock utilization (HDD, household size, household income, and price). *XHeat* is calculated as:

$$XHeat_{y,m} = HeatIndex_y \times HeatUse_{y,m}$$

Where:

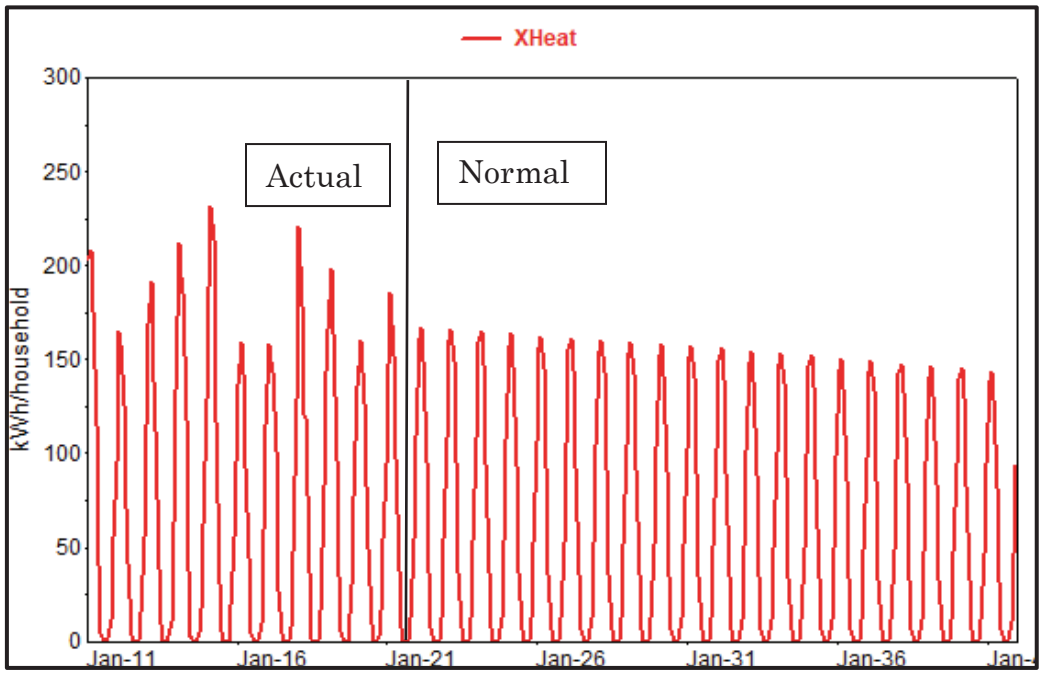
$$HeatUse_{y,m} = \left(\frac{HDD_{y,m}}{HDD_{09}}\right) \times \left(\frac{HHSize_y}{HHSize_{09}}\right)^{0.20} \times \left(\frac{Income_y}{Income_{09}}\right)^{0.20} \times \left(\frac{\text{Pr}\,ice_{y,m}}{\text{Pr}\,ice_{09}}\right)^{-0.10}$$

The heat index is a variable that captures heating end-use efficiency and saturation trends, thermal shell improvement trends, and housing square footage trends. The index is constructed from the EIA's annual end-use

residential forecast for the New England census division. The economic and price drivers are incorporated into the HeatUse variable. By construction, the $HeatUse_{y,m}$ variable sums close to 1.0 in the base year (2015). This index value changes through time and across months in response to changes in weather conditions, prices, household size, and household income.

The heat index (*HeatIndex*) and heat use variable (*HeatUse*) are combined to generate the monthly heating variable XHeat. Figure 18 shows the calculated XHeat variable.

Figure 18: XHeat Variable



The strong decline in the XHeat is largely driven by decline in resistance heat and improvements in heat pump efficiency. Program-related heat pump electricity sales are added to the baseline forecast.

Similar variables are constructed for cooling (*XCool*) and other end-uses (*XOther*).

Figure 19 and Figure 20 show XCool and XOther.

Figure 19: XCool Variable

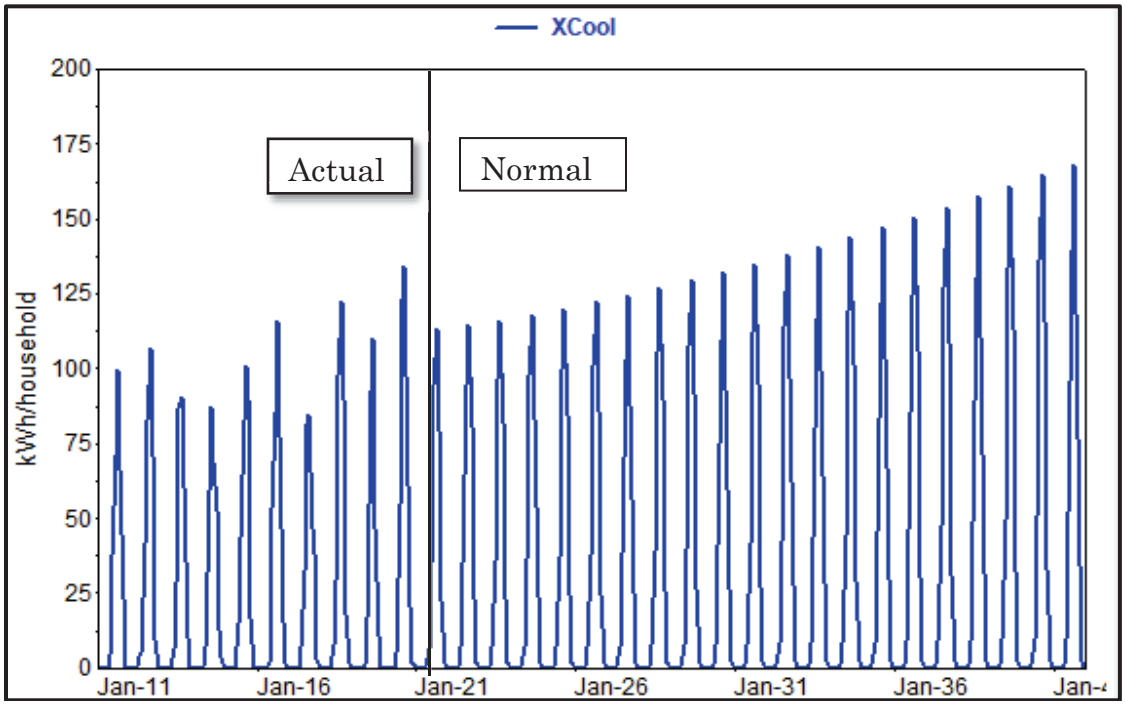
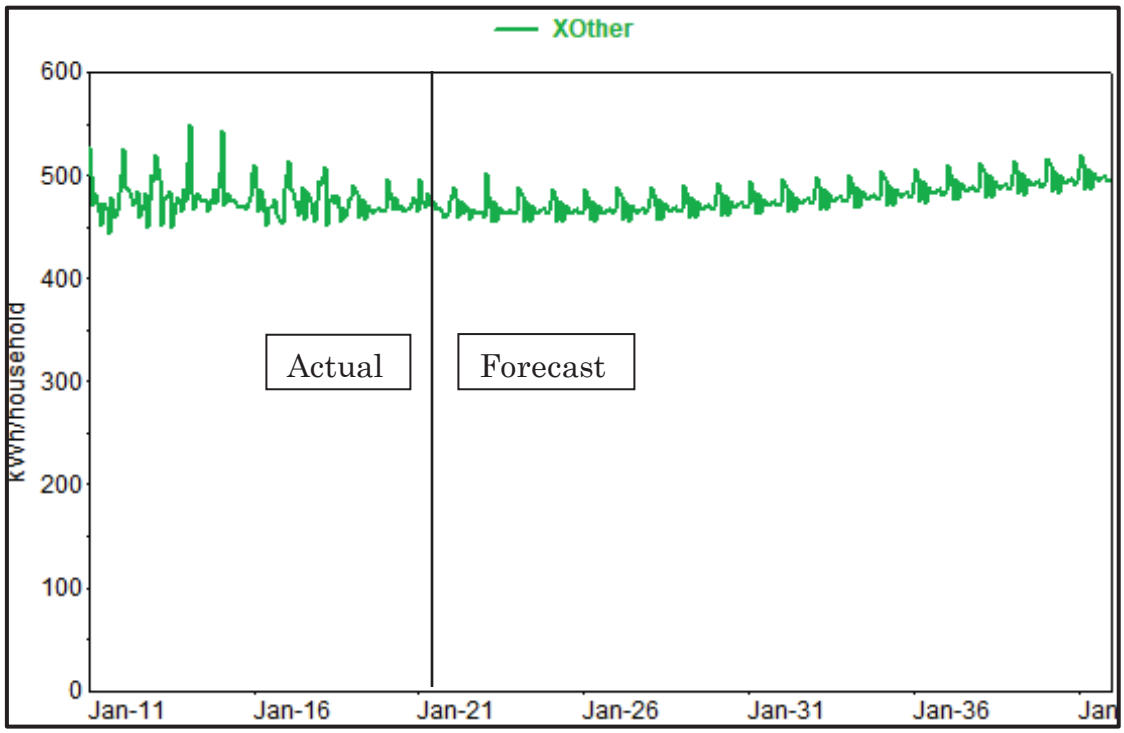


Figure 20: XOther Variable

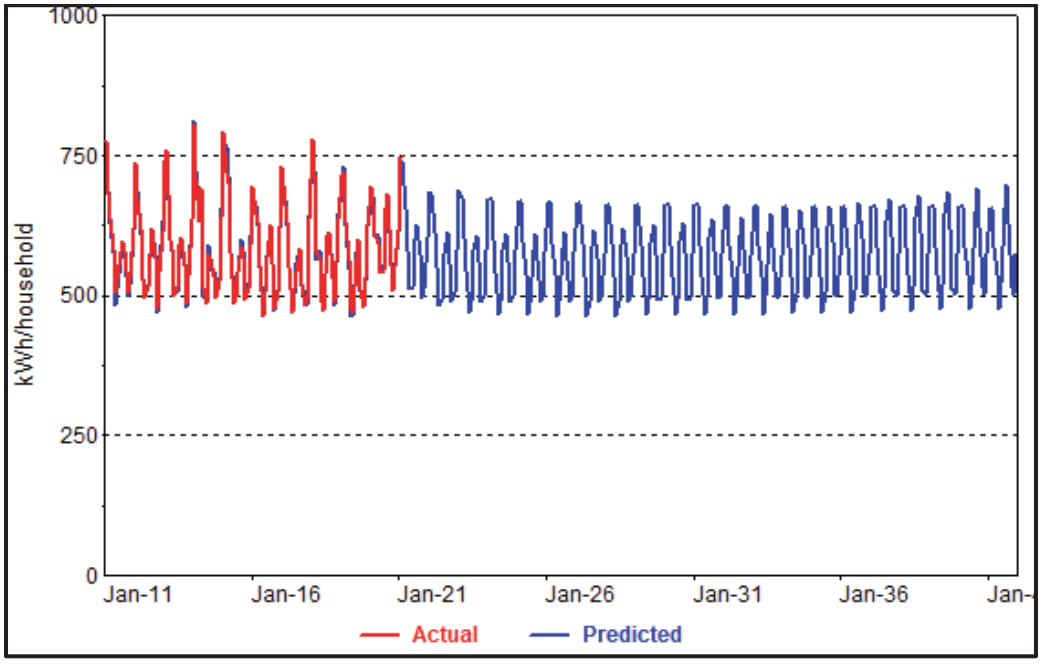


While cooling intensity is relatively small, cooling per household increases over the forecast period largely as a result of increasing air conditioning and heat pump saturation.

XOther (non-weather sensitive use) declines over the forecast period. The monthly variation in XOther reflects variation in the number of monthly billing days, lighting requirements, and monthly variation in water heater and refrigerator use. End-use intensities across non-weather sensitive end-uses are declining and, as a result, XOther also declines driving total average use downwards.

The end-use variables are used to estimate the residential average use model. Figure 21 shows actual and predicted residential average use.

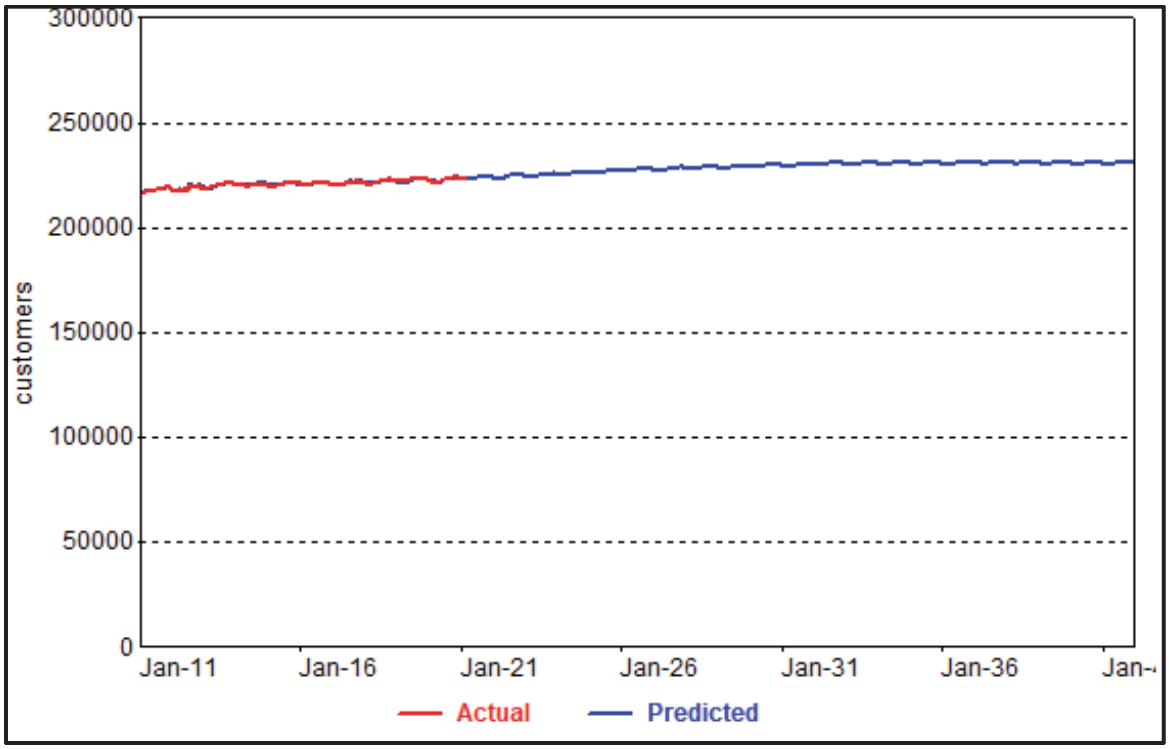
Figure 21: Residential Average Use



The model explains historical monthly sales variation well with an Adjusted R-Squared of 0.97 and a MAPE of 1.7%.

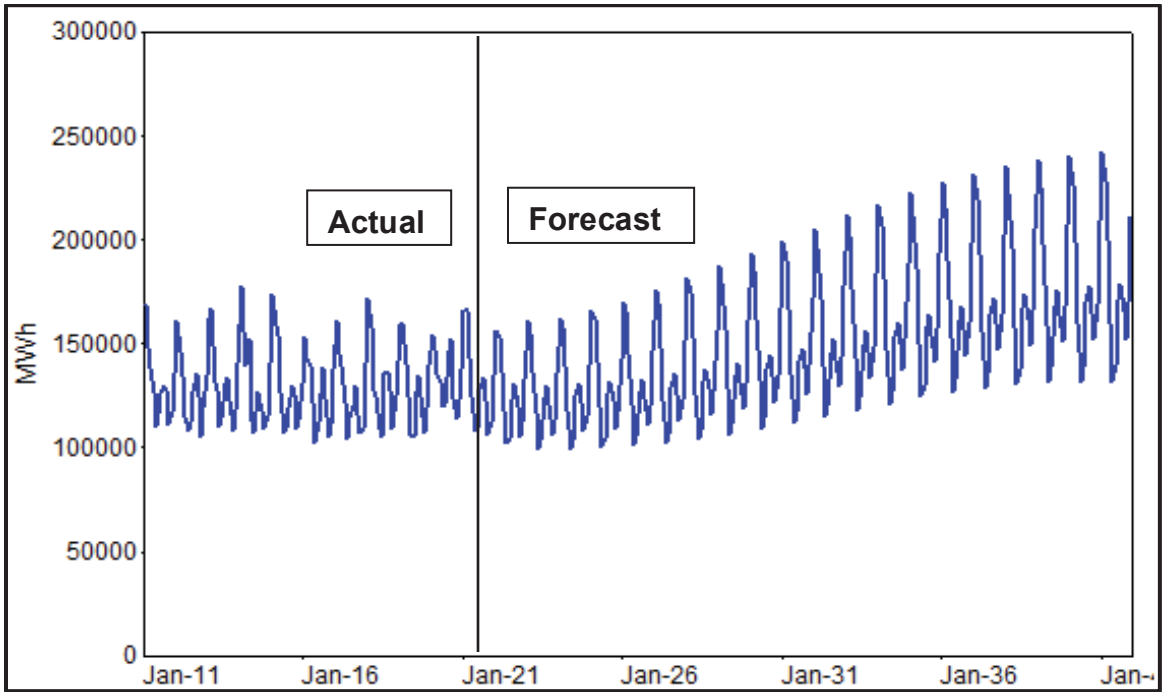
Residential customer projections are based on state household projections. The models explain historical customer growth well with an Adjusted R-Squared of 0.96 and MAPE of 0.1%. Figure 22 shows actual and predicted customers for GMP.

Figure 22: Residential Customer Forecast



Customer and average use forecasts are combined to generate monthly billed sales forecast. Figure 23 shows the monthly residential sales forecast.

Figure 23: Residential Sales Forecast



The strong increase in sales after 2023 is first driven by expected increase in cold climate heat pump sales and later by electric vehicle market growth.

2.7.2 Small C&I Model

The small C&I model is also based on SAE specification.

The SAE small C&I model captures the impact of changing end-use intensity as well as economic conditions, price, and weather in the constructed model variables. As in the residential model, end-use variables XHeat, XCool, and XOther are constructed from end-use saturation and efficiency trends, regional output, price, and weather conditions. The small C&I SAE model is defined as:

$$ComSales_m = a + b_1 \times XHeat_m + b_2 \times XCool_m + b_3 \times XOther_m + b_4 \times DSM + \varepsilon_m$$

The SAE model variables are constructed similarly to that of the residential model, the primary difference is that the end-use intensities are measured on a kWh per square foot basis (vs. kWh per household in the residential model), and output and employment are used to capture economic activity (vs. household income and population in the residential model).

The GMP small C&I class is forecasted using a total sales model where XCool is defined as:

$$XCool_{y,m} = CoolEI_y \times CoolUse_{y,m}$$

Where:

$$CoolUse_{y,m} = \left(\frac{CDD_{y,m}}{CDD_{09}}\right) \times \left(\frac{ComVar_y}{ComVar_{09}}\right) \times \left(\frac{\text{Price}_{y,m}}{\text{Price}_{09}}\right)^{-0.10}$$

.

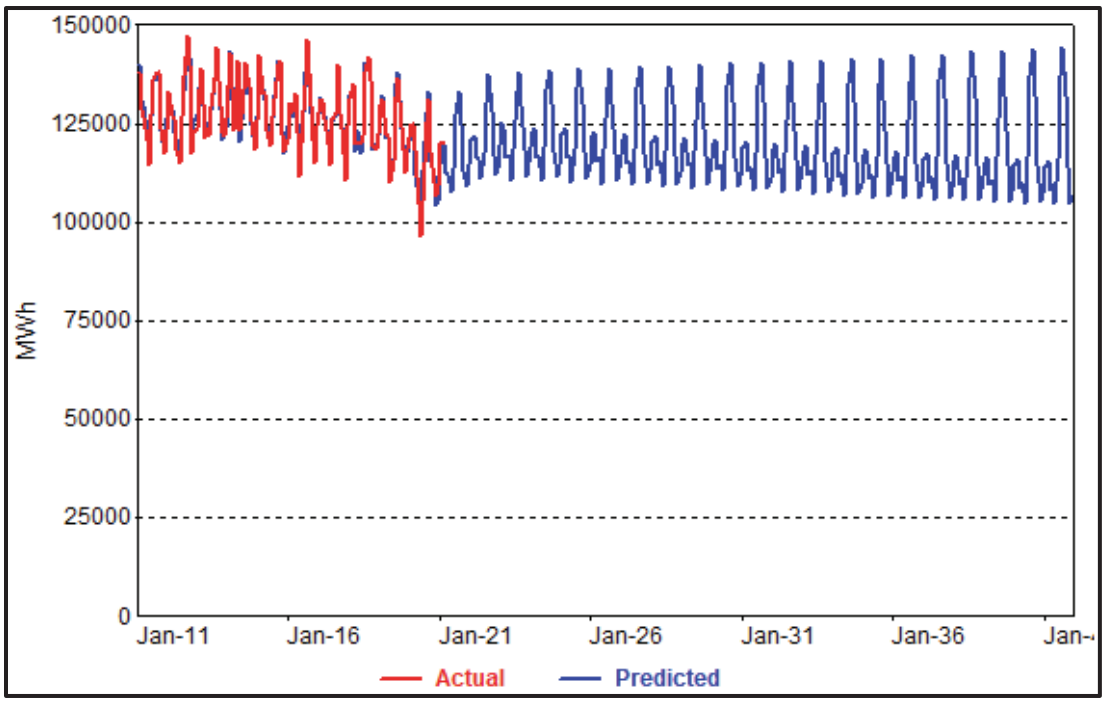
And

$$ComVar_{y,m} = \left(\frac{Emp_{y,m}}{Emp_{09}}\right)^{0.25} \times \left(\frac{GDP_{y,m}}{GDP_{09}}\right)^{0.25} \times \left(\frac{HHs_{y,m}}{HHs_{09}}\right)^{0.50}$$

In the constructed economic variable output and employment are weighted equally reflecting the relationship between economy and sales in the last five years.

A monthly variable is constructed for heating (XHeat) and other use (XOther) similarly to XCool. The model variables are used to drive total sales through an estimated monthly regression model. Figure 24 shows the small C&I sales model results.

Figure 24: Small C&I Sales Forecast



This model fits small C&I data well with an Adjusted R-Squared of 0.94 and model MAPE of 1.4%. Model statistics can be found in the Appendix A.

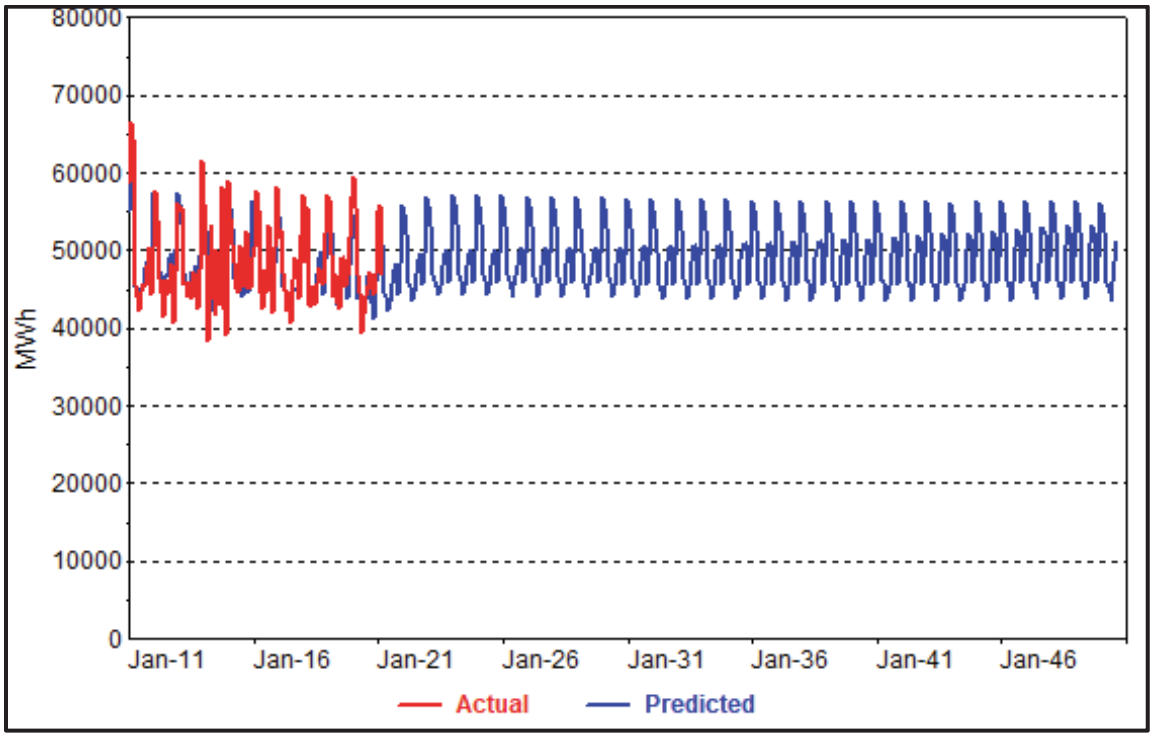
2.7.3 Large C&I Model

Large C&I sales are estimated using a generalized (vs. SAE model) model specification that is driven by economic projections. The economic variable includes both manufacturing employment projections and state GDP where 60% of the weight is on manufacturing employment. The constructed economic variable is summarized below:

$$IndVar_{y,m} = \left(\frac{ManEmp_{y,m}}{ManEmp_{09}}\right)^{0.60} \times \left(\frac{GDP_{y,m}}{GDP_{09}}\right)^{0.40}$$

Seasonal load variation is captured through a set of monthly binary variables. The large C&I model excludes GlobalFoundries and OMYA sales as GMP provides an independent forecast for these customers based on their input. Figure 25 shows actual and predicted large C&I sales.

Figure 25: Large C&I Sales Forecast

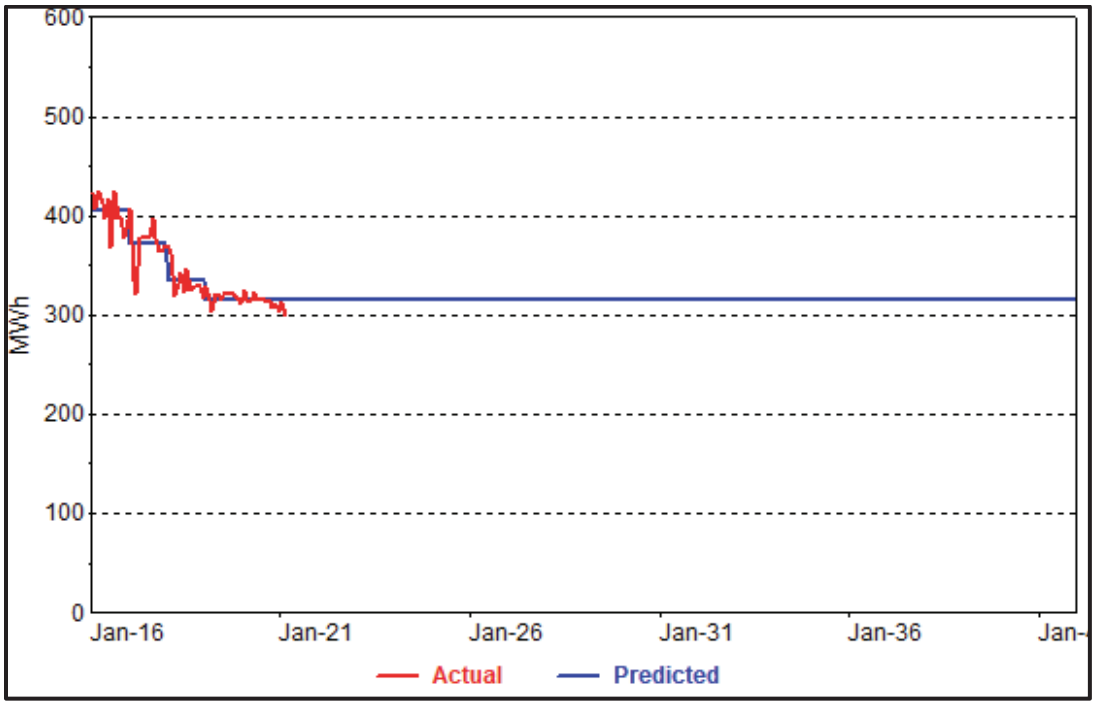


This model Adjusted R-Squared is 0.72 and the MAPE is 4.3%. The lower, relative to other models, Adjusted R-Square is due to the large variation in monthly billed sales data. There is significant month-to-month variation driven by customer-specific activity and billing adjustments that cannot be totally accounted for by economic drivers and weather conditions.

2.7.4 Other Use

Other Use sales are estimated using a simple regression model constructed to capture seasonal effects and shifts in the data. This class is dominated by street lighting, but also includes a small amount of other public authority sales. GMP has seen a significant drop in street lighting sales as existing lamps were replaced with high efficiency lamps. We project flat sales after the savings adjustments. Figure 26 shows actual and forecasted sales for this revenue class.

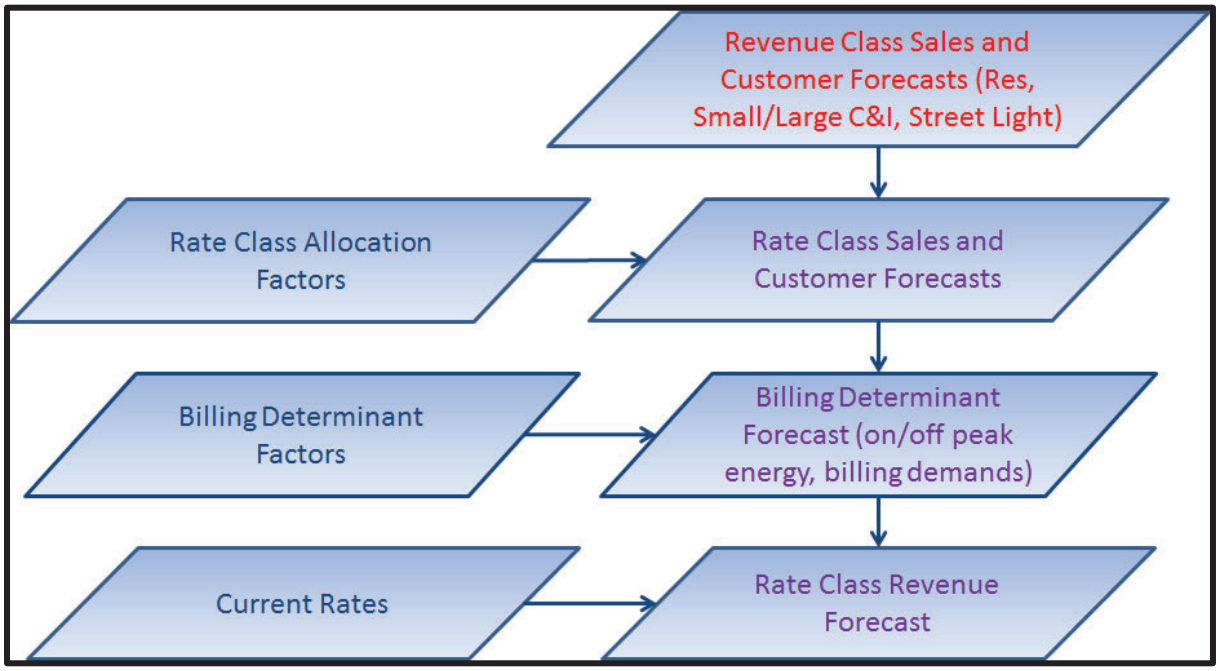
Figure 26: Other Sales Forecast (MWh)



2.8 Revenue Forecast

The revenue forecast is derived at the rate schedule level. Class sales forecasts are allocated to rate schedules and within rate schedules to billing determinants (i.e., customer, on and off-peak use, and billing demands). Revenues are then generated by multiplying rate schedule billing determinants by the current tariff rates. Figure 27 provides an overview of the revenue model.

Figure 27: Revenue Model



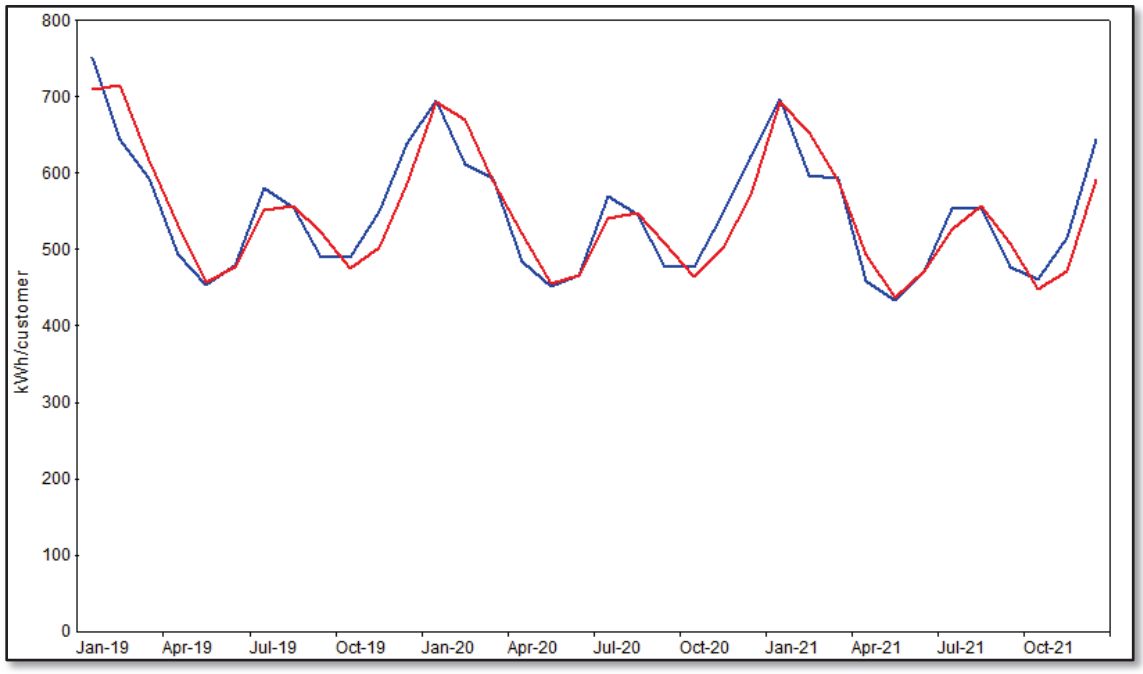
The process is described below.

2.8.1 Calendarize class sales forecast

The estimated models are based on monthly billed sales data. As such the forecast is also on a billed sales basis. For financial analysis and revenue projections sales are converted to a calendar-month basis.

The billing-month spans across calendar-months. In general, the billing month includes the last two weeks of the prior month and the first two weeks of the current month. The September billing-month for example includes the last half of August and the first half of September. The billing month period is determined by the meter read schedule. We use the meter-read schedule to construct monthly HDD and CDD (cycle-weighted degree-days) and number of billing days that are consistent with the billing month period. Utilities report revenues and costs on a calendar-month basis. A MetrixND Simulation Object is used to convert billed sales to calendar sales. This is done by replacing billing-month normal HDD and CDD with calendar-month normal HDD and CDD and replacing the number of billing days with the number of calendar days. Figure 28 shows the result of this simulation for the residential sales class.

Figure 28: Comparison of Billed and Calendar-Month Average Use

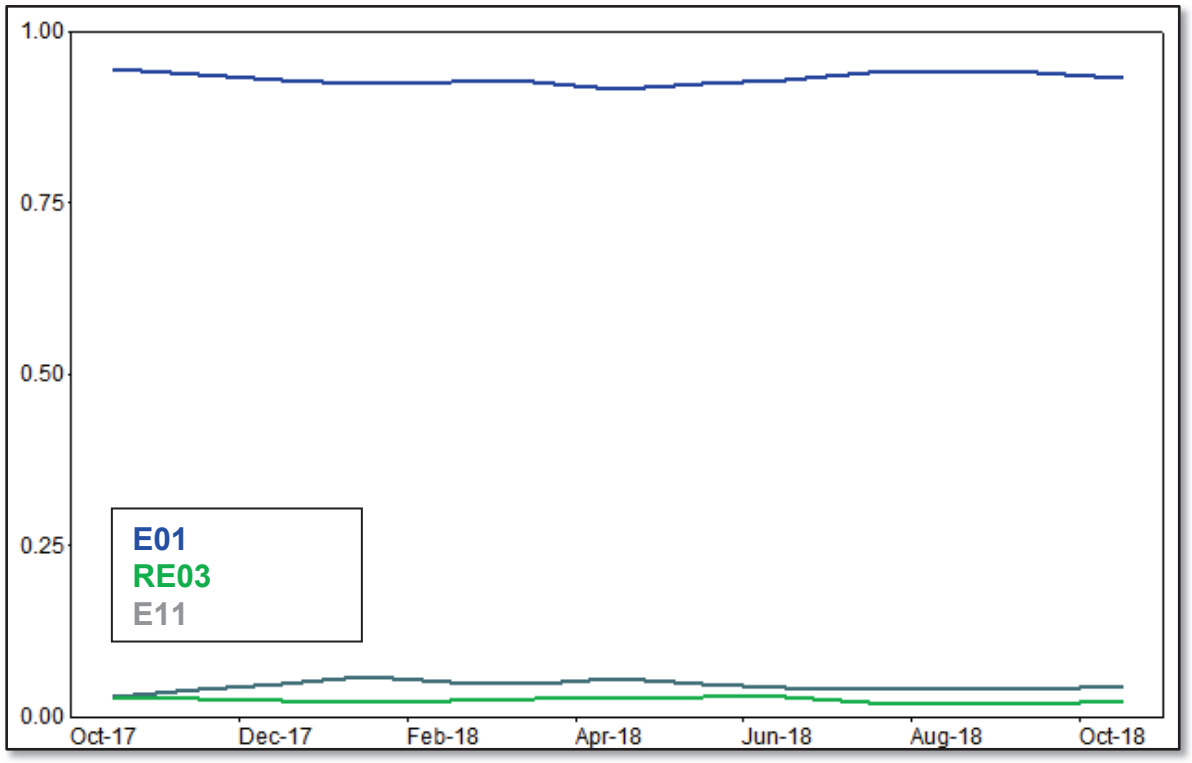


The red line is the forecasted baseline average residential use on a billing month basis and the blue line shows the forecast on a calendar-month basis.

2.8.2 Derive Rate Class Monthly Sales Forecast

Revenue class sales and customer forecasts are first allocated to the underlying rate schedules based on projected monthly allocation factors. The allocation factors are derived from historical billing data and simple regression models that allow us to capture any seasonal variation in the rate class shares. Residential class sales, for example, are allocated to rate schedules - E01, RE03, and E11 rate classes. Figure 29 shows historical and forecasted residential rate class sales shares.

Figure 29: Residential Rate Class Share Forecast



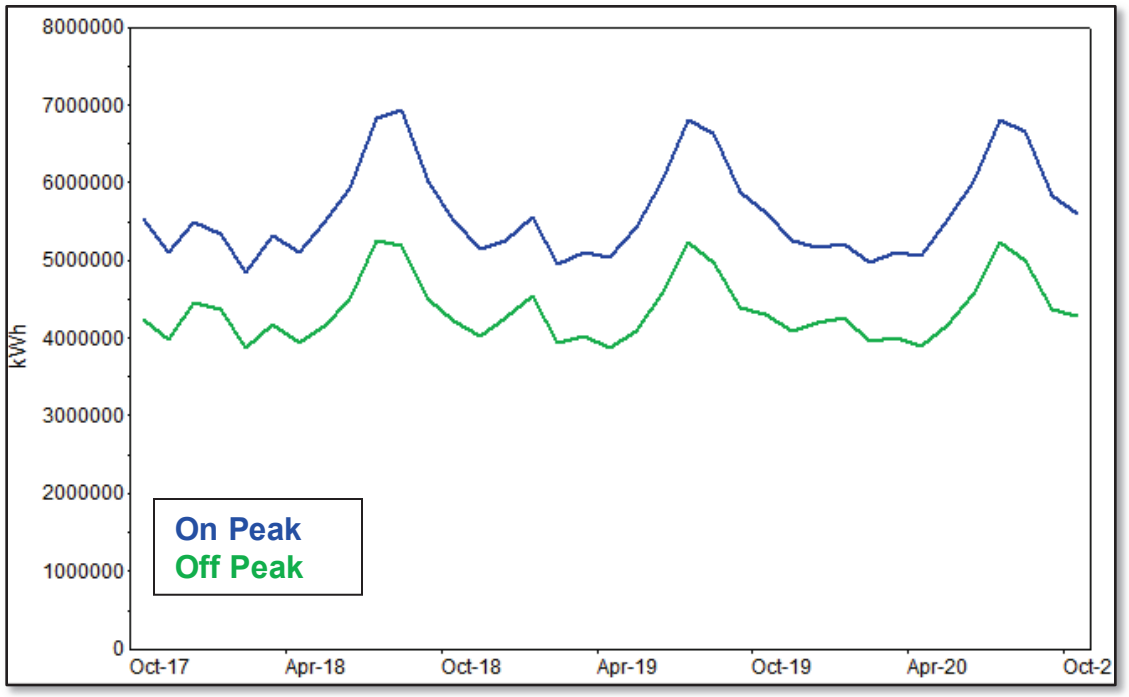
Approximately 95% of residential sales are billed under rate E01. The percentage is slightly lower in the winter months as the electric time-of-use rate (E11) is higher in these months.

2.8.3 Estimate monthly billing determinants.

In the next step, rate class sales (and customers counts for some rates) are allocated to billing blocks, time-of-use billing periods, and on and off-peak billing demand blocks. Billing block and demand factors are derived from historical billing data. For example, residential rate E11 has on-peak and off-peak energy billing periods that are priced differently. Rate E11 monthly sales are allocated to TOU periods based on historical on-peak and off-peak sales data.

Some of the rates are complex. The small C&I rate E65, for example, includes non-demand and demand billed sales and customers, load factor kWh blocks (for demand customers), and different demand charges for demand for on/off peak, which are scheduled to replace block rates within the next two years. Figure 30 shows the resulting sales block forecasts for rate E65 Demand Customers.

Figure 30: Rate E65 Demand Customer - Sales Billing Block Forecast

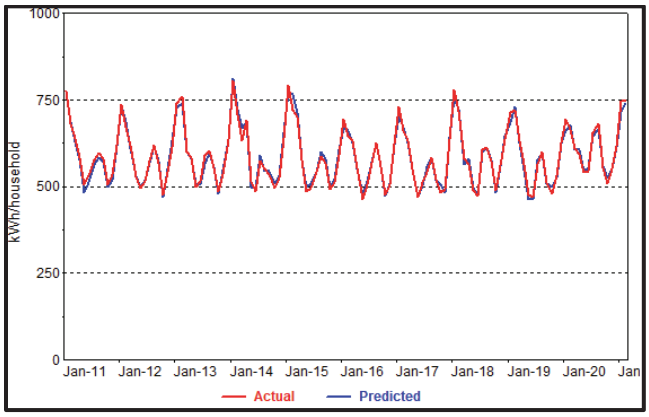


2.8.4 Calculate Rate Schedule and Revenue Class Revenues

Once the billing determinants are derived, revenues are generated by multiplying the forecasted billing determinants by the current customer, energy, and demand charges. Revenues are aggregated by rate schedule and month. Rate schedule revenues are then aggregated to revenue classes: residential, small C&I, large C&I, and street lighting.

APPENDIX A: MODEL STATISTICS AND COEFFICIENTS

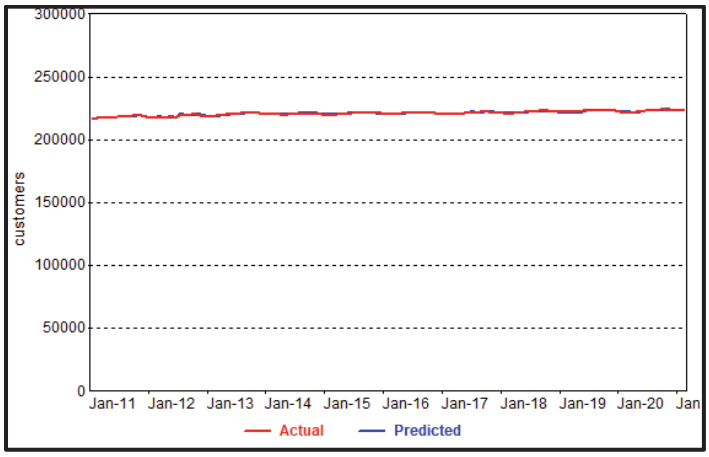
Figure 31: Residential Average Use Model



Variable	Coefficient	StdErr	T-Stat	P-Value
mStructRevRes.XHeat	1.338	0.035	37.732	0.00%
mStructRevRes.XCool	1.489	0.061	24.232	0.00%
mStructRevRes.XOther	0.977	0.012	82.353	0.00%
mSales.Savings_PC	-0.12	0.042	-2.83	0.56%
Covid.ResIndex	28.116	3.744	7.51	0.00%
mBin.Mar	-25.904	4.881	-5.307	0.00%
mBin.Apr	-32.337	5.278	-6.127	0.00%
mBin.May	-19.145	5.555	-3.447	0.08%
mBin.Jun	-17.051	5.142	-3.316	0.13%
mBin.Nov	-9.508	4.669	-2.036	4.42%
mBin.FebMar11	-49.425	11.246	-4.395	0.00%
mBin.Apr14	105.693	14.58	7.249	0.00%
AR(1)	0.22	0.1	2.197	3.02%

Model Statistics	
Iterations	11
Adjusted Observations	121
Deg. of Freedom for Error	108
R-Squared	0.975
Adjusted R-Squared	0.972
AIC	5.329
BIC	5.63
Log-Likelihood	-481.1
Model Sum of Squares	789,729.15
Sum of Squared Errors	20,131.90
Mean Squared Error	186.41
Std. Error of Regression	13.65
Mean Abs. Dev. (MAD)	10.1
Mean Abs. % Err. (MAPE)	1.70%
Durbin-Watson Statistic	2.053

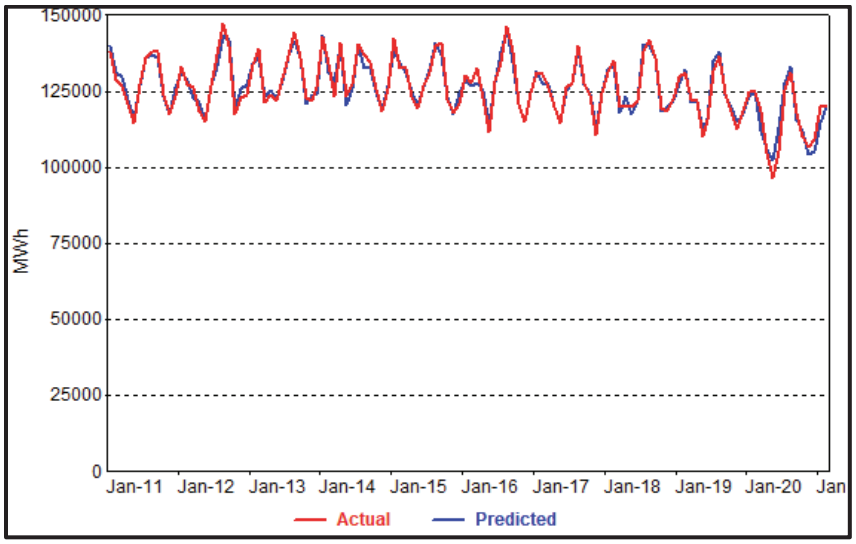
Figure 32: Residential Customer Model



Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	75240.567	20974.2	3.587	0.05%
Economics.HHs	554.043	79.477	6.971	0.00%
mBin.Jan	-834.474	161.651	-5.162	0.00%
mBin.Feb	-905.403	173.345	-5.223	0.00%
mBin.Mar	-831.559	174.944	-4.753	0.00%
mBin.Apr	-956.639	162.092	-5.902	0.00%
mBin.May	-450.3	129.507	-3.477	0.07%
mBin.Dec	-431.348	126.686	-3.405	0.09%
mBin.Jun12	-2028.957	364.332	-5.569	0.00%
mBin.Jul12	1066.404	356.932	2.988	0.35%
AR(1)	0.805	0.057	13.993	0.00%

Model Statistics	
Iterations	15
Adjusted Observations	121
Deg. of Freedom for Error	110
R-Squared	0.946
Adjusted R-Squared	0.942
AIC	12.059
BIC	12.313
F-Statistic	194.582
Prob (F-Statistic)	0
Log-Likelihood	-890.25
Model Sum of Squares	308,049,152.72
Sum of Squared Errors	17,414,504.44
Mean Squared Error	158,313.68
Std. Error of Regression	397.89
Mean Abs. Dev. (MAD)	289.32
Mean Abs. % Err. (MAPE)	0.13%
Durbin-Watson Statistic	2.033

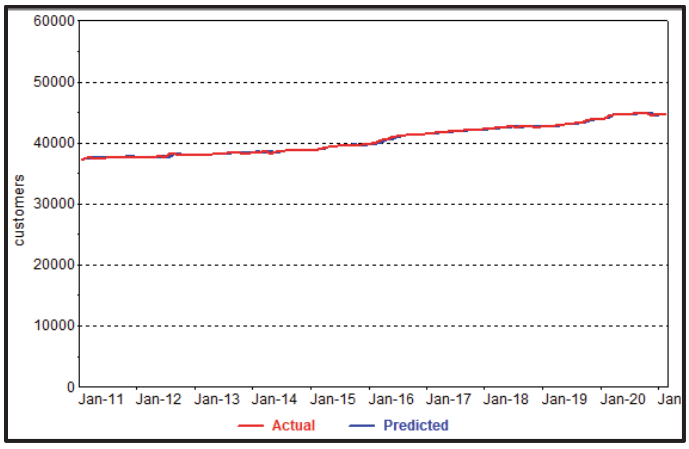
Figure 33: Small C&I Sales Model



Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	16356.973	7098.883	2.304	2.31%
mStructRevCom.XHeat	232265.878	15953.53	14.559	0.00%
mStructRevCom.XCool	84684.066	3765.849	22.487	0.00%
mStructRevCom.XOther	10866.288	774.853	14.024	0.00%
DSM.Com	-0.202	0.068	-2.982	0.35%
Covid.NResIndex	-3975.817	714.623	-5.564	0.00%
mBin.Sep12Plus	6199.589	1093.979	5.667	0.00%
mBin.Feb	1838.296	708.985	2.593	1.08%
mBin.Oct	2756.936	720.022	3.829	0.02%
mBin.Apr14	16996.802	2214.403	7.676	0.00%
mBin.Jul17	-5610.255	2158.617	-2.599	1.06%
MA(1)	0.494	0.089	5.544	0.00%

Model Statistics	
Iterations	19
Adjusted Observations	122
Deg. of Freedom for Error	110
R-Squared	0.942
Adjusted R-Squared	0.937
AIC	15.666
BIC	15.942
F-Statistic	163.901
Prob (F-Statistic)	0
Log-Likelihood	-1,116.76
Model Sum of Squares	10,454,999,544.51
Sum of Squared Errors	637,883,916.18
Mean Squared Error	5,798,944.69
Std. Error of Regression	2,408.10
Mean Abs. Dev. (MAD)	1,769.15
Mean Abs. % Err. (MAPE)	1.42%
Durbin-Watson Statistic	1.847

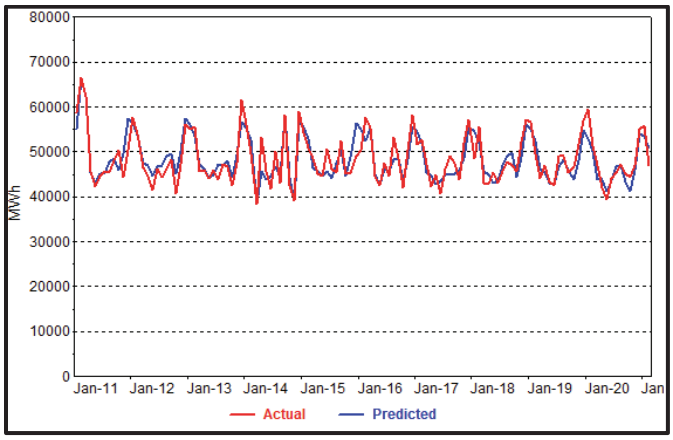
Figure 34: Small C&I Customer Model



Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	-1786959.167	3.6E+08	-0.01	99.61%
Economics.NManEmp	-17.412	16.209	-1.07	28.49%
AR(1)	1	0.007	146.4	0.00%

Model Statistics	
Iterations	99
Adjusted Observations	121
Deg. of Freedom for Error	118
R-Squared	0.995
Adjusted R-Squared	0.995
AIC	10.275
BIC	10.344
F-Statistic	12476.479
Prob (F-Statistic)	0
Log-Likelihood	-790.3
Model Sum of Squares	705,787,039.15
Sum of Squared Errors	3,337,595.18
Mean Squared Error	28,284.70
Std. Error of Regression	168.18
Mean Abs. Dev. (MAD)	115.08
Mean Abs. % Err. (MAPE)	0.28%
Durbin-Watson Statistic	2.72

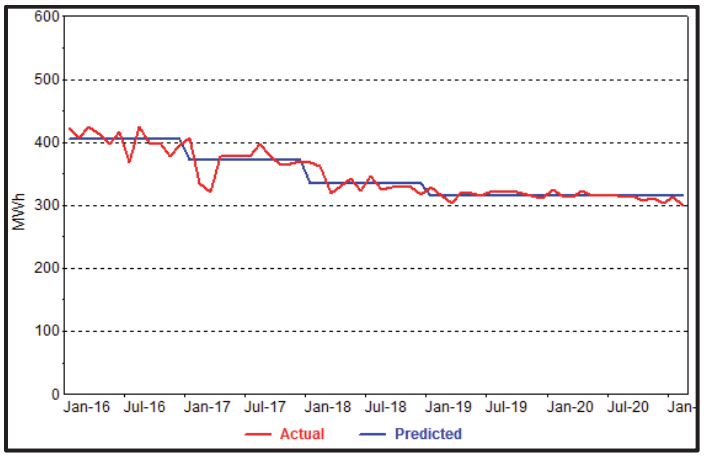
Figure 35: Large C&I Sales Model



Variable	Coefficient	StdErr	T-Stat	P-Value
mEcon.IndVar	52921.573	927.213	57.076	0.00%
mWthrRev.CDD60	33.297	9.891	3.366	0.11%
Covid.NResIndex	487.317	531.077	0.918	36.10%
mBin.Jan	2566.547	1268.26	2.024	4.56%
mBin.Mar	-6406.682	1430.913	-4.477	0.00%
mBin.Apr	-7206.627	1307.429	-5.512	0.00%
mBin.May	-9691.52	1315.148	-7.369	0.00%
mBin.Jun	-11545.429	1732.251	-6.665	0.00%
mBin.Jul	-15259.231	2982.582	-5.116	0.00%
mBin.Aug	-15658.62	3436.688	-4.556	0.00%
mBin.Sep	-11562.021	2476.028	-4.67	0.00%
mBin.Oct	-9764.416	1410.979	-6.92	0.00%
mBin.Nov	-3750.394	1333.402	-2.813	0.59%
mBin.Dec	3778.272	1298.185	2.91	0.44%
mBin.Feb11	14010.086	3043.845	4.603	0.00%
mBin.Mar11	16432.908	3103.265	5.295	0.00%
mBin.Mar14	-8091.464	3103.278	-2.607	1.05%
mBin.Sep14	11317.337	3089.065	3.664	0.04%
mBin.Nov14	-10330.684	3062.025	-3.374	0.11%
mBin.Mar16	9325.318	3103.263	3.005	0.33%

Model Statistics	
Iterations	1
Adjusted Observations	122
Deg. of Freedom for Error	102
R-Squared	0.767
Adjusted R-Squared	0.723
AIC	16.095
BIC	16.555
Log-Likelihood	-1,134.91
Model Sum of Squares	2,824,788,369.76
Sum of Squared Errors	858,989,969.25
Mean Squared Error	8,421,470.29
Std. Error of Regression	2,901.98
Mean Abs. Dev. (MAD)	2,089.71
Mean Abs. % Err. (MAPE)	4.30%
Durbin-Watson Statistic	1.829

Figure 36: Other Sales Model



Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	404.329	4.489	90.072	0.00%
mBin.Yr2017Plus	-33.228	6.348	-5.234	0.00%
mBin.Yr2018Plus	-35.859	6.348	-5.649	0.00%
mBin.Yr2019Plus	-19.726	5.427	-3.635	0.06%

Model Statistics	
Iterations	1
Adjusted Observations	62
Deg. of Freedom for Error	58
R-Squared	0.84
Adjusted R-Squared	0.832
AIC	5.55
BIC	5.688
F-Statistic	101.783
Prob (F-Statistic)	0
Log-Likelihood	-256.04
Model Sum of Squares	73,835.59
Sum of Squared Errors	14,024.87
Mean Squared Error	241.81
Std. Error of Regression	15.55
Mean Abs. Dev. (MAD)	10.7
Mean Abs. % Err. (MAPE)	3.02%
Durbin-Watson Statistic	2.002