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Green Mountain Power
FY 2024 Budget Forecast Report

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1 2024 FISCAL YEAR BUDGET FORECAST SUMMARY

This report presents the FY2024 Forecast. The report summarizes forecast results, discusses methodology and assumptions, and examines the technologies that are reshaping load and sales growth projections.

Separate forecasts are derived for four customer classes – Residential, Small Commercial and Industrial, Large Commercial and Industrial, and Other sales; Other sales is primarily street lighting. Forecasts are derived from a set of linear regression models estimated for average use and customers in the residential class, and total sales in the Small C&I, Large C&I, and other loads. Monthly models are estimated with billed sales and customer data over the period January 2011 to December 2022. While the focus is on FY 2024 (October 2023 to September 2024), the forecast includes expected sales, customers, and revenues through 2033. Revenues are generated at the tariff level using a set of rate class and billing determinant models that translate the revenue class sales and customer forecast to billing determinants that are then priced out at current rates.

Where historically residential sales have been flat to declining, we now see relatively strong sales growth. In 2020, residential sales jumped 2.4% as work and school shifted from commercial sector to residential sector in response to COVID. Sales jumped another 2.4% in 2021. Though sales fell 0.8% in 2022, customer average use is still elevated. Heat pumps are beginning to have a noticeable impact on sales and are expected along with electric vehicles to contribute to strong sales growth.

COVID had the opposite impact on commercial sales. Small C&I fell 6.2% and Large C&I fell 4.1%. While commercial sales have been recovering sales never get back to pre-COVID levels. A large share of employees continues to work at home and strong commercial energy efficiency gains limit positive sales growth from customer and economic growth.

Table 1 shows the fiscal-year sales forecast.

TABLE 1: FISCAL YEAR SALES FORECAST (MWH)

Year	Residential	Chg	Small C&I	Chg	Large C&I	Chg	Other	Chg	Total	Chg
2022	1,557,395		1,451,306		1,117,378		3,728		4,129,808	
2023	1,560,876	0.2%	1,446,544	-0.3%	1,121,454	0.4%	3,639	-2.4%	4,132,513	0.1%
2024	1,602,806	2.7%	1,446,494	0.0%	1,125,771	0.4%	3,634	-0.1%	4,178,705	1.1%
2025	1,624,240	1.3%	1,447,818	0.1%	1,126,974	0.1%	3,634	0.0%	4,202,666	0.6%
2026	1,654,348	1.9%	1,451,298	0.2%	1,128,636	0.1%	3,634	0.0%	4,237,917	0.8%
2027	1,688,882	2.1%	1,453,566	0.2%	747,970	-33.7%	3,634	0.0%	3,894,053	-8.1%
2028	1,728,661	2.4%	1,454,700	0.1%	748,390	0.1%	3,634	0.0%	3,935,385	1.1%
2029	1,773,118	2.6%	1,456,037	0.1%	747,588	-0.1%	3,634	0.0%	3,980,377	1.1%
2030	1,827,099	3.0%	1,454,015	-0.1%	746,721	-0.1%	3,634	0.0%	4,031,470	1.3%
2031	1,889,312	3.4%	1,450,592	-0.2%	744,504	-0.3%	3,634	0.0%	4,088,042	1.4%
2032	1,957,150	3.6%	1,448,307	-0.2%	742,288	-0.3%	3,634	0.0%	4,151,379	1.5%
22-27		1.6%		0.0%		-6.5%		-0.5%		-1.1%
27-32		3.0%		-0.1%		-0.2%		0.0%		1.3%

The customer class sales and customer forecast are allocated to rate schedules and further into billing determinants (e.g., on and off-peak sales, billing demand, demand blocks) based on a set of rate class share and determinant models generated from historical billing data. Revenues are calculated by pricing the billing determinants at the current tariff rates (*Revenues = Billing Determinants * Rates*). Table 2 shows the revenue forecast rolled back up to customer classes.

TABLE 2: FISCAL YEAR REVENUE FORECAST ($)

Year	Residential	Chg	Small C&I	Chg	Large C&I	Chg	Other	Chg	Total	Chg
2022	315,586,115		251,671,002		126,025,638		2,701,231		695,983,985	
2023	322,974,792	2.3%	256,732,156	2.0%	115,608,933	-8.3%	2,721,138	0.7%	698,037,018	0.3%
2024	330,410,199	2.3%	256,750,286	0.0%	112,635,529	-2.6%	2,715,929	-0.2%	702,511,942	0.6%
2025	333,747,753	1.0%	257,214,461	0.2%	113,754,810	1.0%	2,715,929	0.0%	707,432,952	0.7%
2026	338,633,653	1.5%	257,917,660	0.3%	114,711,974	0.8%	2,715,929	0.0%	713,979,216	0.9%
2027	344,058,330	1.6%	258,411,517	0.2%	94,760,795	-17.4%	2,715,929	0.0%	699,946,571	-2.0%
2028	350,290,729	1.8%	258,591,458	0.1%	94,739,015	0.0%	2,715,929	0.0%	706,337,131	0.9%
2029	356,929,736	1.9%	259,035,879	0.2%	94,712,284	0.0%	2,715,929	0.0%	713,393,828	1.0%
2030	365,104,474	2.3%	258,795,257	-0.1%	94,602,472	-0.1%	2,715,929	0.0%	721,218,131	1.1%
2031	374,436,334	2.6%	258,312,368	-0.2%	94,321,700	-0.3%	2,715,929	0.0%	729,786,331	1.2%
2032	384,587,586	2.7%	257,896,943	-0.2%	93,966,869	-0.4%	2,715,929	0.0%	739,167,327	1.3%
22-27		1.7%		0.5%		-5.3%		0.1%		0.1%
27-32		2.3%		0.0%		-0.2%		0.0%		1.1%

1.1 FORECAST APPROACH

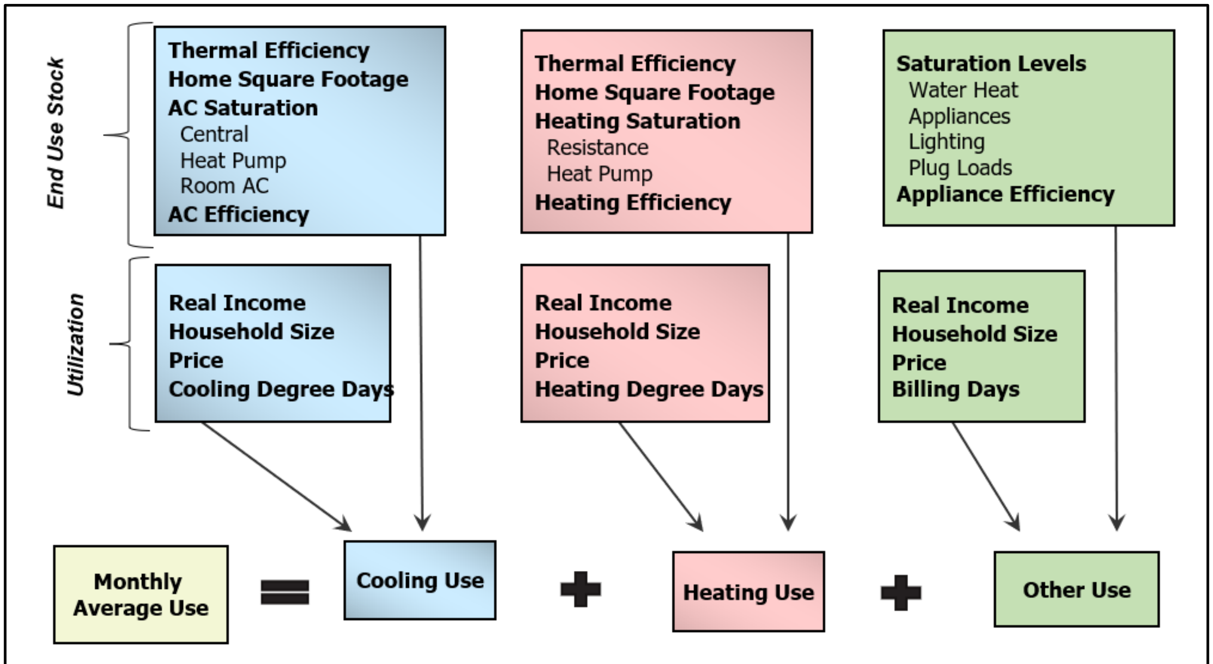
Baseline Sale Forecast. The baseline forecast is derived from historical billed sales and customer data. The baseline forecast represents expected sales before adjustments for additional solar, heat pumps, and electric vehicles. The forecast is derived from a set of monthly customer class regression models that relate customer average use (residential), customers (residential) and sales (Small and Large C&I) to the factors driving historical usage trends. This includes the number of households, employment, real income, GDP, weather, and end-use intensity trends (kWh per households in the residential sector and kWh per Sqft in the commercial sector) that capture end-use ownership and efficiency trends. The end-use intensity trends also capture the impact of state energy efficiency programs. Models are estimated over the period January 2011 to December 2022.

Adjusted Forecast. The baseline forecast is adjusted for projected behind-the-meter (BTM) solar, heat pumps, and C&I electrification projects and in the longer-term electric vehicles. Most of the adjustments impact residential customer class. Solar has little impact on commercial billed sales and revenues as most of the commercial solar generation is treated as a power purchase cost. Heat pump and EV charging sales primarily impact the residential sector and are expected to have a significant impact on future residential sales and revenues.

1.2 RESIDENTIAL BASELINE FORECAST

Residential average use and commercial sales are modeled using a Statistically Adjusted End-Use (SAE) modeling framework. This modeling framework integrates end-use saturation and efficiency trends that capture long-term end-use energy trends with monthly weather, number of days, and economic drivers that capture expected utilization of the end-use stock. End-uses are mapped to heating (XHeat), cooling (XOther), and other uses (XOther). Figure 1 shows the residential average use model and

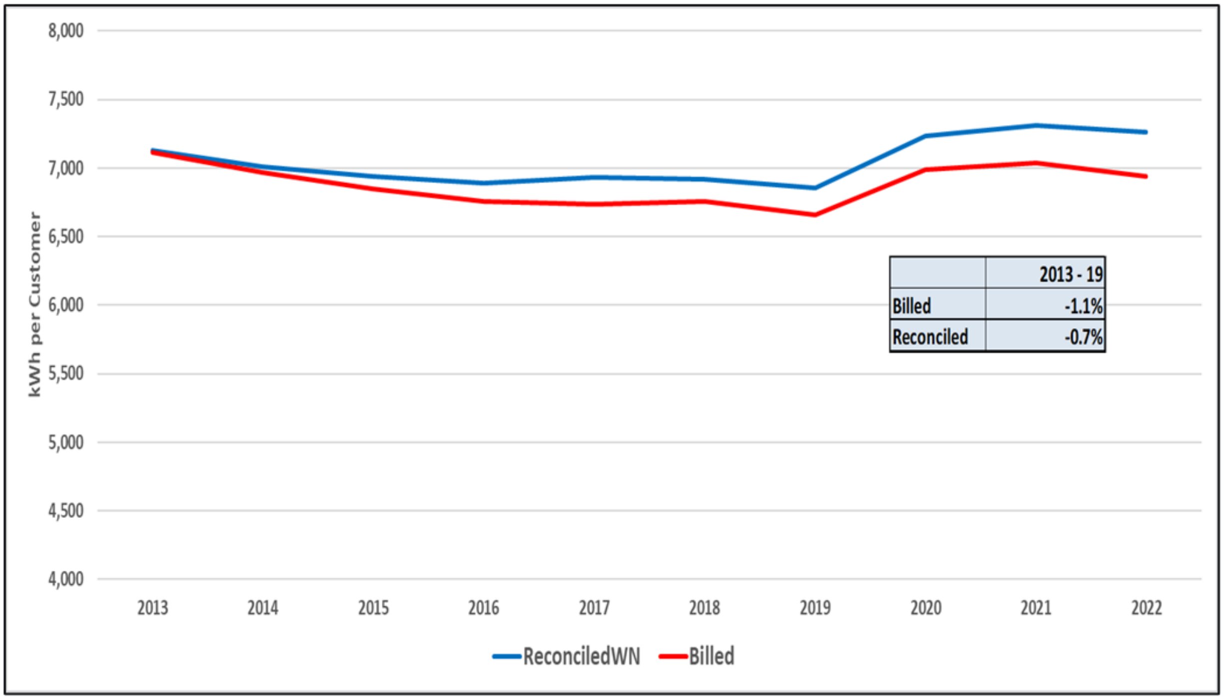
FIGURE 1: RESIDENTIAL AVERAGE USE MODEL



$$AvgUse_m = a + b_c \times XCool_m + b_h \times XHeat_m + b_o \times XOther_m + b_e \times EE_m$$

Sales and Customer Trends. Figure 2 shows weather-normalized average use for both billed and reconstituted sales. Reconstituted sales include customer solar generation for their own use. Residential solar systems are meeting part of their own energy requirements with what is not used directly pushed back into the power grid. Own-use generation is added back to billed sales to generate a historical data series that reflects what the average household uses and not just what the purchase. Ultimately, revenues are based off of billed sales which are calculated by subtracting out historical and forecasted own-use solar generation. Figure 2 shows historical billed and reconstituted average use (weather normalized).

FIGURE 2: RESIDENTIAL WEATHER NORMAL AVERAGE USE



The gap between billed average use and reconciled average use is the estimated amount of customer own generation on a per customer basis. On average residential customers are generating over five percent of their electricity use. This translates into nearly 74,000 MWh.

Between 2013 and 2019, billed average use declined 1.1% per year while reconciled average use has declined 0.7% per year. Solar has accounted for 0.4% of the average annual decline in billed customer use. The long-term trend was upended when COVID-19 hit with work and school moving to the home. In 2020, average billed use jumped 5% to nearly 7,000 kWh, and reconciled use to 7,300 kWh; reconciled average use is higher than it was in 2013.

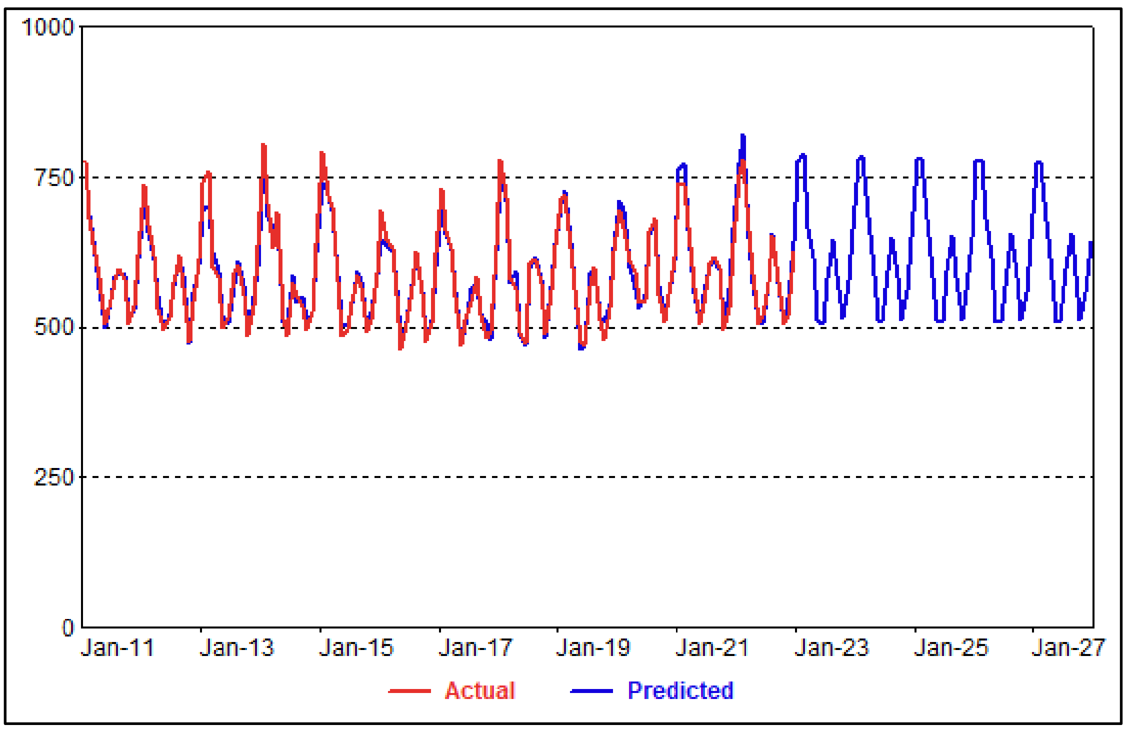
We expected customer use to trend back to pre-COVID levels as business and schools reopened but this never happened as a large share of the workforce continues to work at home. Another contributing factor are the large number of heat pumps that have been installed as part of the state's electrification effort. Through the state incentives program, more than 30,000 heat pumps have been installed over the last three years. With GMP accounting for 71% of the state electric customer base, this translates into over 21,000 new heat pumps in the GMP service area with estimated sales of 46,000 MWh or over 200 kWh per customer.

Customer growth has been relatively consistent over the last ten years with GMP adding on average 600 new customers per year for 0.3% average annual growth. There was a jump of 1,800 in customers in

2021, but this followed a year (2020) in which GMP recorded just 7 new customers. Given state household projections, we expect to see continued customer growth at about the same 0.3% per year growth.

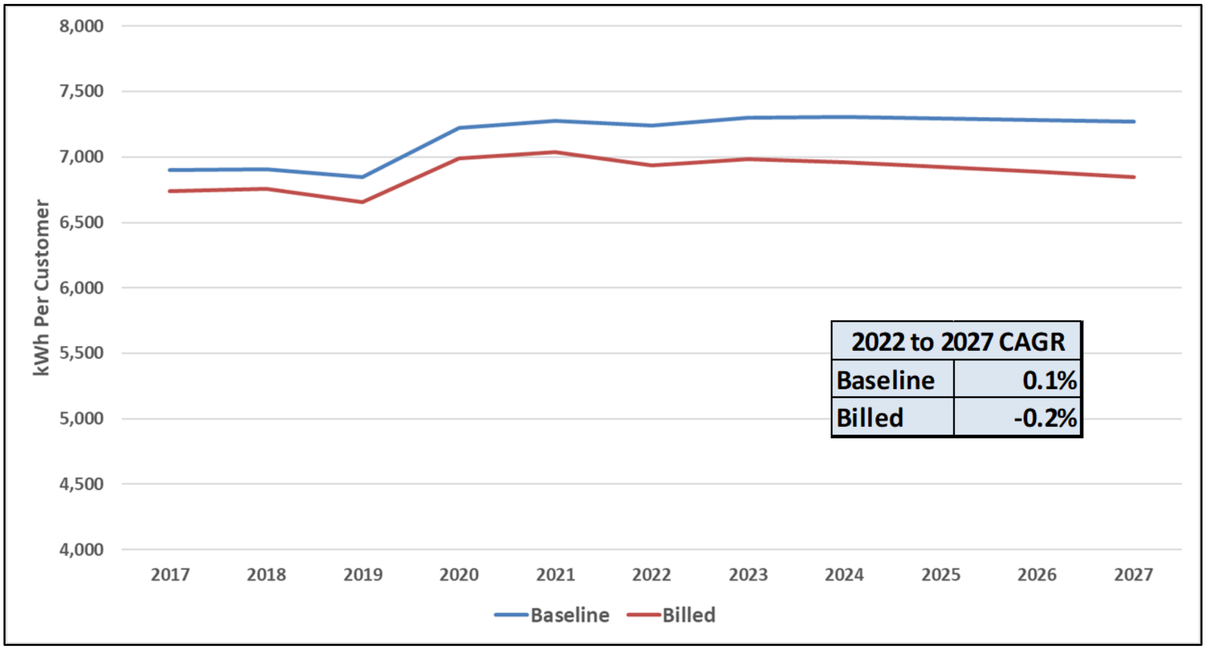
Baseline Average Use Forecast. The baseline model expresses reconstituted average use as function of XCool, XHeat, and XOther. The model is based on billed sales, customers, and own-use solar generation through 2022. The estimated model works well as measured by the model fit statistics. The model Adjusted R-Squared is 0.95 with an average absolute error of 2.0%. Model coefficients and statistics are included in Appendix A. Figure 3 shows actual and predicted baseline average use.

FIGURE 3: RESIDENTIAL BASELINE AVERAGE USE MODEL (KWH)



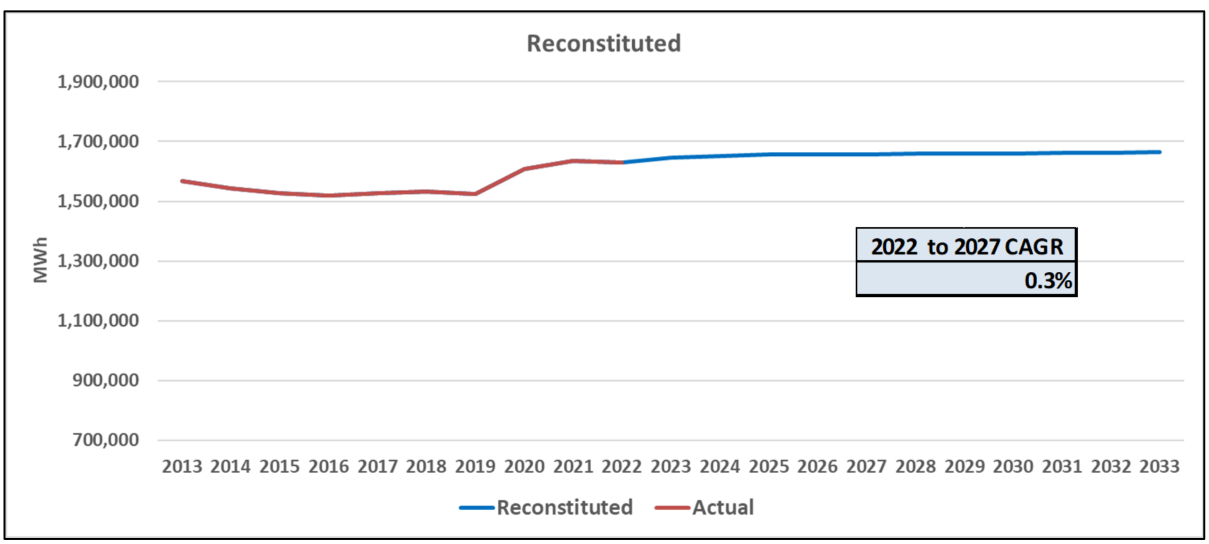
Average use jumps up in 2020 and stays elevated through 2022. We expect baseline loads to stay at this level given the new "work at home" normal and underlying sales gains due to recent heat pump adoption. Figure 4 shows forecasted annual baseline and billed average use.

FIGURE 4: RESIDENTIAL BASELINE AVERAGE USE FORECAST



Baseline average use is relatively flat over the forecast period averaging 0.1% annual growth. Coupled with 0.2% customer growth forecast, baseline sales average 0.3% growth over the next five years. Figure 5 shows the baseline sales forecast with historical weather normalized sales.

FIGURE 5: BASELINE RESIDENTIAL SALES FORECAST

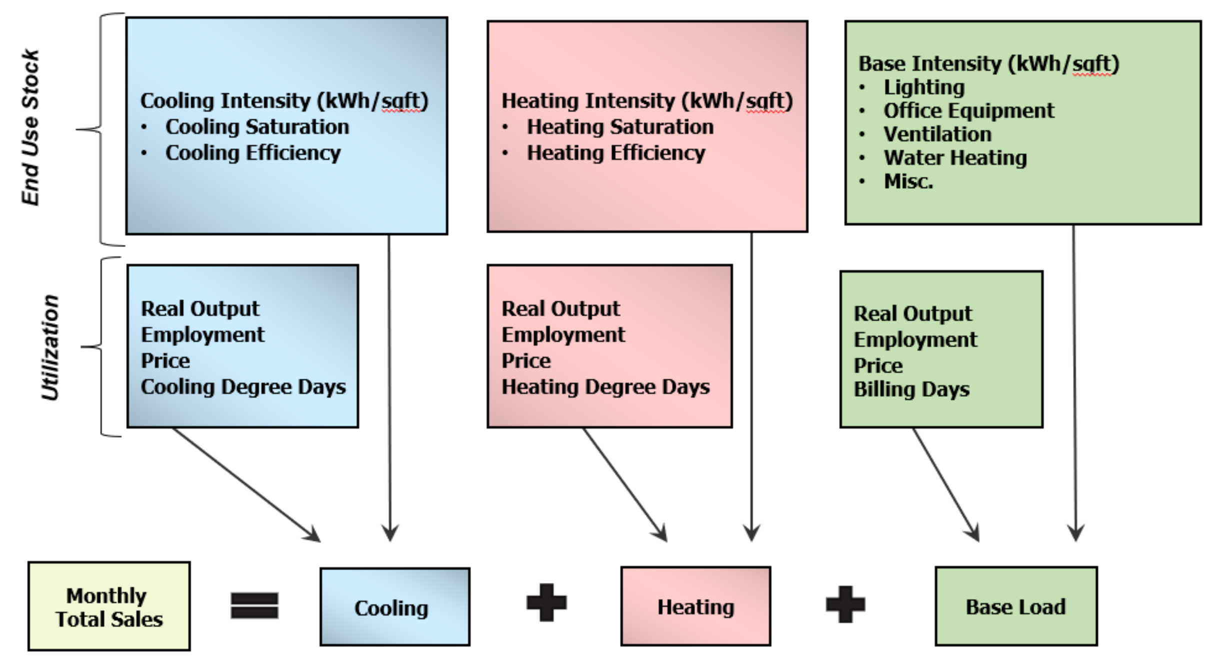


* Includes embedded solar own-use.

1.3 COMMERCIAL BASELINE FORECAST

Separate sales forecast models are estimated for the Small and Large commercial customer classes. Small commercial sales are also estimated using an SAE model where sales are specified as a function of commercial heating (XHeat), cooling (XCool), and base-use energy requirements (XOther). Figure 6 shows the commercial SAE model.

FIGURE 6: COMMERCIAL SALES MODEL



$$MWh_m = \quad a + b_c \times XCool_m + b_h \times XHeat_m + b_o \times XOther_m + b_e \times EE_m$$

Linear regression is used to estimate the model coefficients – b_c, b_h, and b_0. Forecasts of cooling, heating, and base load requirements then drive the monthly sales forecast. The model is estimated with monthly billed sales data from January 2011 to December 2022. The initial model also includes an energy efficiency variable (EE) that when combined with the estimated coefficient (b_e) measures the EE not captured in the structured model variables. A second model drops the EE variable as the end-use intensities are adjusted to account for the *missing* EE program savings.

Large C&I includes GMP's largest commercial and industrial customers; there are 72 Large C&I customers. The Large C&I sales forecast is based on a generalized econometric model that relates monthly consumption to economic activity, weather, and seasonal use captured by monthly binary variables. The model is estimated over the period January 2016 through December 2022. The estimation period is shorter as we elected to use the aggregated AMI data is in estimating the Large C&I model. The model fit statistics using the AMI data is significantly better than using the monthly billed sales data.

Both models explain historical sales variation and trend well. The Small Com model Adjusted R-Squared is 0.94 with an average absolute monthly error of 1.5%. The Large C&I model adjusted R-Squared is 0.88 with an average absolute error of 2.5%. The Large C&I model fit is slightly worse as there is more month-to-month load variation due to variation in large C&I business operation.

Estimated model coefficient and statistics are included in Appendix A. Figure 7 and Figure 8 show actual and predicted sales.

FIGURE 7: ACTUAL AND PREDICTED SMALL COMMERCIAL SALES (MWH)

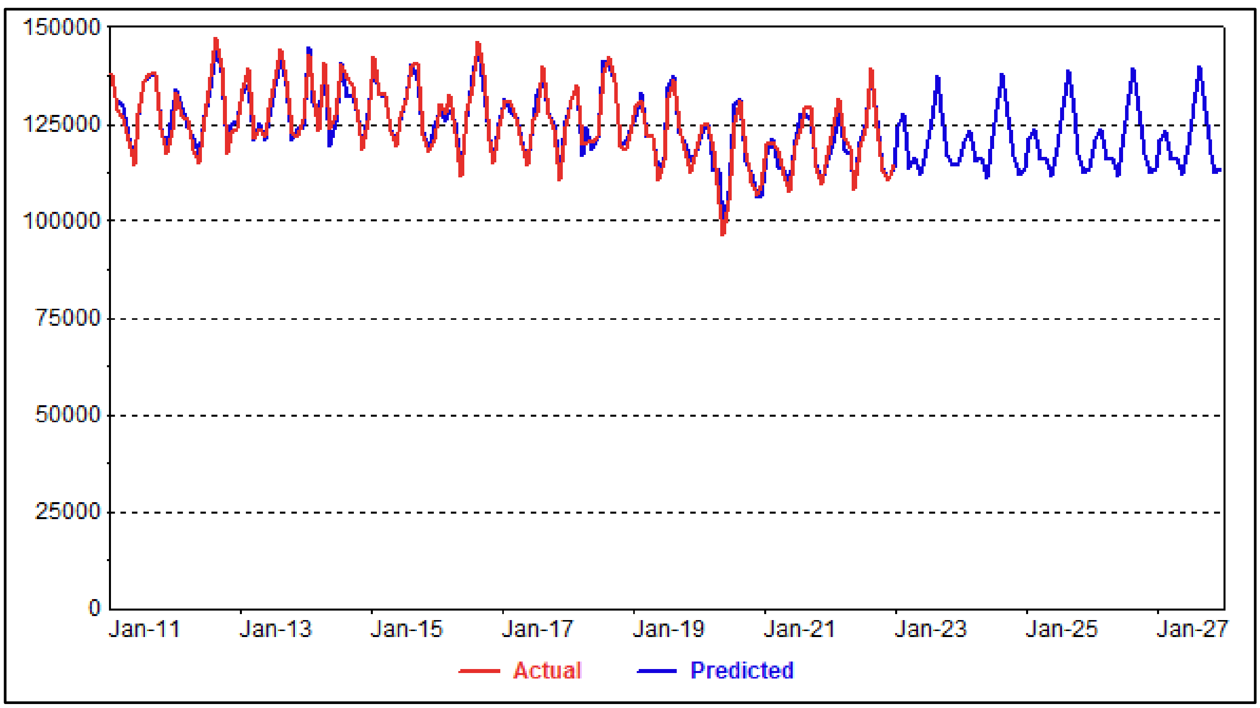
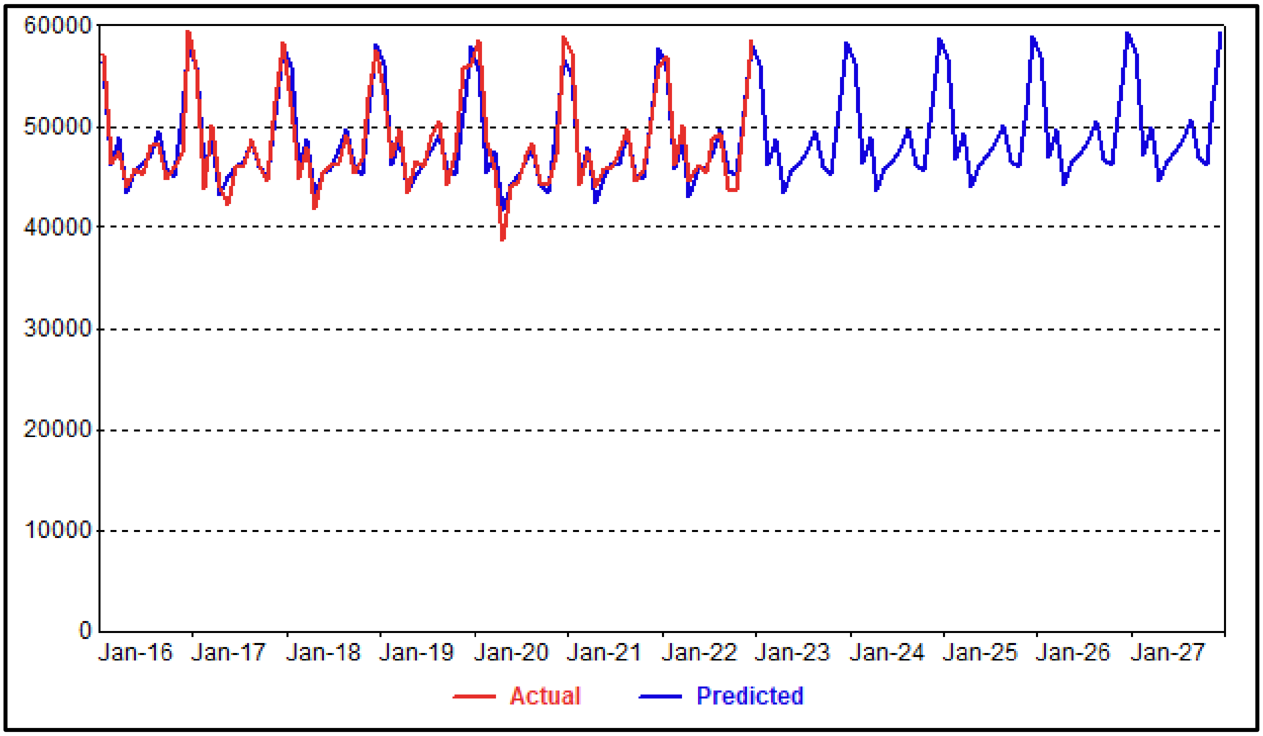
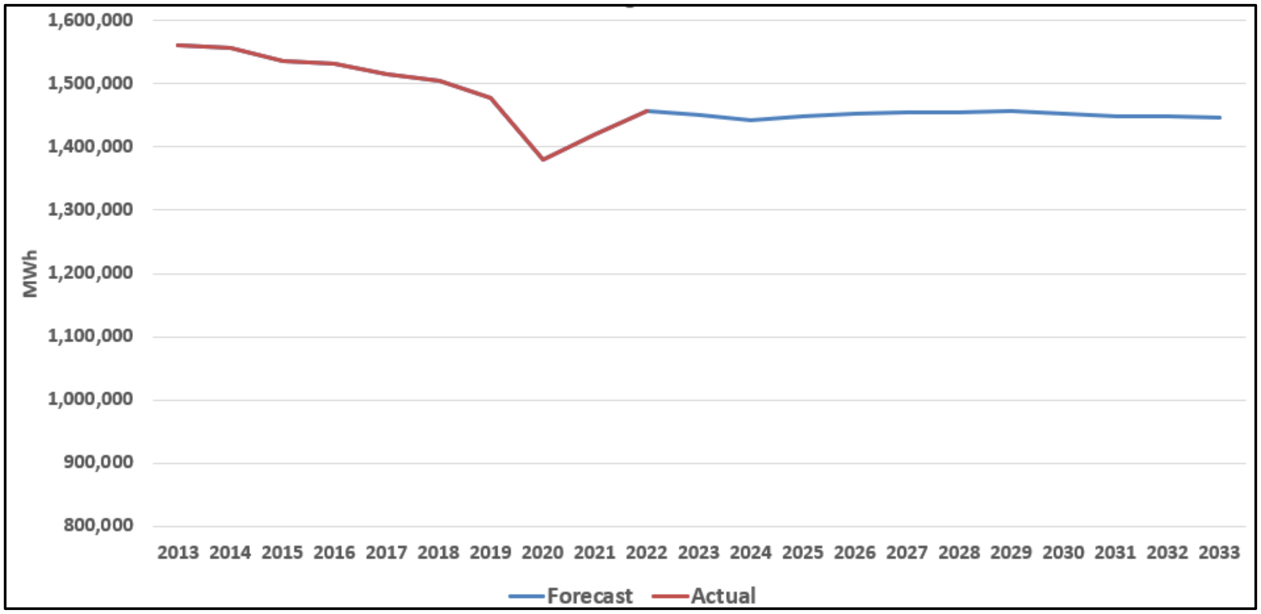


FIGURE 8: LARGE C&I ACTUAL AND PREDICTED SALES (MWH)



Small Commercial Sales Trend and Forecast. Figure 9 shows the weather normalized historical sales (in red) and projected baseline sales on an annual basis.

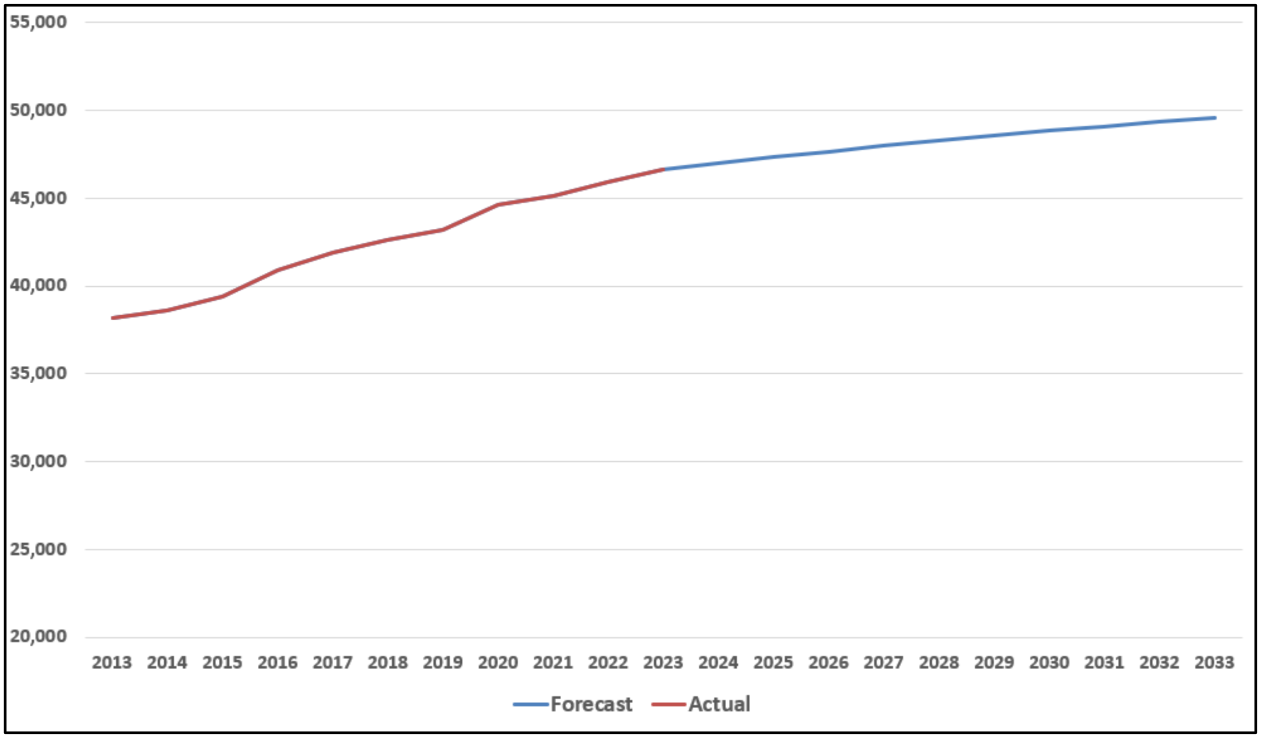
FIGURE 9: SMALL COMMERCIAL SALES (WEATHER NORMALIZED AND FORECAST)



Through 2019 commercial sales averaged 0.9% annual decline; this is largely attributed to strong end-use efficiency gains. COVID-19 had significant impact on commercial sales with normalized sales falling 6.6% as businesses closed and those remaining open significantly reducing business activity. While there has been a large gain in 2021 and 2022 commercial sales, sales are still below pre-COVID levels. Going forward we expect to see flat baseline sales growth as continued efficiency gains weigh against COVID recovery and economic growth driven sales.

Figure 10 shows the actual and forecasted Small C&I customers.

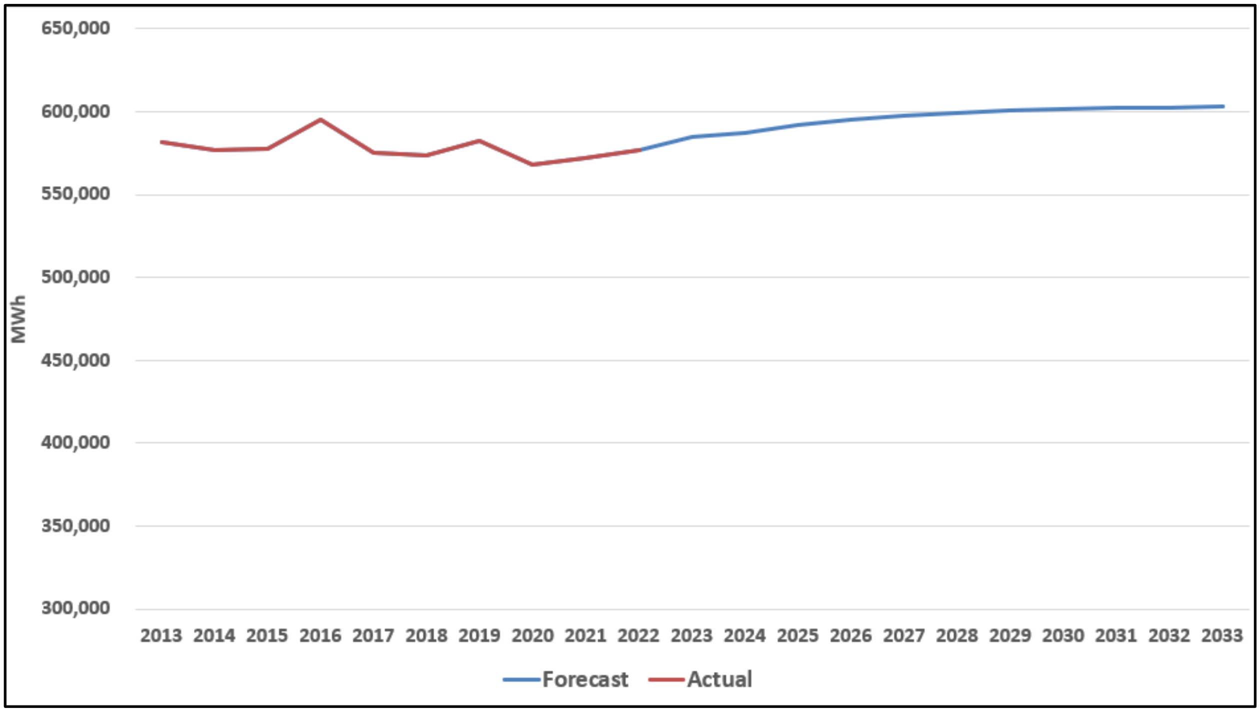
FIGURE 10: SMALL COMMERCIAL CUSTOMERS



The customer forecast is based on an economic driver that incorporates state households, employment, and GDP. While sales have been declining, customers have been increasing at over a 2.0% annual rate. Customer growth slows in the forecast period averaging 0.7% over the next five years matching the average use decline.

Large C&I Sales Trend and Forecast. The Large C&I class is based on a monthly sales model that relates monthly usage to cooling degree-days (CDD), an economic index that incorporates both state GDP and manufacturing employment, and monthly binaries to capture seasonal variation. Figure 11 shows the Large C&I baseline sales forecast.

FIGURE 11: LARGE C&I BASELINE SALES FORECAST



* Excludes Omya and GlobalFoundries. Separate company forecasts are provided by GMP.

Large C&I customers saw a much smaller drop in 2020 sales; normalized sales fell 2.5%. Sales are recovering with positive growth in 2021 and 2022. We expect additional recovery in 2023. Going forward sales average 0.5% tied to state economic growth projections.

Large C&I forecast is consistent with actual customer activity. As part of the forecast process, we review customer-specific activity with GMP customer account representatives. Some customers are expected to add load through onsite expansion activity while others are closing down or reducing operations. The net impact is slightly positive – similar to the model based forecast.

1.4 BASELINE DRIVERS

Several factors drive the sales and customer forecast through the estimated sales and customer models. These drivers include:

- Moody's Analytics December 2022 Vermont economic forecast.
- AEO 2022 end-use efficiency estimates for the New England Census Division (adjusted to reflect Vermont end-use information).

- VEIC current energy efficiency savings projections
- GMP's heat pump and EV forecast filed in their recent IRP.
- 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.
- Expected HDD and CDD based on historical trends.
- COVID-19 trend adjustments.

1.4.1 Economic Forecast

The FY22 forecast is based on Moody's January 2022 state economic projections. The primary economic drivers include the number of state households, state real personal income, employment, and real state economic output (GDP). Table 3 shows historical and projected economic outlook.

TABLE 3: STATE ECONOMIC PROJECTIONS

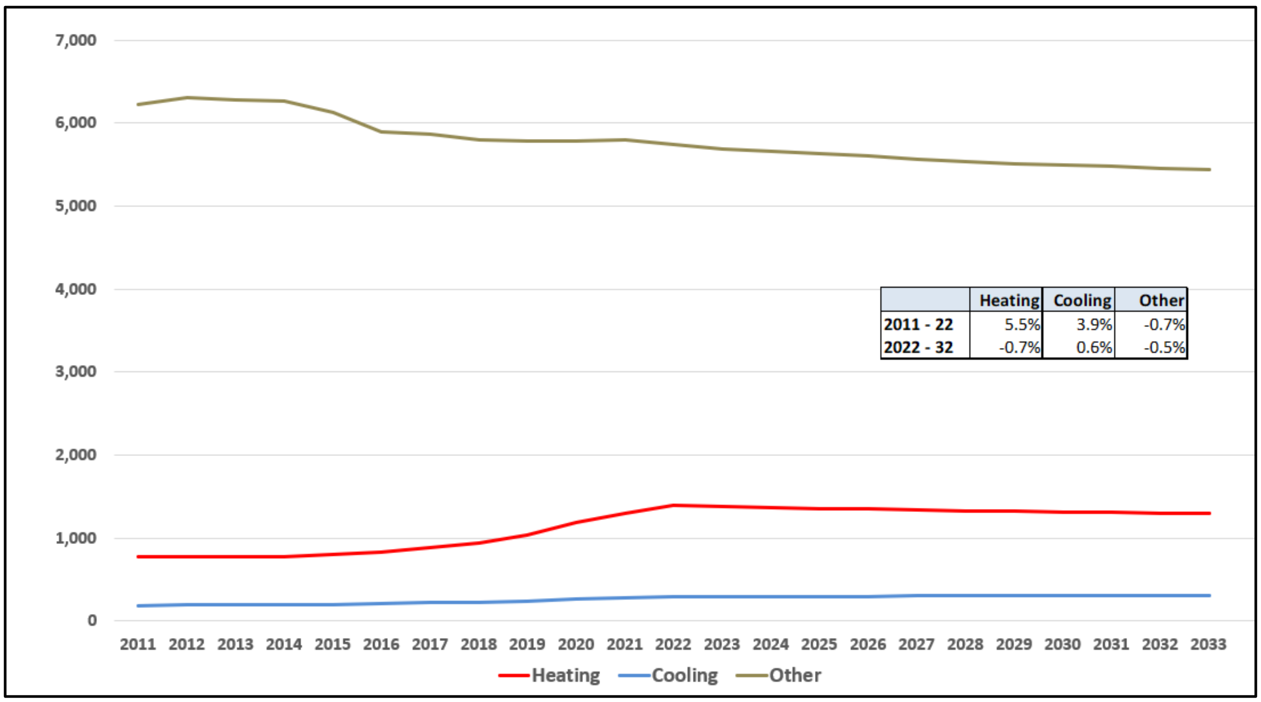
Year	Households (Thou)	Chg	RPI (Mil $)	Chg	GDP (Mil $)	Chg	Emp (Thou)	Chg
2012	260.8		28,505		29,281		304.5	
2013	263.2	0.9%	28,624	0.4%	28,671	-2.1%	306.7	0.7%
2014	264.7	0.6%	29,295	2.3%	28,868	0.7%	309.6	0.9%
2015	265.6	0.3%	30,129	2.8%	29,172	1.1%	312.1	0.8%
2016	265.7	0.0%	30,327	0.7%	29,378	0.7%	313.3	0.4%
2017	266.0	0.1%	30,559	0.8%	29,499	0.4%	315.0	0.5%
2018	266.2	0.1%	31,072	1.7%	29,630	0.4%	316.1	0.3%
2019	264.3	-0.7%	32,330	4.0%	29,831	0.7%	315.4	-0.2%
2020	259.0	-2.0%	34,415	6.4%	29,174	-2.2%	289.3	-8.3%
2021	256.2	-1.1%	34,266	-0.4%	30,491	4.5%	293.4	1.4%
2022	258.8	1.0%	33,163	-3.2%	31,328	2.7%	300.5	2.4%
2023	259.1	0.1%	33,265	0.3%	31,575	0.8%	303.6	1.0%
2024	260.0	0.4%	33,693	1.3%	32,083	1.6%	305.4	0.6%
2025	260.9	0.3%	34,366	2.0%	32,884	2.5%	307.0	0.5%
2026	261.7	0.3%	35,070	2.0%	33,726	2.6%	307.6	0.2%
2027	262.2	0.2%	35,736	1.9%	34,527	2.4%	308.0	0.1%
2028	262.7	0.2%	36,386	1.8%	35,311	2.3%	308.6	0.2%
2029	263.1	0.2%	36,997	1.7%	36,053	2.1%	309.2	0.2%
2030	263.5	0.2%	37,535	1.5%	36,708	1.8%	309.5	0.1%
2031	263.9	0.2%	38,030	1.3%	37,313	1.6%	309.6	0.0%
2032	264.3	0.2%	38,534	1.3%	37,932	1.7%	309.6	0.0%
12-22		-0.1%		1.6%		0.7%		-0.1%
22-32		0.2%		1.5%		1.9%		0.3%

The long-term outlook is for slow household and employment growth, but reasonable household income and real state output. Employment saw a steep drop in 2020 and while recovering through 2023, it never gets back to pre-COVID levels.

1.4.2 Energy Efficiency Impact

While slowing, energy efficiency improvements still have a significant impact. Efficiency gains are captured through the model heating, cooling, and other use end-use intensity projection. 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 2022 Annual Energy Outlook for New England. Residential end-use saturations are calibrated to Vermont-specific end-use saturations where this data is available. This year the starting saturation and end-use energy was calibrated using the recent statewide residential saturation study and housing and building simulation output from the National Energy Renewable Laboratory (NREL). One of the largest adjustments was calibrating to the significant amount of heating load that have been added over the last three years through the state heat pump program. This is shown in Figure 12.

FIGURE 12: RESIDENTIAL END-USE INDICES (KWH PER HOUSEHOLD)

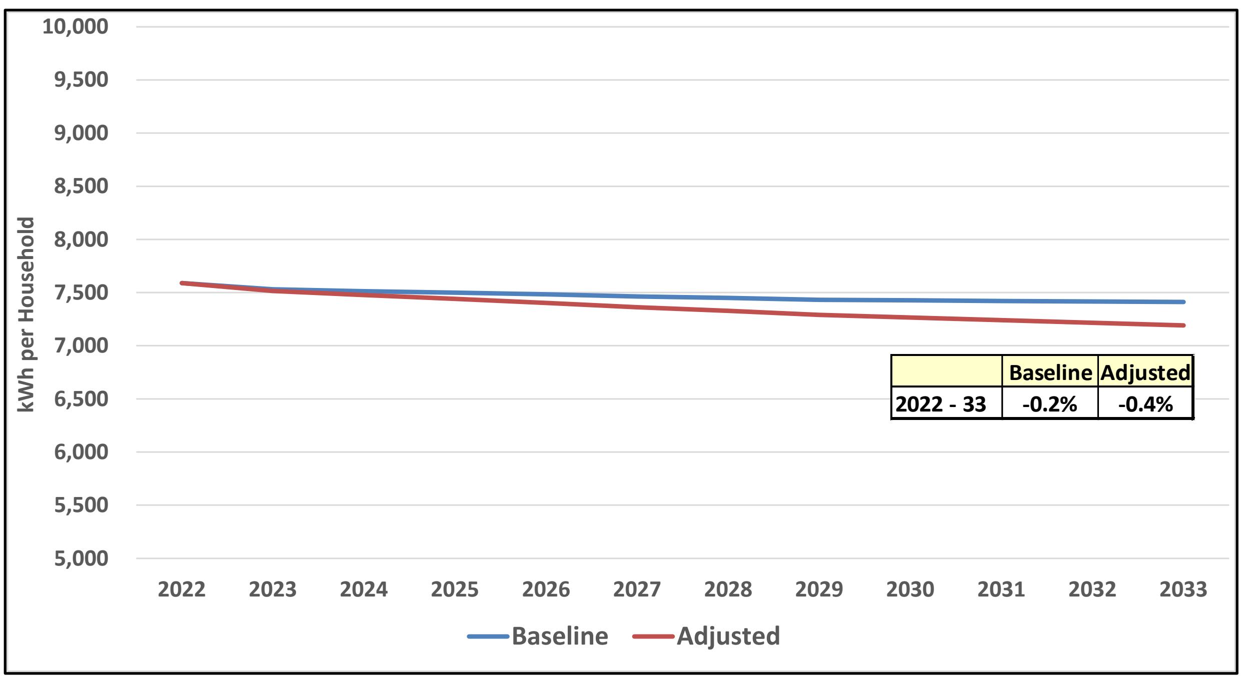


	Heating	Cooling	Other
2011 - 22	5.5%	3.9%	-0.7%
2022 - 32	-0.7%	0.6%	-0.5%

Heating intensity ramps up significantly between 2019 and 2022. For the forecast the heating intensity declines as heat pump saturation is held constant. Heat pumps are held constant as we assume that all heat pump purchases will be through the incentive program. Future heat pump saturation and associated load growth is treated separately and then added to the baseline forecast. Heating decline reflecting continued decline in resistant heat saturation and improvements in furnace fan efficiency. Cooling intensity increases through the forecast period at 0.6% per year. Cooling intensity change is significantly slower than the prior ten years as cooling end-use saturation slows and unit efficiency continues to improve. Average intensity across the other use declines on average 0.5% per year reflecting continued end-use and housing shell efficiency improvements.

End-use intensities are also adjusted for state energy efficiency programs. Most of the savings are captured in the starting EIA end-use intensity projections as EIA builds regional (New England) efficiency savings estimates into the estimated end-use sales and resulting end-use intensities. A simple model is used to isolate the EE savings that are not captured in the initial SAE model. The model indicates that GMP is doing 30% more in efficiency savings than New England. The end-use intensity drivers are adjusted by 30% to account for state EE impacts. Figure 13 compares total intensity against the EE savings adjusted intensities.

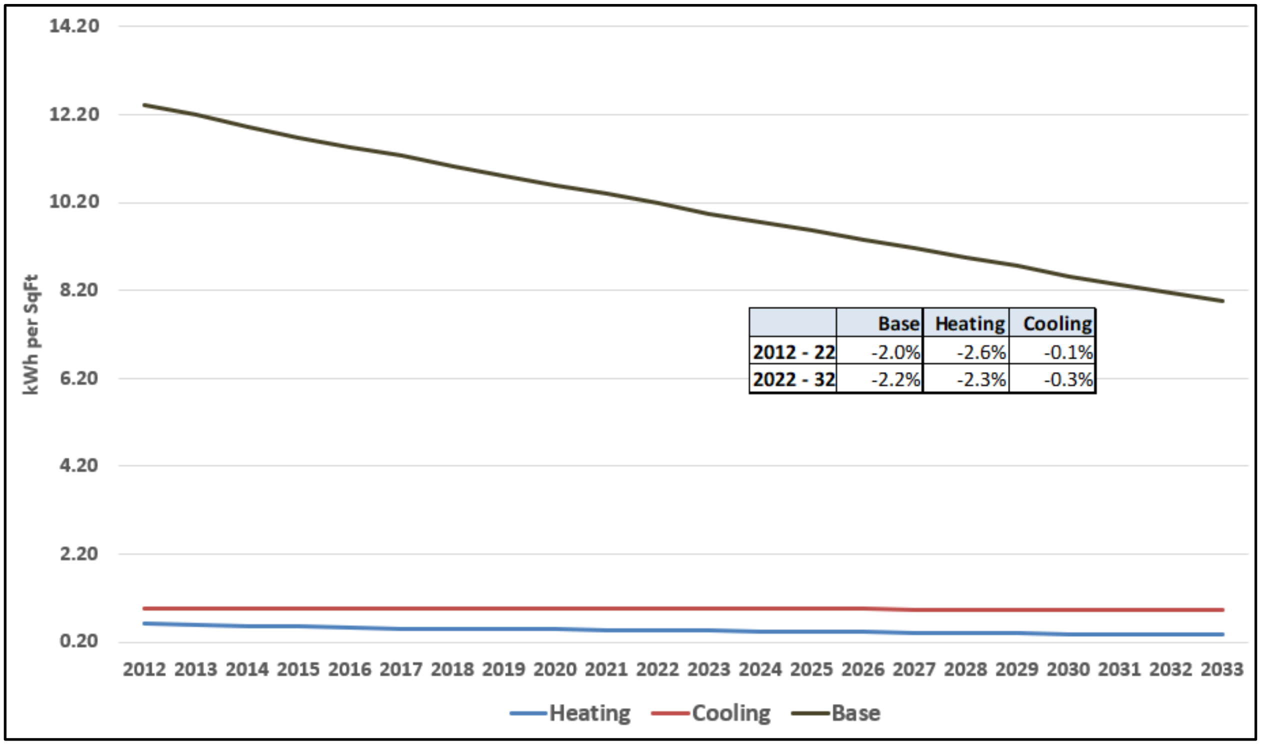
FIGURE 13: RESIDENTIAL BASELINE AND EE ADJUSTED INTENSITY COMPARISON



The EE program adjusted total intensity declines 0.4% per year compared with the initial EIA projection of 0.2% annual decline. The adjusted intensity is in line with the intensity trend before the recent jump in heat pump sales.

Figure 14 shows commercial heating, cooling, and other use intensity trends. Intensities are expressed on a kWh per square foot basis. Heating and cooling are relatively small in New England; most of the heating and cooling related loads show up in the ventilation end-use which is part of the base intensity. Ventilation and lighting are two of the largest commercial end-uses; EIA expects significant efficiency gains in these end-uses. Figure 14 shows historical and forecasted primary end-use intensity trends.

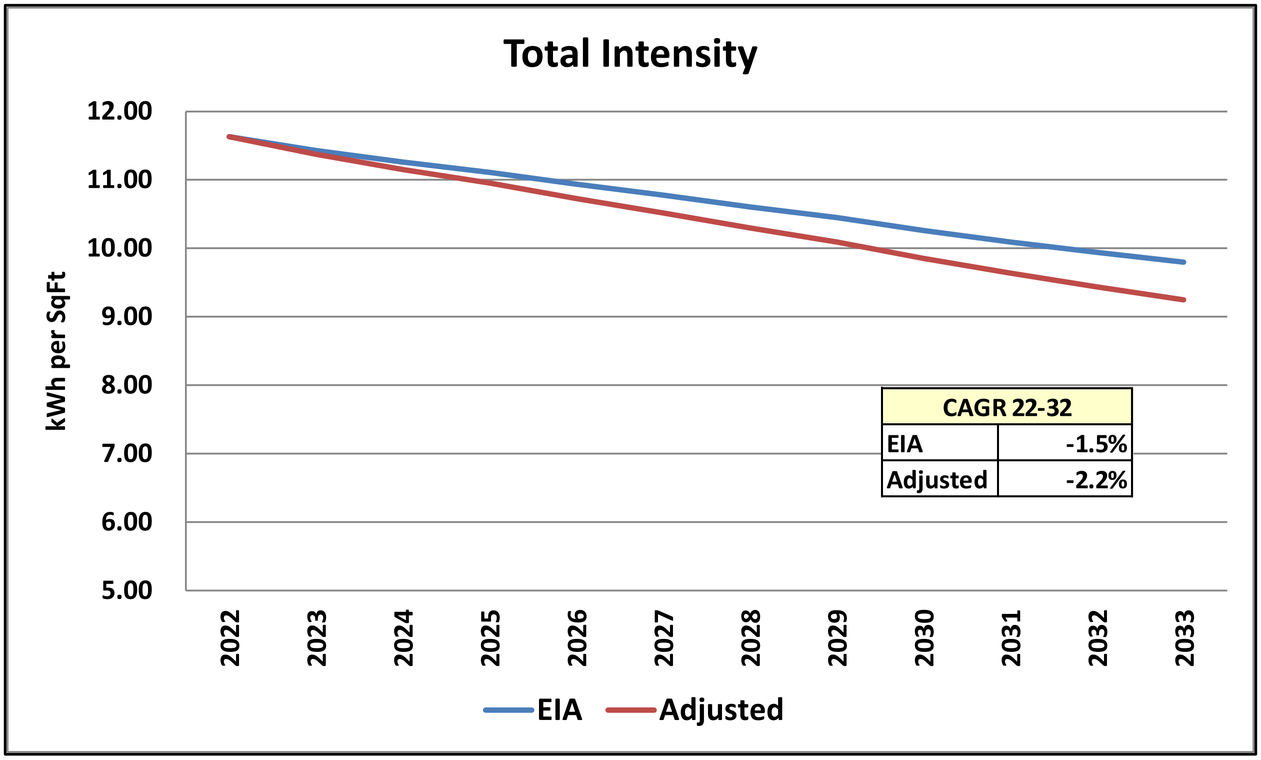
FIGURE 14: SMALL C&I END-USE INTENSITIES (KWH/SQFT)



	Base	Heating	Cooling
2012 - 22	-2.0%	-2.6%	-0.1%
2022 - 32	-2.2%	-2.3%	-0.3%

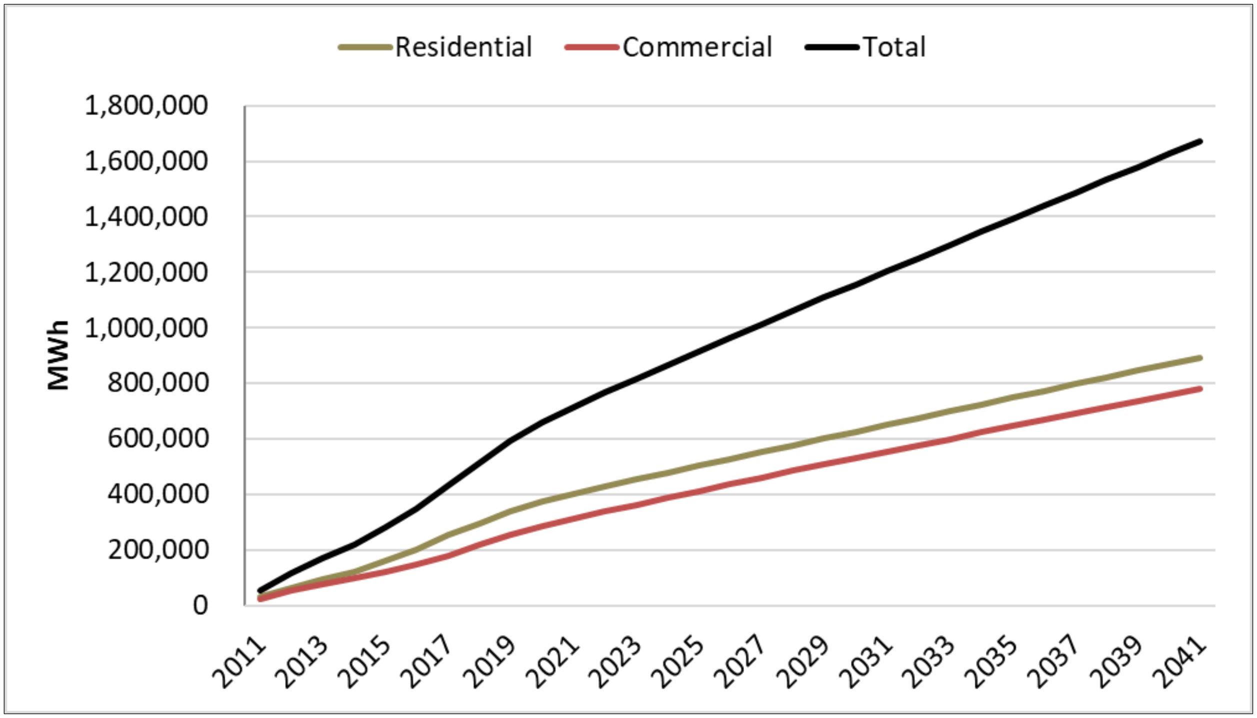
The long-term decline in commercial intensity is the primary reason there has been little to no growth in commercial sales. The intensity projection also reflects expected impact of future EE savings which contribute roughly 0.7% of the annual intensity decline as shown in Figure 15.

FIGURE 15: COMMERCIAL INTENSITY COMPARISON



Savings projections are based on the current Demand Resource Plan (DRP). Figure 16 shows cumulative historical savings and projected savings.

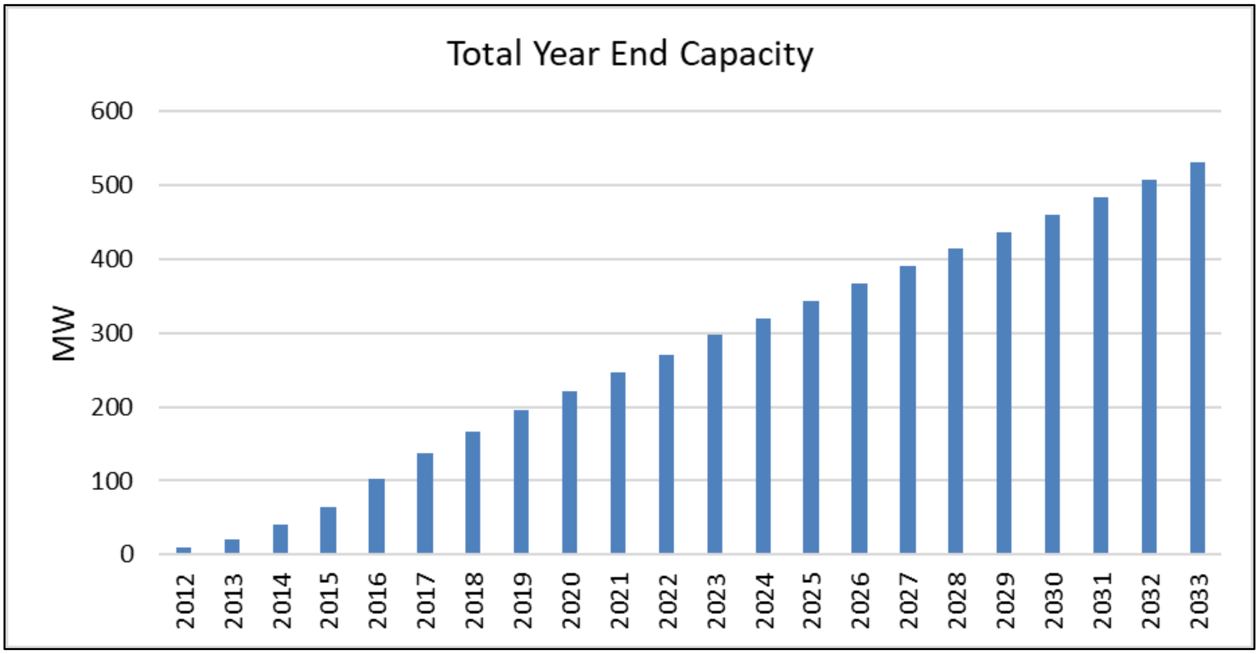
FIGURE 16: CUMULATIVE EE SAVINGS



1.4.3 Behind the Meter Solar

Solar Capacity Forecast. Behind the meter (BTM) solar capacity forecast is developed by GMP based on historical trends and the interconnection application que. As of December 2022, an estimated 270 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 28 MW of capacity in 2023 and approximately 24 MW per year between 2024 and 2033. Figure 17 shows the year end capacity forecast.

FIGURE 17: YEAR-END SOLAR CAPACITY FORECAST



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 4 shows the allocation factors.

TABLE 4: CAPACITY ALLOCATION FACTORS

Class	Previous 12 Mnth Generation (MWh)	Share of Total
Residential	115,261	33.2%
Commerical	194,510	56.0%
Industrial	37,820	10.9%
Total	347,591	

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 5 shows the solar generation load factors.

TABLE 5: 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 18 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 18: BTM SOLAR GENERATION

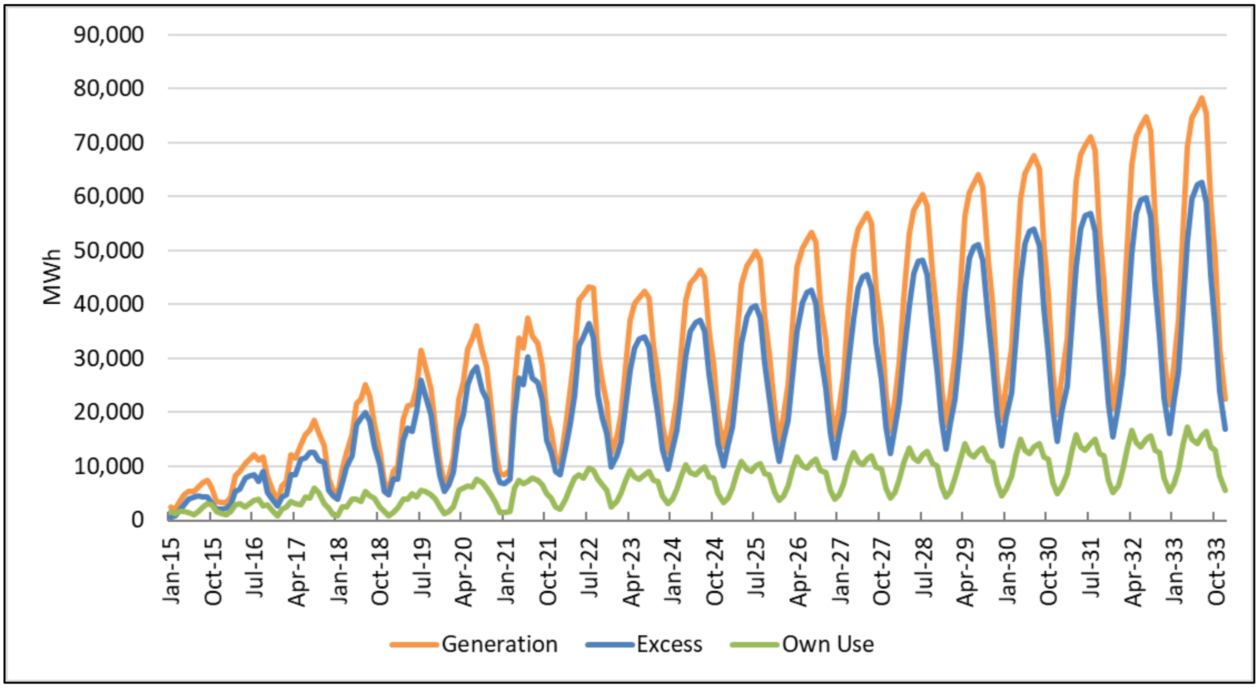


Table 6 shows the forecasted capacity and solar generation by rate case.

TABLE 6: SOLAR GENERATION

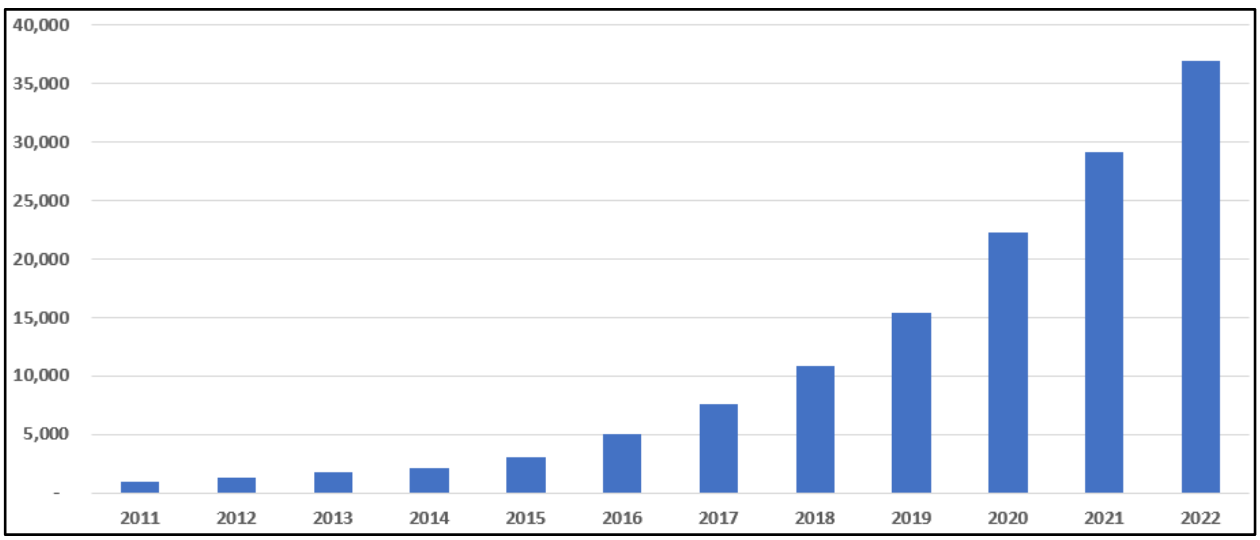
Year	Year End Capacity (MW)	Total MWh Generation	Total MWh Excess	Total MWh Own Use	Residential MWh Generation	Residential MWh Excess	Residential MWh Own Use	Commercial & Industrial MWh Generation	Commercial & Industrial MWh Excess	Commercial & Industrial MWh Own Use
2023	297.4	355,693	274,477	81,216	117,948	42,030	75,918	237,745	232,448	5,298
2024	319.6	389,205	300,324	88,881	129,060	45,961	83,099	260,145	254,363	5,781
2025	342.6	416,992	321,790	95,202	138,274	49,269	89,006	278,717	272,521	6,196
2026	366.5	446,535	344,589	101,946	148,071	52,758	95,313	298,464	291,830	6,634
2027	389.7	476,556	367,758	108,798	158,026	56,304	101,722	318,530	311,454	7,076
2028	413.3	507,195	391,375	115,820	168,186	59,890	108,296	339,009	331,485	7,525
2029	436.9	536,162	413,759	122,404	177,791	63,345	114,447	358,371	350,414	7,957
2030	460.6	566,148	436,900	129,248	187,734	66,886	120,848	378,413	370,013	8,400
2031	484.2	596,133	460,041	136,092	197,678	70,428	127,249	398,455	389,613	8,843
2032	507.8	627,382	484,122	143,260	208,040	74,078	133,962	419,342	410,044	9,299
2033	531.4	656,104	506,323	149,780	217,564	77,512	140,052	438,540	428,811	9,728

The sales forecast is adjusted for solar load impacts by subtracting cumulative new solar own-use generation from the appropriate class sales forecasts. By 2033, solar generation reduces residential sales by an additional 140,052 MWh, which represents a reduction of 608 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.

1.4.4 Heat Pumps

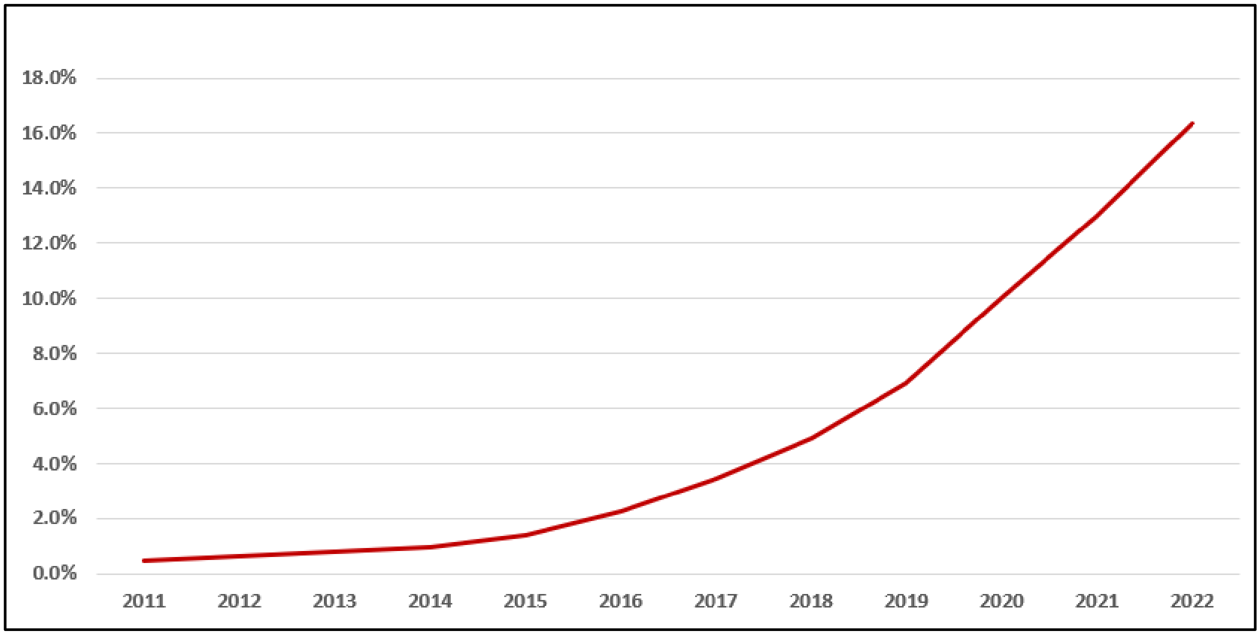
The heat pump program is one of the state's largest programs to limit greenhouse gas emissions. The number of heat pumps that have been installed has far exceeded the 2020 forecast. Since 2014 over 49,000 heat pumps have been purchased through the state incentive program. This translates into approximately 36,000 heat pumps in the GMP service area. Figure 19 shows estimated annual number of heat pumps.

FIGURE 19: INSTALLED HEAT PUMPS



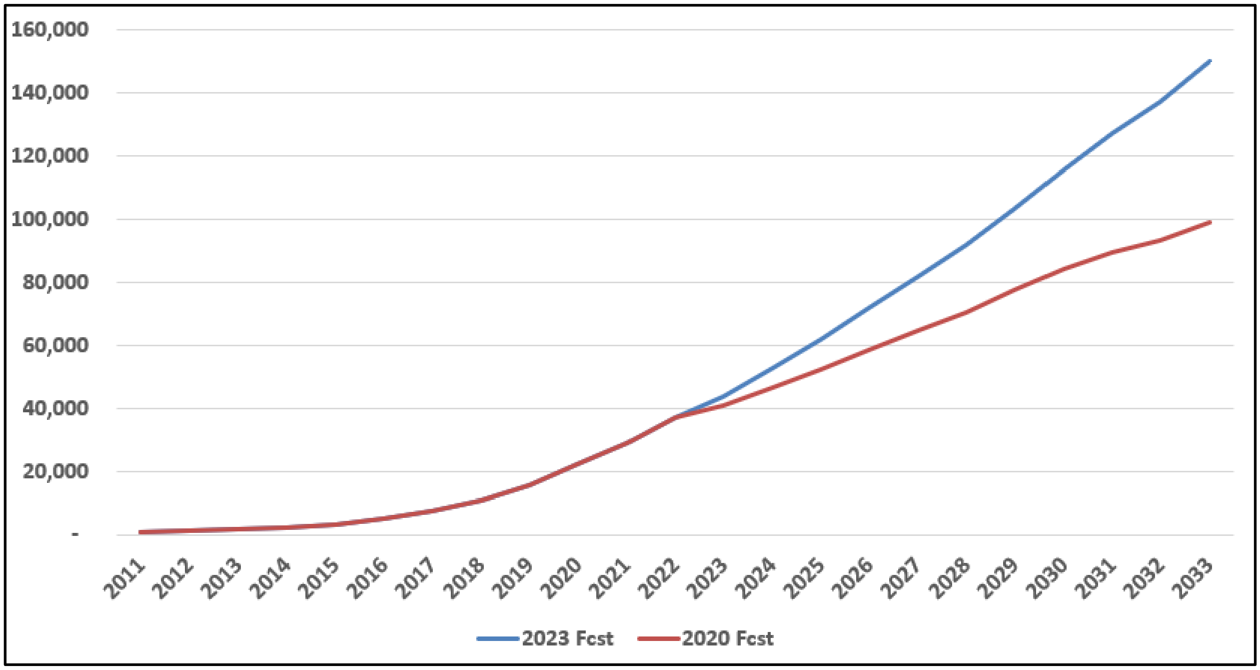
Given the number of customers, this implies that up to 17% of residential customers have a heat pump. The actual saturation rate is probably smaller as customers often have more than one unit. In comparison the estimated saturation in 2017 was less than 4%. Figure 20 shows how heat pump penetration has changed over time.

FIGURE 20: HEAT PUMP SATURATION (UNITS / CUSTOMERS)



Given the success of the program, VEIC most recent *medium* forecast has been significantly increased. The forecast has been filed as part of the recently filed DRP. The GMP forecast is based on the VEIC medium case. The GMP forecast is calculated by multiplying the VEIC medium case forecast by 71.2% (current share of electric customers served by GMP). Results are significantly higher than the medium case scenario filed in GMP's last IRP. Figure 21 shows the IRP base case forecast (2020) and the updated heat pump forecast (2023).

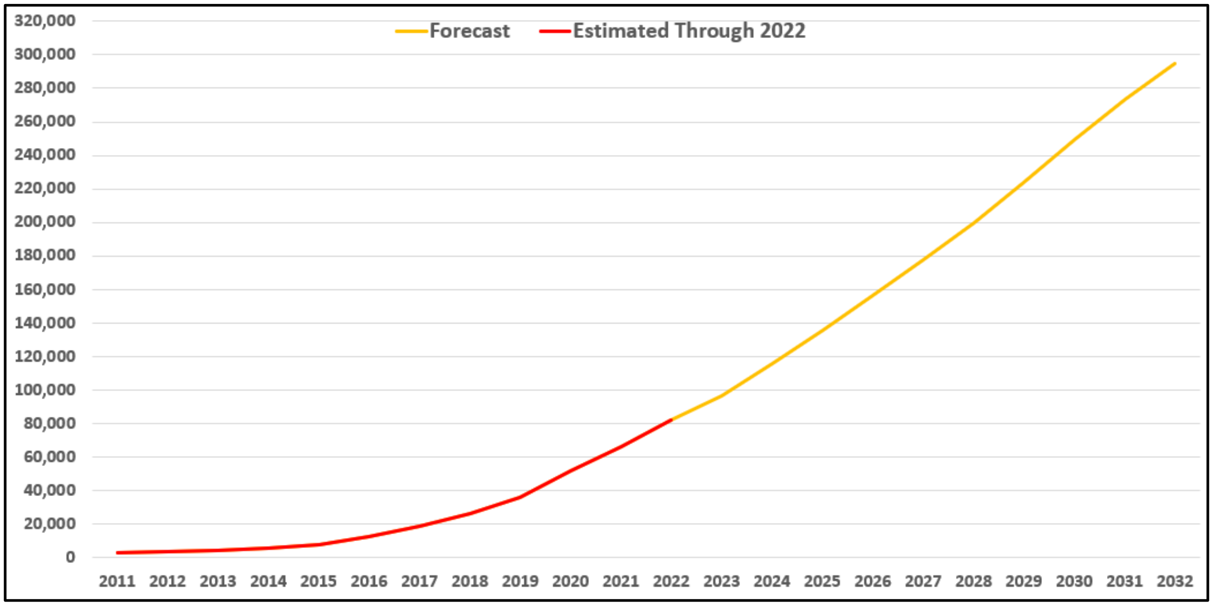
FIGURE 21: HEAT PUMP UNIT FORECAST



In 2022 there is an estimated 40,000 heat pumps in place. By 2027 the number of heat pumps more than doubles to 82,000 and in ten years (2032) the number of installed heat pumps reaches nearly 140,000; this implies a heat pump saturation of 36% of homes by 2027 and 60% in ten years.

The heat pump kWh use is based on a Cadmus study that monitored several heat pumps in Vermont. Heating is assumed to use around 2,100 kWh and cooling 150 kWh. This would imply that units that are being installed are relatively small supplemental units. Even at these levels of usage, total heat pump sales are significant with heat pumps estimated to contribute 80,000 MWh of use in 2022 increasing to 178,000 MWh by 2027 and nearly 300,000 MWh by 2032. Projected sales are shown in Figure 22.

FIGURE 22: HEAT PUMP SALES FORECAST

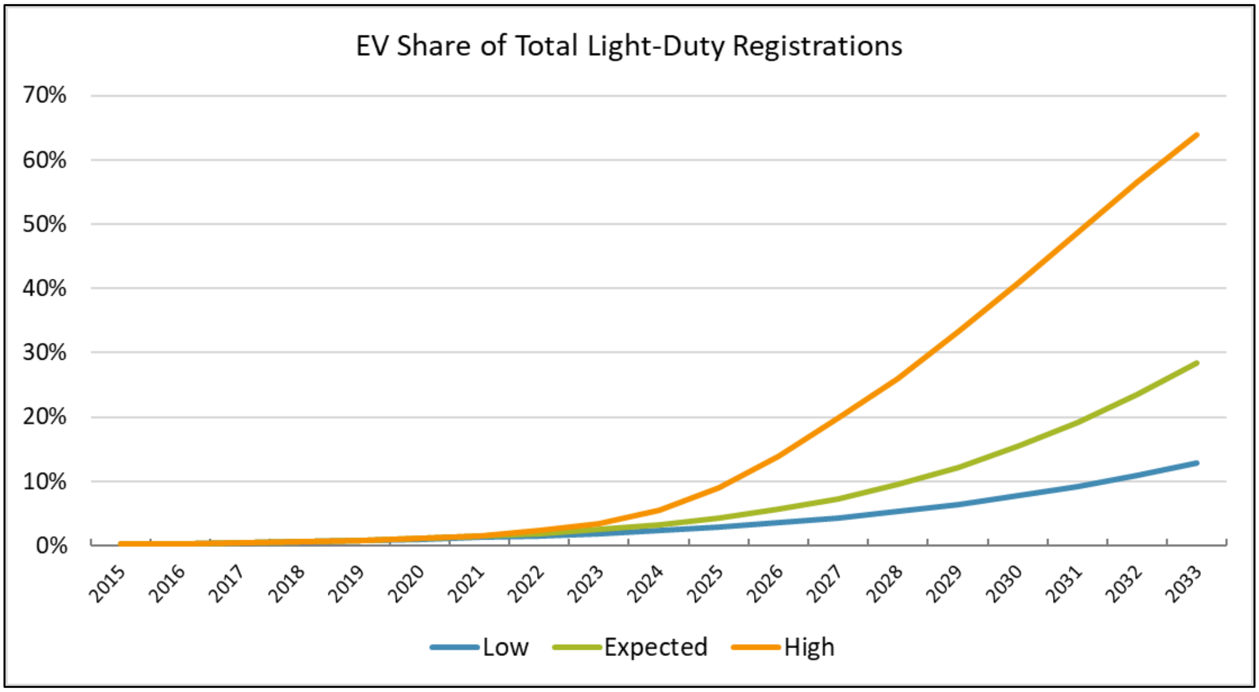


1.4.5 Electric Vehicles

As of January 2023, Vermont had approximately 8,875 registered plug-in hybrid (PHEV) and all battery electric (BEV) vehicles, this is up 35% from the prior year. While electric vehicles constituted only 6.9% of all new light duty vehicle sales in 2022, demand is expected to significantly increase over the next five years with declining vehicle costs, increased range, improving infrastructure, and new vehicle models. EV investment commitments from GM, Volkswagen, Ford, and other major vehicle manufacturers along with new federal funding as a result of the Inflation Reduction Act, all but guarantee strong growth in electric vehicle sales.

The EV sales forecast is based on VEICs 2020 EV projections, calibrated into July 2022 Vermont vehicle registrations (latest available at time of forecast). The VEIC forecast was updated as part of VELCO's 2020 IRP forecast. Figure 23 shows EV share of total light-duty vehicle stock.

FIGURE 23: EV SATURATION FORECAST



Projections show low, expected, and high saturation scenarios. The GMP forecast is based on VEIC's expected saturation path and the assumption that 76% of the state's EVs will fall in GMP service territory. Figure 24 shows the project of GMP electric vehicles.

FIGURE 24: REGISTERED ELECTRIC VEHICLES

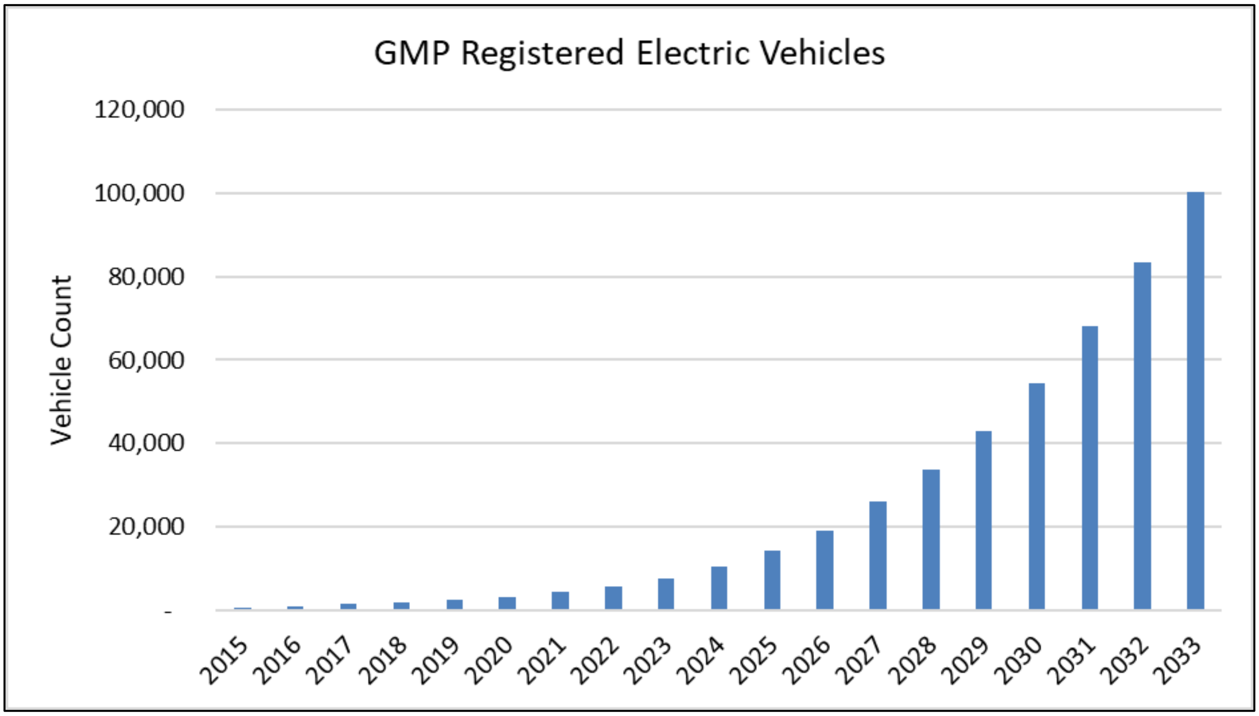
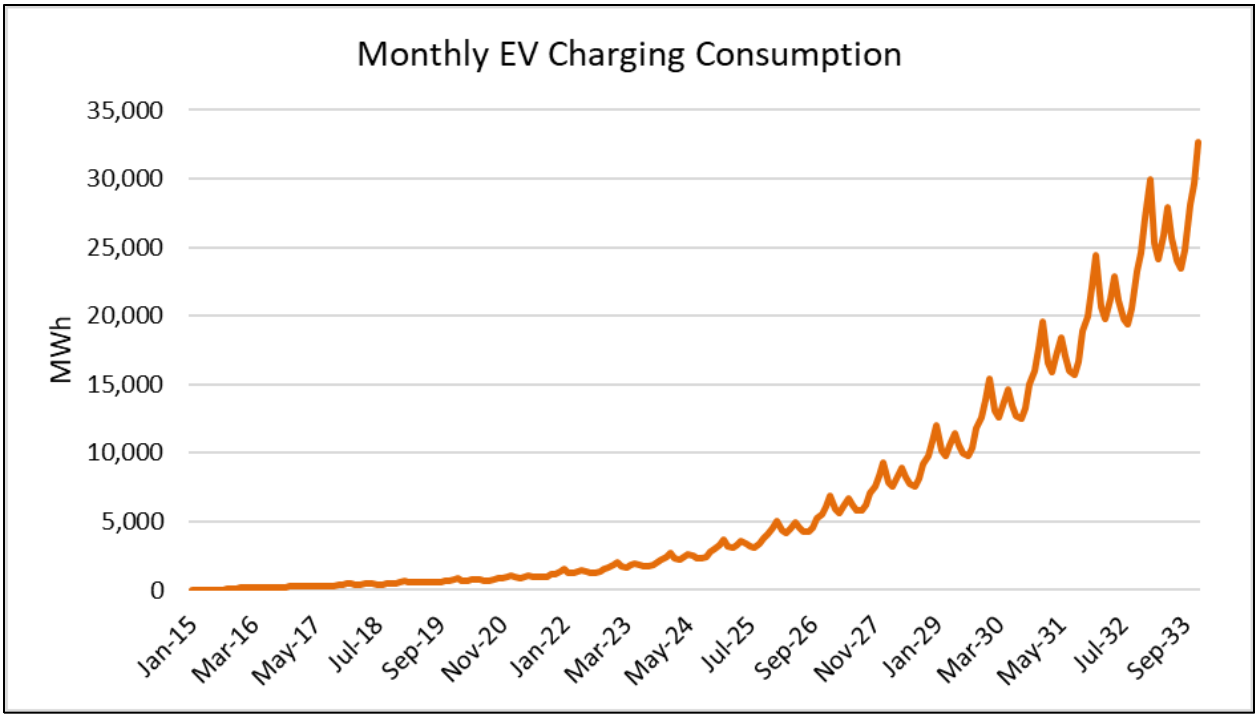


Figure 25 shows the GMP electric vehicle sales forecast. Inputs include number of EVs, average annual miles driven, and miles per kWh. The monthly charging consumption is based on AMI vehicle charging data and reflects the impact of increased charging needs in colder months.

FIGURE 25: ELECTRIC VEHICLE SALES



1.4.6 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 1,232 MWh.

The largest load adjustment is for the removal of GlobalFoundries from GMP's service territory as they commence operations as their own electric utility, consistent with the Vermont Public Utility Commission's Order in Case Nos. 21-1107-PET and 21-1109-PET. GMP is currently serving GlobalFoundries' load under a transitional power purchase agreement (PPA), which represents a third of the Large C&I class sales. This PPA expires in October 2026, at which time GlobalFoundries load is removed from the sales forecast.

1.4.7 Load Adjustments Summary

Table 7 summarizes load adjustments applied to the baseline forecast. Electrification programs and increasing penetration of electric vehicles combine to virtually negate the impact efficiency and solar have on sales. The large drop in 2027 sales reflects the removal of GlobalFoundries load as described above.

TABLE 7: ADJUSTMENTS SUMMARY

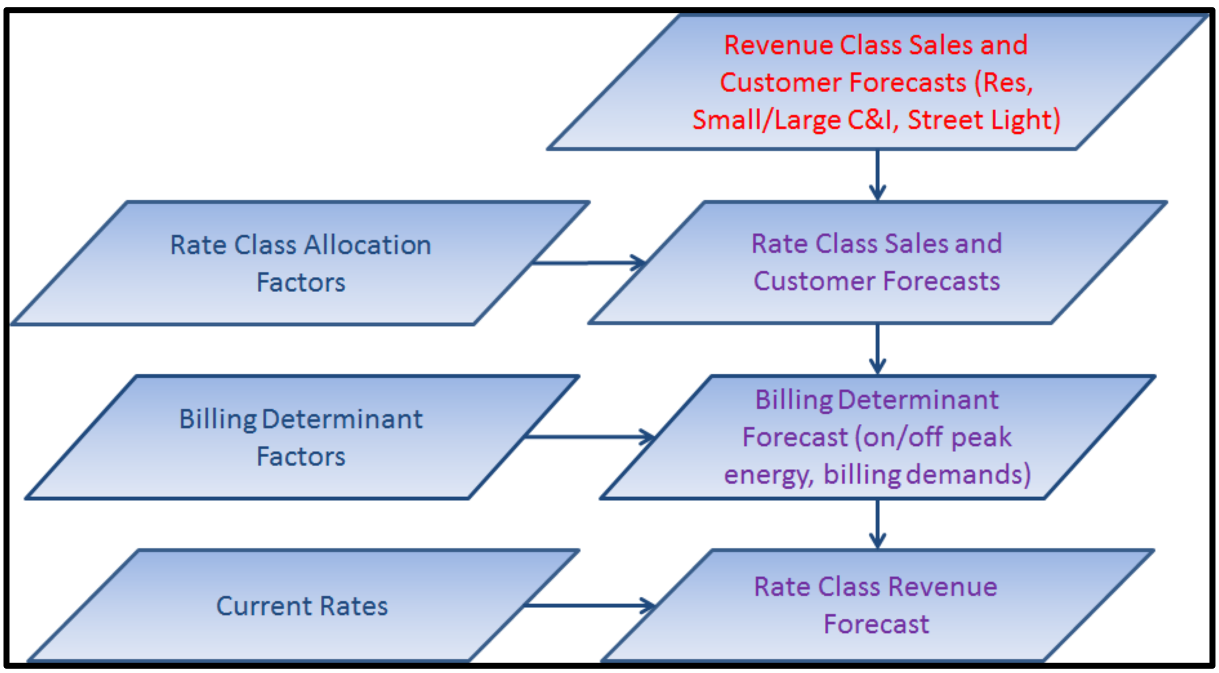
Year	NoEE(1)	EE(2)	Solar(3)	Tier3(4)	EV(5)	SpotLds(6)	TtlAdj	Forecast
2023	4,173,777	-41,819	-6,345	4,111	1,866	924	-41,263	4,132,513
2024	4,262,644	-104,451	-12,149	22,187	9,241	1,232	-83,939	4,178,705
2025	4,295,747	-140,106	-18,430	44,763	19,459	1,232	-93,081	4,202,666
2026	4,338,547	-177,765	-24,984	67,518	33,368	1,232	-100,631	4,237,917
2027	3,996,422	-215,805	-31,693	91,618	52,279	1,232	-102,369	3,894,053
2028	4,034,208	-254,068	-38,507	115,956	76,563	1,232	-98,823	3,935,385
2029	4,069,959	-291,584	-44,991	140,961	104,800	1,232	-89,582	3,980,377
2030	4,103,829	-329,637	-51,685	168,145	139,586	1,232	-72,360	4,031,470
2031	4,135,679	-366,379	-58,379	194,355	181,534	1,232	-47,637	4,088,042
2032	4,167,648	-401,260	-65,327	218,441	230,644	1,232	-16,269	4,151,379

1. No EE forecast assumes no efficiency improvements after 2022.
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. Tier 3 heat pump forecast is derived by adjusting VEIC projections for Vermont for the share of GMP sales.
5. VEIC EV forecast adjusted for GMP state share of electricity sales.
6. Customer specific spot load adjustments.

1.5 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 26 provides an overview of the revenue model.

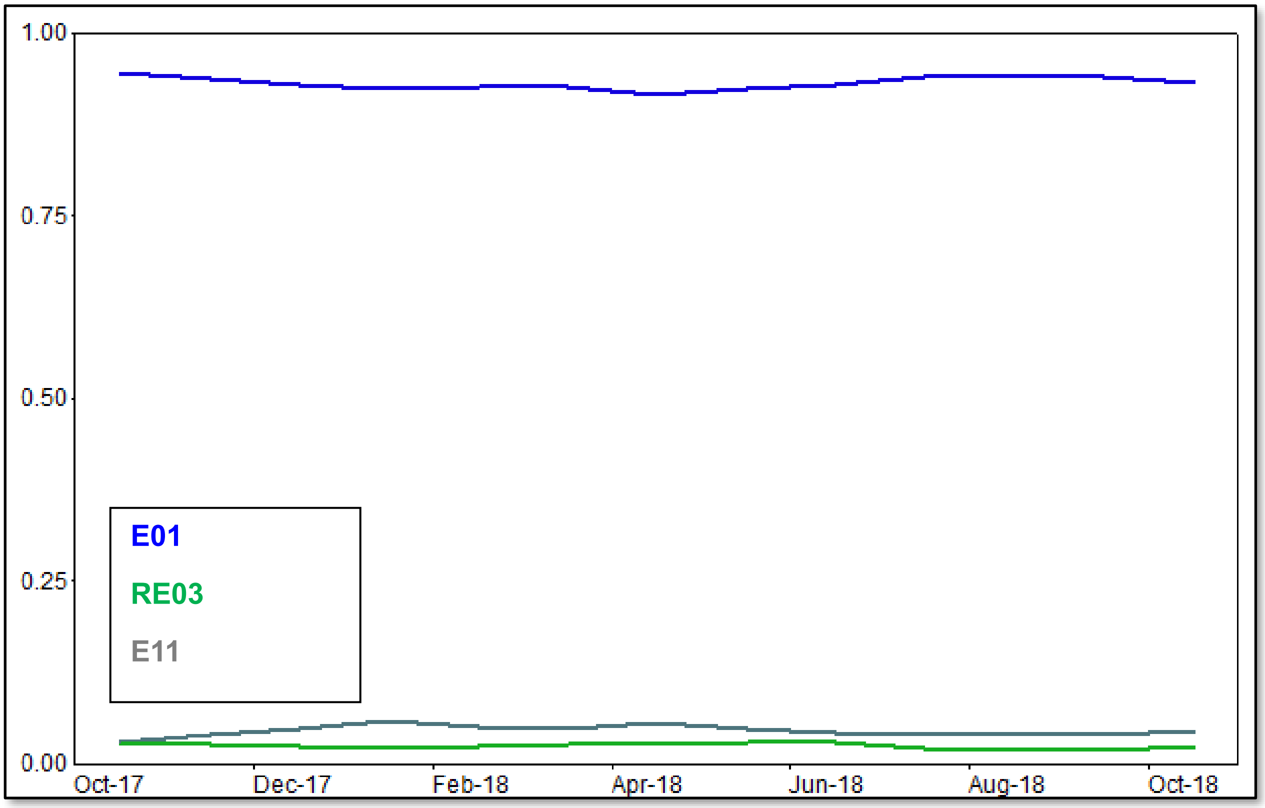
FIGURE 26: REVENUE MODEL



1.5.1 Derive Rate Class Monthly Sales Forecast

Revenue class sales and customer forecasts are 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 capture any share trends and seasonal variation. Residential class sales, for example, are allocated to rate schedules - E01, RE03, and E11 rate classes. Figure 27 shows historical and forecasted residential rate class sales shares.

FIGURE 27: RESIDENTIAL RATE CLASS SHARE FORECAST



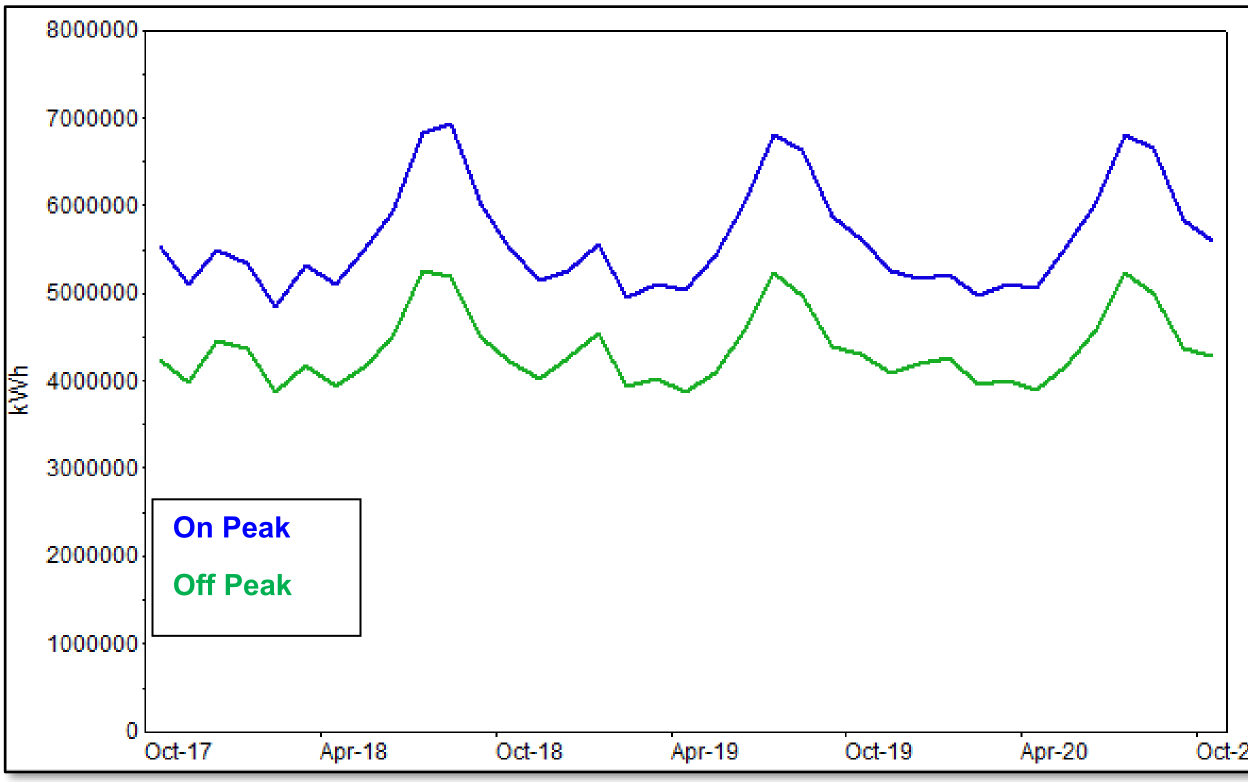
Approximately 95% of residential sales are billed under rate E01. The percentage is slightly lower in the winter months as the electric time-of-use rate (E11) is higher in these months.

1.5.2 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 28 shows the resulting sales block forecasts for rate E65 Demand Customers.

FIGURE 28: RATE E65 DEMAND CUSTOMER - SALES BILLING BLOCK FORECAST

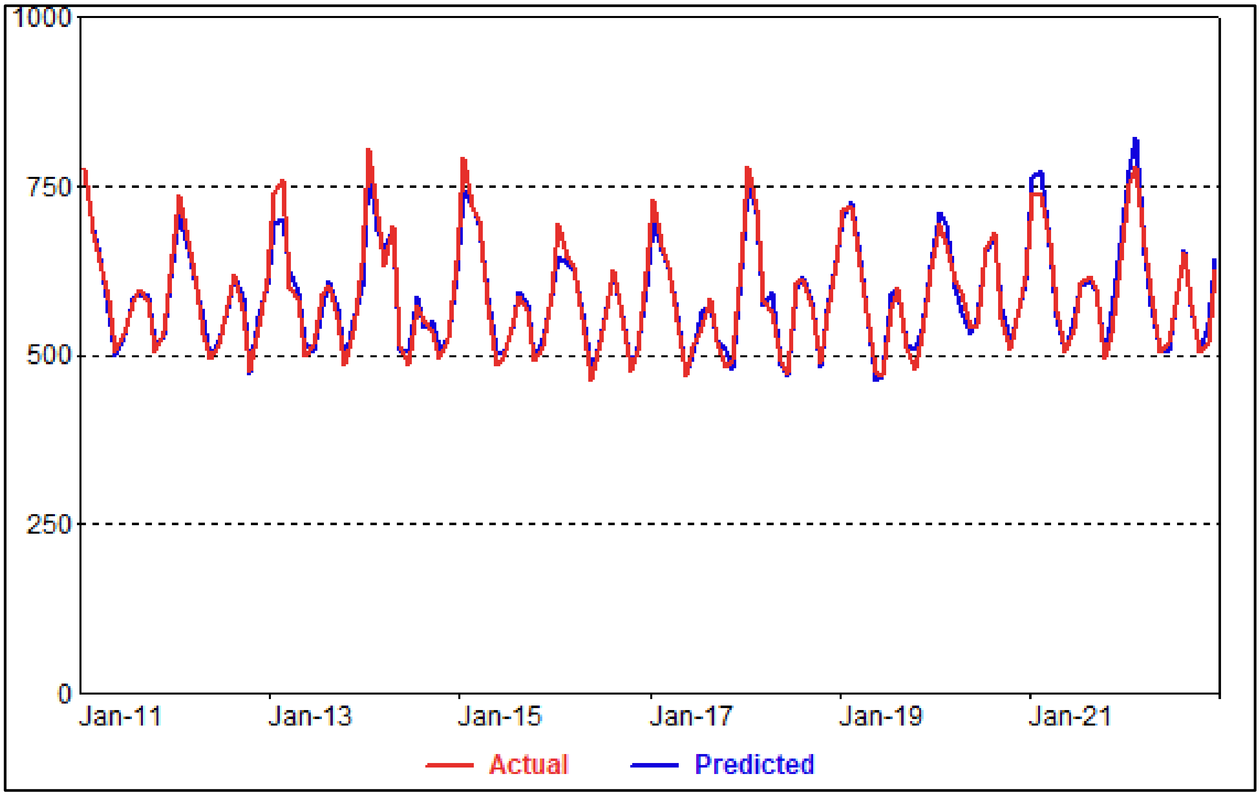


1.5.3 Calculate Rate Schedule and Revenue Class Revenues

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 mapped back to the customer classes residential, small C&I, large C&I, and street lighting as reported in the Summary Table 2.

APPENDIX A: MODEL STATISTICS AND COEFFICIENTS

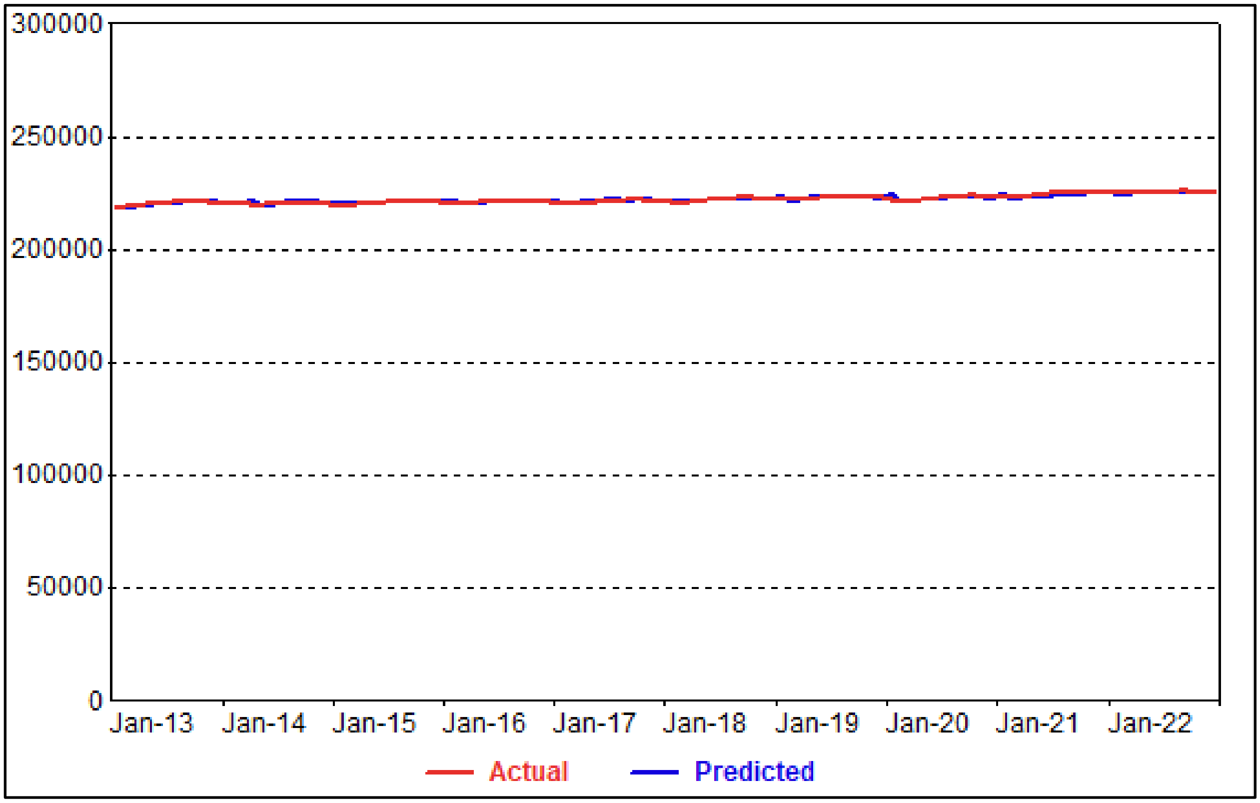
FIGURE 29: RESIDENTIAL AVERAGE USE MODEL



Variable	Coefficient	StdErr	T-Stat	P-Value
mStructRevRes.XHeat	1.211	0.045	26.662	0.00%
mStructRevRes.XCool	1.212	0.057	21.237	0.00%
mStructRevRes.XOther	0.938	0.014	66.714	0.00%
mBin.Feb	-23.3	5.86	-3.976	0.01%
mBin.Mar	-32.482	6.958	-4.668	0.00%
mBin.Apr	-27.866	7.37	-3.781	0.02%
mBin.May	-26.08	7.293	-3.576	0.05%
mBin.Jun	-26.553	5.83	-4.555	0.00%
mBin.Apr14	105.127	14.847	7.081	0.00%
AR(1)	0.7	0.067	10.388	0.00%

Model Statistics	
Iterations	9
Adjusted Observations	143
Deg. of Freedom for Error	133
R-Squared	0.957
Adjusted R-Squared	0.954
AIC	5.782
BIC	5.99
Log-Likelihood	-606.35
Model Sum of Squares	895,510.10
Sum of Squared Errors	40,350.53
Mean Squared Error	303.39
Std. Error of Regression	17.42
Mean Abs. Dev. (MAD)	12.45
Mean Abs. % Err. (MAPE)	2.06%
Durbin-Watson Statistic	1.563

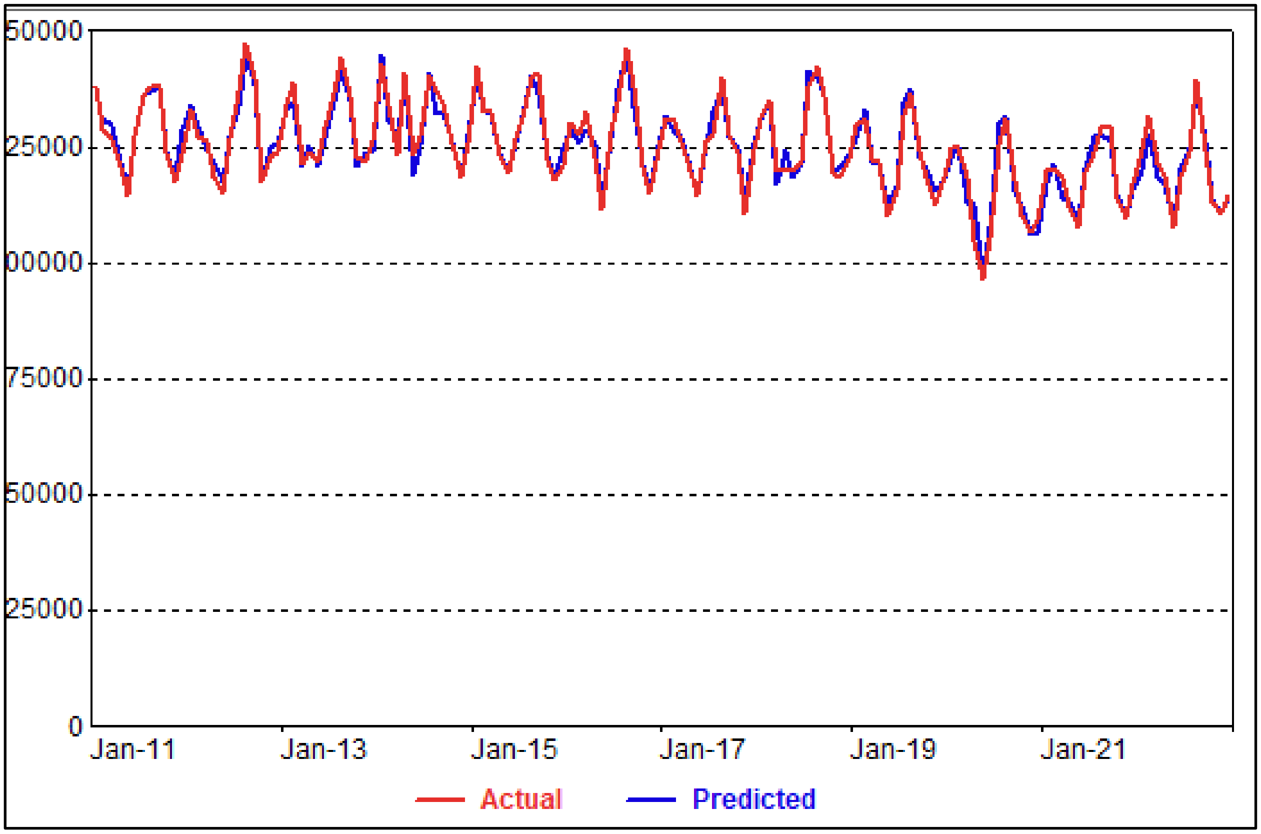
FIGURE 30: RESIDENTIAL CUSTOMER MODEL



Variable	Coefficient	StdErr	T-Stat	P-Value
Economics.HHs	833.745	0.866	962.88	0.00%
mBin.Yr19Plus	2861.968	461.884	6.196	0.00%
mBin.Yr20Plus	3631.352	535.93	6.776	0.00%
mBin.Yr21Plus	2877.418	514.418	5.594	0.00%
MA(1)	0.92	0.09	10.165	0.00%
MA(2)	0.743	0.105	7.109	0.00%
MA(3)	0.343	0.091	3.789	0.03%

Model Statistics	
Iterations	32
Adjusted Observations	120
Deg. of Freedom for Error	113
R-Squared	0.862
Adjusted R-Squared	0.855
AIC	13.129
BIC	13.292
Log-Likelihood	-951.03
Model Sum of Squares	336,669,606.49
Sum of Squared Errors	53,759,704.98
Mean Squared Error	475,749.60
Std. Error of Regression	689.75
Mean Abs. Dev. (MAD)	460.27
Mean Abs. % Err. (MAPE)	0.21%
Durbin-Watson Statistic	1.826

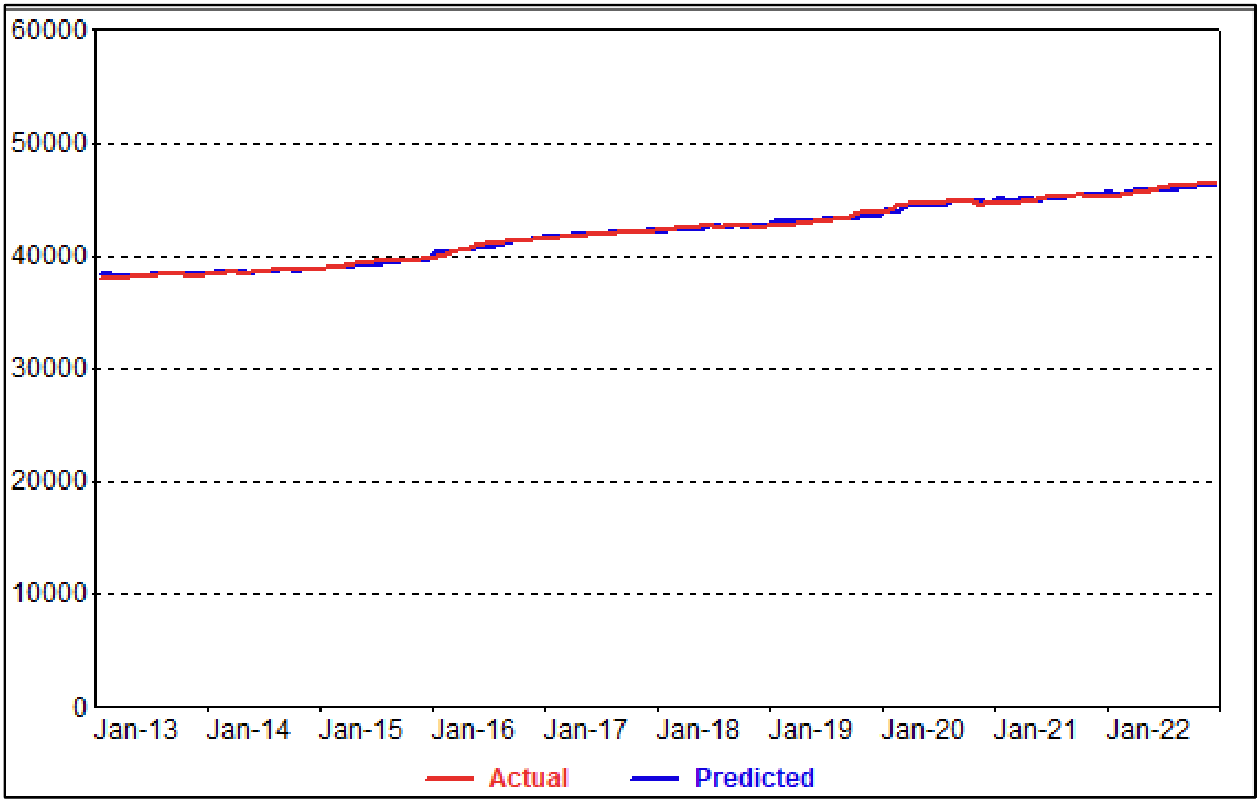
FIGURE 31: SMALL C&I SALES MODEL



Variable	Coefficient	StdErr	T-Stat	P-Value
mStructRevCom.XHeat	167804.628	10477.02	16.016	0.00%
mStructRevCom.XCool	84218.692	3328.419	25.303	0.00%
mStructRevCom.XOther	9217.923	88.993	103.58	0.00%
mBin.Feb	2165.627	664.979	3.257	0.14%
mBin.Oct	3126.696	678.546	4.608	0.00%
mBin.Apr14	15185.05	2171.814	6.992	0.00%
mBin.May20	-7304.935	2423.667	-3.014	0.31%
mBin.Jun20	-8337.973	2407.943	-3.463	0.07%
mBin.May22	-5964.771	2182.115	-2.733	0.71%
Covid.NResIndex	-3153.04	1119.97	-2.815	0.56%
mBin.TrendVar	1346.003	140.946	9.55	0.00%
AR(1)	0.53	0.078	6.821	0.00%

Model Statistics	
Iterations	14
Adjusted Observations	143
Deg. of Freedom for Error	131
R-Squared	0.94
Adjusted R-Squared	0.935
AIC	15.691
BIC	15.94
Log-Likelihood	-1,312.82
Model Sum of Squares	12,427,687,076.20
Sum of Squared Errors	788,852,715.39
Mean Squared Error	6,021,776.45
Std. Error of Regression	2,453.93
Mean Abs. Dev. (MAD)	1,864.53
Mean Abs. % Err. (MAPE)	1.50%
Durbin-Watson Statistic	2.051

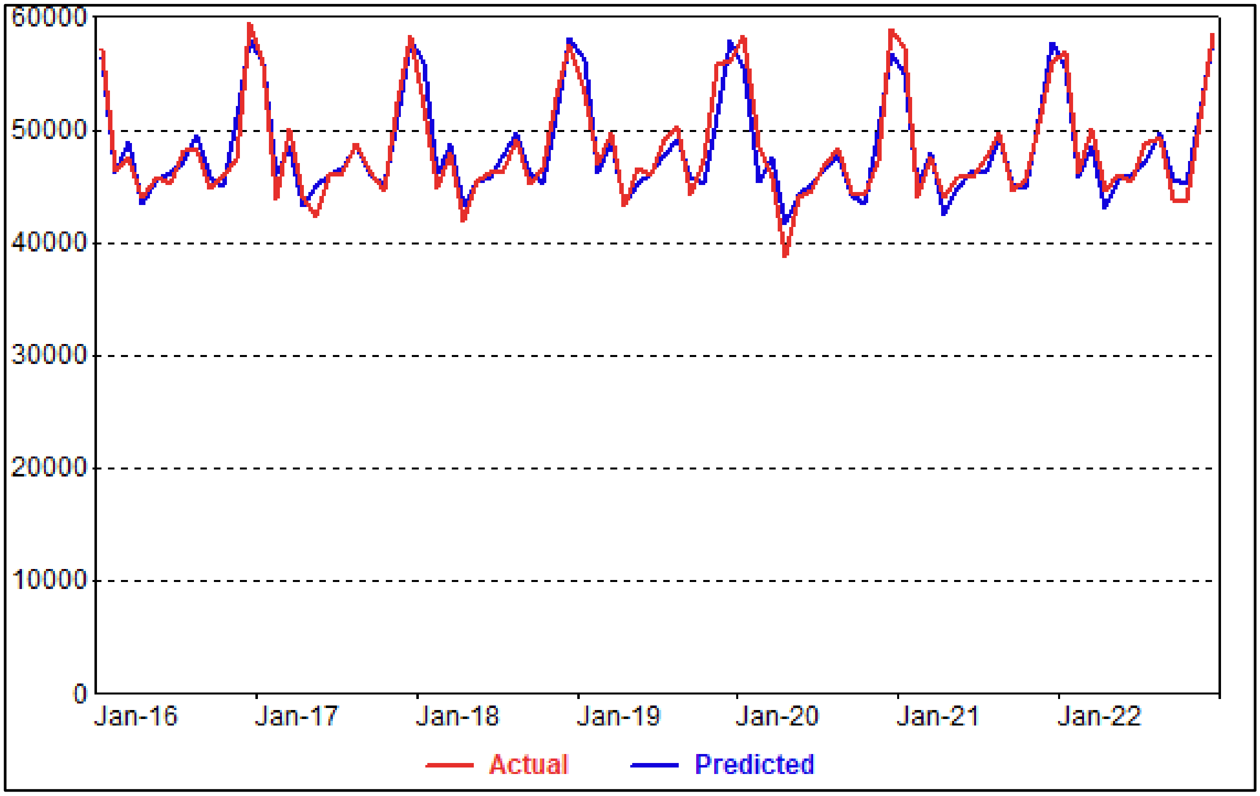
FIGURE 32: SMALL C&I CUSTOMER MODEL



Variable	Coefficient	StdErr	T-Stat	P-Value
mBin.Yr16Plus	870.27	130.609	6.663	0.00%
mBin.Yr19Plus	404.161	128.059	3.156	0.21%
mBin.Yr20Plus	775.164	170.087	4.557	0.00%
mEcon.ComVar	11008.062	1749.92	6.291	0.00%
ComCust.LagDep(6)	0.723	0.045	16	0.00%
MA(1)	0.472	0.083	5.706	0.00%

Model Statistics	
Iterations	14
Adjusted Observations	120
Deg. of Freedom for Error	114
R-Squared	0.992
Adjusted R-Squared	0.992
AIC	10.95
BIC	11.089
Log-Likelihood	-821.27
Model Sum of Squares	814,119,366.56
Sum of Squared Errors	6,183,944.37
Mean Squared Error	54,245.13
Std. Error of Regression	232.91
Mean Abs. Dev. (MAD)	181.77
Mean Abs. % Err. (MAPE)	0.43%
Durbin-Watson Statistic	1.673

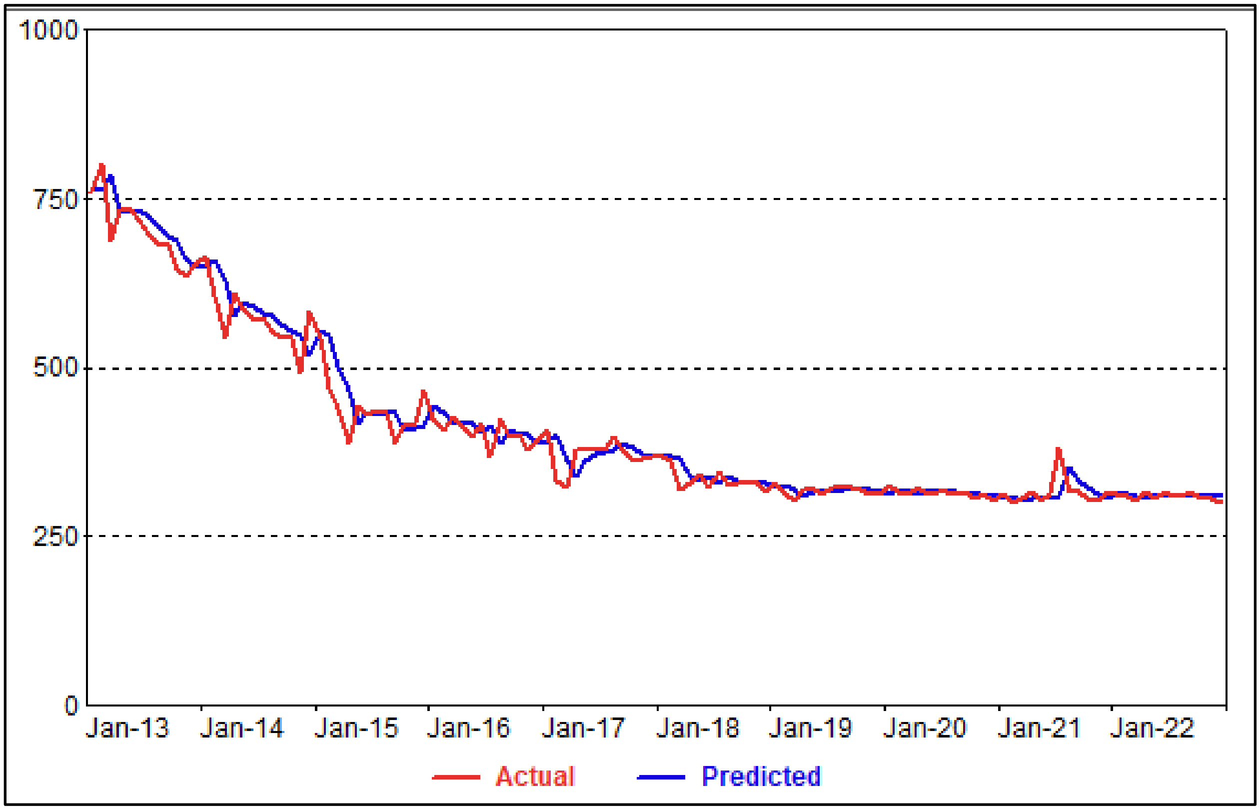
FIGURE 33: LARGE C&I SALES MODEL



Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	17771.154	14784.78	1.202	23.33%
mEcon.IndVar	27697.56	15023.04	1.844	6.93%
mBin.Jan	11149.607	743.139	15.003	0.00%
mBin.Feb	1118.349	741.92	1.507	13.60%
mBin.Mar	3722.965	743.483	5.007	0.00%
mBin.Apr	-1677.647	749.356	-2.239	2.82%
mBin.Aug	2314.291	754.684	3.067	0.30%
mBin.Nov	6285.081	742.356	8.466	0.00%
mBin.Dec	13123.5	743.801	17.644	0.00%
mWthrCal.CDD60	6.664	2.166	3.076	0.30%
Covid.NResIndex	-367.171	450.453	-0.815	41.77%

Model Statistics	
Iterations	1
Adjusted Observations	84
Deg. of Freedom for Error	73
R-Squared	0.894
Adjusted R-Squared	0.879
AIC	14.899
BIC	15.217
F-Statistic	61.522
Prob (F-Statistic)	0
Log-Likelihood	-733.93
Model Sum of Squares	1,609,094,442.62
Sum of Squared Errors	190,930,173.50
Mean Squared Error	2,615,481.83
Std. Error of Regression	1,617.25
Mean Abs. Dev. (MAD)	1,185.95
Mean Abs. % Err. (MAPE)	2.45%
Durbin-Watson Statistic	2.094

FIGURE 34: OTHER SALES MODEL



Variable	Coefficient	StdErr	T-Stat	P-Value
Simple	0.588	0.084	7.034	0

Model Statistics	
Iterations	8
Adjusted Observations	120
Deg. of Freedom for Error	119
R-Squared	0.957
Adjusted R-Squared	0.957
AIC	6.577
BIC	6.601
Log-Likelihood	-563.92
Model Sum of Squares	1,890,339
Sum of Squared Errors	84,816
Mean Squared Error	712.74
Std. Error of Regression	26.7
Mean Abs. Dev. (MAD)	17.16
Mean Abs. % Err. (MAPE)	4.05%
Durbin-Watson Statistic	1.996