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Weather Normalized Distribution System Throughput Forecast: 2020-2024

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1 INTRODUCTION

This report outlines the results of, and methodology used to derive, the 2020 to 2024 weather normal throughput forecast (or "load forecast") prepared for EPCOR Natural Gas Limited Partnership ("ENGLP").

The methodology outlined in this report is largely consistent with the methodology used in ENGLP's 2020 COS application (EB-2018-0336) and the methodology used by Natural Gas Resources Limited ("NRG") in previous rates applications. Parties agreed to the results of the 2020 throughput forecast in settlement and the overall methodology was last approved in EB-2010-0018. Alternate methods were tested but generally found to be inferior to the previously approved methodology.

In the EB-2018-0336 settlement, ENGLP agreed to collect additional customer data to improve the quality of the forecast for its next COS application.[1] This forecast has been produced without the additional data.

> *The Parties agree ENGLP will request furnace efficiency and number of persons in household in future customer engagement surveys and will update its volume throughput and revenue forecasting methodology in its next rebasing application to reflect these variables.*

The regression equations used to normalize and forecast ENGLP's weather sensitive load use monthly heating degree days as measured at Environment Canada's London CS weather station to take into account temperature sensitivity. This location is the closest weather station to ENGLP's service territory with strong historical weather data. ENGLP experiences peak loads in winter months, though certain rate classes are not weather sensitive. Environment Canada defines heating degree days as the difference between the average daily temperature and 18°C for each day. Heating degree days is 0 when the average temperature is above 18°C. New to this forecast, Elenchus considered heating degree day data with alternate temperature thresholds other than 18°C, consistent with recent changes to electricity load forecast methodologies that have been approved by the Board.

ENGLP serves six rate classes, R1 to R6, one of which (R1) contains three sub-classes: Residential, Commercial, and Industrial. Each R1 sub-class and the R3 class are weather-sensitive. Consumption of the R2, R4, R5, and R6 rate classes are not correlated to heating degree days. Consumption per customer forecasts for the R1 sub-classes use a baseload and excess consumption methodology to examine the impact of temperature on consumption. The R3 class' baseload consumption has fluctuated in historic years so

[1] EB-2018-0336 - Decision and Interim Rate Order, July 4, 2019 , Page 10

the regression for this uses total consumption with a time trend. The previous 2020 forecast used the 5-year rolling average consumption per customer to forecast consumption of the non-weather sensitive classes, consistent with previously approved forecasts. Due to recent increases in consumption per customer that materially exceed historic averages, the number of years used to calculate average consumption has been reduced for certain classes, as described in Section 6 of this report.

In addition to the weather, economic variables, a time trend variable, number of days and number of working days in each month, number of customers, and month of year variables, have been examined for weather sensitive rate classes. More details on the individual class specifications are provided in the next section.

ENGLP does not have a DSM plan so no adjustments were made to the class forecasts to account for DSM savings.

1.1 SUMMARIZED RESULTS

The following table summarizes the historic and weather normalized consumption.

Normal Forecast

	2017 Actual	2018 Actual	2019 Actual	2019 Normal	2020 Forecast	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast
R1 Residential	15,400,135	17,442,260	18,006,476	17,605,176	17,521,080	18,114,687	18,728,136	19,362,081	20,017,199
R1 Industrial	1,752,123	2,050,371	2,461,420	2,369,312	2,230,507	2,388,524	2,556,992	2,736,573	2,927,968
R1 Commercial	4,734,213	5,363,288	5,890,510	5,766,774	5,739,519	5,952,003	6,171,885	6,399,414	6,634,844
R2 Seasonal	1,410,653	1,520,647	1,279,499	*1,279,499*	1,166,433	1,124,687	1,084,435	1,045,624	1,008,202
R3	1,653,466	1,711,013	1,510,164	1,465,408	1,579,434	1,507,691	1,444,418	1,388,075	1,337,485
R4	1,124,029	1,327,953	1,953,378	*1,953,378*	1,734,530	1,946,379	2,184,104	2,450,862	2,750,202
R5	753,900	624,337	927,203	*927,203*	757,096	757,096	757,096	757,096	757,096
R6	36,485,139	40,205,243	62,525,354	*62,525,354*	62,525,354	62,525,354	62,525,354	62,525,354	62,525,354
Total	**63,313,659**	**70,245,110**	**94,554,003**	**93,892,105**	**93,253,953**	**94,316,421**	**95,452,420**	**96,665,079**	**97,958,351**

Table 1 Consumption Forecast by class

The following table summarizes the historic and forecast customer/connections for 2017-2024:

Customers / Connections

	2017 Actual	2018 Actual	2019 Actual	2020 Forecast	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast
R1 Residential	8110	8400	8663	8929	9204	9488	9780	10081
R1 Industrial	66	68	73	77	82	86	90	95
R1 Commercial	462	487	537	552	568	584	600	617
R2 Seasonal	55	54	49	47	46	44	42	41
R3	5	6	6	6	6	6	6	6
R4	36	37	37	40	41	42	43	45
R5	5	4	4	4	4	4	4	4
R6	1	1	1	1	1	1	1	1
Total	**8,738**	**9,056**	**9,370**	**9,656**	**9,952**	**10,255**	**10,566**	**10,890**

Table 2 Customer Forecast for 2013-2020

Forecasts of 2021 consumption by tier, for the classes billed based on volume tiers, is provided below.

2021 Tier Forecast

kW	Period	Tier 1	Tier 2	Tier 3	Total
R1 Residential		18,001,376	113,311		**18,114,687**
R1 Industrial		562,790	1,825,735		**2,388,524**
R1 Commercial		2,818,850	3,133,153		**5,952,003**
Seasonal	**Apr-Oct**	74,884	625,490	119,494	**819,868**
Seasonal	**Nov-Mar**	58,113	231,410	15,296	**304,819**
R4	**Jan-Mar**	30,497	6,174		**36,671**
R4	**Apr-Dec**	159,745	1,749,963		**1,909,708**

Table 3 2020 Consumption Forecast by Tier

2 METHODOLOGY

Energy use for R1 Residential, R1 Industrial, R1 Commercial and R3 rate classes are forecast with multivariate regressions. Regressions were not selected for R2 Seasonal, R4, R5 and R6 rate classes as these classes do not exhibit sufficient sensitivity to the explanatory variables available for a statistical regression approach.

2.1 CONSUMPTION OF WEATHER SENSITIVE CLASSES

Consumption of the three R1 rate classes are forecast using a base load and excess consumption method. Average monthly consumption per customer is first calculated for each class. The amounts are then reduced by the base load consumption, which is considered the average consumption in the summer months of July and August. The remaining consumption is considered the weather-sensitive load (or “excess” load). A baseline trend is applied to certain classes that have ongoing increasing consumption per customer that is not related to heating.

The excess load is regressed by the actual heating degree days in each month to determine the impact of cold weather on average consumption. A time-series (Prais-Winsten) regression is used to determine the coefficient, consistent with the methodology used in prior NRG throughput forecasts. A simple Ordinary Least Squares (“OLS”) model is not appropriate as the errors exhibit a high level of autocorrelation (as demonstrated by Durbin-Watson statistics close to, or below, 1).

Alternate heating degree days data were also considered for each weather-sensitive class. Elenchus considered heating degree day figures for a range of reference temperatures from 10°C to 20°C. Using alternate HDD temperatures considers the possibility that classes, on average, begin consuming natural gas for their heating load at temperatures other than 18°C.

Actual heating degree days are then multiplied by the coefficients and base load consumption is added back to determine the average predicted consumption in each

month. Predicted total consumption of a class is determined by multiplying this sum by the actual number of customers.

The methodology is similar for the R3 class but the base load is not removed before the regression. While the calculated base load consumption is generally consistent from year to year for the R1 classes, the base load appears to have declined in historic years. As a consequence of higher base load consumption in earlier years, the calculated base load is higher than consumption in 25 of the 107 sample months and over double the volume of consumption in the most recent summer months.

To forecast 2020 consumption forecast heating degree days, as described in section 4, are used in place of actual heating degree days. Weather normalized consumption in historic years is determined by removing the deviations from average weather from consumption. This is done by multiplying the coefficients by the difference between actual and average heating degree days and applying the difference to actual consumption.

2.2 CONSUMPTION OF NON-WEATHER SENSITIVE CLASSES

Consumption of four rate classes (R2 Seasonal, R4, R5 and R6) are not weather-sensitive and do not exhibit sensitivity to the explanatory variables. Total and monthly volumes fluctuate from year to year so a rolling average is used to forecast monthly consumption for these classes, with the exception of R4 in which a trend is also applied. The number of years used in the average calculations is explained in Section 6.

2.3 CUSTOMER COUNTS

Annual customer counts for 2020-2024 are forecast by applying the geometric mean annual growth rate from 2009 to 2019 to the 2019 average customer count. Calculations for each class are provided in section 5 and 6 of this report. Monthly customer counts are derived by applying equal percentage increases in each month such that the annual average of monthly forecasts is equal to the annual forecast.

2.4 CONSUMPTION TIERS

The R1 classes, R2 Seasonal Class, and R4 classes are billed according to consumption tiers (also known as volume blocks). Historic tiered data from January 2017 to November 2018 was used to derive weather-normal tiered forecasts. The allocation from total class throughput to tiered throughput has not been updated for this forecast.

The R1 classes are billed different rates on consumption above and below a 1,000 m^3 threshold. As these classes are weather-sensitive, the share of energy consumed in each tier is determined by adjusting actual consumption in each month for each individual customer to weather normal consumption. This method allows a class' forecast

consumption to be consistent with the weather normalized total volume while maintaining the consumption profile of the rate classes. The weather-normalized consumption split between Tier 1 and Tier 2 in historic years is determined for each month and used to forecast the monthly splits in the forecast months. When two years of data was available, an average of the 2017 and 2018 splits was used.

The R2 Seasonal and R4 classes are not weather-sensitive so the average of 2017 and 2018 tier splits were applied to total annual consumption. The month of December 2017 was used with the 2018 data to provide a full year of data.

3 CLASS SPECIFIC CONSUMPTION REGRESSIONS

3.1 R1 RESIDENTIAL

For the R1 Residential Class consumption the equation was estimated using 120 observations from 2010:01 to 2019:12. The natural logarithm of heating degree days at 18°C for the months of September to June were used, as measured at the London CS weather station as described in the introduction.

Several other variables were examined and found to not show a statistically significant relationship to energy usage. Those included alternate reference temperatures, economic indicators of full-time employment and GDP, days in each month, work days in each month, and a time trend.

A baseload trend was used to remove from 31.98m^3 in 2010 to 36.03m^3 in 2019 from the average consumption variable in each month. This amount is added back to the predicted values.

The following table outlines the resulting regression model:

Model 4: Prais-Winsten, using observations 2010:01-2019:12 (T = 120)
Dependent variable: ExLNResAverageTrend
rho = 0.217952

	coefficient	std. error	t-ratio	p-value
const	0.17501721	0.058259181	3.0041138	3.30E-03
LNHDDJanuary18	0.844936999	0.014361967	58.8315668	2.03E-84
LNHDDFebruary18	0.84222508	0.01466373	57.43593722	2.56E-83
LNHDDMarch18	0.83721223	0.015037916	55.67342155	6.85E-82
LNHDDApril18	0.807118074	0.016249329	49.67085621	1.08E-76
LNHDDMay18	0.754699024	0.018567313	40.64664798	1.10E-67
LNHDDJune18	0.416211774	0.019517272	21.32530433	1.08E-40
LNHDDSeptember18	0.413965759	0.018539588	22.32874588	1.81E-42

LNHDDOctober18	0.742247424	0.016982053	43.70775474	6.30E-71
LNHDDNovember18	0.809830283	0.015527806	52.1535545	6.55E-79
LNHDDDecember18	0.840999785	0.014809569	56.78759271	8.48E-83

Statistics based on the rho-differenced data			
Mean dependent var	3.747150343	S.D. dependent var	2.03E+00
Sum squared resid	5.81439078	S.E. of regression	0.230961111
R-squared	0.988154319	Adjusted R-squared	0.987067559
F(10, 109)	636.2628014	P-value(F)	8.98E-92
rho	-0.015802205	Durbin-Watson	2.03E+00

Table 4 R1 Residential Regression Model

In the above table, and all regression results tables in the section, LN denotes natural logarithm, HDD denotes heating degree days, the month name denotes a dummy variable representing 1 in the labeled month and 0 in all other months, and the '18' denotes the reference HDD temperature of 18°C. The values within the LNHDDJanuary variable, for example, includes the natural logarithm of the number of heating degree days for each January, and 0 in all other months. The label for the dependent variable includes "Ex" denoting the values of this variable are the excess consumption above the class' base load.

Using the above model coefficients, we derive the following:

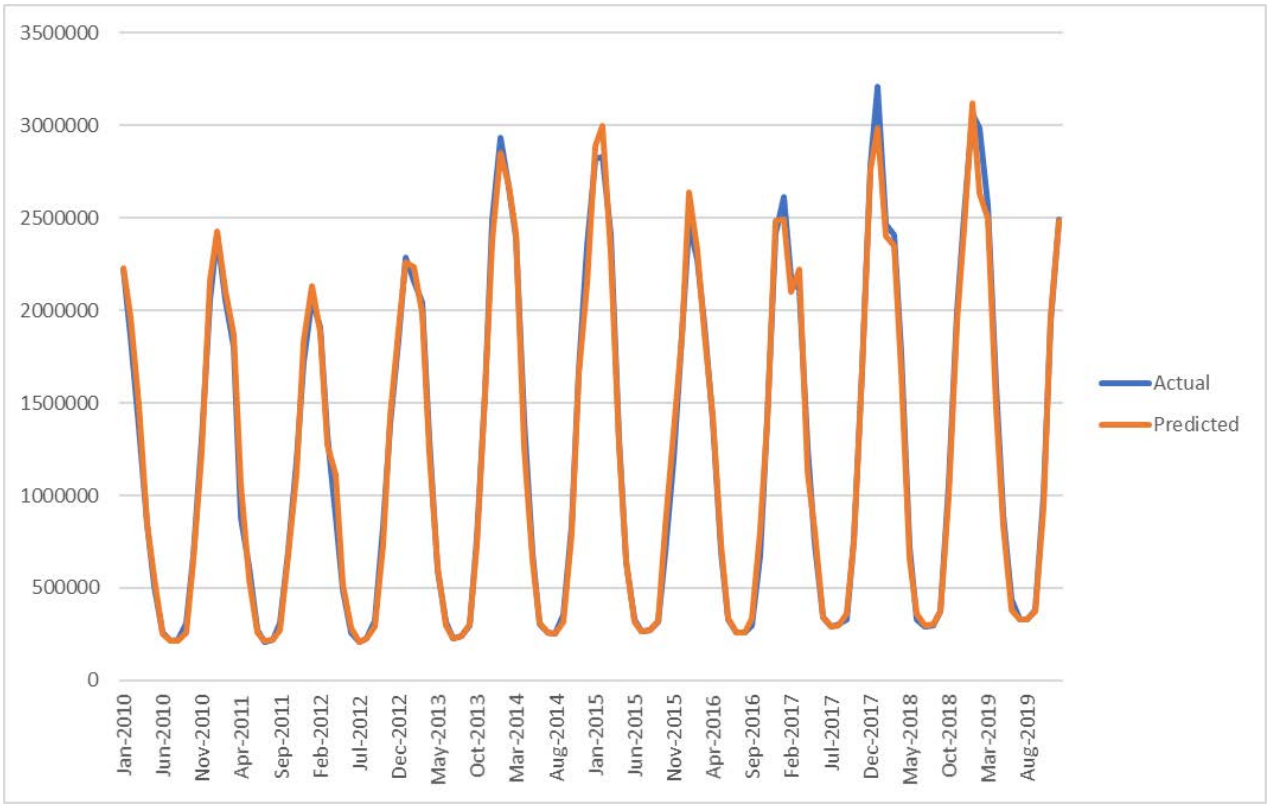

Figure 1 R1 Residential Predicted vs Actual observations

Annual estimates using actual weather are compared to actual values in the table below. Mean absolute percentage error (MAPE) for annual estimates per customer for the period is 2.5%. The MAPE calculated monthly over the period is 4.7%.

	Residential		Absolute
Year	Actual	Predicted	Error (%)
2010	11,839,669	12,078,242	2.0%
2011	12,393,486	12,606,827	1.7%
2012	11,751,822	11,991,510	2.0%
2013	14,287,143	14,062,409	1.6%
2014	16,127,158	15,588,140	3.3%
2015	14,948,329	15,323,843	2.5%
2016	14,417,053	14,893,460	3.3%
2017	15,400,135	15,239,243	1.0%
2018	17,442,260	16,770,737	3.8%
2019	18,006,476	17,358,894	3.6%
Total	146,613,530	145,913,303	0.5%

Mean Absolute Percentage Error (Annual)	2.5%
Mean Absolute Percentage Error (Monthly)	4.7%

Table 5 R1 Residential model error

3.2 R1 INDUSTRIAL

For the R1 Industrial Class consumption the equation was estimated using 120 observations from 2010:01 to 2019:12. The natural logarithm of heating degree days at 16°C for the months from August to June were used, as measured at the London CS weather station.

Several other variables were examined and found to not show a statistically significant relationship to energy usage. Those included alternate reference temperatures, economic indicators of full-time employment and GDP, days in each month, work days in each month, and a time trend.

A baseload trend was used to remove from 354.23m^3 in 2010 to 747.27m^3 in 2019 from the average consumption variable in each month. This amount is added back to the predicted values.

The following table outlines the resulting regression model:

Model 4: Prais-Winsten, using observations 2010:01-2019:12 (T = 120)
Dependent variable: ExLNR1AverageTrend
rho = 0.139801

	coefficient	std. error	t-ratio	p-value

const	1.913912226	0.323677	5.91304	5.14E-08
LNHDDJanuary16	1.097743327	0.070482192	15.57476138	2.24E-29
LNHDDFebruary16	1.092914581	0.071964295	15.18690034	1.46E-28
LNHDDMarch16	1.112515471	0.074173599	14.99880674	3.66E-28
LNHDDApril16	1.152992116	0.081500941	14.14697922	2.45E-26
LNHDDMay16	1.127594829	0.093335364	12.0811103	8.91E-22
LNHDDJune16	0.358434994	0.09099386	3.939111862	1.45E-04
LNHDDAugust16	0.506629899	8.65E-02	5.859407562	5.10E-08
LNHDDSeptember16	1.158643078	0.098920456	11.71287643	6.01E-21
LNHDDOctober16	1.418227108	0.087464306	16.21492442	1.05E-30
LNHDDNovember16	1.307412801	0.077265137	16.92112181	3.81E-32
LNHDDDecember16	1.157471569	0.07300954	15.85370318	5.86E-30

Statistics based on the rho-differenced data			
Mean dependent var	6.064599553	S.D. dependent var	2.676961
Sum squared resid	111.9705615	S.E. of regression	1.02E+00
R-squared	0.868697588	Adjusted R-squared	8.55E-01
F(11, 108)	52.93181809	P-value(F)	2.22E-38
rho	0.012150663	Durbin-Watson	1.972853

Table 6 R1 Industrial Regression Model

Using the above model coefficients we derive the following:

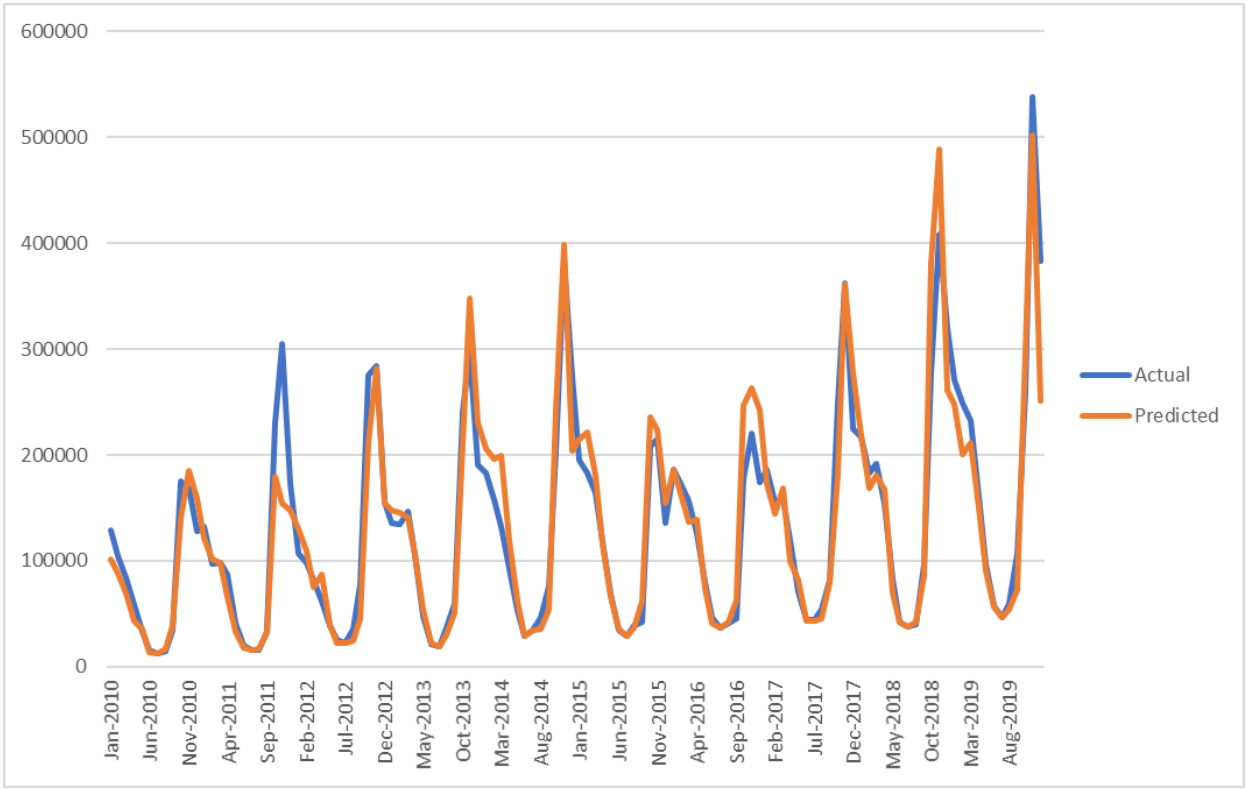

Figure 2 R1 Industrial Predicted vs Actual observations

Annual estimates using actual weather are compared to actual values in the table below. Mean absolute percentage error (MAPE) for annual estimates for the period is 8.4%. The MAPE calculated monthly over the period is 14.4%.

	R1 Industrial		Absolute
Year	Actual	Predicted	Error (%)
2010	960,283.0	902,983.5	6.0%
2011	1,247,376.0	984,793.9	21.1%
2012	1,265,913.0	1,205,000.5	4.8%
2013	1,436,592.0	1,506,840.6	4.9%
2014	1,666,209.0	1,780,304.5	6.8%
2015	1,430,900.0	1,576,575.4	10.2%
2016	1,462,707.0	1,631,184.6	11.5%
2017	1,752,123.4	1,699,899.8	3.0%
2018	2,050,371.1	2,146,137.1	4.7%
2019	2,461,420.1	2,182,390.2	11.3%
Total	15,733,894.5	15,616,110.1	0.7%
Mean Absolute Percentage Error (Annual)			8.4%
Mean Absolute Percentage Error (Monthly)			14.4%

Table 7 R1 Industrial model error

3.3 R1 COMMERCIAL

For the R1 Commercial Class consumption the equation was estimated using 120 observations from 2010:01 to 2019:12. The natural logarithm of heating degree days at 18°C for the months from September to June were used, as measured at the London CS weather station.

Several other variables were examined and found to not show a statistically significant relationship to energy usage. Those included economic indicators of full-time employment and GDP, days in each month, work days in each month, and a time trend.

Several other variables were examined and found to not show a statistically significant relationship to energy usage. Those included alternate reference temperatures, economic indicators of full-time employment and GDP, days in each month, work days in each month, and a time trend.

A baseload trend was used to remove from 170.96m^3 in 2010 to 237.68m^3 in 2019 from the average consumption variable in each month. This amount is added back to the predicted values.

The following table outlines the resulting regression model:

Model 37: Prais-Winsten, using observations 2010:01-2019:12 (T = 120)
Dependent variable: ExLNComAverageTrend
rho = -0.119542

	coefficient	std. error	t-ratio	p-value
const	1.357739	0.161544	8.404739	1.79E-13
LNHDDJanuary18	0.911654	0.044369	20.54706	2.79E-39
LNHDDFebruary18	0.911422	0.04527	20.13309	1.62E-38
LNHDDMarch18	0.902554	0.046453	19.42927	3.39E-37
LNHDDApril18	0.875092	0.05039	17.36654	3.60E-33
LNHDDMay18	0.813178	0.05814	13.98657	4.48E-26
LNHDDJune18	0.407374	0.068559	5.941987	3.43E-08
LNHDDSeptember18	0.562077	0.065119	8.631498	5.54E-14
LNHDDOctober18	0.799521	0.05317	15.03707	2.41E-28
LNHDDNovember18	0.871919	0.048142	18.11127	1.19E-34
LNHDDDecember18	0.902779	0.045785	19.71786	9.67E-38

Statistics based on the rho-differenced data

Mean dependent var	5.239867	S.D. dependent var	2.276938
Sum squared resid	63.98861	S.E. of regression	0.766193
R-squared	0.896286	Adjusted R-squared	0.886771
F(10, 109)	113.3418	P-value(F)	7.74E-53
rho	0.023951	Durbin-Watson	1.95E+00

Table 8 R1 Commercial Regression Model

Using the above model coefficients we derive the following:

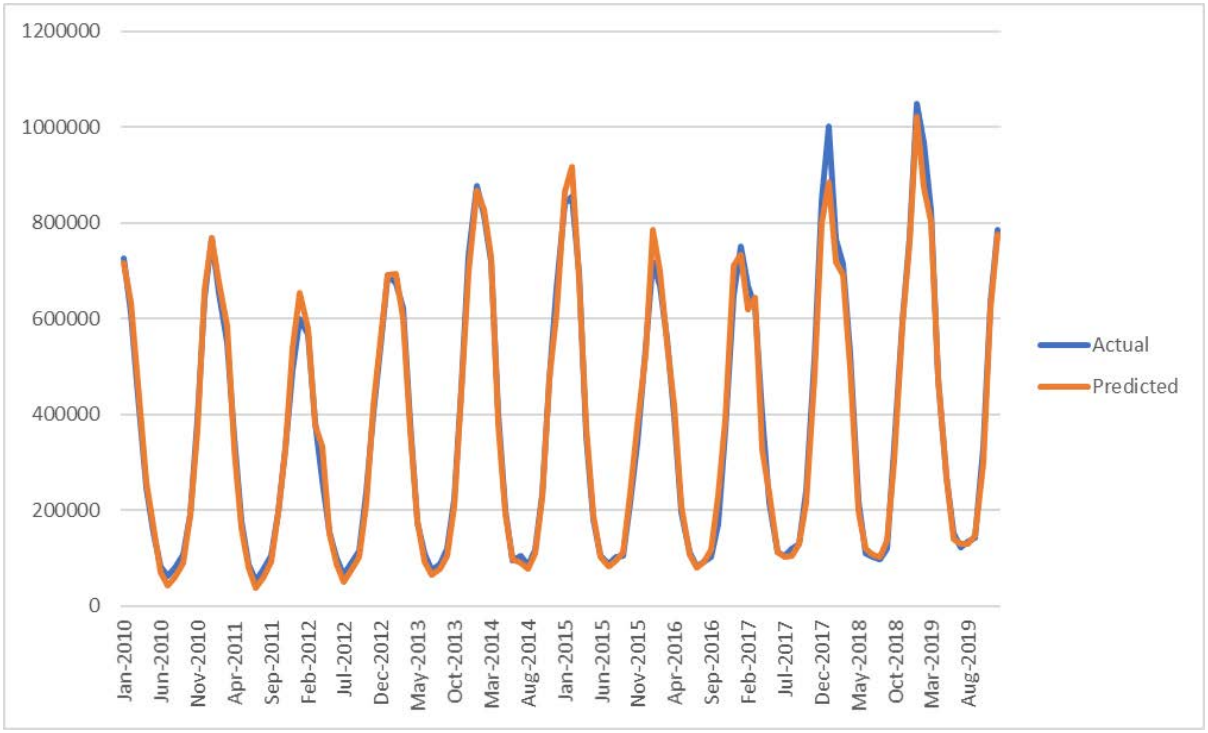

Figure 3 R1 Commercial Predicted vs Actual observations

Annual estimates using actual weather are compared to actual values in the table below. Mean absolute percentage error (MAPE) for annual estimates for the period is 3.1%. The MAPE calculated monthly over the period is 7.8%.

	R1 Commercial		Absolute
Year	Actual	Predicted	Error (%)
2010	3,735,278.0	3,724,519.2	0.3%
2011	3,846,511.0	3,853,242.5	0.2%
2012	3,526,397.0	3,607,534.3	2.3%
2013	4,352,319.0	4,227,633.7	2.9%
2014	4,788,282.0	4,682,141.3	2.2%
2015	4,420,443.0	4,563,294.2	3.2%
2016	4,117,374.0	4,389,307.9	6.6%
2017	4,734,212.7	4,506,387.4	4.8%
2018	5,363,287.7	5,112,770.2	4.7%
2019	5,890,509.5	5,685,102.0	3.5%
Total	44,774,613.9	44,351,932.8	0.9%

Mean Absolute Percentage Error (Annual)	3.1%
Mean Absolute Percentage Error (Monthly)	7.8%

Table 9 R1 Commercial model error

3.4 R3

For the R3 Class consumption the equation was estimated using 120 observations from 2010:01 to 2019:12. The natural logarithm of heating degree days at 20°C for the months from September to May were used, as measured at the London CS weather station. A natural log of a time trend is also included, beginning at ln(1) in January 2010 (increasing to ln(120) in December 2019) is used as this class exhibits declining average consumption over time.

The R3 class' customer count declined from 6 to 4 from October 2009 to June 2010, which had a clear impact on average consumption per customer, as shown on the below chart. A dummy variable is used for this period (denoted d2009), set at 1 for the months October 2009 to May 2010 and 0.5 in June 2010, the month the customer count fell to 4. A dummy variable for June was included as consumption in June was typically greater than what was expected based on the weather in that month. A dummy variable for the shoulder months of March, April, May, September, October, and November was also used to reflect lower consumption in those months than could be explained by heating degree days.

Several other variables were examined and found to not show a statistically significant relationship to energy usage. Those included alternate weather variables, economic indicators of full-time employment and GDP, days in each month, and work days in each month.

The following table outlines the resulting regression model:

Model 30: Prais-Winsten, using observations 2010:01-2019:12 (T = 120)
Dependent variable: LNContractR3Average
rho = 0.636909

	coefficient	std. error	t-ratio	p-value
const	11.5927014	0.407682	28.43562619	2.05E-51
LNHDDJanuary20	0.251761969	0.017399	14.46950165	7.57E-27
LNHDDFebruary20	0.239180602	0.017823	13.4197517	1.36E-24
LNHDDMarch20	0.654968258	0.159295	4.111659494	7.77E-05
LNHDDApril20	0.63774168	0.170622	3.737744131	3.01E-04
LNHDDMay20	0.637301243	0.19535	3.262363721	1.49E-03
LNHDDSeptember20	0.05953108	0.015929	3.737356325	3.02E-04
LNHDDOctober20	0.614589215	0.179525	3.423411851	8.80E-04
LNHDDNovember20	0.633413508	0.164705	3.845740039	2.05E-04
LNHDDDecember20	0.23040555	0.017368	13.26612808	2.93E-24
lnTrend	-0.53911329	0.097399	-5.535120173	2.27E-07

d2009	-1.007228716	0.251017	-4.012599425	1.12E-04
Shoulder	-2.706594904	1.022258	-2.647662856	9.34E-03
June	0.213369441	0.078102	2.73E+00	0.007377

Statistics based on the rho-differenced data			
Mean dependent var	10.2304787	S.D. dependent var	7.30E-01
Sum squared resid	5.387608858	S.E. of regression	2.25E-01
R-squared	0.915112049	Adjusted R-squared	9.05E-01
F(13, 106)	55.20940352	P-value(F)	4.45E-41
rho	0.012353087	Durbin-Watson	1.97E+00

Table 10 R3 Regression Model

Using the above model coefficients we derive the following:

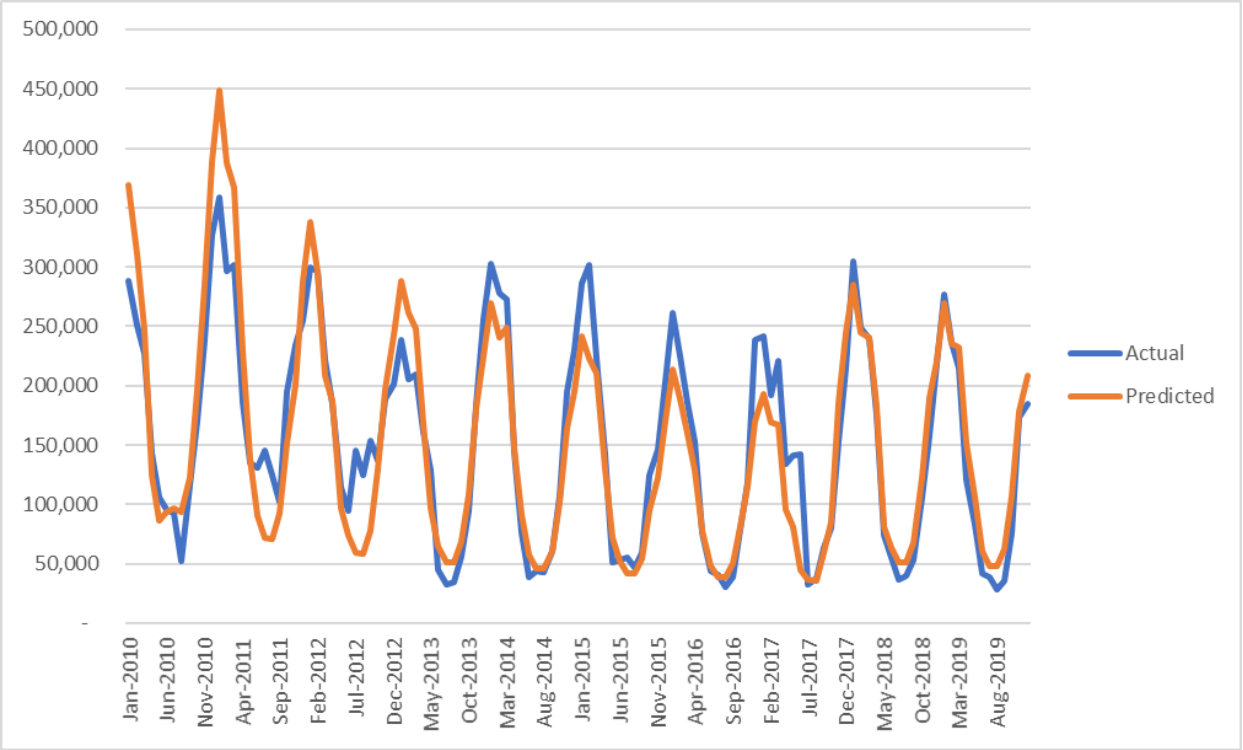

Figure 4 R3 Predicted vs Actual observations

Annual estimates using actual weather are compared to actual values in the table below. Mean absolute percentage error (MAPE) for annual estimates for the period is 10.4%. The MAPE calculated monthly over the period is 21.8%. The MAPEs are relatively high for this class but more variance can be expected in a class with only 4 to 6 customers.

	R3		Absolute
Year	Actual	Predicted	Error (%)
2010	445,893.3	481,596.9	8.0%

2011	616,171.8	610,633.1	0.9%
2012	540,426.3	495,807.8	8.3%
2013	411,185.5	461,725.4	12.3%
2014	448,001.5	429,751.8	4.1%
2015	423,082.0	378,318.8	10.6%
2016	373,086.5	346,150.4	7.2%
2017	375,566.4	327,721.9	12.7%
2018	195,783.4	213,096.0	8.8%
Total	3,633,413.2	3,531,706.1	2.8%

Mean Absolute Percentage Error (Annual)	10.4%
Mean Absolute Percentage Error (Monthly)	21.8%

Table 11 R3 model error

4 WEATHER NORMALIZATION

It is not possible to accurately forecast weather for months or years in advance. Therefore, one can only base future weather expectations on what has happened in the past. Individual years may experience unusual spells of weather (unusually cold winter, unusually warm summer, etc.). However, over time, these unusual spells "average" out. While there may be trends over several years (e.g., warmer winters for example), using several years of data rather than one particular year filters out the extremes of any particular year. While there are several different approaches to determining an appropriate weather normal, ENGLP has adopted the 10-year trend of 10-year monthly degree day averages.

Various methods were analysed to determine the most appropriate methodology to forecast monthly heating degree days in 2020. A 5-year average, 10-year average, 20-year trend, 5-year weighted average, 10-year trend of 5 year averages, 10-year trend of 10-year averages, and the midpoint of the 10-year average and 20-year trend.

Data from 1980 to 2018 was used to evaluate each method's predicted heating degree days against the actual heating degree days for each month since January 2000. Data from Environment Canada's London Airport weather station was used for the period from 1980 to 2002. London Airport's temperature data is only provided until 2002, which is approximately when temperature data for London CS begins. Data from the London A weather station (another London Airport weather station with temperature data as of March 2012) is used in place of London CS when data from that station is unavailable.

Each method was ranked according to the magnitude of the deviations between predicted and actual heating degree days, with 1 being the closest predicted value and 7 being the furthest. The rankings were done on monthly and annual bases. The following table

shows the annual rankings, average annual and monthly rankings, and variance of the deviations on monthly and annual bases.

Year	5-Year Average	10-Year Average	20-Year Trend	Weighted 5-Year Average	10-Year Trend (5MA)	10-Year Trend (10MA)	10-Yr Avg & 20-Yr Trend Midpoint
2000	2	1	5	6	7	4	3
2001	2	5	3	1	7	6	4
2002	2	5	1	4	7	6	3
2003	7	2	5	6	4	1	3
2004	6	2	5	4	7	1	3
2005	4	3	6	2	7	1	5
2006	6	2	4	7	1	5	3
2007	2	4	6	3	7	1	5
2008	1	4	6	3	7	2	5
2009	1	2	6	3	4	7	5
2010	3	5	2	7	6	1	4
2011	1	6	5	4	7	2	3
2012	5	6	1	4	7	3	2
2013	4	3	7	6	1	2	5
2014	4	2	7	6	3	1	5
2015	4	2	5	1	7	6	3
2016	6	3	5	7	1	2	4
2017	2	4	6	7	1	3	5
2018	1	5	2	7	6	3	4
2019	2	6	5	1	4	7	3
Average Rank							
Monthly	4.01	3.89	4.08	4.25	3.97	3.88	3.91
Annual	3.25	3.60	4.60	4.45	5.05	3.20	3.85
Variance of Difference between Predicted and Actual							
Monthly	4,094	3,704	4,135	4,460	4,036	3,639	3,881
Annual	64,928	58,198	63,942	72,703	68,261	53,951	60,118

Table 12 HDD Rankings and Variance

The rankings and variance analysis reveals that the 10-year trend of the 10-year average is the best methodology for predicting future heating degree days. On a monthly and annual basis, the predicted heating degree days using this methodology is closest to actual heating degree days and the deviations from actual weather have the lowest variance among the methods analysed.

For clarity, the 10-year trend of the 10-year moving average is the annualized trend of one 10-year period to the next 10-year period. For example, the 2000 predicted value

uses the trend from the average heating degree days between 1980 and 1989 to the average between 1990 and 1999.

This method is the best predictive method as it accounts for trends in heating degree days over time without being over-reliant on data of any one year. Simple averages do not consider weather trends over time and typical trend forecasts can be significantly impacted by single data points.

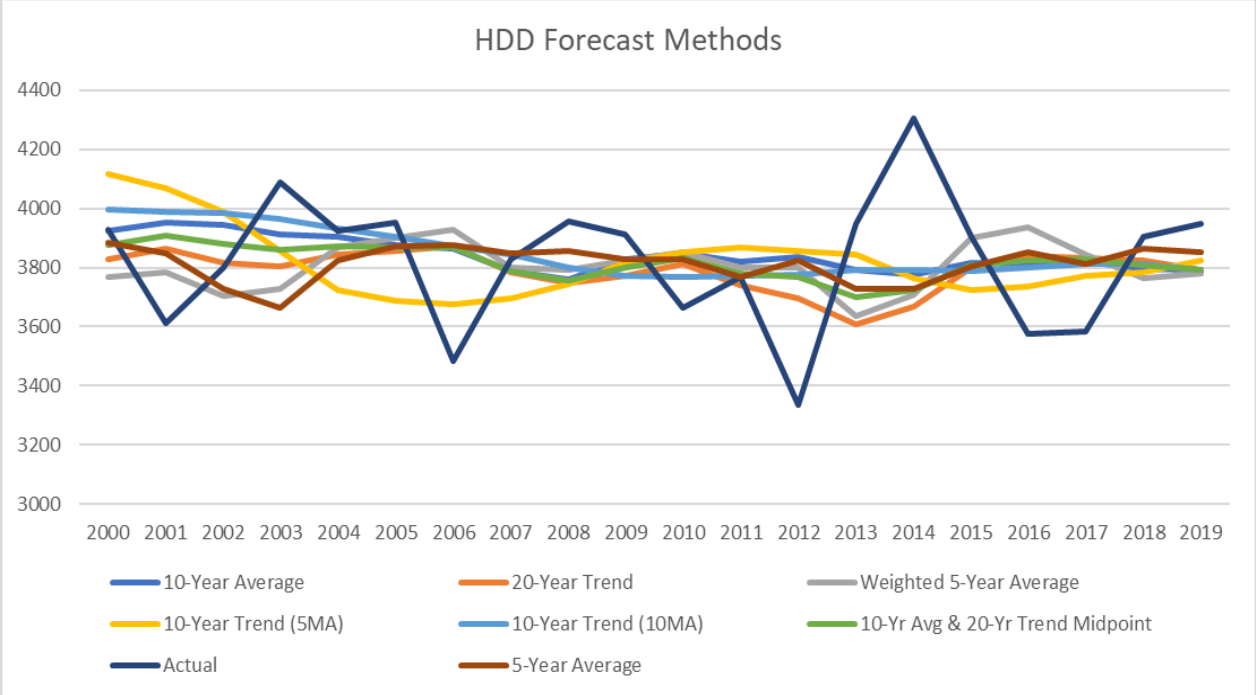

Figure 5 Weather Forecast for Various Methods

The monthly predicted and forecast heating degree days are detailed in the following tables for heating degree days at 18°C.

18°C	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total	Actual
2010	717	627	551	319	175	97	107	91	94	260	402	636	**4,075**	**4,032**
2011	716	637	552	313	176	95	106	92	92	261	401	638	**4,079**	**4,099**
2012	719	648	554	310	176	92	107	93	90	262	400	638	**4,089**	**3,716**
2013	721	656	548	308	173	90	110	93	91	261	401	634	**4,086**	**4,234**
2014	720	661	543	308	170	89	113	92	92	257	406	633	**4,084**	**4,509**
2015	719	667	545	310	167	88	115	91	95	254	416	630	**4,096**	**4,161**
2016	722	677	549	313	162	86	114	89	97	252	422	618	**4,101**	**3,948**
2017	727	682	547	318	158	85	113	89	99	249	424	611	**4,102**	**3,863**
2018	727	676	547	319	154	85	113	89	101	245	424	608	**4,089**	**4,297**
2019	732	668	547	325	150	85	113	89	105	243	427	604	**4,089**	**4,227**
2020	733	662	549	332	148	84	114	91	107	241	435	601	**4,096**	
2021	735	662	549	335	145	83	114	90	109	238	438	597	**4,095**	
2022	736	663	549	338	141	82	114	90	110	236	441	594	**4,095**	

2023	738	663	549	340	138	81	115	90	112	234	444	590	**4,094**
2024	739	664	549	343	135	80	115	90	114	231	447	586	**4,094**

Table 13 Forecast HDD 18°C

5 WEATHER-NORMALIZED CLASS FORECASTS

5.1 R1 RESIDENTIAL

Incorporating the normalized and forecast heating degree days the following weather corrected consumption and forecast values are calculated:

		R1 Residential				
		Consumption		Actual	Normalized	
Year	Customers	Per Customer	Total		Per Customer	Total
2010	6472	1827	11,824,006	11,839,669	1858	12,035,522
2011	6609	1876	12,400,852	12,393,486	1877	12,405,808
2012	6896	1705	11,756,626	11,751,822	1885	12,981,939
2013	7181	1990	14,289,175	14,287,143	1951	13,998,135
2014	7470	2162	16,150,603	16,127,158	1998	14,917,794
2015	7726	1938	14,974,492	14,948,329	1889	14,586,896
2016	7956	1813	14,425,323	14,417,053	1884	14,982,522
2017	8110	1892	15,347,218	15,400,135	1983	16,125,645
2018	8400	2075	17,426,321	17,442,260	2031	17,076,186
2019	8663	2082	18,035,849	18,006,476	2036	17,605,176
2020	8929				1,967	17,521,080
2021	9204				1,973	18,114,687
2022	9488				1,978	18,728,136
2023	9780				1,984	19,362,081
2024	10081				1,990	20,017,199

Table 14 Actual vs Normalized R1 Residential

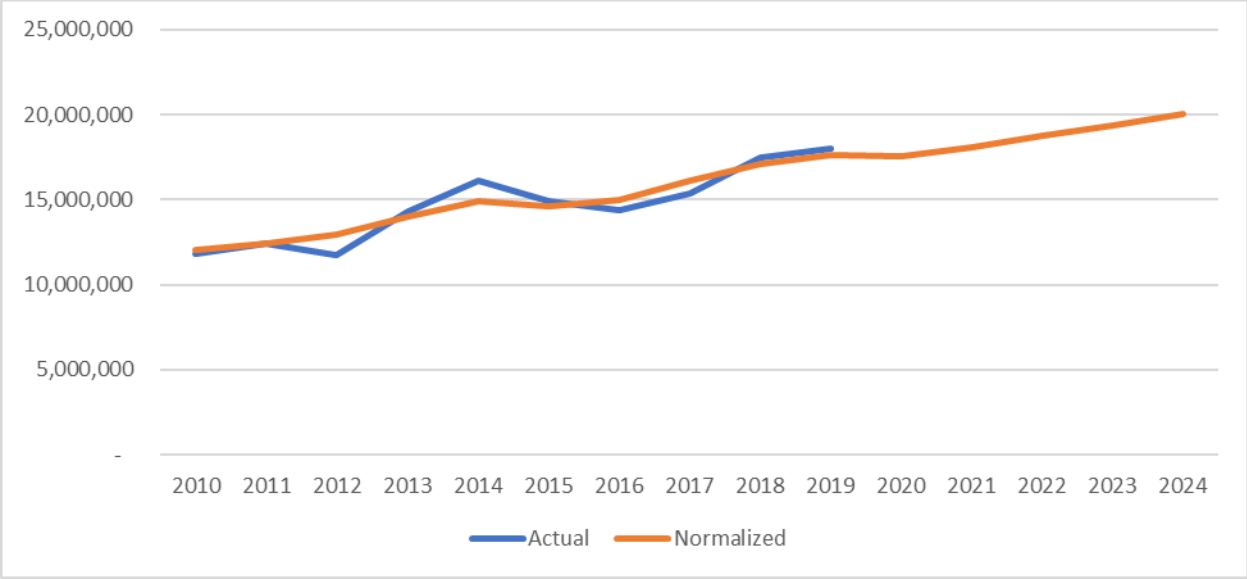

Figure 6 Actual vs Normalized R1 Residential

A tiered forecast was produced using actual individual customer data adjusted to weather-normal consumption.

	R1 Residential		
	Tier 1	**Tier 2**	**Total**
2018	17,315,346	111,193	17,442,260
2019	17,895,136	111,340	18,006,476
2020	17,411,364	109,715	17,521,080
2021	18,001,376	113,311	18,114,687
2022	18,611,112	117,024	18,728,136
2023	19,241,224	120,857	19,362,081
2024	19,892,384	124,815	20,017,199

Table 15 Forecasted R1 Residential Tiered Consumption

The Geometric mean of the annual growth from 2009 to 2019 was used to forecast the growth rate from 2020 to 2024.

Year	Residential Customers	Percent of Prior Year
2009	6396	
2010	6472	101.2%
2011	6609	102.1%
2012	6896	104.3%
2013	7181	104.1%
2014	7470	104.0%
2015	7726	103.4%
2016	7956	103.0%

2017	8110	101.9%
2018	8400	103.6%
2019	8663	103.1%
2020	8929	103.1%
2021	9204	103.1%
2022	9488	103.1%
2023	9780	103.1%
2024	10081	103.1%

Table 16 Forecasted R1 Residential Customer Count

5.2 R1 INDUSTRIAL

Incorporating the normalized and forecast heating degree days the following weather corrected consumption and forecast values are calculated:

	R1 Industrial					
		Consumption		Actual	Normalized	
Year	Customers	Per Customer	Total		Per Customer	Total
2010	43	24101	1,034,341	960,283	25694	1,026,414
2011	43	28608	1,225,376	1,247,376	31041	1,365,720
2012	51	24350	1,252,019	1,265,913	25676	1,333,692
2013	58	24752	1,429,444	1,436,592	24202	1,404,859
2014	63	26306	1,659,456	1,666,209	24376	1,544,491
2015	62	23186	1,439,435	1,430,900	23865	1,468,069
2016	65	22433	1,461,881	1,462,707	24030	1,567,399
2017	66	26620	1,752,499	1,752,123	29079	1,913,949
2018	68	29425	2,005,771	2,050,371	27097	1,887,565
2019	73	33281	2,440,611	2,461,420	32080	2,369,312
2020	77				28,713	2,230,507
2021	82				29,228	2,388,524
2022	86				29,744	2,556,992
2023	90				30,260	2,736,573
2024	95				30,777	2,927,968

Table 17 Actual vs Normalized R1 Industrial

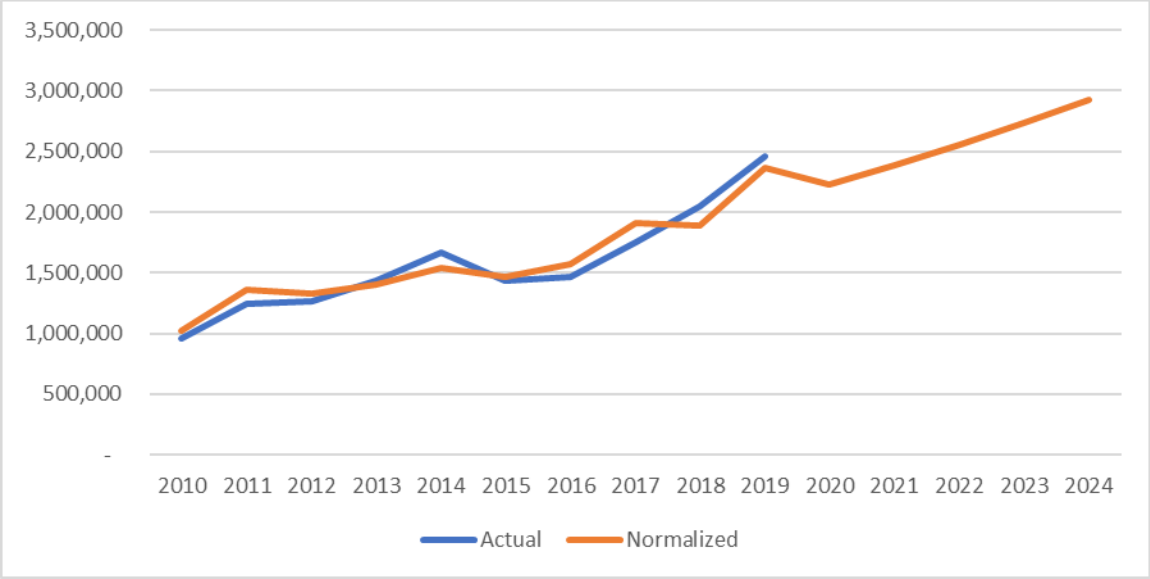

Figure 7 Actual vs Normalized R1 Industrial

A tiered forecast was produced using actual individual customer data adjusted to weather-normal consumption.

	R1 Industrial		
	Tier 1	**Tier 2**	**Total**
2018	551,950	1,845,532	2,050,371
2019	568,630	1,892,790	2,461,420
2020	522,787	1,707,719	2,230,507
2021	562,790	1,825,735	2,388,524
2022	605,547	1,951,446	2,556,992
2023	651,236	2,085,336	2,736,573
2024	700,049	2,227,919	2,927,968

Table 18 Forecasted R1 Industrial Tiered Consumption

The Geometric mean of the annual growth from 2009 to 2019 was used to forecast the growth rate from 2020 to 2024. The number of customers in this class grew significantly from 2009 to 2013 so the growth rates from these years was excluded as they do not reflect the current customer growth trend.

The following table includes the customer Actual / Forecast customer count on this basis:

	R1 Industrial	
Year	Customers	Percent of Prior Year
2009	30	
2010	43	141.5%
2011	43	99.8%
2012	51	120.0%
2013	58	112.3%

2014	63	109.2%
2015	62	98.4%
2016	65	105.0%
2017	66	101.0%
2018	68	103.5%
2019	73	107.6%
2020	77.1	105.2%
2021	81.2	105.2%
2022	85.4	105.2%
2023	89.8	105.2%
2024	94.5	105.2%

Table 19 Forecasted R1 Industrial Customer Count

5.3 R1 COMMERCIAL

Incorporating the normalized and forecast heating degree days the following weather corrected consumption and forecast values are calculated:

		R1 Commercial				
		Consumption		Actual	Normalized	
Year	Customers	Per Customer	Total		Per Customer	Total
2010	405	9216	3,736,259	3,735,278	9375	3,800,757
2011	405	9477	3,833,380	3,846,511	9472	3,843,466
2012	415	8515	3,533,844	3,526,397	9445	3,909,010
2013	424	10227	4,336,095	4,352,319	10005	4,256,860
2014	437	10964	4,795,706	4,788,282	10084	4,405,401
2015	445	9935	4,421,983	4,420,443	9659	4,300,426
2016	453	9065	4,102,131	4,117,374	9443	4,288,115
2017	462	10219	4,716,893	4,734,213	10736	4,970,457
2018	487	10958	5,332,657	5,363,288	10765	5,267,106
2019	537	10938	5,875,761	5,890,510	10708	5,766,774
2020	552				10,414	5,739,519
2021	568				10,503	5,952,003
2022	584				10,592	6,171,885
2023	600				10,681	6,399,414
2024	617				10,770	6,634,844

Table 20 Actual vs Normalized R1 Commercial

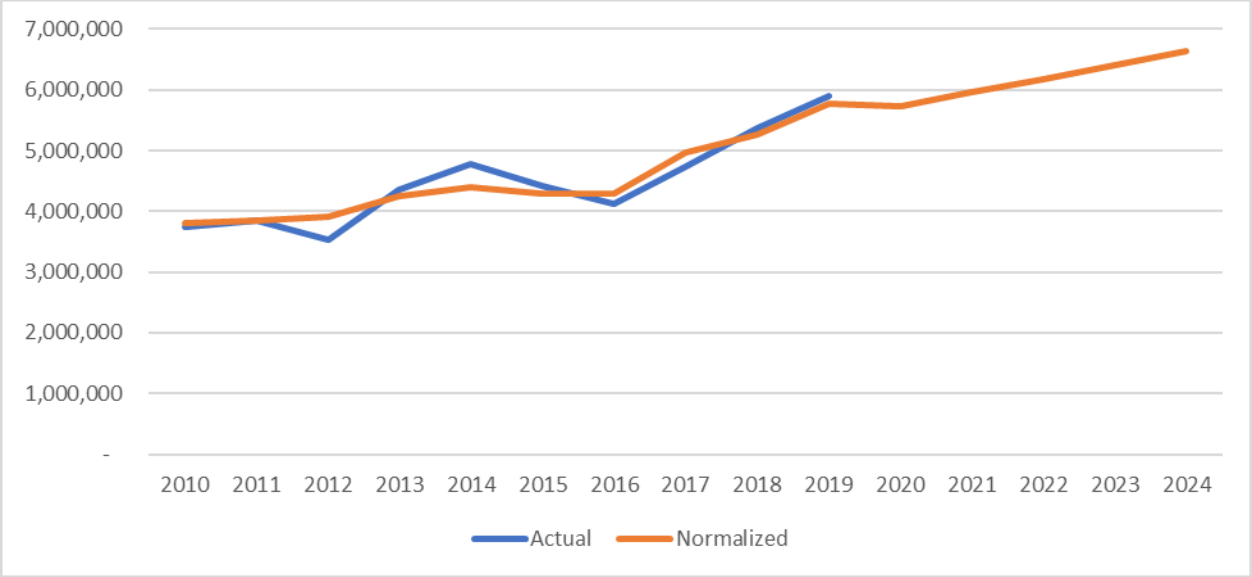

Figure 8 Actual vs Normalized R1 Commercial

A tiered forecast was produced using actual individual customer data adjusted to weather-normal consumption.

	R1 Commercial		
	Tier 1	**Tier 2**	**Total**
2018	2,520,526	2,840,928	5,363,288
2019	2,781,639	3,108,870	5,890,510
2020	2,715,528	3,023,992	5,739,519
2021	2,818,850	3,133,153	5,952,003
2022	2,925,827	3,246,058	6,171,885
2023	3,036,585	3,362,829	6,399,414
2024	3,151,249	3,483,595	6,634,844

Table 21 Forecasted R1 Commercial Tiered Consumption

The Geometric mean of the annual growth from 2009 to 2019 was used to forecast the growth rate from 2020 to 2024.

The following table includes the customer Actual / Forecast customer count on this basis:

	R1 Commercial	
Year	Customers	Percent of Prior Year
2009	407	
2010	405	99.7%
2011	405	99.8%
2012	415	102.6%
2013	424	102.2%
2014	437	103.2%
2015	445	101.8%

2016	453	101.7%
2017	462	102.0%
2018	487	105.4%
2019	537	110.4%
2020	552.3	102.8%
2021	567.9	102.8%
2022	583.9	102.8%
2023	600.4	102.8%
2024	617.4	102.8%

Table 22 Forecasted R1 Commercial Customer Count

5.4 R3

Incorporating the normalized and forecast heating degree days, continuing time trend and calendar dummy variables, the following weather corrected consumption and forecast values are calculated:

		R3				
		Consumption		Actual	Normalized	
Year	Customers	Per Customer	Total		Per Customer	Total
2010	5	445,893	2,117,993	2,108,344	456,457	2,167,534
2011	4	616,172	2,464,687	2,464,687	620,802	2,483,206
2012	4	540,426	2,161,705	2,161,705	569,689	2,278,755
2013	4	411,186	1,644,742	1,644,742	406,649	1,626,595
2014	4	448,002	1,792,006	1,792,006	426,307	1,705,227
2015	4	423,082	1,692,328	1,692,328	419,936	1,679,745
2016	4	373,087	1,492,346	1,492,346	380,071	1,520,284
2017	5	375,566	1,690,049	1,653,466	381,060	1,673,955
2018	6	285,169	1,711,013	1,711,013	278,459	1,670,754
2019	6	251,694	1,510,164	1,510,164	244,235	1,465,408
2020	6				263,239	1,579,434
2021	6				251,282	1,507,691
2022	6				240,736	1,444,418
2023	6				231,346	1,388,075
2024	6				222,914	1,337,485

Table 23 Actual vs Normalized R3

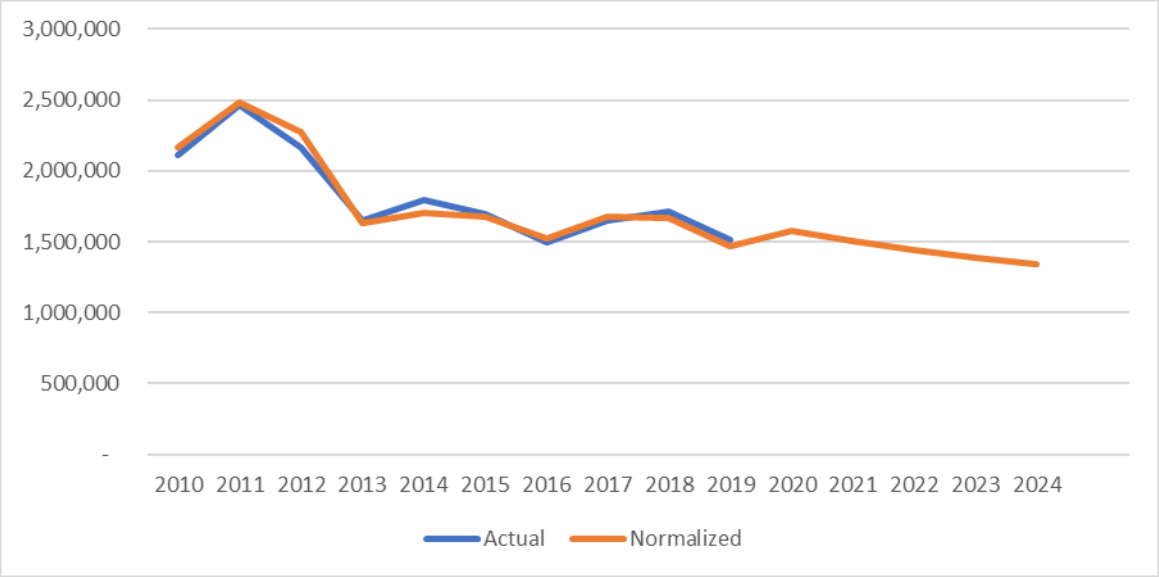

Figure 9 Actual vs Normalized R3

The R3 class has fluctuated between 4 and 6 customers since 2009. The current count of 6 customers is expected to continue through 2021-2024.

6 NON-WEATHER SENSITIVE CLASS FORECASTS

6.1 R2 SEASONAL

Monthly consumption is forecast using a five-year average of consumption per customer in each month. The sum of monthly forecast values per customer are used to calculate annual total consumption as follows:

Year	Customers	R2 Seasonal Consumption		Actual	Forecast	
		Per Customer	Total		Per Customer	Total
2010	65	25,388	1,650,218	1,638,992		
2011	65	27,387	1,768,757	1,849,679		
2012	66	28,174	1,868,851	1,885,826		
2013	64	28,302	1,820,741	1,844,495		
2014	65	30,594	1,980,940	1,988,124		
2015	63	20,017	1,256,038	1,242,867		
2016	59	23,524	1,382,013	1,394,132		
2017	55	26,211	1,435,062	1,410,653		
2018	54	28,488	1,526,500	1,520,647		
2019	49	25,819	1,267,264	1,279,499	24,812	1,217,839
2020	47				24,812	1,166,433
2021	46				24,812	1,124,687
2022	44				24,812	1,084,435
2023	42				24,812	1,045,624
2024	41				24,812	1,008,202

Table 24 Actual vs Normalized R2 Seasonal

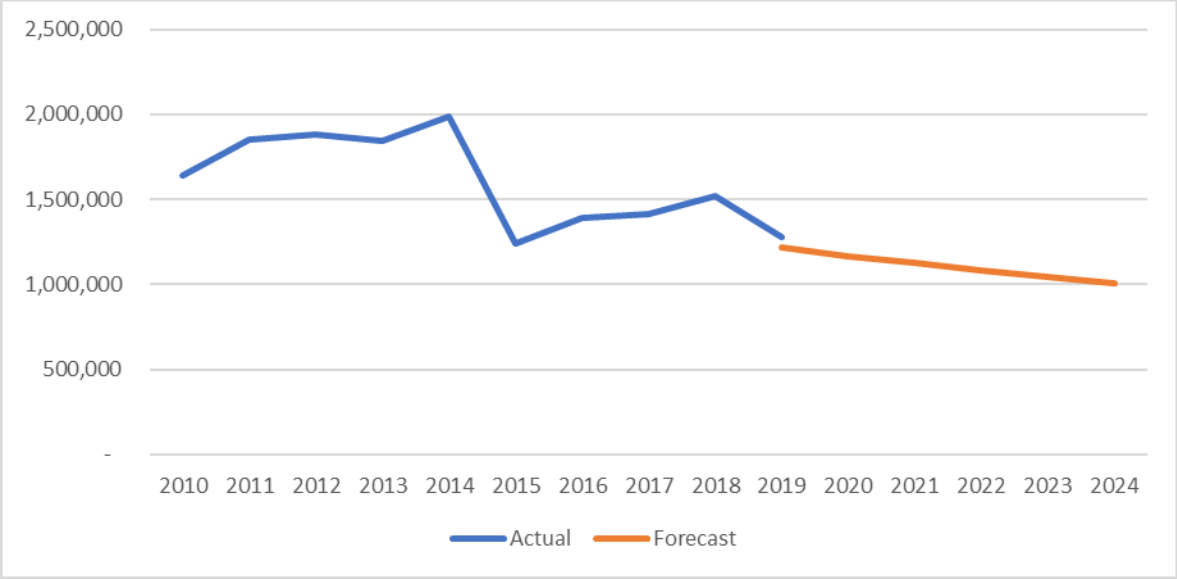

Figure 10 Actual vs Normalized R2 Seasonal

An average of tiered consumption shares in 2017 and 2018 was used to forecast tiered consumption in future years. The R2 seasonal class has three tiers with different rates in April to October and November to March. Tier 1 consumption is consumption up to 1,000 m^3, tier 2 applies to consumption between 1,000 m^3 and 25,000 m^3, and all consumption above 25,000 m^3 is considered Tier 3.

R2 Seasonal

	April 1 to Oct 31			Nov 1 to Mar 31			
	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3	Total
2018	99,403	817,953	191,157	65,331	312,273	34,529	1,520,647
2019	85,191	711,589	135,943	66,113	263,263	17,401	1,279,499
2020	77,663	648,707	123,930	60,270	239,999	15,863	1,166,433
2021	74,884	625,490	119,494	58,113	231,410	15,296	1,124,687
2022	72,204	603,105	115,218	56,034	223,128	14,748	1,084,435
2023	69,619	581,520	111,094	54,028	215,142	14,220	1,045,624
2024	67,128	560,708	107,118	52,095	207,442	13,711	1,008,202

The Geometric mean of the annual growth from 2009 to 2019 was used to forecast the growth rate from 2020 to 2024.

The following table includes the customer Actual / Forecast customer count on this basis:

Year	R2 Seasonal Customers	Percent of Prior Year
2009	71	
2010	65	92.0%
2011	65	99.4%
2012	66	102.7%
2013	64	97.0%
2014	65	100.6%
2015	63	96.9%
2016	59	93.6%
2017	55	93.2%
2018	54	97.9%
2019	49	91.6%
2020	47.3	96.4%
2021	45.6	96.4%
2022	44.0	96.4%
2023	42.4	96.4%
2024	40.9	96.4%

Table 25 Forecasted R2 Seasonal Customer Count

6.2 R4

Consumption per R4 customer is not consistent and shows a clear increasing trend so the 5-year average does not accurately reflect current consumption for the class. The 2020 forecast is instead based on a 3-year average and the trend in consumption per

customer is forecast to continue through to 2024. The trend, 9.55%, is derived as the geometric mean of year over year changes to the 3-year rolling average from 2009-2011 to 2017-2019.

		R4				
		Consumption		Actual	Forecast	
Year	Customers	Per Customer	Total		Per Customer	Total
2010	23	11,597	269,634	267,879		
2011	23	21,688	487,988	477,633		
2012	25	23,036	575,898	678,458		
2013	32	26,175	831,059	861,111		
2014	33	39,661	1,318,721	1,345,169		
2015	34	29,232	996,339	994,710		
2016	35	25,140	888,266	904,160		
2017	36	31,238	1,119,348	1,124,029		
2018	37	35,029	1,278,561	1,327,953		
2019	37	50,232	1,841,844	1,953,378	42,543	1,559,897
2020	40				42,543	1,734,530
2021	41				46,607	1,946,379
2022	42				51,059	2,184,104
2023	43				55,937	2,450,862
2024	45				61,280	2,750,202

Table 26 Actual vs Forecast R4

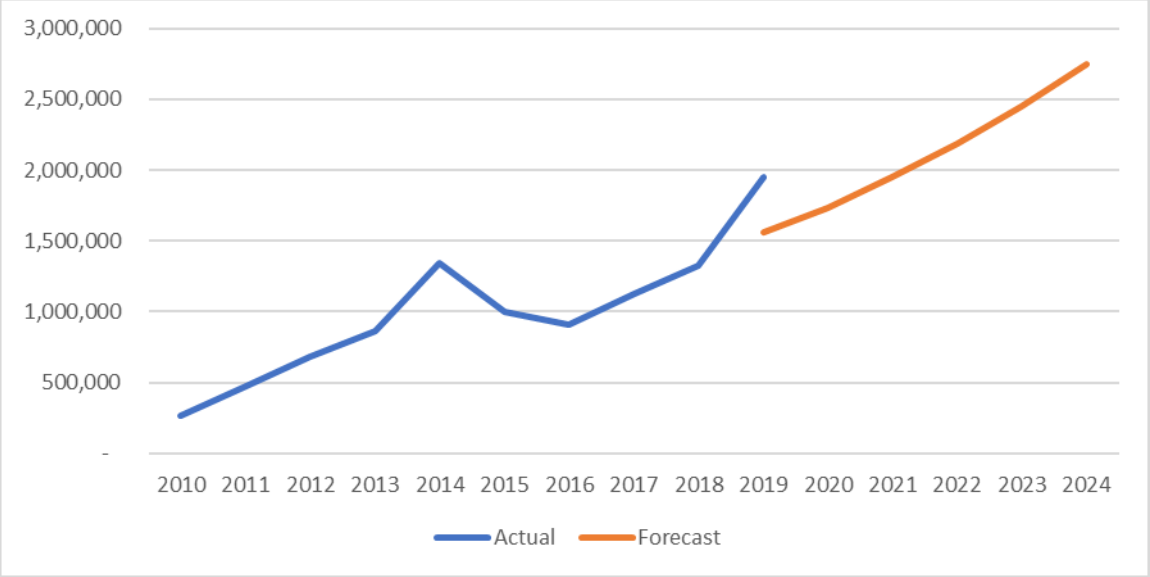

Figure 11 Actual vs Normalized R4

An average of tiered consumption shares in 2017 and 2018 was used to forecast tiered consumption in future years. The R4 class has two tiers with different rates in January to

March and April to December. Tier 1 consumption is consumption up to 1,000 m^3 and all consumption above 1,000 m^3 is considered tier 2.

	R4				
	Jan 1 to Mar 31		Apr 1 to Dec 31		
	Tier 1	Tier 2	Tier 1	Tier 2	Total
2018	18,721	6,298	118,280	1,184,653	1,327,953
2019	30,607	6,196	160,320	1,756,256	1,953,378
2020	27,178	5,502	142,358	1,559,492	1,734,530
2021	30,497	6,174	159,745	1,749,963	1,946,379
2022	34,222	6,928	179,256	1,963,698	2,184,104
2023	38,401	7,774	201,150	2,203,537	2,450,862
2024	43,092	8,724	225,718	2,472,669	2,750,202

The Geometric mean of the annual growth from 2009 to 2019 was used to forecast the growth rate from 2020 to 2024. The number of customers in this class grew significantly from 2009 to 2013 so the growth rates from these years was excluded as they do not reflect the current customer growth trend. The R4 classes ended 2019 with 40 customers so the geometric mean growth rate is applied to that figure. End of year counts typically exceed the average but the 8.1% difference (40/37) is out of line with observed trends so an adjustment is necessary.

The following table includes the customer Actual / Forecast customer count on this basis:

	R4	
Year	Customers	Percent of Prior Year
2009	23	
2010	23	101.1%
2011	23	96.8%
2012	25	111.1%
2013	32	127.0%
2014	33	104.7%
2015	34	102.5%
2016	35	103.7%
2017	36	101.4%
2018	37	101.9%
2019	37	100.5%
2020	40.4	102.4%
2021	41.4	102.4%
2022	42.4	102.4%
2023	43.5	102.4%
2024	44.5	102.4%

Table 27 Forecasted R4 Customer Count

6.3 R5

Consumption per R5 customer differed materially between 2011 to 2014 and 2015 to 2018 so a the 5-year average does not accurately reflect current consumption for the class. The 2020-2024 forecast is instead based on a 3-year average from 2017 to 2019, which is in line with average consumption per customer per year since 2010.

		R5				
Year	Customers	Consumption		Actual	Forecast	
		Per Customer	Total		Per Customer	Total
2010	5	138,769	728,538	697,560		
2011	5	222,975	1,114,874	1,114,874		
2012	5	177,350	886,748	886,748		
2013	5	203,326	1,016,630	1,016,630		
2014	5	225,771	1,147,669	1,128,958		
2015	5	134,524	672,622	672,622		
2016	5	112,572	562,860	562,860		
2017	5	186,530	870,472	753,900		
2018	4	149,492	610,424	624,337		
2019	4	231,801	927,203	927,203	189,274	757,096
2020	4				189,274	757,096
2021	4				189,274	757,096
2022	4				189,274	757,096
2023	4				189,274	757,096
2024	4				189,274	757,096

Table 28 Actual vs Forecast R5

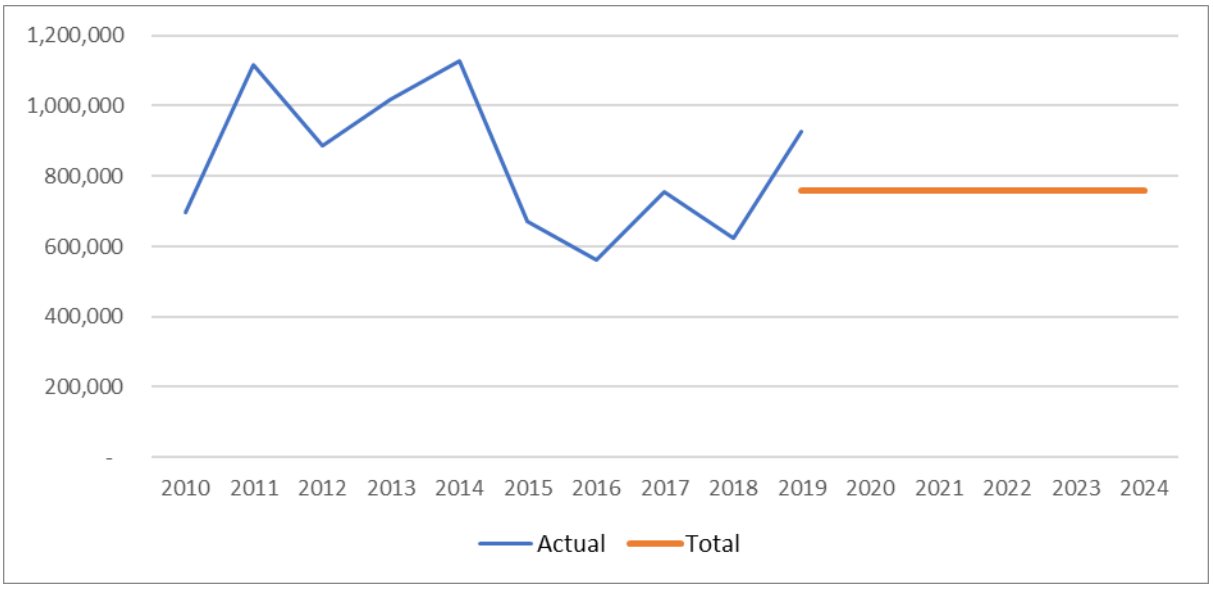

Figure 12 Actual vs Normalized Large Use R5

The R5 class had 5 customers from 2009 to 2017 and had 4 customers in 2018 and 2019. It is expected to maintain 4 customers through 2020 to 2024.

6.4 R6

R6 consumption increases significantly in 2019 over historic volumes. The 2020-2024 forecast uses 2019 consumption as forecast consumption in each year.

		R6				
		Consumption		Actual	Forecast	
Year	Customers	Per Customer	Total		Per Customer	Total
2010	1	33,459,684	33,459,684	33,459,684		
2011	1	30,758,504	30,758,504	30,758,504		
2012	1	31,628,262	31,628,262	31,628,262		
2013	1	31,582,423	31,582,423	31,582,423		
2014	1	31,735,774	31,735,774	31,735,774		
2015	1	34,710,609	34,710,609	34,710,609		
2016	1	40,074,176	40,074,176	40,074,176		
2017	1	36,485,139	36,485,139	36,485,139		
2018	1	40,205,243	40,205,243	40,205,243		
2019	1	62,525,354	62,525,354	62,525,354	62,525,354	62,525,354
2020	1				62,525,354	62,525,354
2021	1				62,525,354	62,525,354
2022	1				62,525,354	62,525,354
2023	1				62,525,354	62,525,354
2024	1				62,525,354	62,525,354

Table 29 Actual vs Forecast R6

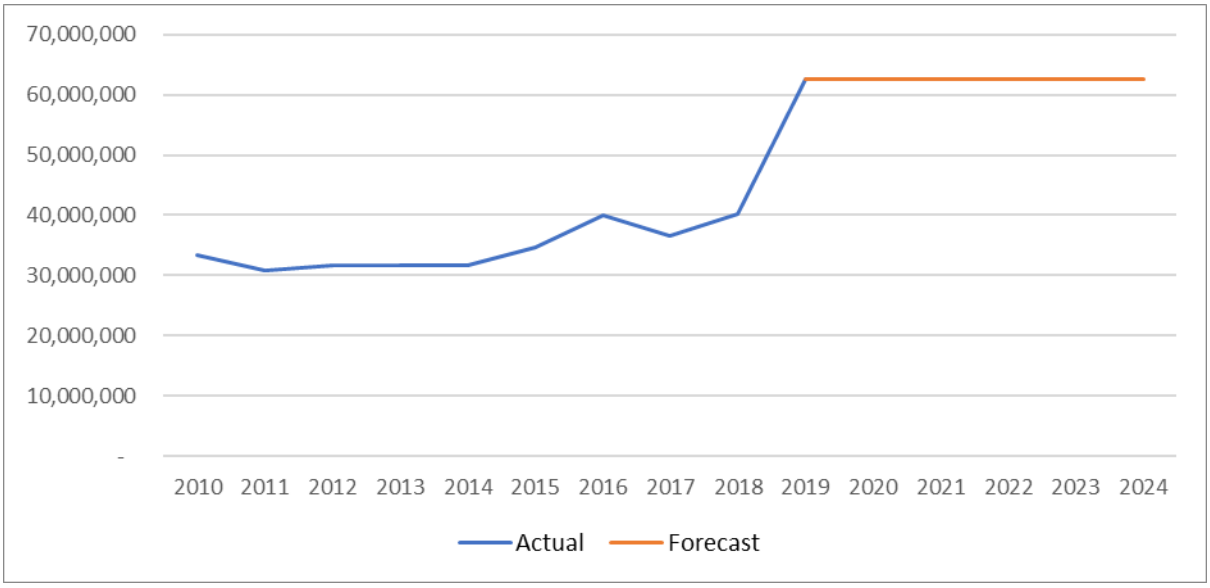

Figure 13 Actual vs Normalized R6

The R6 class has one customer and is expected to persist with one customer through 2024. As there is only one customer in this class, discussions directly with the customer of its consumption plans would provide a more accurate forecast than can be estimated with historic data.

7 WEATHER SENSITIVITY

This section provides alternate low forecasts for scenarios with mild winters and high forecasts for cold winters. The low forecast uses the warmest winter in the past 10 years, which was 3,716 HDD (at 18°C) in 2012. The high forecast uses the coldest winter in the past 10 years, 4,509 HDD in 2014. The derived 18°C HDD forecast temperatures from 2020 to 2024 are provided with the normal forecast for reference. Forecast and actual HDDs from 2010 to 2019 are provided in Table 13.

Low Forecast	HDD	HDD	3,716.4	3,716.4	3,716.4	3,716.4	3,716.4
	2019 Actual	**2019 Normalized**	**2020 Forecast**	**2021 Forecast**	**2022 Forecast**	**2023 Forecast**	**2024 Forecast**
R1 Residential	18,006,476	17,605,176	16,458,824	17,021,686	17,603,608	18,205,228	18,827,209
R1 Industrial	2,461,420	2,369,312	2,060,852	2,210,782	2,370,735	2,541,347	2,723,296
R1 Commercial	5,890,510	5,766,774	5,390,700	5,593,367	5,803,179	6,020,378	6,245,215
R2 Seasonal	1,279,499	*1,279,499*	1,166,433	1,124,687	1,084,435	1,045,624	1,008,202
R3	1,510,164	1,465,408	1,525,087	1,456,463	1,395,982	1,342,164	1,293,877
R4	1,953,378	*1,953,378*	1,734,530	1,946,379	2,184,104	2,450,862	2,750,202
R5	927,203	*927,203*	757,096	757,096	757,096	757,096	757,096
R6	62,525,354	*62,525,354*	62,525,354	62,525,354	62,525,354	62,525,354	62,525,354
Total	**94,554,003**	**93,892,105**	**91,618,877**	**92,635,815**	**93,724,492**	**94,888,054**	**96,130,452**

Table 30 Low HDD Forecast

Normal Forecast	HDD	HDD	4,095.7	4,095.2	4,094.7	4,094.3	4,093.8
	2019 Actual	**2019 Normalized**	**2020 Forecast**	**2021 Forecast**	**2022 Forecast**	**2023 Forecast**	**2024 Forecast**
R1 Residential	18,006,476	17,605,176	17,521,080	18,114,687	18,728,136	19,362,081	20,017,199
R1 Industrial	2,461,420	2,369,312	2,230,507	2,388,524	2,556,992	2,736,573	2,927,968
R1 Commercial	5,890,510	5,766,774	5,739,519	5,952,003	6,171,885	6,399,414	6,634,844
R2 Seasonal	1,279,499	*1,279,499*	1,166,433	1,124,687	1,084,435	1,045,624	1,008,202
R3	1,510,164	1,465,408	1,579,434	1,507,691	1,444,418	1,388,075	1,337,485
R4	1,953,378	*1,953,378*	1,734,530	1,946,379	2,184,104	2,450,862	2,750,202
R5	927,203	*927,203*	757,096	757,096	757,096	757,096	757,096
R6	62,525,354	*62,525,354*	62,525,354	62,525,354	62,525,354	62,525,354	62,525,354
Total	**94,554,003**	**93,892,105**	**93,253,953**	**94,316,421**	**95,452,420**	**96,665,079**	**97,958,351**

Table 31 Normal HDD Forecast

High Forecast	HDD	HDD	4,508.7	4,508.7	4,508.7	4,508.7	4,508.7
	2019 Actual	**2019 Normalized**	**2020 Forecast**	**2021 Forecast**	**2022 Forecast**	**2023 Forecast**	**2024 Forecast**
R1 Residential	18,006,476	17,605,176	18,608,454	19,237,523	19,887,690	20,559,657	21,254,151
R1 Industrial	2,461,420	2,369,312	2,408,830	2,576,865	2,755,865	2,946,516	3,149,546
R1 Commercial	5,890,510	5,766,774	6,096,228	6,318,806	6,549,091	6,787,343	7,033,825
R2 Seasonal	1,279,499	*1,279,499*	1,166,433	1,124,687	1,084,435	1,045,624	1,008,202
R3	1,510,164	1,465,408	1,645,657	1,571,609	1,506,348	1,448,276	1,396,173
R4	1,953,378	*1,953,378*	1,734,530	1,946,379	2,184,104	2,450,862	2,750,202
R5	927,203	*927,203*	757,096	757,096	757,096	757,096	757,096
R6	62,525,354	*62,525,354*	62,525,354	62,525,354	62,525,354	62,525,354	62,525,354
Total	**94,554,003**	**93,892,105**	**94,942,582**	**96,058,320**	**97,249,984**	**98,520,729**	**99,874,550**

Table 32 High HDD Forecast

The graph below displays total forecast consumption for the three scenarios. The majority of consumption is not weather-sensitive so the range does not vary considerably on a total consumption basis.

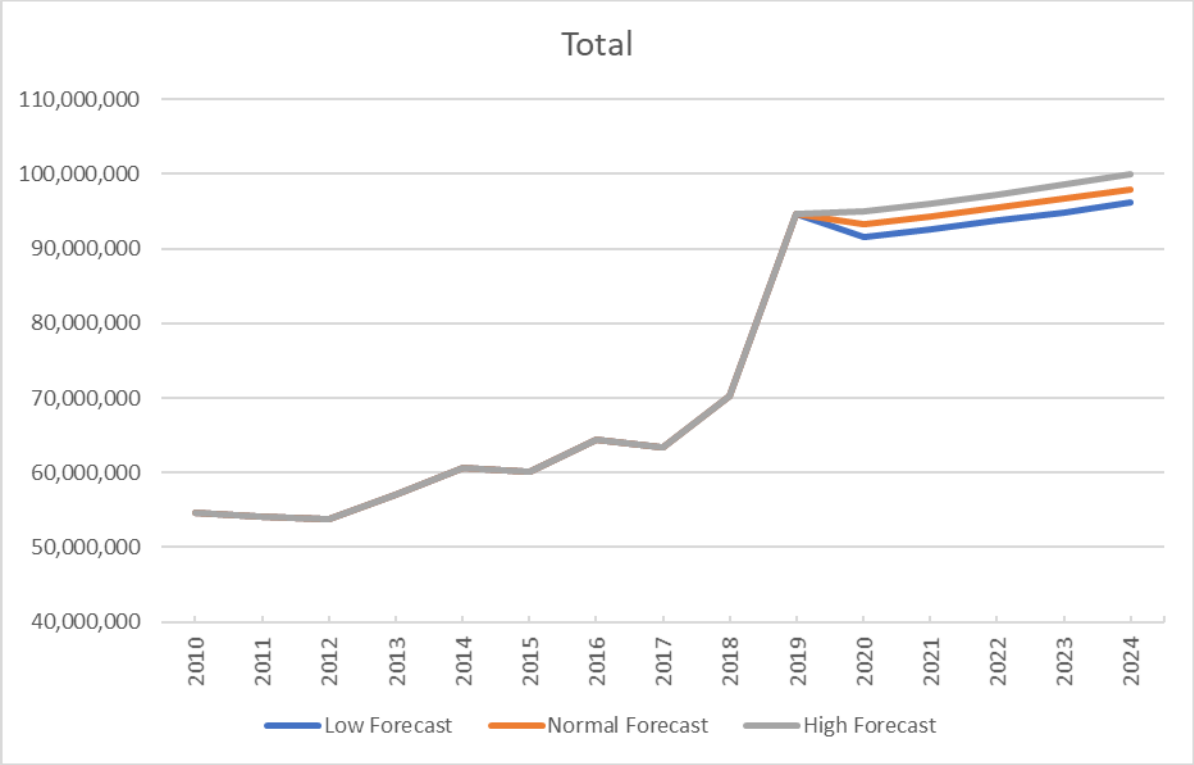

Figure 14 Weather Sensitivity – Total Consumption

Consumption forecasts for only largest weather-sensitive class, R1 Residential, are displayed in the following graph. Note the y-intercept is non-zero in each graph.

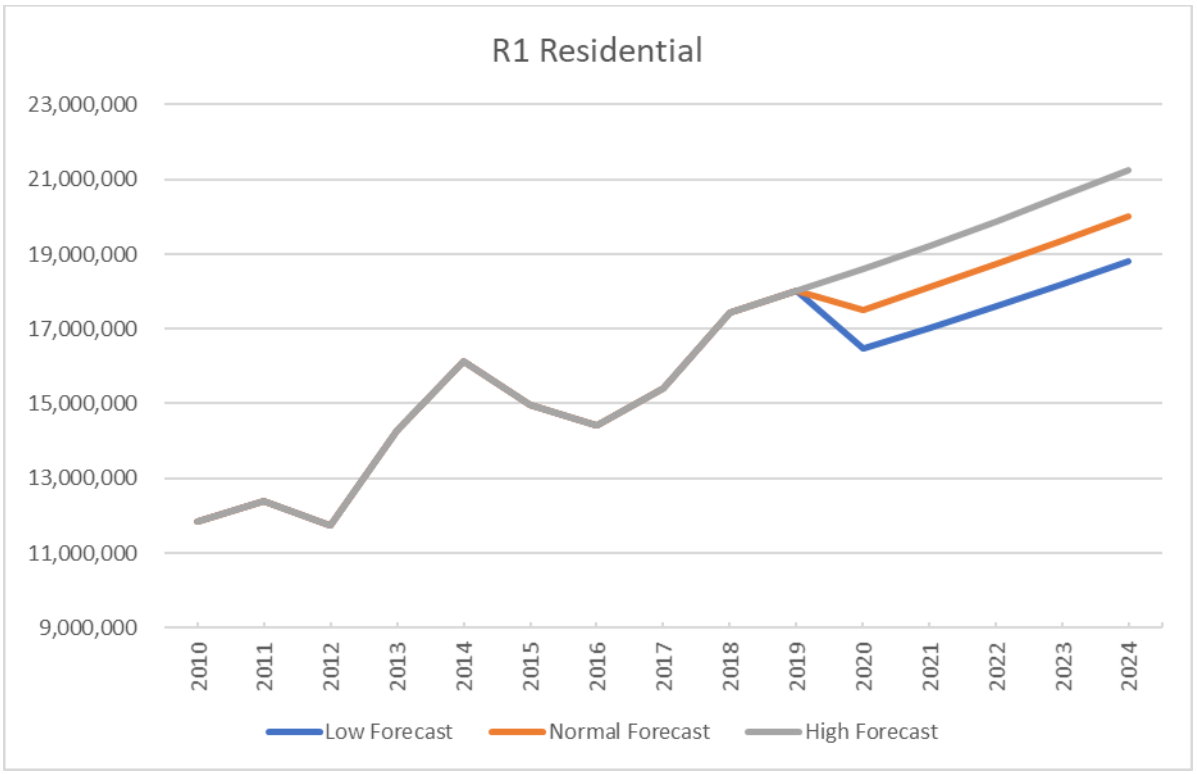

Figure 15 Weather Sensitivity – R1 Residential