2020 Forecasting Benchmark Survey

Itron, Inc.
12348 High Bluff Drive, Suite 210
San Diego, CA 92130-2650
858-724-2620

September 22, 2020

2020 Forecasting Benchmark Survey

Since 2012, Itron's annual benchmarking survey has reported a broad picture of the electric and gas industry forecasting practices. Like prior years, the 2020 survey examines utility forecast accuracy, growth projections and forecast characteristics.

Annually, the survey collects data from February through June culminating with this report in the fall. In March 2020, the COVID-19 pandemic disrupted normal business practices and utility operations resulting in fewer survey responses than normal. Despite this disruption, the survey still includes 48 electric companies and 11 natural gas companies representing approximately 1.74 billion kWh of electricity and 1.4 BCF of natural gas. Figure 1 shows the number of survey responses for 2020 and the prior years.

Figure 1: Survey Respondents

Year	Electric	Natural Gas	Total
2012	77	NA	77
2013	74	NA	74
2014	71	10	81
2015	75	9	84
2016	64	8	72
2017	73	13	86
2018	78	16	94
2019	61	12	73
2020	48	11	59

With the COVID-19 pandemic impacting electric consumption, companies were updating their forecasts in the first half of 2020 to revise business plans. As a result, the forecasts generated at the end of 2019 for the 2020 budget year were discarded in favor of an updated forecast. To remove any potential confusion in the survey responses, all respondents were asked to report pre-pandemic forecasts for 2020 and beyond. As a result, the forecast values in this report show a "business as usual" case excluding the reduction of sales or revisions caused by COVID-19.

Additionally, the low number of survey responses substantially increases the margin of error in regional reporting. As a result, this year's results are only reported at the total level.

This report includes the following sections.

- Forecast Accuracy Overview
- Electric Forecast Growth Overview
- Natural Gas Forecast Growth Overviews
- Customer Growth
- Residential Sales Growth
- Commercial Sales Growth
- Industrial Sales Growth
- System Sales Growth
- Electric Forecast Accuracy
- Natural Gas Forecast Accuracy
- Key Forecast Characteristics

Forecast Accuracy Overview

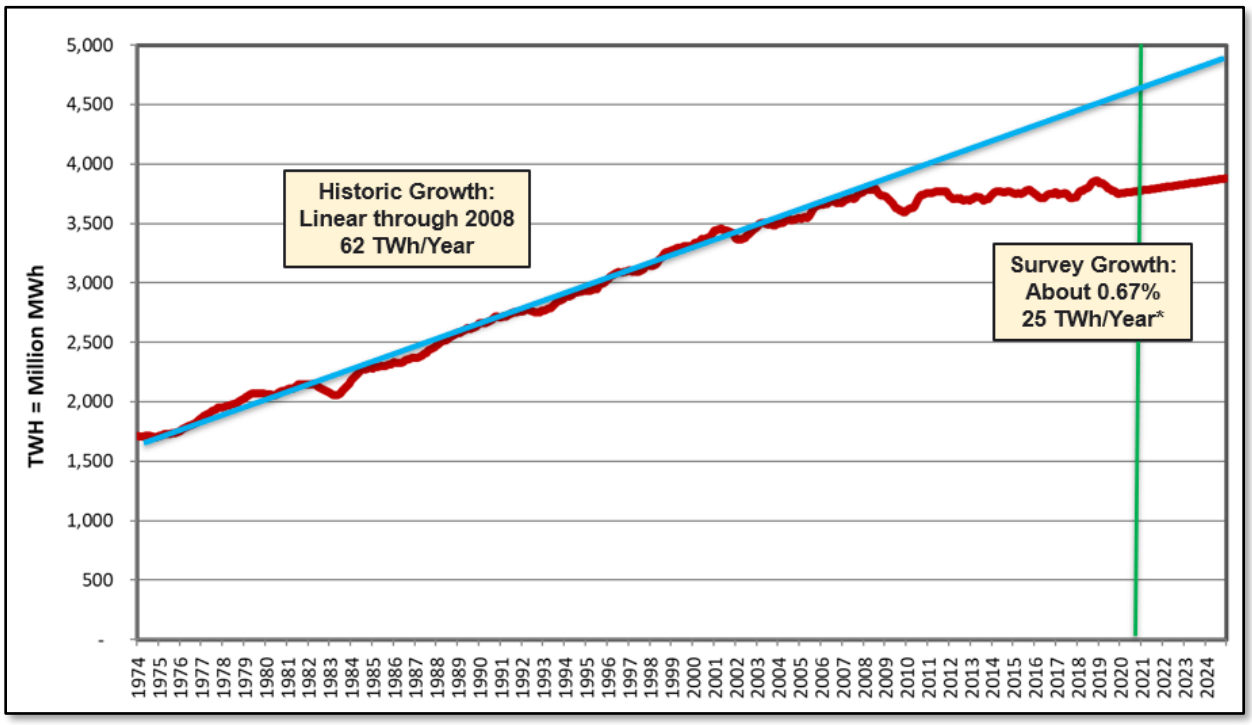
The 2020 survey asks companies about their 2019 forecast accuracy by comparing their 2019 forecast (generated in 2018) with their 2019 weather normalized sales. Except for the electric industrial class, the average electric forecast sales accuracy is consistent with prior years and ranges between 1.1% and 2.4%. The 2019 electric industrial class sales accuracy is slightly over 4% and significantly higher than prior survey results. The 2019 natural gas sales accuracy for the residential, commercial and system is consistent with prior years and ranges between 3.0% and 5.0%. Like prior years, the natural gas industrial class sales error is large, but consistent with prior surveys. Detailed results are further discussed in this report with the accuracy values shown in Figure 12 and Figure 24.

Electric Forecast Growth Overview

When averaged across electric company responses, the system sales are forecasted to grow 0.59% per year over the next ten years. The ten-year forecasted annual growth rate for retail sales (i.e., residential, commercial and industrial classes) is slightly higher at 0.67%. The difference between systems sales and retail sales is that system sales include additional classes such as wholesale and street lighting. The long-term sales growth outlook is consistent with the prior year survey results and continues to show a sharp contrast to historic growth in the United States from 1974 through 2008.

Figure 2 shows historical sales from 1974 through 2019 as 12-month rolling sums. The red line shows historic sales through 2019 with forecast sales based on the survey's retail projections through 2025. The blue lines show the long-term growth trend through 2008 and extrapolated from 2009 through the forecast period.

Figure 2: Survey Electric Sales Growth



Beginning with the "Great Recession" in 2008, sales deviate from the long-term trend line. Since 2008, sales are relatively flat despite the economic recovery. Accounting for the absence of growth, utilities are cautiously optimistic that sales will grow over the next decade. Figure 3 shows historic annual growth rates over various time periods from 1974 through 2019 for the major electric classes.

Figure 3: U.S. Historical Electric Sales Growth Rate (%)

Time Frame	Residential	Commercial	Industrial	Total
1974-2014	2.23%	2.77%	0.94%	1.96%
1980-1990	2.81%	3.93%	1.36%	2.56%
1990-2000	2.49%	3.23%	1.46%	2.37%
2000-2008	2.22%	2.29%	-0.27%	1.49%
2009-2019	0.36%	0.17%	-0.42%	0.08%

Since 2009, the annual growth rate for total sales has averaged close to zero (0.08%) which is consistent with the survey results.

Natural Gas Forecast Growth Overview

Natural gas companies expect sales to increase by 0.56% per year over the next ten years. The ten-year forecasted annual growth rate for retail sales (i.e., residential, commercial and industrial classes) is lower at 0.19%. Detailed growth rates are shown in Figure 11. Historically, gas sales have shown long cycles of growth and decline with smaller year-to-year fluctuations based on weather. Despite gas sales being at a 40-year high, survey respondents are forecasting modest increases in all classes.

Figure 4 shows a 12-month rolling sum of monthly retail gas sales. The forecast is based on reported forecast growth rates beginning in 2019. Figure 5 shows average annual growth rates for selected periods of time.

Figure 4: U.S. Historical Natural Gas Sales

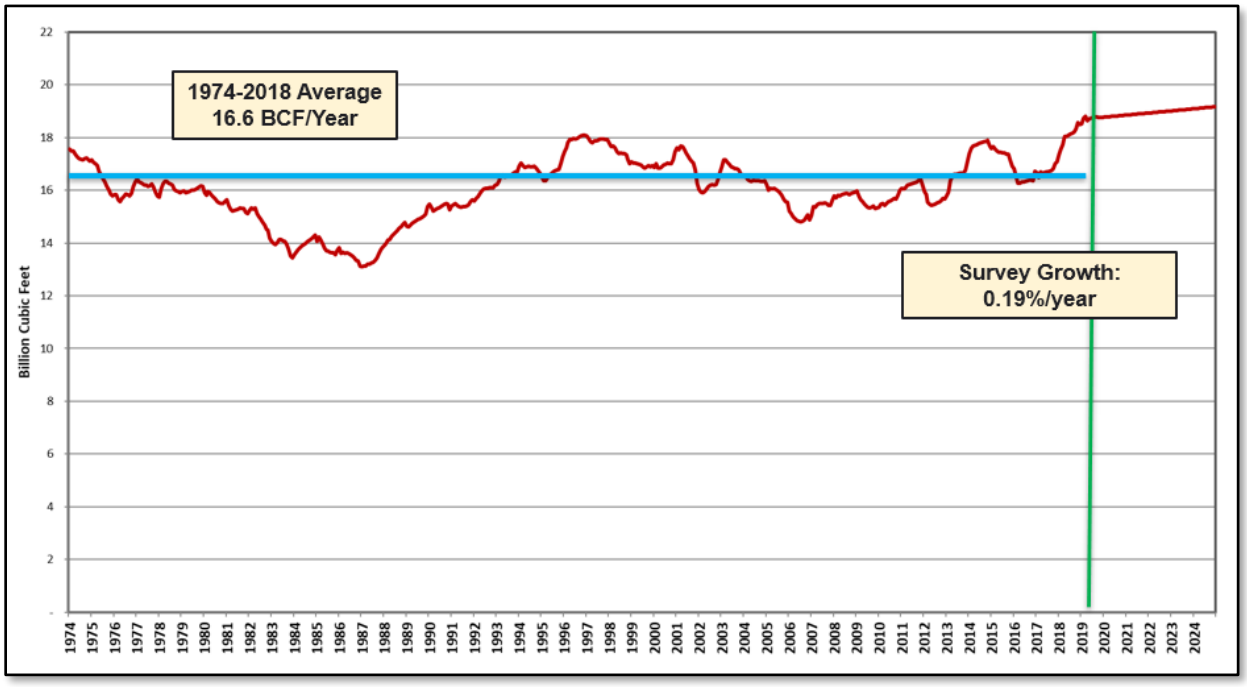


Figure 5: U.S. Historical Natural Gas Sales Growth Rate (%)

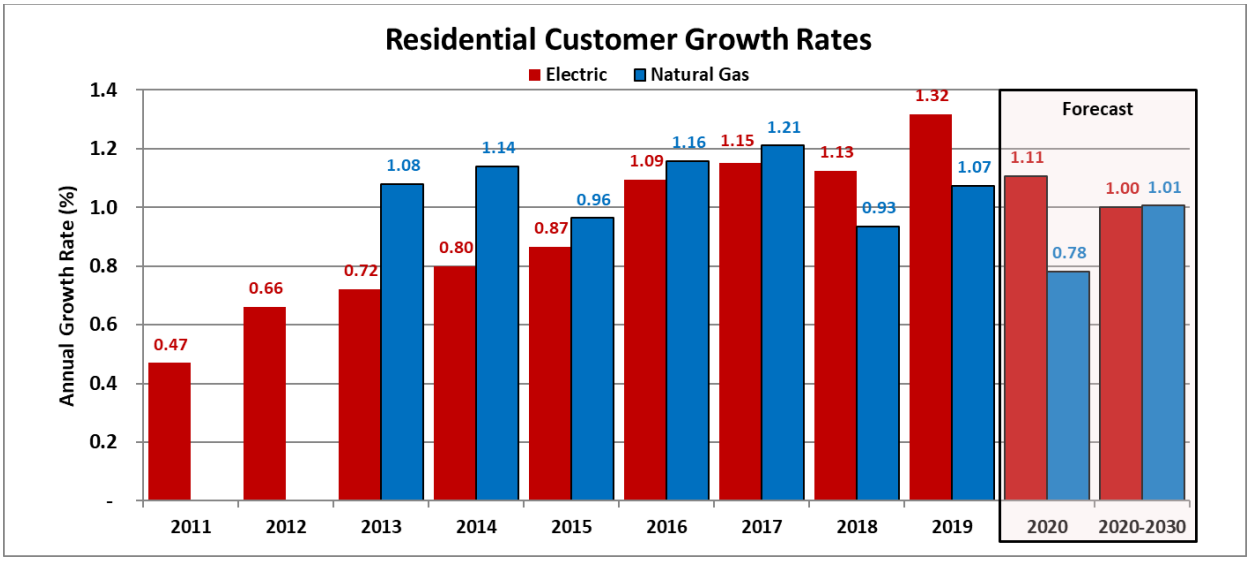
Time Frame	Residential	Commercial	Industrial	Total
1974-2014	0.30%	0.80%	-0.20%	0.09%
1980-1990	-0.50%	0.23%	-0.99%	-0.58%
1990-2000	0.29%	1.50%	1.94%	1.32%
2000-2008	0.51%	0.25%	-1.57%	-0.64%
2009-2019	0.83%	1.44%	2.27%	2.92%

Customer Growth

Historic and forecast customer growth rates for the residential and commercial classes are shown in Figure 6 and Figure 7. Forecast growth rates for 2020 and the long term (2020-2030) are highlighted and reflect pre-Covid19 forecasts. For comparative purposes, growth rates from the 2012 through 2019 surveys are displayed with the 2020 survey results.

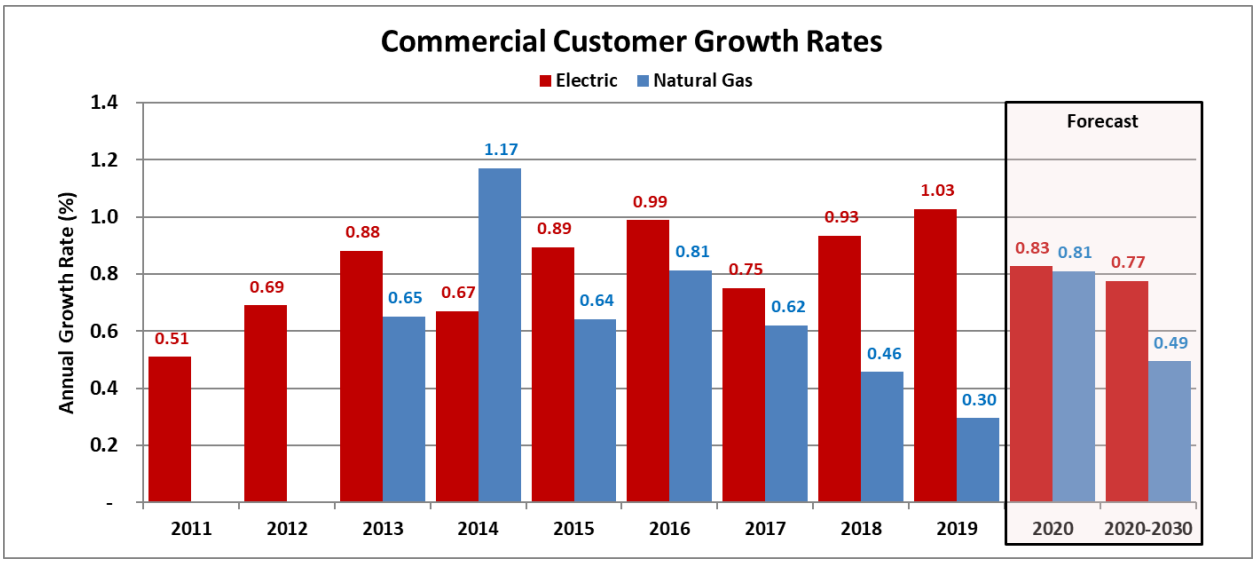
Reported 2019 electric customer growth is 1.32% for the residential class and 1.03% for the commercial class. Natural gas customer growth is 1.07% for the residential class and 0.30% for the commercial class.

Figure 6: Residential Average Customer Growth (%)



Residential electric customer growth has consistently increased from 0.47% (2011) to 1.32% (2019) exceeding the most recent the 5-year (2015-2019) average of 1.11%. Unlike the residential electric customer growth, the residential natural gas customer growth fluctuates between 0.96% and 1.16% consistent with the most recent 5-year average of 1.07%. Both electric and natural gas customer growth rate forecasts are slightly higher than the Energy Information Administration's (EIA's) 2020 Annual Energy Outlook long-term single-family household forecast growth rate of 0.7%.

Figure 7: Commercial Average Customer Growth (%)



Unlike residential electric customer growth, commercial electric customer growth fluctuates between 0.51% and 1.03% consistent with the most recent 5-year average growth of 0.92%. Commercial natural gas customer growth has been declining from 1.17% (2014) to 0.30% (2019). The current natural gas customer growth forecast is slightly below the most recent 5-year average of 0.57%. For comparative purposes, the EIA's 2020 Annual Energy Outlook long-term commercial floorspace growth rate is 1.0%.

Residential Sales Growth

Figure 8 shows past and current reported weather normalized residential sales growth rates. The figure also shows the 2020 forecast growth rate and the ten-year forecast growth rate. Both forecasts reflect pre-COVID-19 input assumptions.

Figure 8: Residential Sales Growth

Region	Actual 2011	Actual 2012	Actual 2013	Actual 2014	Actual 2015	Actual 2016	Actual 2017	Actual 2018	Actual 2019	Forecast 2020	Forecast 2020-2030
Electric Total	0.41	0.25	0.35	0.66	(0.38)	0.33	0.16	1.19	0.03	0.76	0.78
Itron WN	0.06	0.29	(0.14)	0.36	0.31	0.17	0.74	0.62	(0.80)		
Natural Gas Total			3.13	0.63	(0.72)	0.91	1.53	(1.88)	1.08	(1.05)	0.55

Electric. Electric companies report 0.03% weather normalized residential sales growth for 2019. Since 2011, electric sales growth has fluctuated between -0.38% and 0.66%, excluding the 2018 sales growth of 1.19%. Over the past 5-years (2015-2019), the annual average growth rate is 0.27%.

Each year, Itron weather normalizes United States sales based on EIA data. While Itron shows a -0.80% growth in 2019, we expect this growth rate to increase when EIA updates the data at the end of 2020. Despite the negative growth in 2019, Itron's historic 5-year average growth rate is 0.21% which is consistent with the most recent 5-year average (2015-2019) survey growth of 0.27%.

The 2019 survey sales growth (0.03%) coupled with the residential customer growth (1.32%) imply a 1.28% decrease in average use. The declining average use is slightly larger than the most recent 5-year average (2015-2019) of -0.84% and EIA's long -term residential energy intensity forecast growth rate of -0.60%.

Natural Gas. Natural gas companies saw average weather normal sales increase of 1.08% in 2019 and forecast long-term growth forecast to be 0.55% per year. The most recent 5-year annual average residential sales growth rate is 0.19%. Historic fluctuations in the residential sales growth are expected given the relatively small number of reporting natural gas companies.

Commercial Sales Growth

Figure 9 shows past and current historical weather normalized commercial sales growth rates. The figure also shows the 2020 forecast growth rate and the ten-year forecast growth rate. The forecasts reflect pre-COVID-19 input assumptions.

Figure 9: Commercial Sales Growth

Region	Actual 2011	Actual 2012	Actual 2013	Actual 2014	Actual 2015	Actual 2016	Actual 2017	Actual 2018	Actual 2019	Forecast 2020	Forecast 2020-2030
Electric Total	0.15	0.24	0.51	0.80	0.28	0.32	0.32	1.25	(0.42)	0.70	0.40
Itron WN	(0.08)	0.23	1.51	0.88	0.04	(0.07)	(0.01)	1.34	(1.44)		
Natural Gas Total			4.38	2.25	(0.58)	0.69	3.99	(1.04)	2.13	(1.89)	0.39

Electric. Companies reported a weather normalized sales decline of 0.42% in 2019 and project a 0.70% growth rate in 2020. The ten-year average forecast growth rate is 0.40%. The commercial sales decline is the first reported decline since Itron began surveying utilities in 2011. Despite the 2019 decline, the long-term forecast (2019-2029) growth of 0.40% is consistent with the most recent 5-year average growth rate of 0.35%.

Consistent with the survey's reported 2019 sales decline, Itron's estimate of weather normalized commercial sales shows a decline of 1.44%. Like the residential data, Itron's weather normalized sales are preliminary since the EIA updates its data at the end of the year. Despite the expected update, Itron expects the weather 2019 normalizes sales to remain negative due to its current size.

Like the residential class, commercial average use per customer is also declining. In 2019, the survey average use declines 1.45% which is a stronger then the most recent 5-year average decline of 0.57%. For comparison, the EIA's 2020 AEO forecast shows a long-term commercial intensity decline of 0.7% per year.

Natural Gas. Companies report 2.13% increase in 2019 weather-normal gas sales. The short and long-term forecasts of commercial sales show mixed results with the 2020 forecast decreasing 1.89% and the long-term forecast (2020-2030) increasing 0.39%.

Industrial Sales Growth

Responses to historic and forecast industrial growth are shown in Figure 10. This figure combines reported growth rates from the prior surveys with reported and forecasted growth rates from the 2019 Survey. The forecasts reflect pre-COVID-19 forecasts.

Figure 10: Industrial Sales Growth

Region	Actual 2011	Actual 2012	Actual 2013	Actual 2014	Actual 2015	Actual 2016	Actual 2017	Actual 2018	Actual 2019	Forecast 2020	Forecast 2020-2030
Electric Total	1.78	0.73	0.32	1.30	(0.33)	(0.23)	0.33	0.76	0.21	2.39	0.83
Natural Gas Total			4.47	(0.43)	(0.13)	4.61	2.33	(0.33)	3.23	(1.64)	0.37

Electric Growth. The 2019 sales growth of 0.21% is consistent with the most recent 5-year average (2015-2019) of 0.15%. The pre-Covid industrial forecasts show some optimism, with a 2020 forecast of more than 2% growth and 10-year forecast close to 1% growth.

Natural Gas. The 2019 sales growth is 3.23%. This strong growth is driven by a few companies with new large industrial projects.

System Sales Growth

Total system (electric and natural gas) growth and electric system peak demand growth are shown in Figure 11. Total system growth includes all utility classes and may include wholesale, resale, and agricultural classes. Electric peaks are aggregated for all companies. Beginning in 2018, peak growth is divided between summer and winter peak companies. In 2019, approximately 84% of companies are summer peaking.

Figure 11: System Energy and Peak Growth

Region	Actual 2012	Actual 2013	Actual 2014	Actual 2015	Actual 2016	Actual 2017	Actual 2018	Actual 2019	Forecast 2020	Forecast 2020-2030
Electric Energy	0.22	0.33	0.87	(0.12)	0.21	0.26	1.24	(0.25)	1.38	0.59
Electric Peak	(0.35)	(0.45)	0.18	0.70	0.65	(0.28)	1.71	0.26	0.92	0.62
Summer Peak	-	-	-	-	-	-	1.93	0.25	1.05	0.64
Winter Peak	-	-	-	-	-	-	1.12	0.32	0.45	0.58
Natural Gas	-	2.97	1.13	1.50	1.48	1.54	(0.56)	2.82	(3.18)	0.56

Electric Growth. 2019 weather normalized system energy requirement declines 0.25% driven by the declines in the commercial class. The decline reverses the growth trend from 2016 and is opposite to the most recent 5-year average (2015-2019) growth of 0.27%. System peak demand growth increases 0.26% with similar growth rates for both summer (0.25%) and winter (0.32%) peaking companies. The increasing peak demand with decreasing system energy suggests declining system load factors.

Natural Gas. 2019 natural gas system normalized energy shows an increase of 2.82%, which is consistent with the reported growth in the residential, commercial, and industrial sectors. While the near-term forecast projects a decline in 2020, the long-term forecast shows modest growth of 0.56%.

Electric Forecast Accuracy

The survey asks companies about their 2019 forecast accuracy. Companies are asked for three error calculations. First, companies are asked to compare their 2019 forecast (generated in 2018) against weather normalized 2019 sales. Second, companies are asked to compare the same forecast against actual 2019 sales. These calculations report errors on an annual basis. For the third calculation, companies are asked to compare the same forecast and report the errors on a monthly average basis.

Annual Forecast Accuracy. The average forecast errors calculated as the Mean Absolute Percent Error (MAPE) are shown in Figure 12 and Figure 13. The figures show the 2020 MAPE, the average annual MAPEs from the 2015 through 2019 surveys, and the variance associated with the annual average MAPEs from 2015 through 2019. Figure 12 shows the annual forecast errors measured against weather normalized values. Figure 13 shows the annual forecast error measured against actual sales values. All MAPE values are unweighted.

Figure 12: Annual Electric MAPE - Forecast vs. Weather Normal Actuals

Class	2020 Survey	2015-2020 Mean	2015-2020 Variance
Residential	1.17	1.57	0.08
Commerical	1.65	1.60	0.08
Industrial	4.07	2.99	0.62
System	1.39	1.41	0.08
Peak	2.38	2.57	0.11

Figure 13: Annual Electric MAPE - Forecast vs. Actuals

Class	2020 Survey	2015-2020 Mean	2015-2020 Variance
Residential	1.83	2.56	0.74
Commerical	1.50	1.64	0.07
Industrial	4.02	3.06	0.60
System	1.18	1.60	0.11
Peak	2.92	2.04	0.65

The distributions of the sales forecast errors are shown in Figure 14 through Figure 17. The forecast error distributions are measured against normalized sales (left chart) and actual sales (right chart). When the error is below zero, this means that actual sales came in below the forecast value. When the forecast error is above zero, this means that the actual sales came in above the forecast value.

The figures show that the error distribution against normalized actuals are relatively balanced for the residential and industrial forecasts, but are skewed to the left for the commercial, system and peak forecast. When the errors are skewed left, this means that normalized results came in weaker than the forecast values, both of which are intended to reflect the same “normal” weather forecast.

When compared against actual values, the residential forecast shows errors skewed to the right, implying that actual sales came in above the forecast values. This is expected since 2019’s summer was warmer than normal in most regions. Unlike the residential forecasts, the commercial and system forecasts are skewed left indicating weak sales despite the presence of stronger than normal weather patterns.

Figure 14: Residential Electric Error Distributions

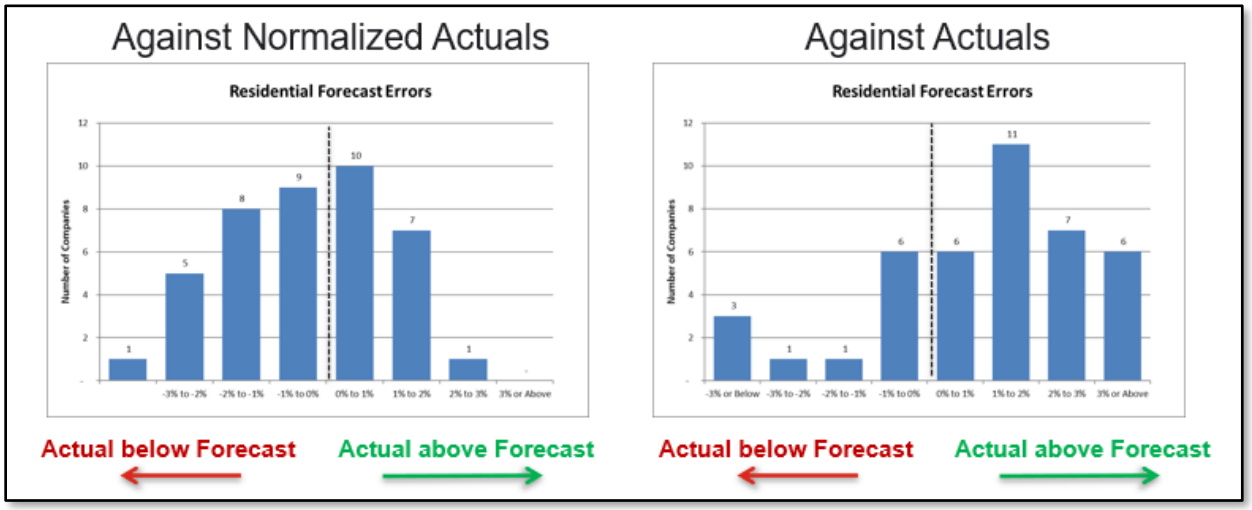


Figure 15: Commercial Electric Error Distributions

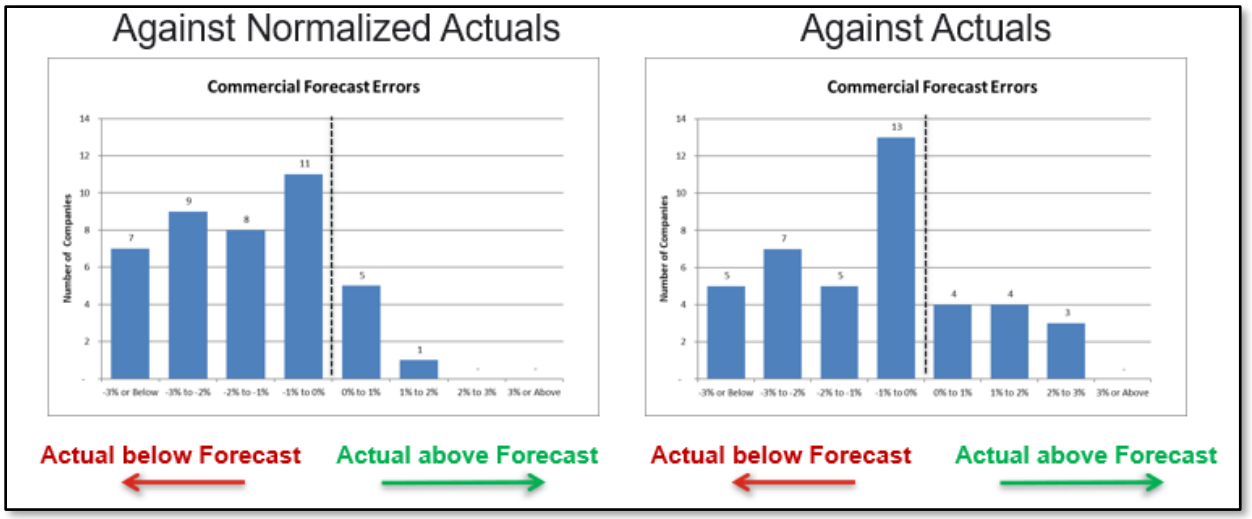


Figure 16: Industrial Electric Error Distributions

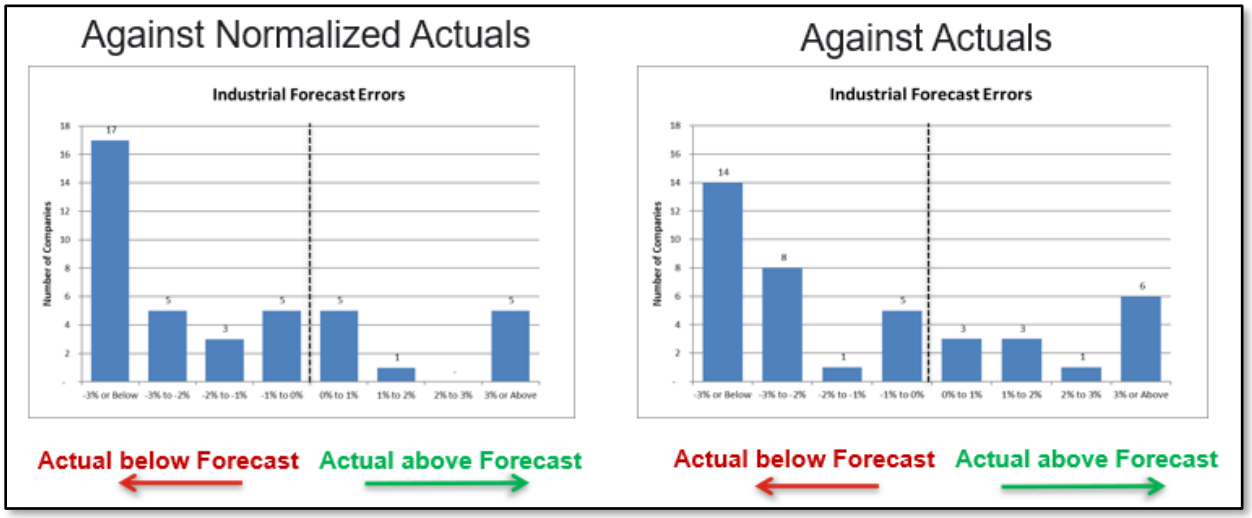
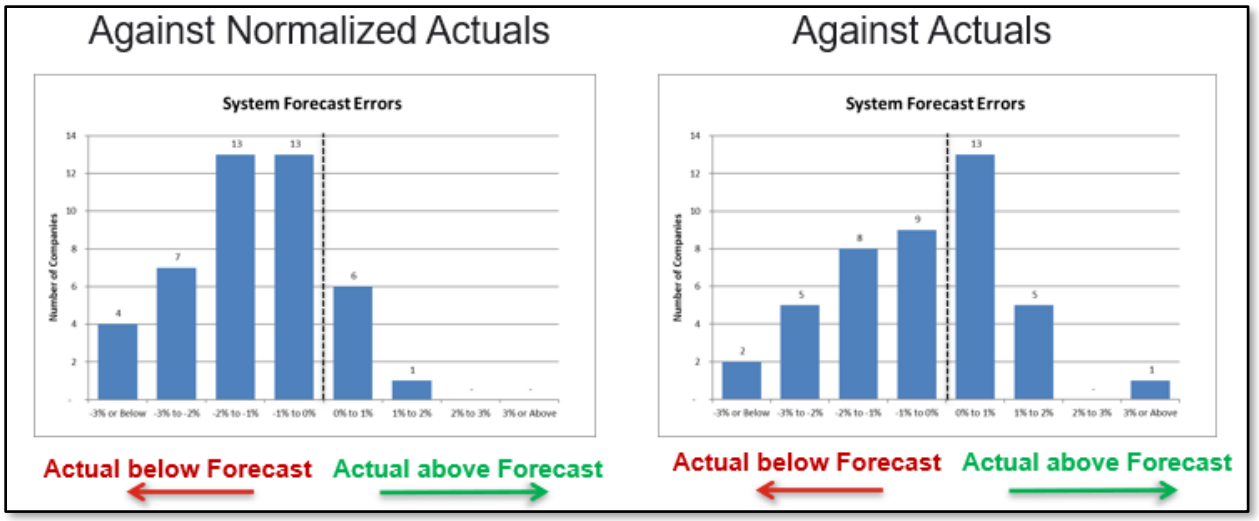


Figure 17: Electric System Error Distributions



The distribution of peak forecast errors is shown in Figure 18 and Figure 19. In these figures, the summer peak and winter peaks are separated. Like the system sales forecast distributions, both error distributions skew left indicating that peaks are weaker than expected despite a warmer than normal summer and colder than normal winter.

Figure 18: Summer Peak Error Distributions

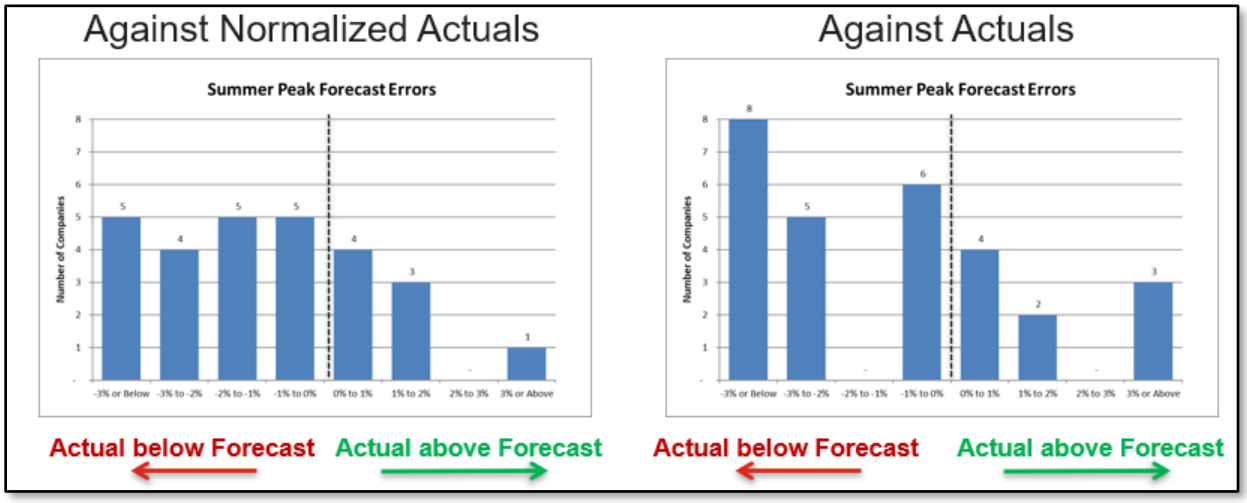
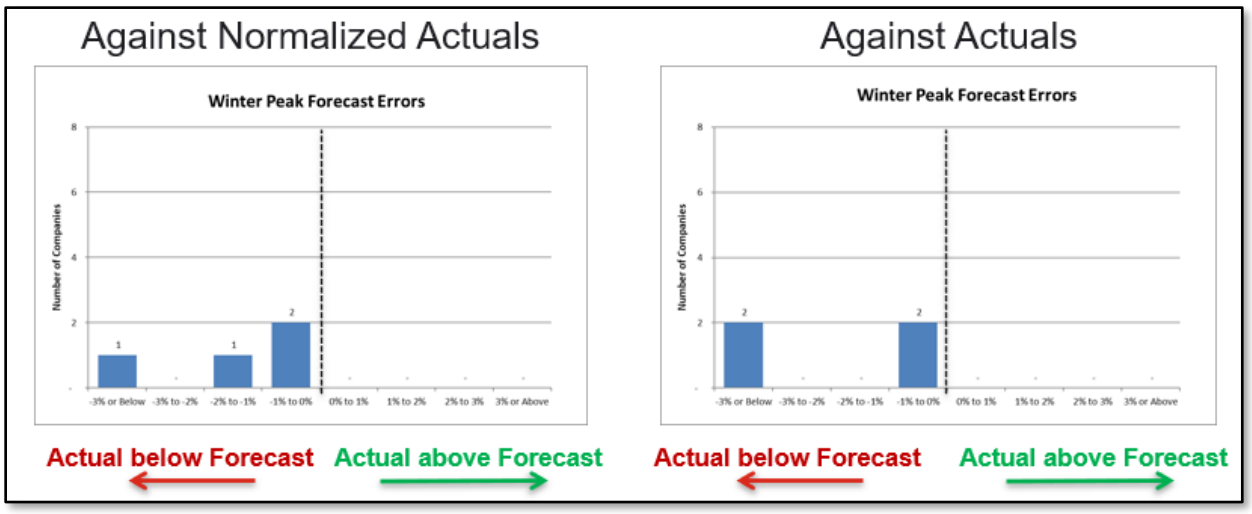


Figure 19: Winter Peak Error Distributions



Monthly Forecast Accuracy. While Figure 12 through Figure 19 present annual forecast errors, Figure 20 through Figure 23 present monthly average forecast errors. Monthly average errors are calculated as the average of the 12 monthly errors in 2019 and comparable to monthly model estimation errors for 2019. Figure 20 shows the monthly average errors by class with comparative values from the 2018 and 2019 surveys. As expected, the reported errors are higher than the annual error reported in Figure 12 because errors in one month are not offset by errors in another month. The large Industrial error is driven by 27% of companies showing errors above 6%.

Figure 20: Monthly Average Electric Error Results (Unweighted)

Class	2018 Survey	2019 Survey	2020 Survey
Residential	3.76	4.26	3.02
Commerical	3.03	3.45	2.57
Industrial	3.87	3.86	4.70

The distribution of monthly errors in Figure 21 through Figure 23 show the range of responses. In the residential class, 66% of companies show errors less than 3%. Like the residential class, the commercial class also shows 66% of companies with errors less than 3%. In the industrial class 47% of respondents show less than 4%.

Figure 21: Residential Monthly Errors

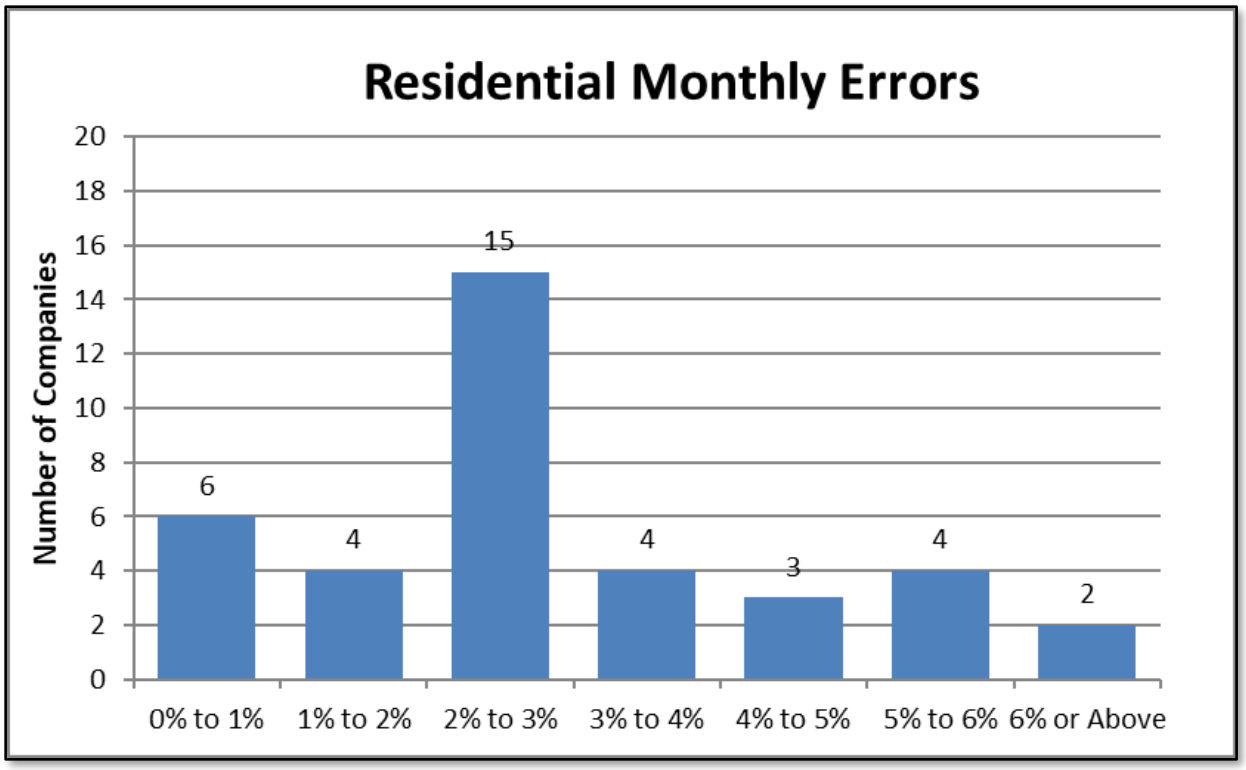


Figure 22: Commercial Monthly Errors

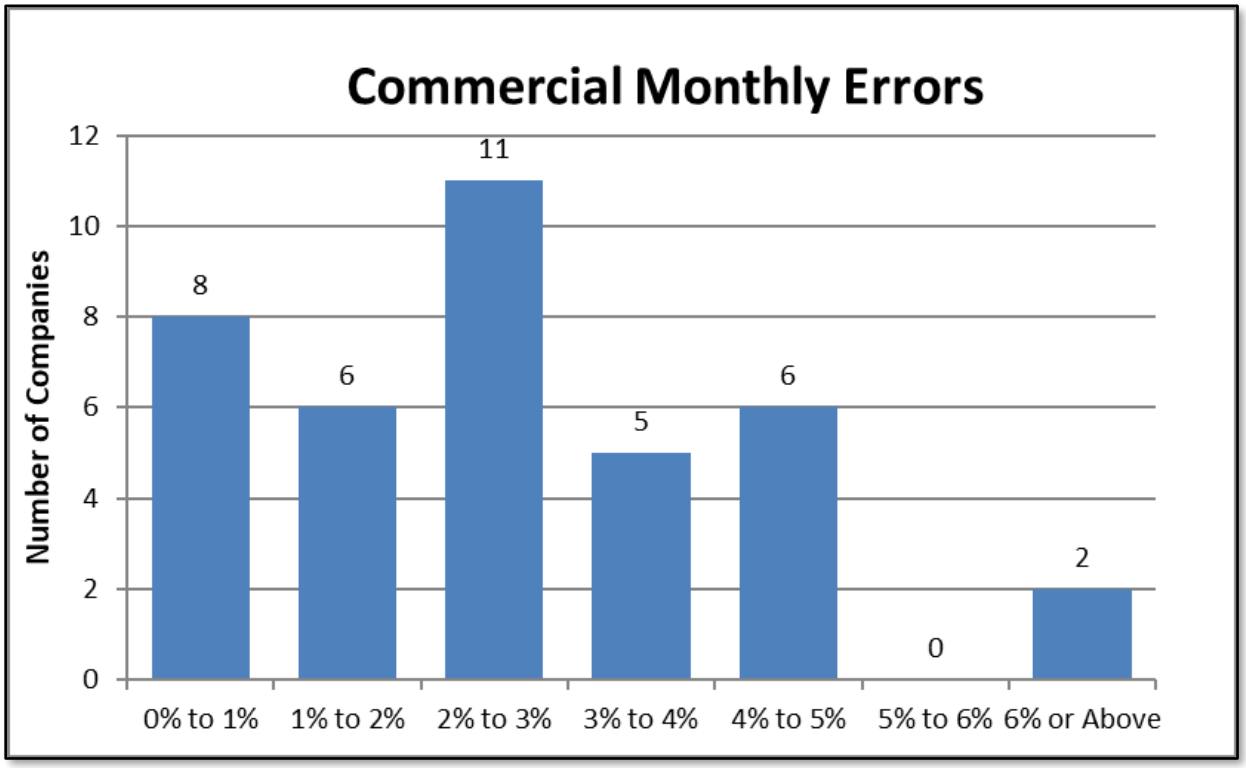
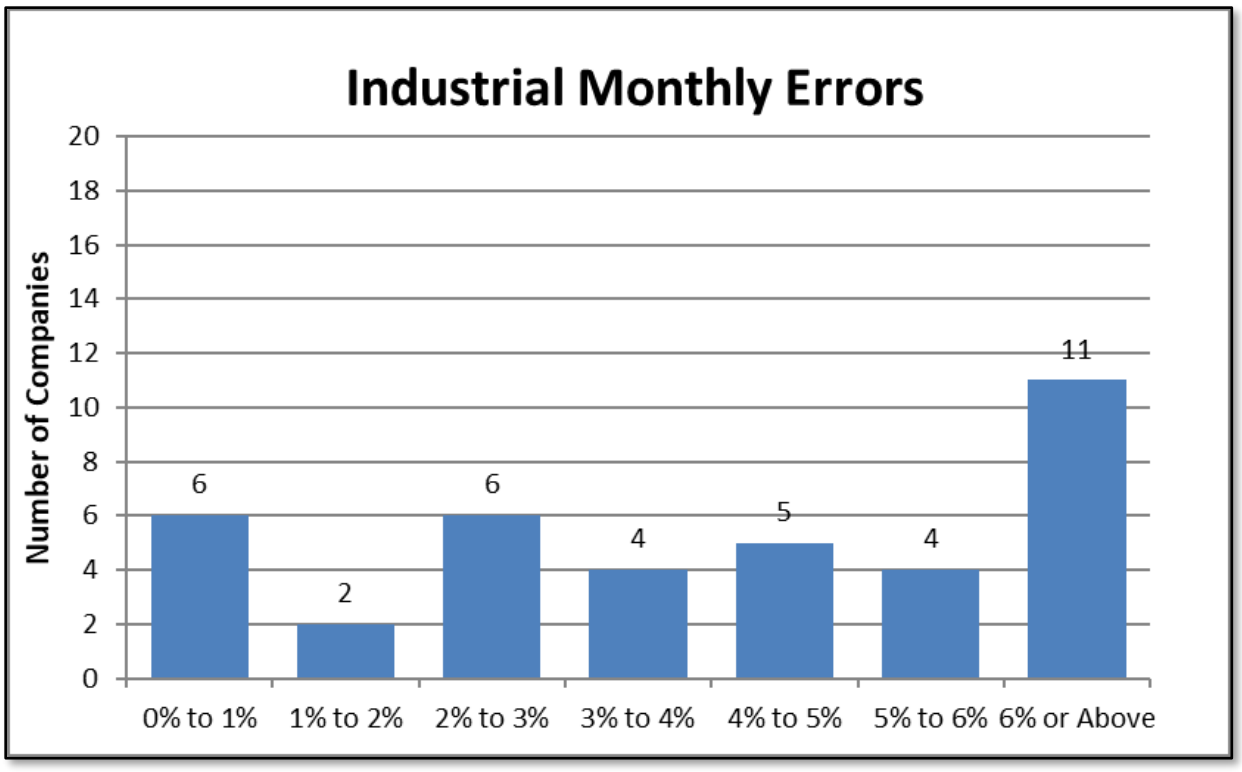


Figure 23: Industrial Monthly Errors



Natural Gas Forecast Accuracy

Similar to the electric forecasting errors, natural gas companies are asked to compare their forecast for 2019 (generated in 2018) against actual and weather normalized sales in 2019. Figure 24 and Figure 25 shows the companies' unweighted annual MAPEs. The figures show the annual MAPE, the average annual MAPEs from the 2015 through 2019 surveys, and the variance associated with the annual average MAPEs from 2015 through 2019. Figure 26 shows the unweighted monthly MAPEs.

Annual Forecast Accuracy. Figure 24 and Figure 25 shows that all class forecasting errors are consistent with prior survey results. The 2020 survey errors are close to the average errors obtained from the 2015 through 2020 surveys.

Figure 24: Annual Natural Gas MAPE - Forecast Versus Weather Normal Actuals

Class	2020 Survey	2015-2020 Mean	2015-2020 Variance
Residential	2.94	2.84	0.45
Commerical	4.82	4.01	1.08
Industrial	8.45	7.67	13.66
System	4.16	4.06	1.55

Figure 25: Annual Natural Gas MAPE - Forecast Versus Actuals

Class	2020 Survey	2015-2020 Mean	2015-2020 Variance
Residential	6.21	9.13	13.43
Commerical	6.98	6.70	6.80
Industrial	9.10	8.47	13.81
System	7.29	7.65	4.49

Monthly Forecast Accuracy. As expected, monthly forecast accuracy statistics show that monthly percentage errors are higher than the corresponding annual errors. The monthly MAPEs are shown in Figure 26.

Figure 26: Monthly Average Gas Error Results (Unweighted)

Class	2018 Survey	2019 Survey	2020 Survey
Residential	7.28	6.82	9.87
Commerical	6.68	8.84	10.98
Industrial	10.17	10.33	13.58

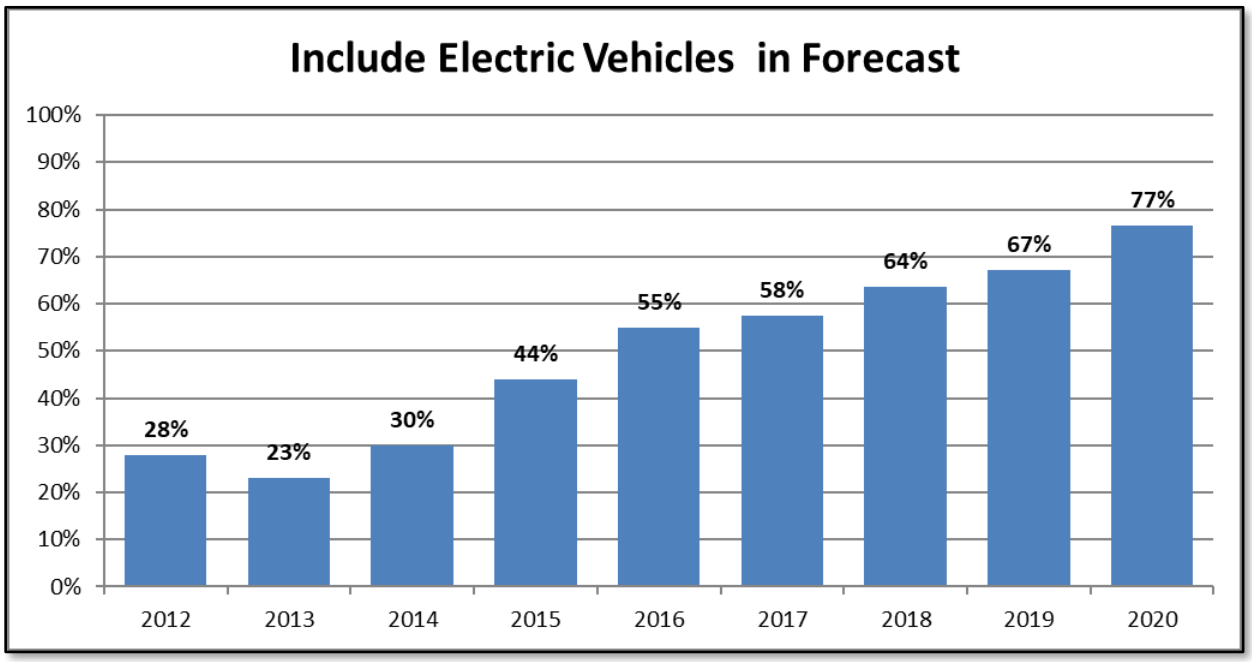
Key Forecast Characteristics

As part of the annual survey, Itron tracks changes in forecasting practices. These changes include accounting for new technologies, forecast methods and business processes. In addition to the regular questions about electric vehicles, photovoltaics, energy storage, normal weather, forecasting techniques and AMI data usage, this year's survey includes questions about CO2 emission targets, climate change adjustments and forecasting staff size.

Electric Vehicles.

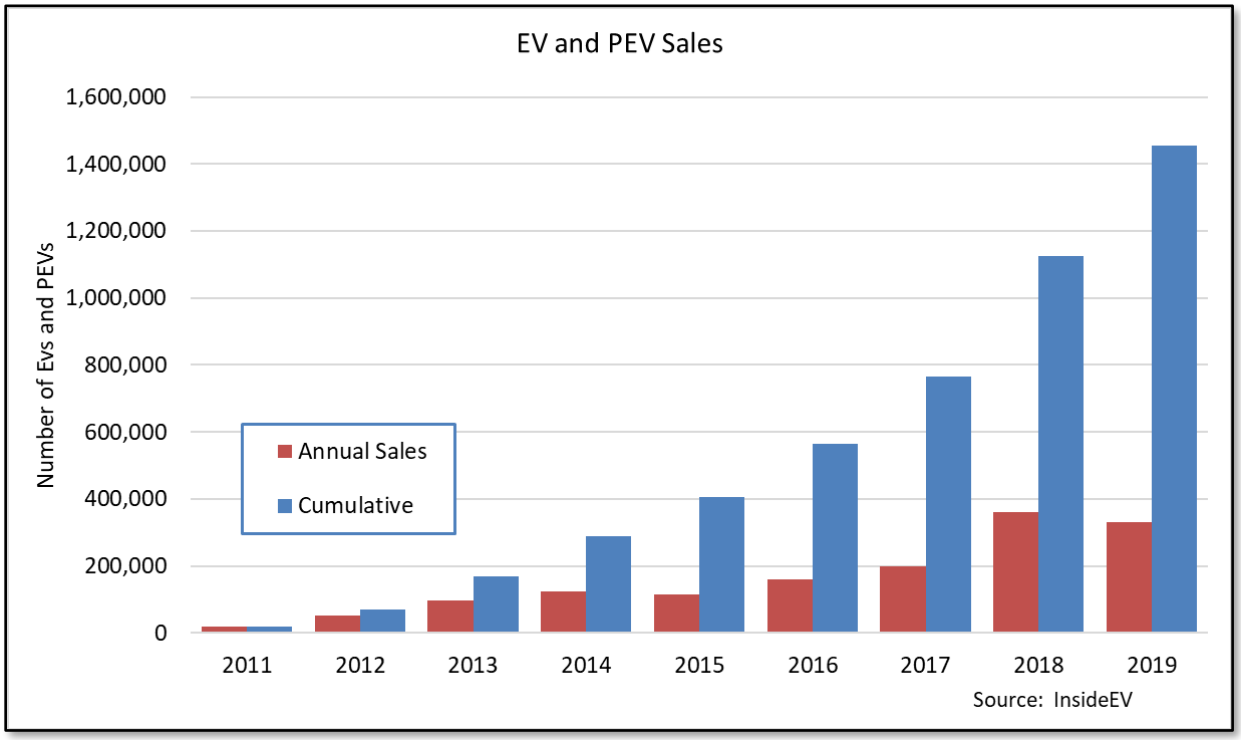
The percentage of companies who explicitly include electric vehicles (EVs) in their forecast continues to increase. Since the question was introduced, the percent of companies including EVs in their forecast has grown from 28% in 2012 to 77% in 2020. Figure 27 shows the 2020 survey result compared with prior year results.

Figure 27: Include Electric Vehicles in the Forecast



In 2019, EV sales plateau with sales slightly lower than 2018. However, EVs constitute approximately 6% of car sales (excluding SUVs, pickups and vans/minivans) and include over one million vehicles on the road. In 2019, Tesla continues to dominate the EV market accounting for approximately 50% of all 2019 EV sales. Figure 28 shows cumulative number of EV and plug-in EV sales, compiled from *InsideEV* data reports.

Figure 28: Historic EV and PEV Sales



Photovoltaics.

Figure 29 shows the share of companies that include photovoltaics (PV) in their forecast. This year, 83% of respondents now include PV forecasts in their forecasts.

Figure 29: Include Photovoltaics in the Forecast

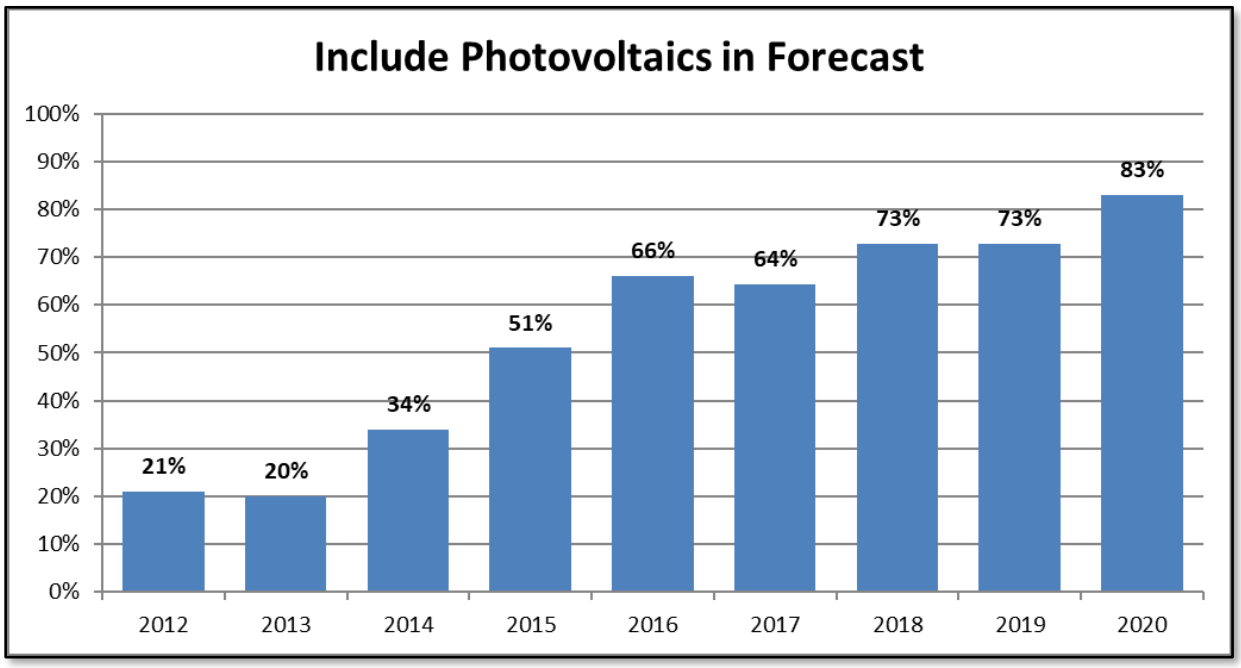
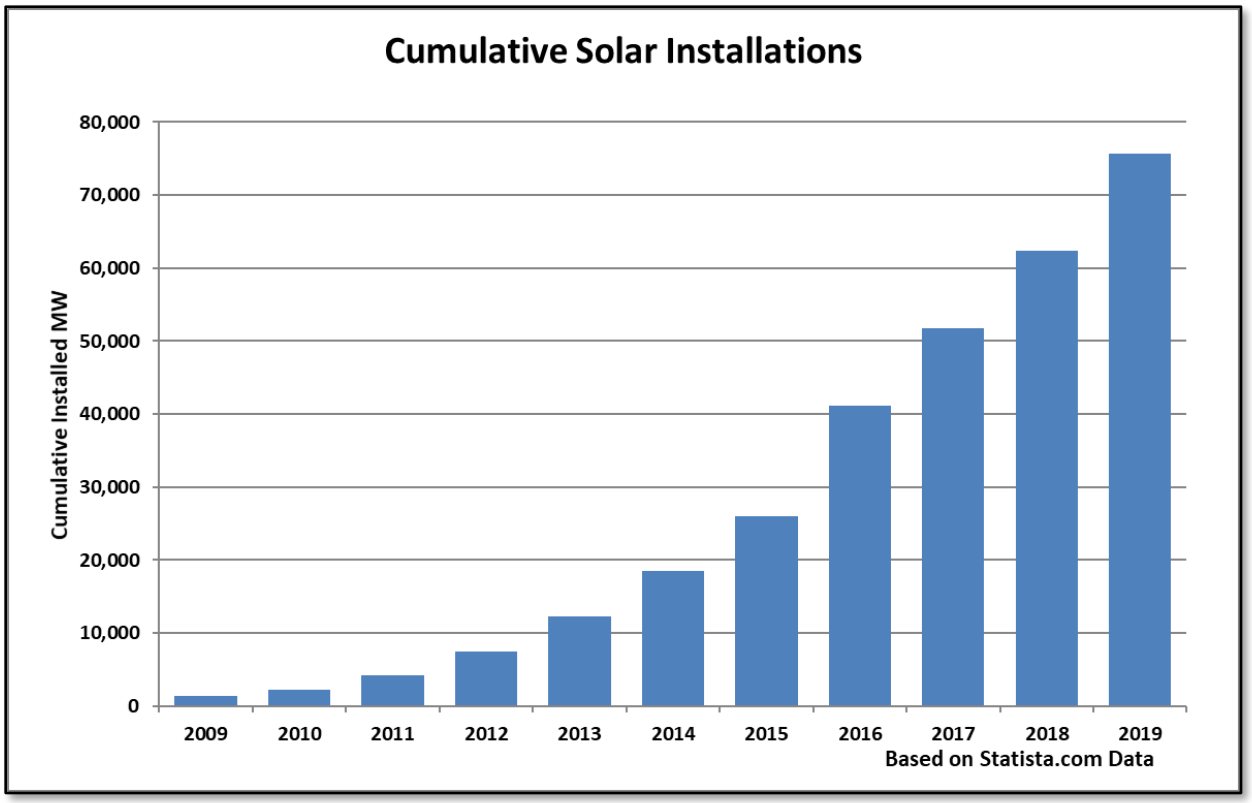


Figure 30 shows the cumulative growth in installed solar capacity across the United States. Based on *Statista.com* data, PV installations slowed in 2017 and 2018 from their peak in 2016. However, 2019 shows a return to strong growth with cumulative PV installations rising 21% from 2018 to 2019. Overall, the cumulative level of installations continues to show a strong upward trend.

Figure 30: Solar Installations

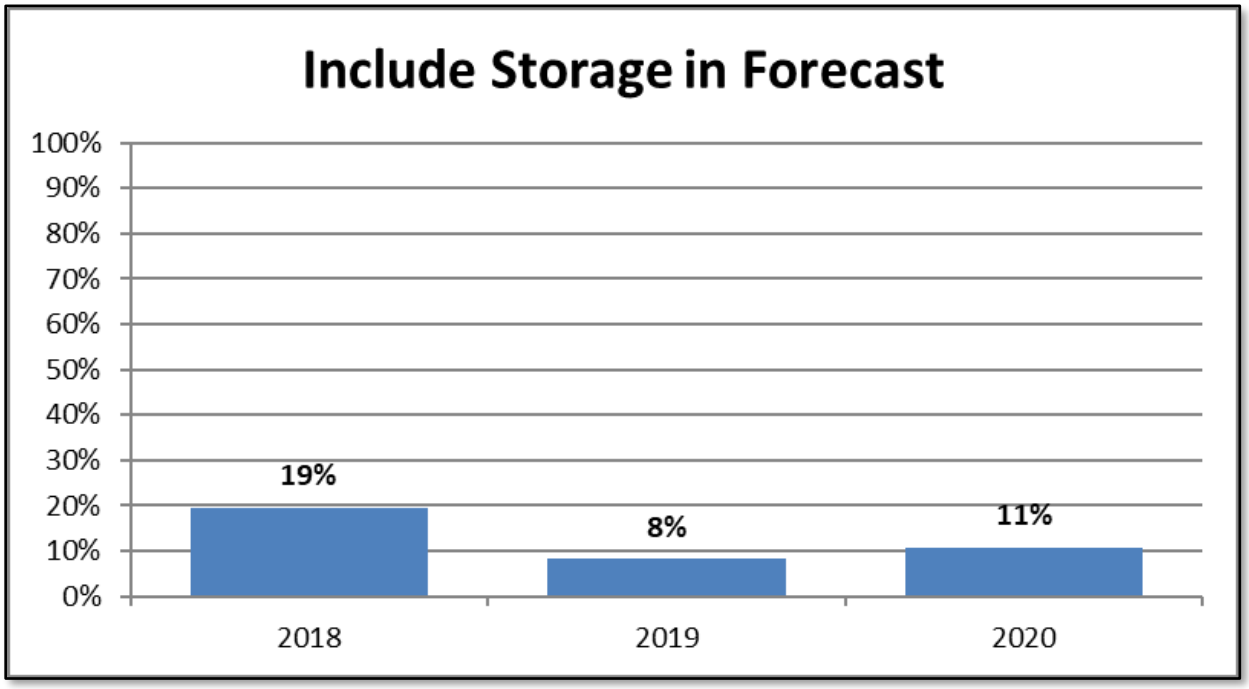


Electric Storage.

For the third consecutive year, the survey asks whether companies are explicitly including energy storage in their forecasts. The results are shown in Figure 31. Over the past three years, very few companies account for storage. While the percentage of survey respondents fluctuates, the difference is attributed to the change in survey participants.

The storage market continues to be in the nascent stages, which makes forecasting technology penetration and usage patterns difficult. As with any new technology, companies should closely watch the market to identify signs and factors that will assist them in forecasting this technology.

Figure 31: Include Battery/Storage in the Forecast



DSM Modeling.

For the second consecutive year, the survey asks companies how they model DSM in their forecast. Figure 32 compares the 2019 and 2020 survey results. Overall, there is not a significant change from the 2019 survey result. Variations in the responses are attributed to the difference in survey respondents.

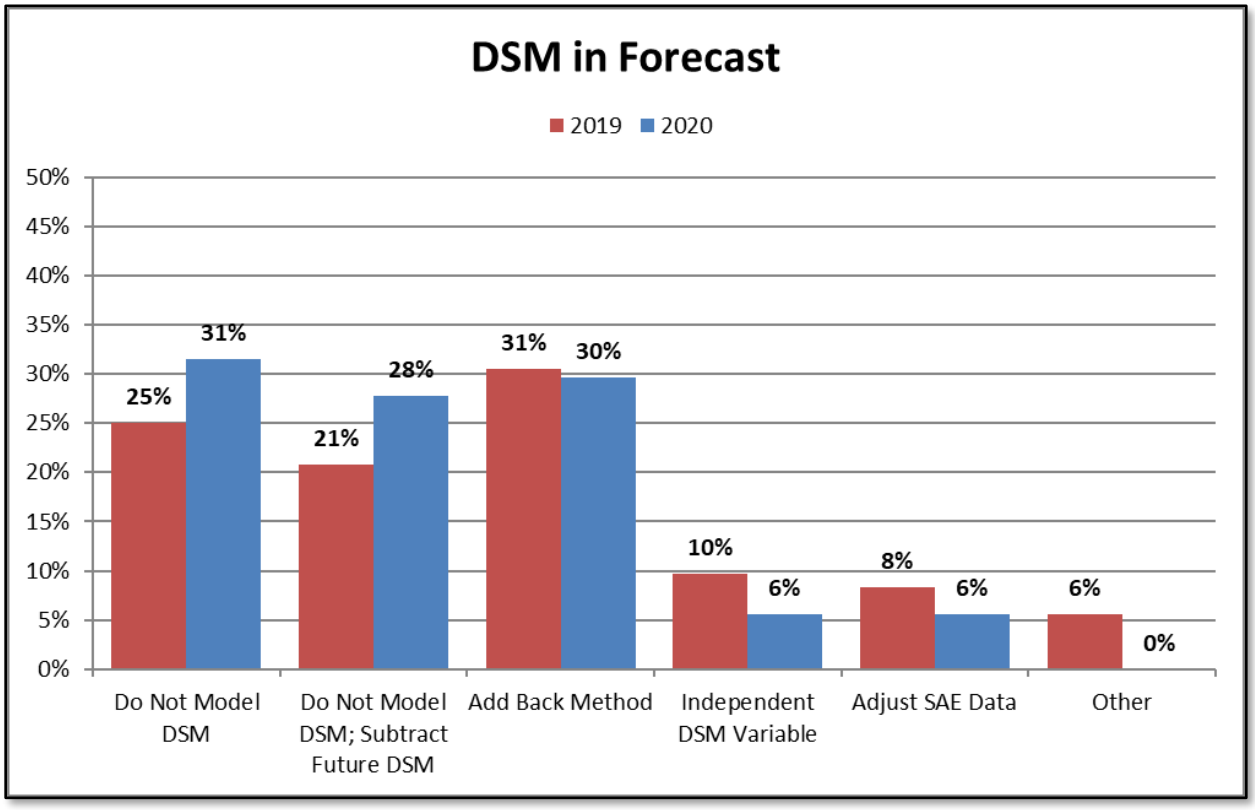
The 2020 results show that 31% of companies do not model DSM and 28% do not model DSM but subtract future DSM from the forecast. These responses imply that historic DSM, if present, is embedded in the historical data series and no further modeling adjustment is needed.

In the Add Back method (30%), companies reconstruct historic sales by reconstituting (or adding back) historic DSM savings. The forecast models are developed assuming growth in the absence of DSM. As a final step, the historic DSM is subtracted from the forecast.

Using an Independent DSM Variable (6%) allows the regression model to capture the statistical significance of historic DSM and applies the regression coefficient to the changes in DSM throughout the forecast period.

A Statistically Adjusted End-Use (SAE) model captures changes in energy efficiency in the embedded regression driver variables. The Adjust SAE Data (6%) method modifies the underlying SAE efficiency driver variables to capture historic DSM savings.

Figure 32: DSM Modeling Techniques

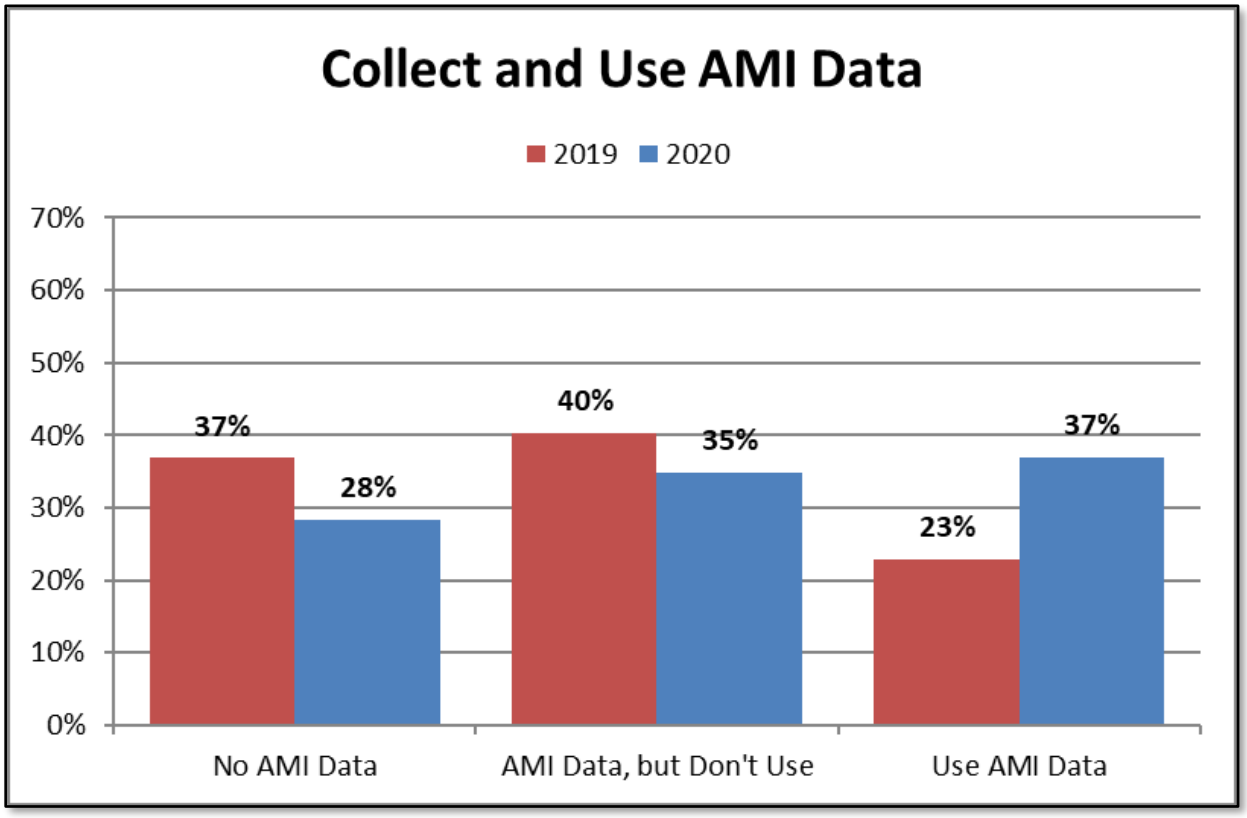


AMI Data Usage.

Like 2019, Itron asked companies about their AMI deployments. Two questions are asked. First, companies are asked whether they have access to AMI data. These results are show in Figure 33. Second, companies that have AMI data are asked how they use the data. These results are shown in Figure 34.

As shown in Figure 33, 72% of companies have access to AMI data with 37% of companies using the data. This result is a small increase from the 2019 results.

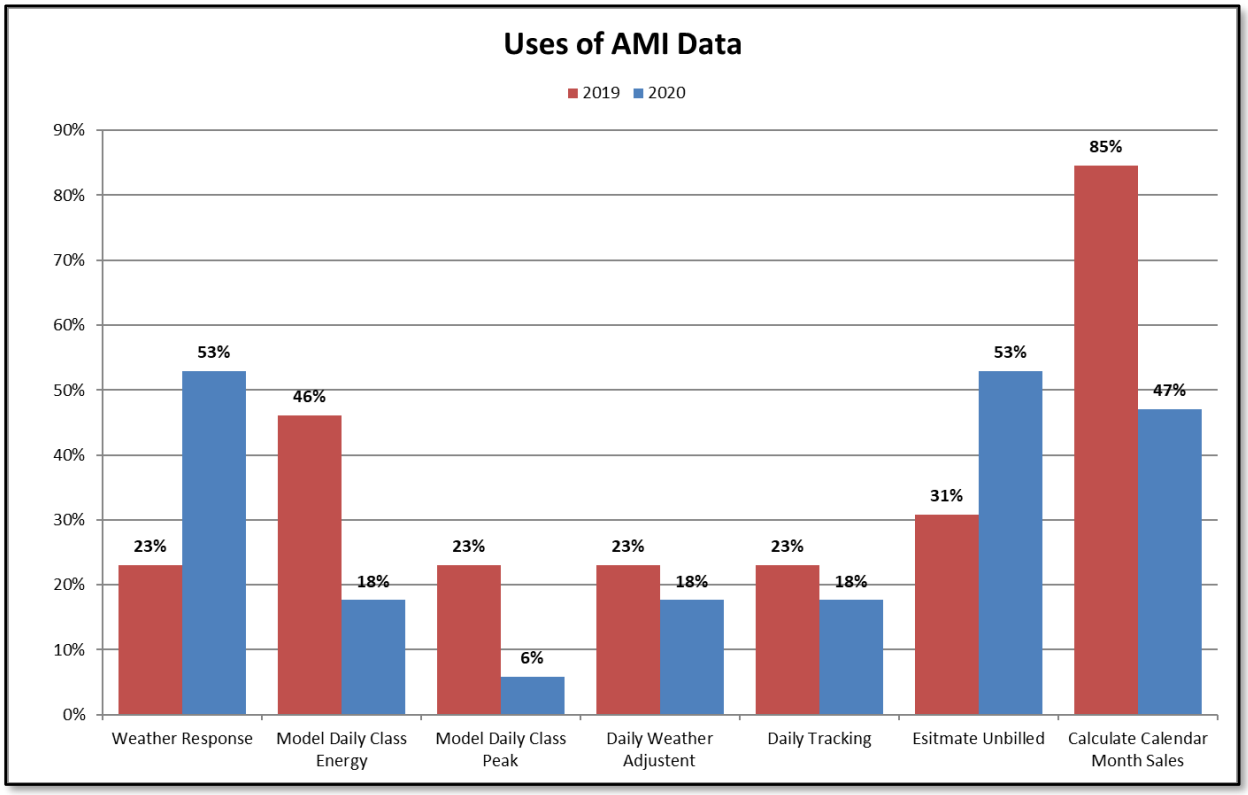
Figure 33: AMI Data Availability



Of respondents who have AMI data, Figure 34 show how companies are using the AMI data. While the difference between the 2019 and 2020 survey results are attributed to the variation in survey participants, the results show that the largest uses of AMI data are in the following areas.

- Weather Response,
- Modeling Daily Class Energy,
- Estimating Unbilled Energy, and
- Calculate Calendar Month Sales.

Figure 34: AMI Data Usage



Forecast Model Method.

Since 2015, Itron has asked companies about their long-term modeling techniques. For the residential and commercial classes, companies are asked whether they use a general econometric approach, Itron's Statistically Adjusted End-Use (SAE) model approach, or another method. The results are shown in Figure 35 and Figure 36.

In 2020, 52% of companies use the SAE approach for the residential class and 42% use it for the commercial class. The 2020 modeling techniques remain consistent with prior survey results and show very little change since 2015.

Unlike the general econometric approach, the SAE approach captures energy efficiency changes by including end-use saturation and efficiency data in the model. These variables allow companies to capture the impact of changing codes and standards as well as energy efficiency programs in their forecast.

Figure 35: Forecasting Model Technique – Residential Class

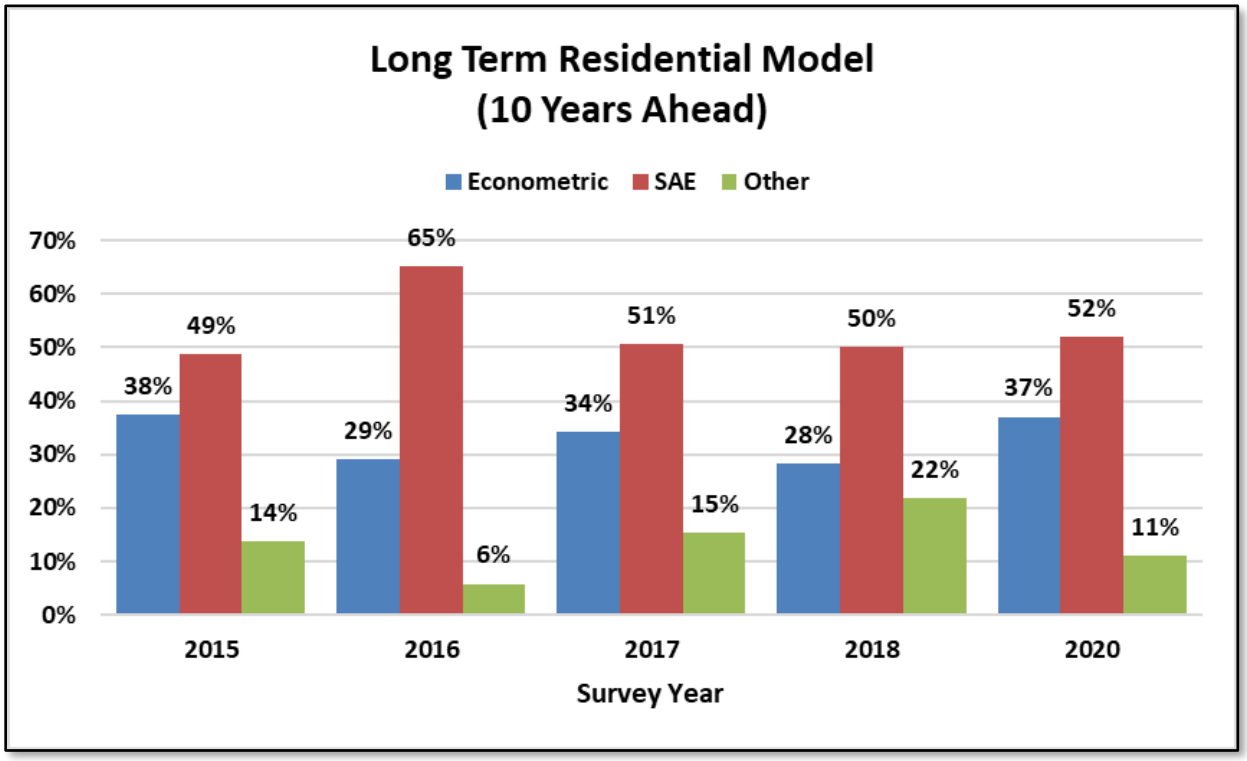
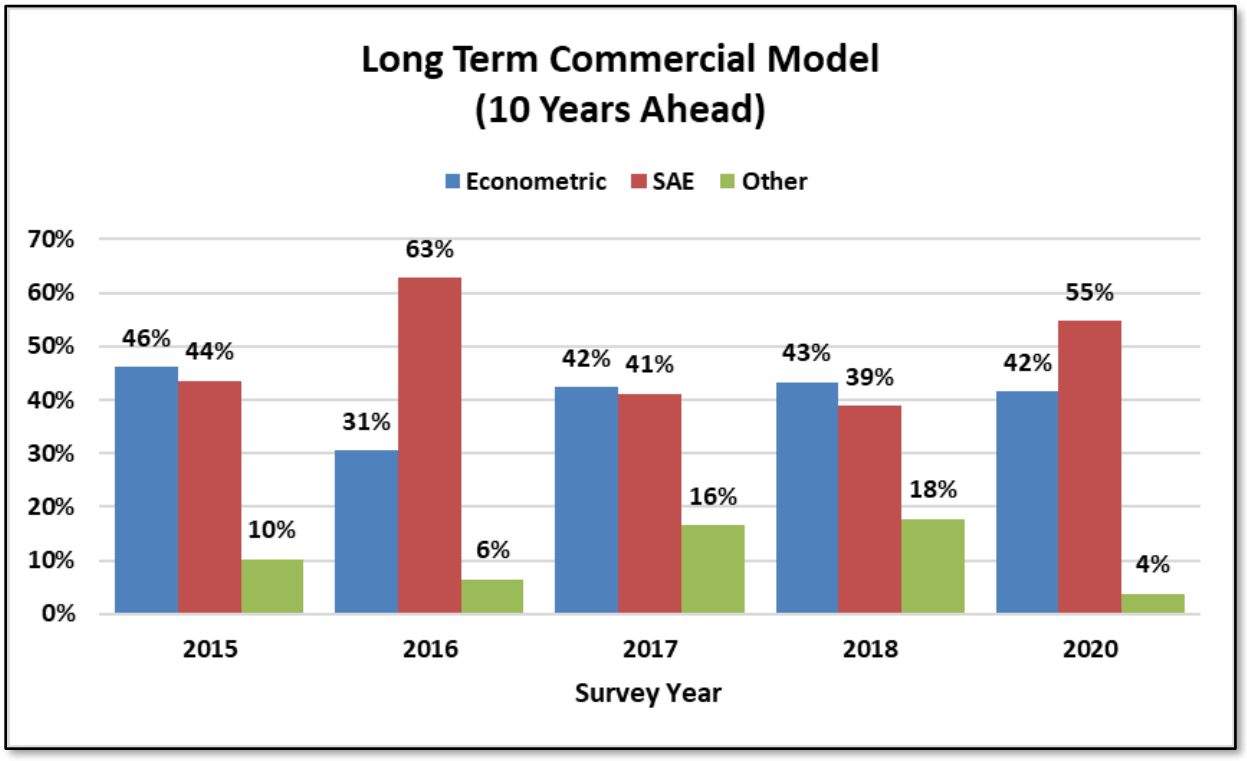


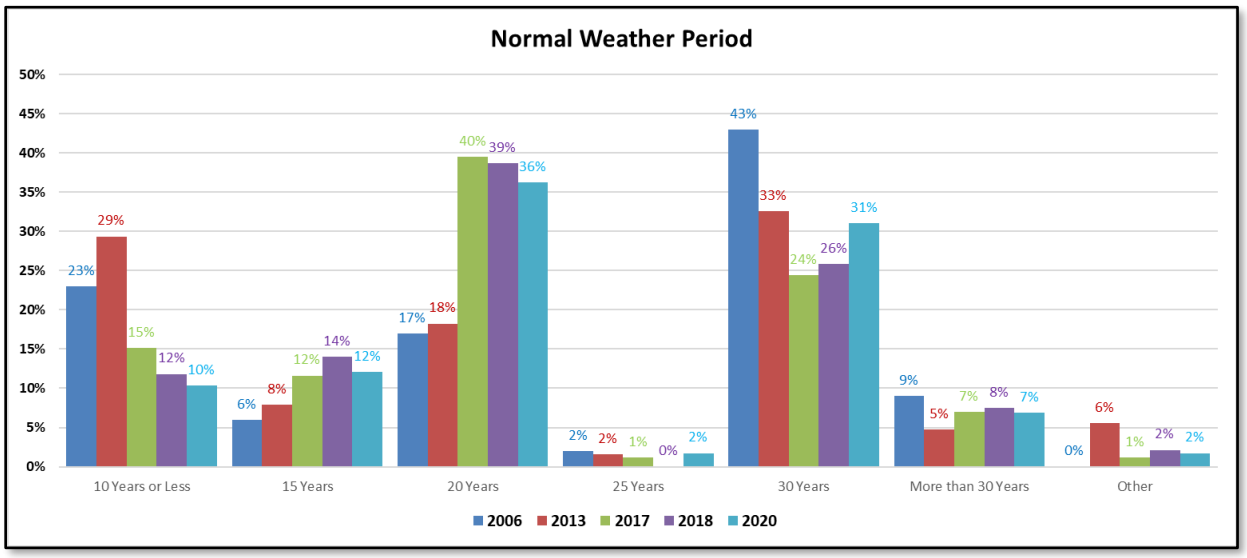
Figure 36: Forecasting Model Technique – Commercial Class



Normal Weather.

The 2020 survey asked respondents how many years of historical weather data they use to calculate normal weather. These results are combined with Itron's 2006, 2013, 2017 and 2018 survey results and are presented in Figure 37.

Figure 37: Normal Weather Years

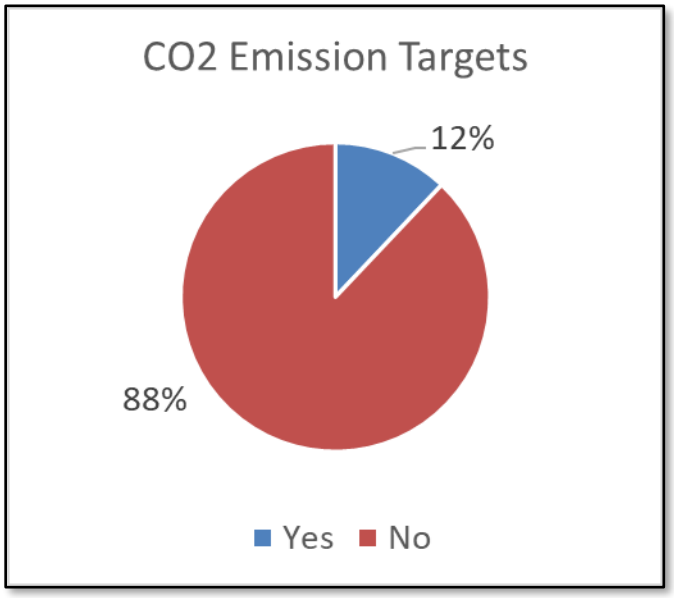


Historically, companies have favored 30-year averages to represent normal weather. In 2006, 43% of companies used the 30-year average. In 2013, the survey shows a slight movement away from the 30-year average toward the 10-year average. Beginning in 2017, the 20-year average becomes the dominate normal weather period. In the 2017, 2018 and 2020 surveys, over 36% of the companies reported using the 20-year average.

CO2 Emission Targets and Climate Change Adjustments.

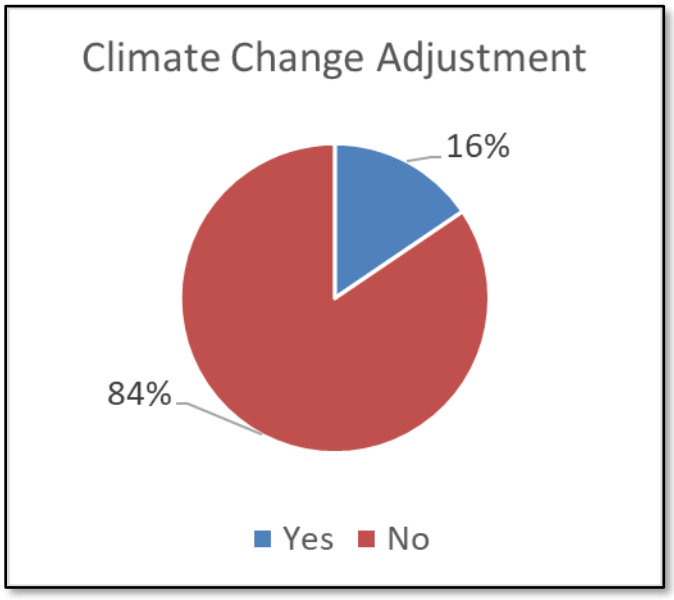
In the 2020 survey, Itron asked two questions to understand how companies are managing climate change issues. First, Itron asked whether companies are adjusting their forecasts for mandated carbon (CO2) emission standards. Second, Itron asked whether companies are adjusting their normal weather calculation beyond managing the number of years used to calculate normal weather. These results are shown in Figure 38 and Figure 39.

Figure 38: Incorporating CO2 Emission Targets in the forecast



CO2 emissions targets refer to the emission reduction level goals set by states to address climate change. Currently, 23 states and the District of Columbia have implemented statewide CO2 emission targets. To achieve the emission targets, states are exploring a variety of methods including increased electrification. If increased electrification is adopted, electric sales forecasts will likely increase. In this year's survey 15% of companies are including the CO2 emissions target impacts in their forecast.

Figure 39: Adjusting Normal Weather for Climate Change



In many areas, climate change impacts the long-term normal weather projections. If average temperatures rise by 1-degree Fahrenheit per decade, the implication is that the long-term forecast

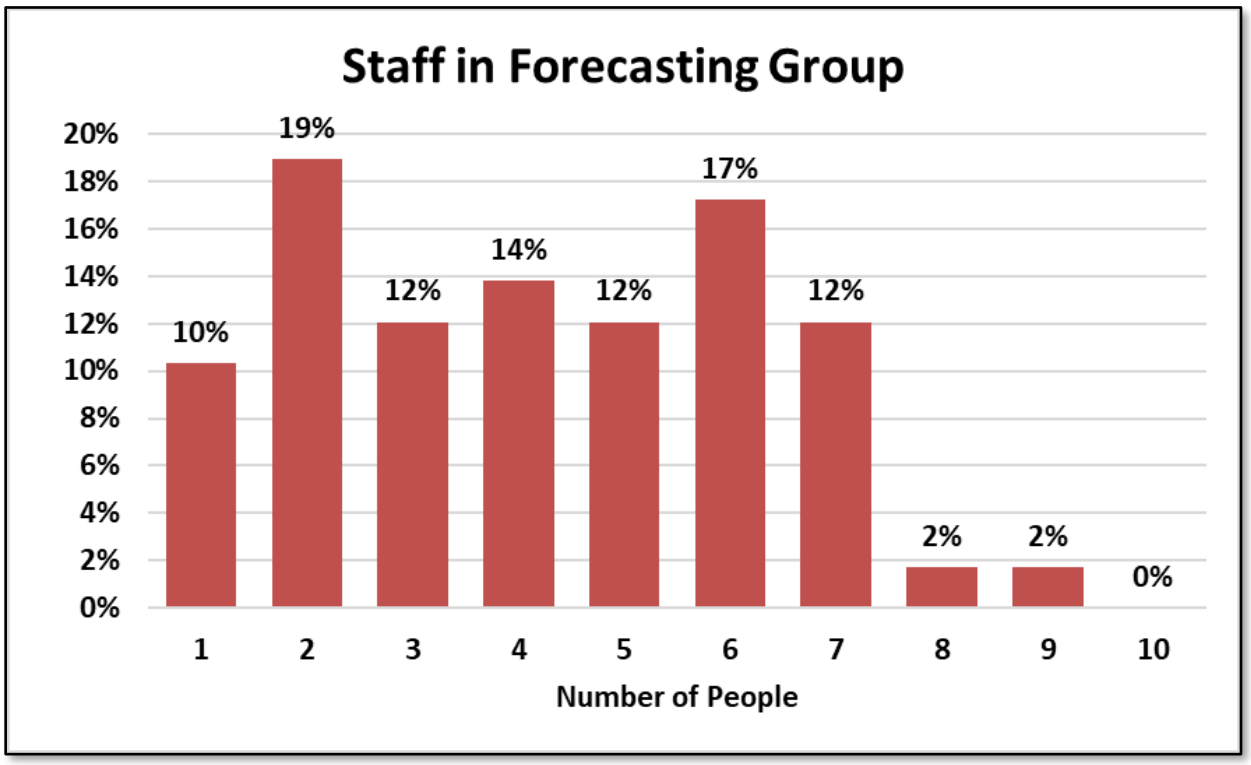
should capture this change. One way to capture this change is by adjusting the normal weather forecast. In this year's survey, 16% of companies are making an additional adjustment to their weather normal calculation to account for climate change. For those making adjustments, the process starts with the traditional normal calculation based on a multiyear average. Next, the companies apply a trend to the normal weather calculation in the forecast period. In the survey, companies only indicated that they trend the result, they did not provide explicit details on the trending assumptions.

While Figure 38 and Figure 39 show a similar percentage, only 3 companies are including both CO2 emission targets and adjusting their normal weather.

Forecasting Staff Size.

In the 2020 survey, Itron asked companies about the size of their forecasting staff. Respondents were asked to include analysts as well as managers. The results shown in Figure 40 show that 55% of forecasting staffs include 5 or fewer members.

Figure 40: Forecasting Staff Size



Conclusion

Since 2012, Itron's Forecasting Benchmark Survey has provided benchmarking data and insights into the changing outlook of energy demand. While the 2020 survey includes fewer companies in the past, these companies still represent 1.74 billion kWh of electricity and 1.4 BCF of natural gas demand.

The 2020 survey shows that forecast accuracy remains consistent with prior year surveys creating a rich set of benchmarking data. The survey also provides a forecast growth baseline prior to the Covid-19 pandemic. For both the electric and natural gas systems the baseline annual growth is slightly higher than 0.5% per year.

Consistent with prior years, the 2020 survey reaffirms several common forecasting practices. These practices include capturing EVs, PV and DSM in the modeling process and capitalizing on available AMI data. New to this year, the survey shows that capturing climate change by adjustment normal weather and incorporating CO2 emission targets are rarely used, but worthwhile to monitor for future development.

Overall, energy forecasting continues to be challenging. While the 2020 survey provides insights into these challenges under normal circumstances, the Covid-19 pandemic will create a new set of challenges in the coming years. Itron intends to continue using this survey as an instrument to inform the energy industry about how these challenges are being addressed.