ANNEXE

Itron

Knowledge to Shape Your Future

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information collection, analysis and application

2014 Forecasting Benchmark Survey

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2014 Forecasting Benchmark Survey

For the third year, Itron surveyed energy forecasters across North America with the goal of obtaining growth and accuracy benchmarks. This year's survey was conducted two parts, the Forecast Outlook Survey and the Forecast Accuracy Survey. Both surveys were conducted in the first half of 2014 with results finalized in June 2014. This report combines the responses of the two surveys.

Survey results are presented by geographic region and are weighted average responses unless otherwise noted. The geographic regions are shown in Figure 1. Weights are calculated based on the self-reported 2013 annual energy or natural gas consumption for each utility. The number of respondents and the overall weights for each Survey are shown in Figure 2. For comparative purposes the number of responses from the 2012 and 2013 surveys is included. The actual weights for each survey question response will vary slightly from the overall weights as some utilities did not respond to all questions.

Figure 1: Survey Regions

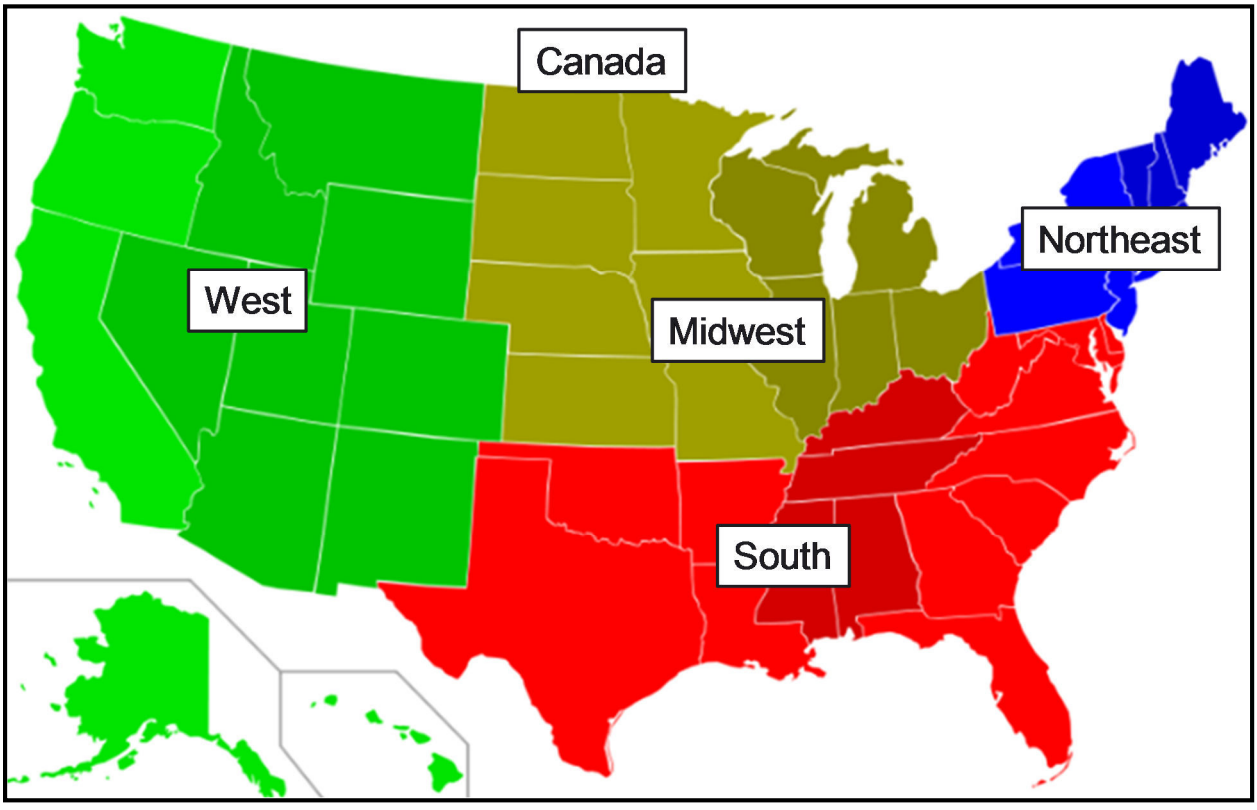


Figure 2: Survey Respondents

Forecast Outlook

Region	2012	2013	2014	2014 Weights
Canada	9	9	8	14%
Midwest	18	23	17	22%
Northeast	10	7	10	15%
South	25	25	12	35%
West	15	10	20	14%
Electric Total	77	74	67	100%
Other Electric			4	100%
Natural Gas Total			10	100%

Forecast Accuracy

Region	2012	2013	2014	2014 Weights
Canada	9	9	6	11%
Midwest	18	23	19	20%
Northeast	10	7	10	17%
South	25	25	15	40%
West	15	10	16	11%
Electric Total	77	74	66	100%
Other Electric			5	100%
Natural Gas Total			15	100%

The 2014 Survey includes responses for over 80 electric and gas companies. The electric utility responses are divided into regions and represent almost 2 billion kWh of annual energy consumption. This year, two new categories of respondents are included. Other Electric responses include Independent System Operators and Electric Retailers. These respondents are included in a separate category due to their wide geographic dispersion. Natural Gas respondents are aggregated into a single category due to the number of responses.

Summary of Results

The 2014 Survey examines utility forecast accuracy and growth projections. This section summarizes the overall findings. Detailed results by class are presented in the remaining sections.

Forecast Accuracy

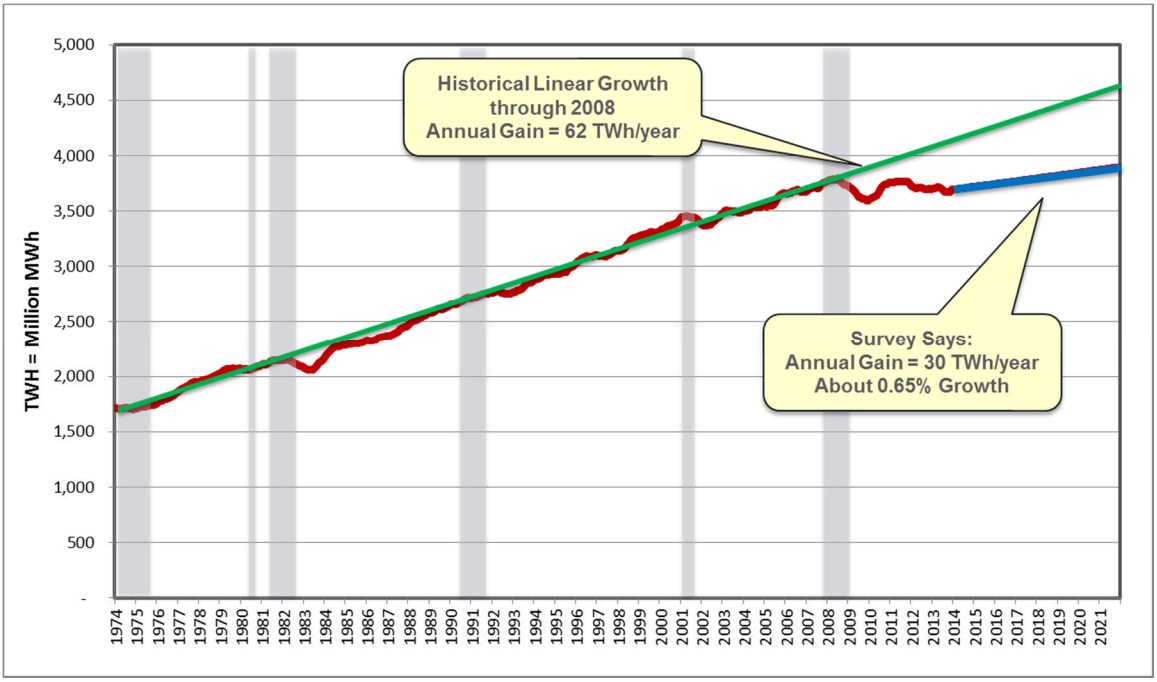
The forecast accuracy for electric companies ranges between 1.4% and 4.4%. Natural gas company accuracy ranges between 2.1% and 6.5%. Values are reported as unweighted mean absolute percent errors (MAPEs) as shown in Figure 17. The electric companies' accuracy is consistent with expected standards and is similar to the 2012 and 2013 survey results. The 2014 survey distribution of errors centered around zero. Natural gas companies' accuracies are skewed with a large tendency to forecast higher than actual sales.

Electric Forecast Growth

Forecast electric sales growth through the ten-year time horizon is close to 0.65% per year (Figure 15). The sales growth is primarily due to customer growth as residential and commercial electric intensities are flat or declining through the forecast horizon. The growth forecast is consistent with the 2012 Survey results and continues to show a sharp contrast to historic sales growth in the United States over the past 30 years.

Figure 3 shows historical sales from 1974 through 2013 based on Energy Information Administration (EIA) data. The figure shows a 12-month rolling sum of monthly utility sales with recessions highlighted in grey. Data values are extended using forecast growth rates beginning in 2014. This figure is overlaid with a linear trend (green line) which roughly approximates historical sales growth from 1974 through 2008.

Figure 3: Survey Electric Sales Growth



Beginning in 2008, sales drop as a result of the 2008 recession and remain flat through 2013. Figure 4 shows historic annual growth rates over various time periods from 1974 through 2013 for the major electric classes.

Figure 4: U.S. Historical Electric Sales Growth Rate (%)

Time Frame	Residential	Commercial	Industrial	Total
1974-2012	2.28%	2.86%	0.99%	2.02%
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%	-0.26%	1.49%
2009-2013	-0.04%	-0.15%	-1.12%	-0.39%

Natural Gas Forecast Growth

Forecast natural gas system sales growth through the ten-year time horizon is close to 0.67% per year (Figure 15). Since 1974, natural gas sales have remained flat with slow fluctuations of up to 4 Bcf over large periods. Figure 5 shows historical sales from 1974 through 2013 based on Energy Information Administration (EIA) data. The figure shows a 12-month rolling sum of monthly retail sales with recessions highlighted in grey. Data values are extended using forecast growth rates beginning in 2014. This figure is overlaid with the 1974-2013 average sales (green). Figure 6 shows average annual growth rates for selected periods of time.

Figure 5: U.S. Historical Natural Gas Sales

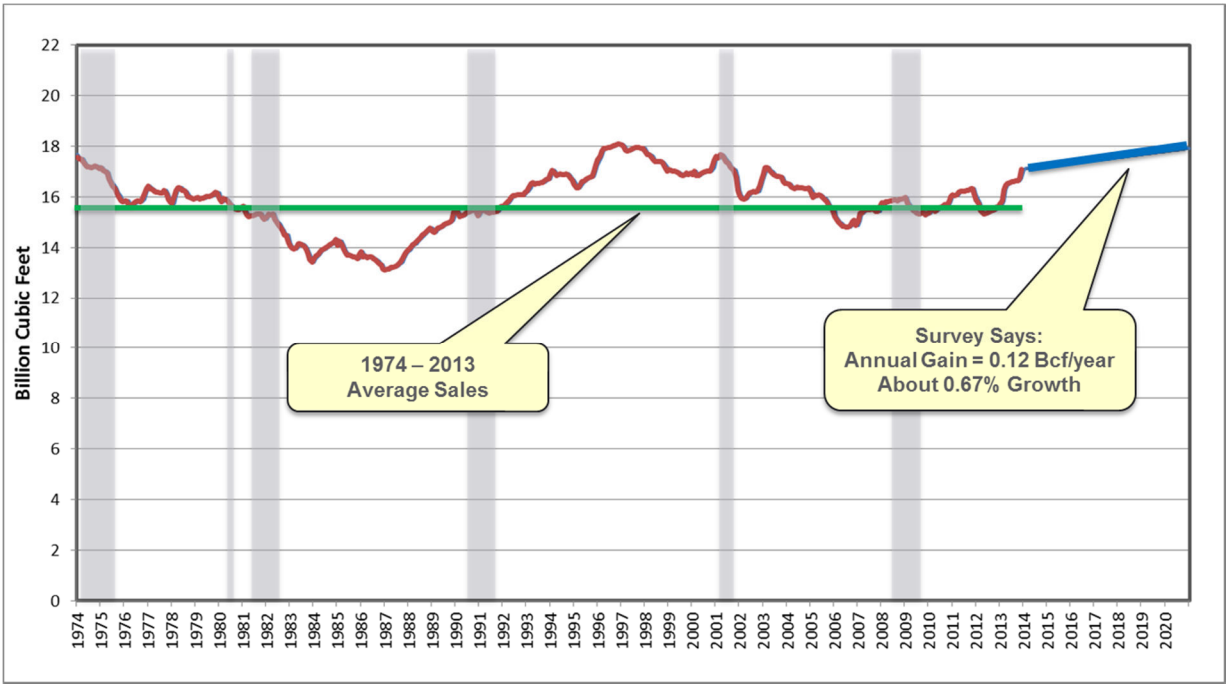


Figure 6: U.S. Historical Natural Gas Sales Growth Rate (%)

Time Frame	Residential	Commercial	Industrial	Total
1974-2012	-0.24%	0.39%	-0.42%	-0.27%
1980-1990	-0.50%	0.23%	-0.99%	-0.65%
1990-2000	0.29%	1.50%	1.94%	1.35%
2000-2008	0.51%	0.25%	-1.57%	-0.68%
2009-2013	-0.22%	0.47%	1.77%	0.86%

Customer Growth Rates

The weighted average responses to historic and forecast customer growth rates for the residential and commercial classes are shown in Figure 7 and Figure 8. These figures combine the reported growth rates from the 2012 and 2013 survey with the reported and forecasted growth rates from the 2014 survey.

The 2014 Survey shows annual electric customer growth from 2012 to 2013 (2014 Survey result) is 0.72% for the residential class and 0.88% for commercial class. Natural gas customer growth is 1.08% for residential class and 0.65% for the commercial class. Long-term forecast growth rates for both electric and gas customers are similar to the 2012-2013 actual growth rates.

While some diversity exists among the regions and classes, the overall growth in electric customers has increased since 2011 based on three years of survey results. For comparative purposes, United States (U.S.) and Canada population growth rates between 2011 and 2013 are 0.73% and 1.12% respectively. U.S. non-farm employment grew at 1.5% for the same period.

Figure 7: Residential Average Customer Growth (%)

Region	Actual 2010-2011	Actual 2011-2012	Actual 2012-2013	Forecast 2013-2014	Forecast 2014-2024
Canada	0.81	1.11	1.35	1.40	1.19
Midwest	0.08	0.13	0.34	0.59	0.53
Northeast	0.03	1.18	(0.20)	0.36	0.33
South	0.62	0.81	1.05	0.78	0.88
West	0.60	0.88	1.03	1.00	1.58
Electric Total	0.47	0.66	0.72	0.79	0.86
Natural Gas Total			1.08	0.65	1.09

Figure 8: Commercial Average Customer Growth (%)

Region	Actual 2010-2011	Actual 2011-2012	Actual 2012-2013	Forecast 2013-2014	Forecast 2014-2024
Canada	0.44	0.74	1.70	0.98	0.85
Midwest	0.26	0.42	0.72	0.60	0.54
Northeast	0.10	0.40	0.39	0.42	0.40
South	0.75	1.04	0.97	0.98	0.94
West	0.62	0.65	0.88	1.19	1.61
Electric Total	0.51	0.69	0.88	0.84	0.86
Natural Gas Total			0.65	0.47	0.67

Residential Sales Growth Rates

The weighted average responses to historic and forecast residential growth are shown in Figure 9. This figure combines the reported growth rates from the 2012 and 2013 surveys with the reported and forecasted growth rates from the 2014 Survey.

Electric Growth. Total electric sales weather normalized growth in 2012-2013 (2014 Survey result) is 0.35%. Forecasted growth remains low with near-term and long-term projections at 0.48% and 0.68% respectively. The survey results show declining use-per-customer as customer growth outpaces sales growth.

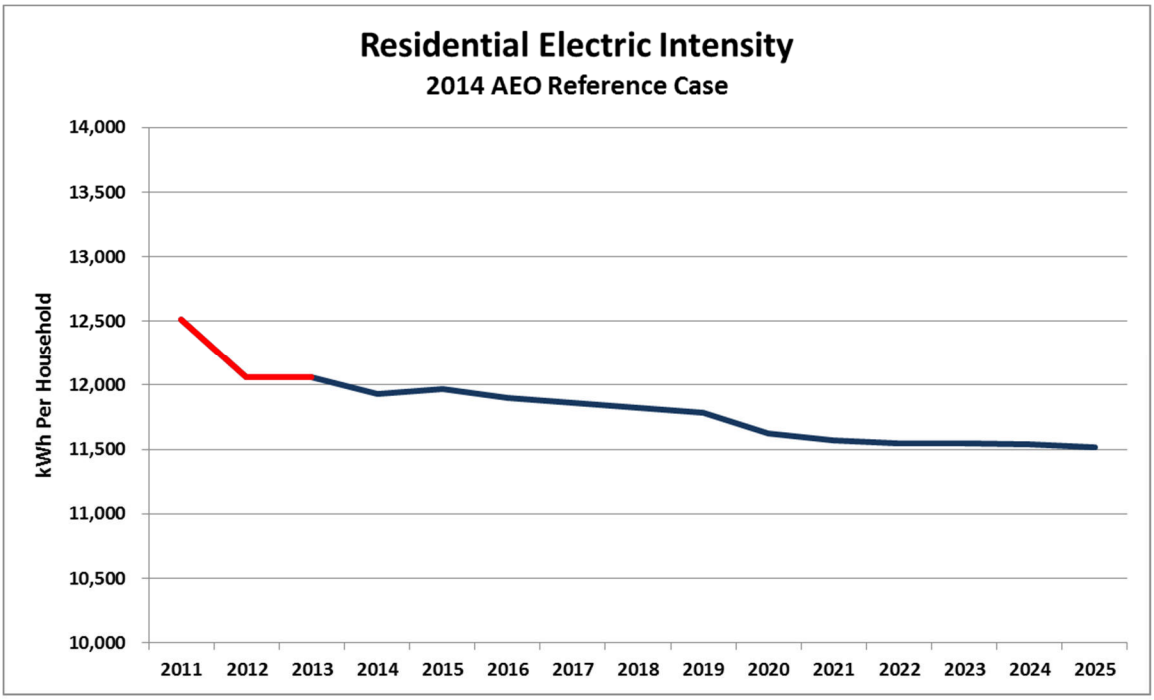
Figure 9: Residential Sales Growth

Region	Actual 2010-2011	Actual 2011-2012	Actual 2012-2013	Forecast 2013-2014	Forecast 2014-2024
Canada	(0.08)	0.35	2.22	1.31	0.97
Midwest	(0.04)	(0.93)	0.19	0.16	0.20
Northeast	1.15	0.44	0.85	(0.03)	0.35
South	0.78	1.26	0.13	0.84	0.78
West	0.38	0.34	(0.35)	0.34	1.23
Electric Total	0.41	0.25	0.35	0.48	0.68
Natural Gas Total			3.13	(1.25)	0.24

Declining usage in the residential class has been consistently reported in Itron surveys since 2012. This trend is expected to continue as shown in EIA's 2014 Annual Energy Outlook (AEO) in

Figure 10.

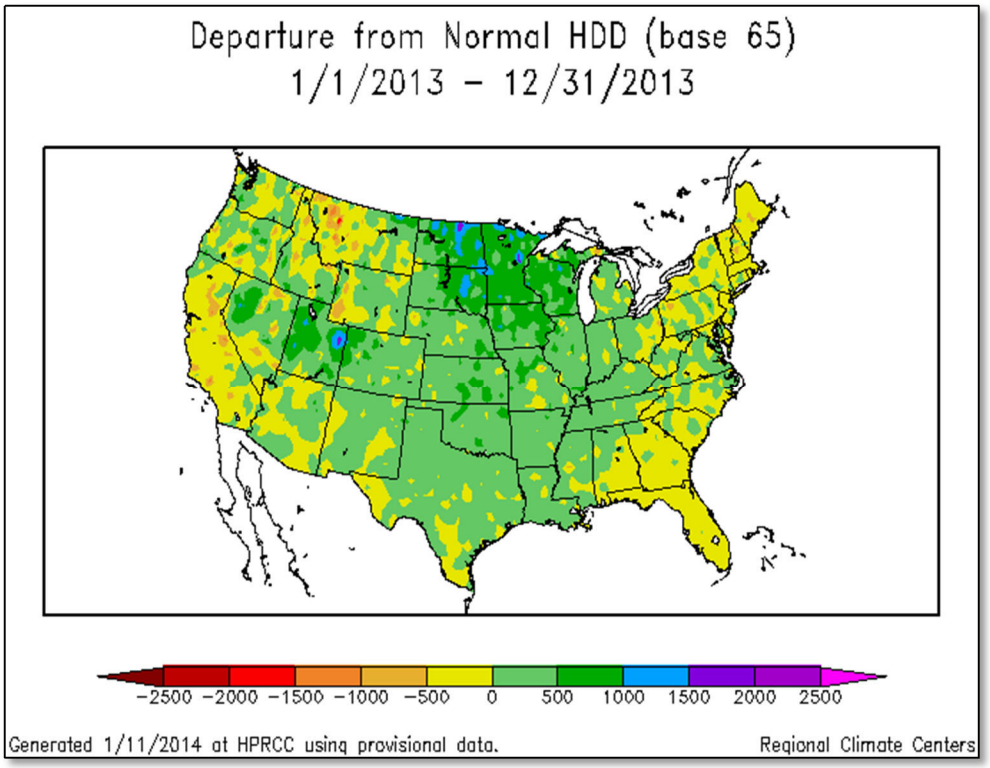
Figure 10: AEO Residential Electric Use Intensity (kWh/Household)



Natural Gas. The 2014 Survey is the first year natural gas utilities were asked for weather normalized sales. The survey responses in Figure 9 report 2012-2013 annual growth of 3.13% with a long-term forecast of 0.24%. The survey represents a weighted average of 10 respondents for historical growth and 15 respondents for forecast growth.

The 2013 growth is skewed high from a few respondents reporting large sales growth. The presence of high growth may result from the difficulty in the weather normalization process. Generally, weather normalization models perform well during cold years, but struggle to properly capture weather response when winter temperatures show little heating during a mild year. Figure 11 shows 2013 was a mild year.

Figure 11: 2013 Heating Degree Days compared to Normal



Commercial Sales Growth Rates

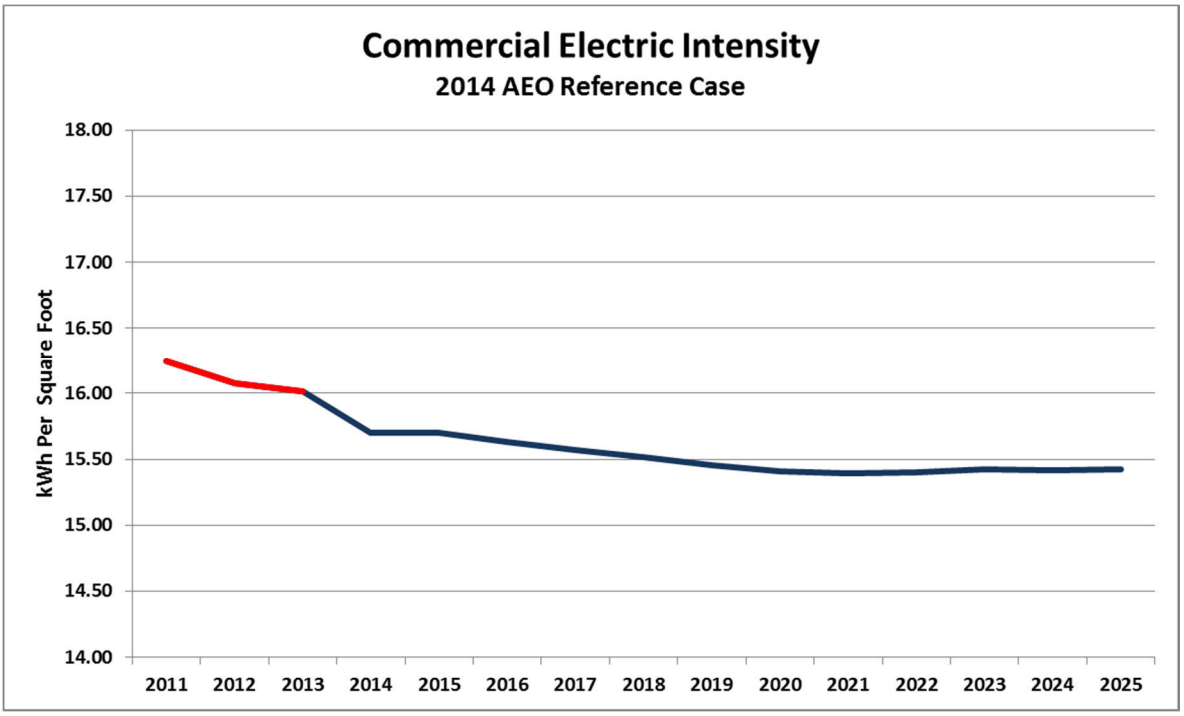
The weighted average responses to historic and forecast commercial growth are shown in Figure 12. This figure combines the reported growth rates from the 2012 and 2013 surveys with the reported and forecasted growth rates from the 2014 Survey.

Electric Growth. Total electric weather normalized sales growth in 2012-2013 is 0.51%. Forecasted growth lifts to over 0.7% in the near-term and long-term projections. Since Itron's 2012 survey, actual growth has increased from 0.15% in 2011 to the current 0.51%. However, declining use per customer continues to persist a customer growth outpaces sales grow. The declining usage is consistent with EIA's 2014 AEO forecast of customer intensity shown in Figure 13.

Figure 12: Commercial Sales Growth

Region	Actual 2010-2011	Actual 2011-2012	Actual 2012-2013	Forecast 2013-2014	Forecast 2014-2024
Canada	0.82	0.07	0.75	1.06	1.24
Midwest	0.02	(0.02)	0.64	0.38	0.31
Northeast	(0.52)	(0.57)	0.12	0.77	0.15
South	0.32	0.65	0.60	1.11	0.89
West	(0.07)	0.40	0.43	0.60	0.97
Electric Total	0.15	0.24	0.51	0.79	0.71
Natural Gas Total			4.38	(0.81)	(0.14)

Figure 13: AEO Commercial Electric Use Intensity (kWh/Square Foot)



Natural Gas. The 2014 Survey shows weather normalized 2013 sales growth is 4.38% with long-term sales growth declining. Similar to the residential class, historic sales growth is skewed by a few respondents reporting high growth values.

Industrial Sales Growth Rates

The weighted average responses to historic and forecast industrial growth are shown in Figure 14. This figure combines the reported growth rates from the 2012 and 2013 surveys with the reported and forecasted growth rates from the 2014 Survey.

Electric Growth. Industrial electric sales growth in 2012-2013 is 0.32%. Forecasted growth increases to 1.18% in 2014 due to several utilities forecasting identifiable new industrial project in their service territory. The long-term growth rate is 0.61%.

Figure 14: Industrial Sales Growth

Region	Actual 2010-2011	Actual 2011-2012	Actual 2012-2013	Forecast 2013-2014	Forecast 2014-2024
Canada	(0.26)	(0.67)	1.80	3.44	1.32
Midwest	2.06	(0.37)	(0.09)	2.44	0.53
Northeast	0.51	(1.32)	(1.56)	(0.75)	(0.20)
South	2.48	2.22	1.53	(0.74)	0.38
West	0.68	2.70	(1.03)	5.22	1.52
Electric Total	1.78	0.73	0.32	1.18	0.61
Natural Gas Total			4.47	(2.84)	0.21

Natural Gas. While the 2014 Survey shows strong growth in industrial sales in 2013 with 4.47%, long-term projections are flat at 0.21%. As with the commercial and residential classes, a few respondents reported large growth rates raising the weighted average result. Because the industrial class typically has a very low weather response, adjustments should be minimal and represent actual growth rates. Compared to EIA's historical 2013 growth rate of 4.5%, the survey results appear consistent.

System Sales Growth Rates

The weighted average responses to historic and forecast system and peak growth are shown in Figure 15 and Figure 16. These figures combine the reported growth rates from the 2012 and 2013 surveys with the reported and forecasted growth rates from the 2014 survey. System sales include all utility classes and may include wholesale, resale, and agricultural classes.

Electric Growth. System electric sales growth in 2012-2013 is 0.33%. Forecasted growth increases to 0.88% in 2014 due to several utilities forecasting identifiable new industrial project in their service territory. The long-term growth rate is 0.65%.

Peak growth continues to show large variations. While growth in 2011 was positive, 2012 and 2013 growth is negative. The historic peak variation is due to a variety of peak normalization techniques and demand response assumptions. However, the long-term peak forecast (0.68%) is consistent with the long-term energy forecast (0.65%)

Figure 15: System Sales Growth

Region	Actual 2010-2011	Actual 2011-2012	Actual 2012-2013	Forecast 2013-2014	Forecast 2014-2024
Canada		0.44	0.71	0.49	0.91
Midwest		(0.68)	(0.01)	0.78	0.27
Northeast		(0.36)	(0.34)	0.07	0.12
South		1.05	0.89	1.50	0.75
West		0.40	(0.40)	0.68	1.20
Electric Total		0.22	0.33	0.88	0.65
Natural Gas Total			2.97	(2.63)	0.67

Figure 16: Peak Growth

Region	Actual 2010-2011	Actual 2011-2012	Actual 2012-2013	Forecast 2013-2014	Forecast 2014-2024
Canada	0.76	0.99	(0.00)	0.19	0.62
Midwest	(0.25)	(0.90)	(1.55)	2.43	0.46
Northeast	(0.35)	1.76	(0.71)	1.12	0.50
South	0.08	(1.00)	(1.09)	1.90	0.73
West	2.28	(0.47)	3.95	1.27	1.14
Electric Total	0.43	(0.35)	(0.45)	1.59	0.68

Natural Gas. While the 2014 Survey shows strong growth in system sales in 2013 with 2.97%. This growth is due to the large growth rates reported in the residential, commercial and industrial classes. The long-term forecast growth rate is 0.67% which is slightly high relative to flat growth experienced in the industry over the past 30 years.

Distribution of Electric Forecast Errors

The 2014 Survey asked for 2013 forecast errors to benchmark forecast accuracy. Companies were asked to compare their forecast for 2013 (generated in 2012) against weather normalized sales in 2013. The average forecast errors calculated as the Mean Absolute Percent Error (MAPE) are shown in Figure 17. This figure compares the MAPEs from the 2012 and 2013 surveys. All MAPE values are unweighted.

Figure 17: Electric Error Results (Unweighted)

Class	2012 Survey Electric MAPE	2013 Survey Electric MAPE	2014 Survey Electric MAPE
Residential	1.74%	1.45%	1.70%
Commercial	1.71%	1.95%	2.08%
Industrial	3.19%	3.19%	4.44%
System	NA	1.59%	1.46%
Peak	1.85%	2.73%	3.09%

Within the Residential and System classes, the MAPEs are consistent through time. MAPEs are increasing in the Commercial and Industrial. As identified last year, commercial and industrial forecasting remains challenging as the traditional economic drivers for these classes weaken.

Figure 18 compares U.S. commercial sales against non-farm employment beginning in 1973. Even with commercial sales growth outpacing employment, a strong correlation between sales and employment has existed for the prior 30 years. Since 2010, commercial sales have remained flat with employment increasing to pre-2008 recession levels.

Figure 18: Commercial Electric Sales and Non-Farm Employment

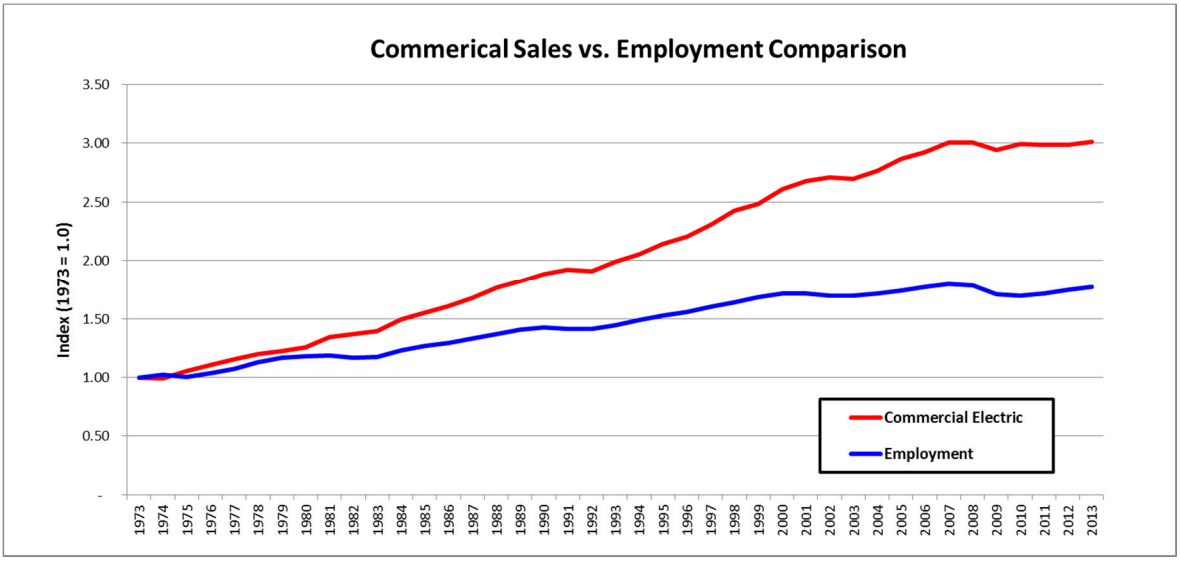


Figure 19 compares industrial sales with U.S. GDP indexed to 1973 values. The most dramatic change in the relationship between sales and GDP occurs after 2010 with sales decreasing and GDP increasing.

The changing relationship with GDP implies the need for new forecasting drivers such as industrial class intensities.

Figure 19: Industrial Electric Sales and GDP

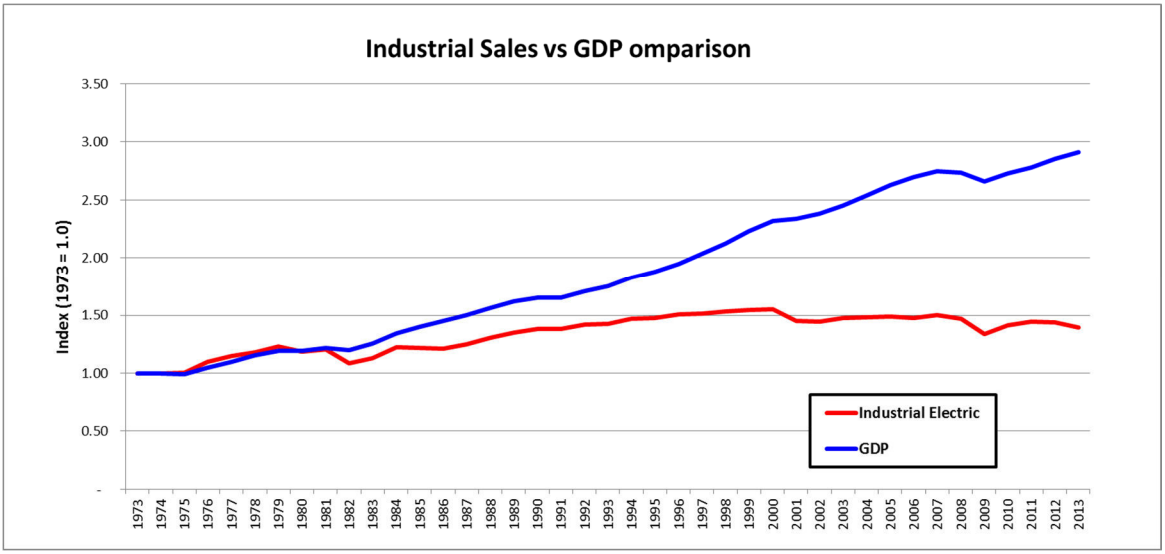


Figure 20 through Figure 24 present the distribution of errors reported by utilities. In these graphs, a negative error value represents an under-forecast (forecasts below the actual values). In the 2014 Survey, all distributions appear centered at zero implying that companies are just as likely to error high and low compared to actuals.

Figure 20: Residential Electric Error Distribution

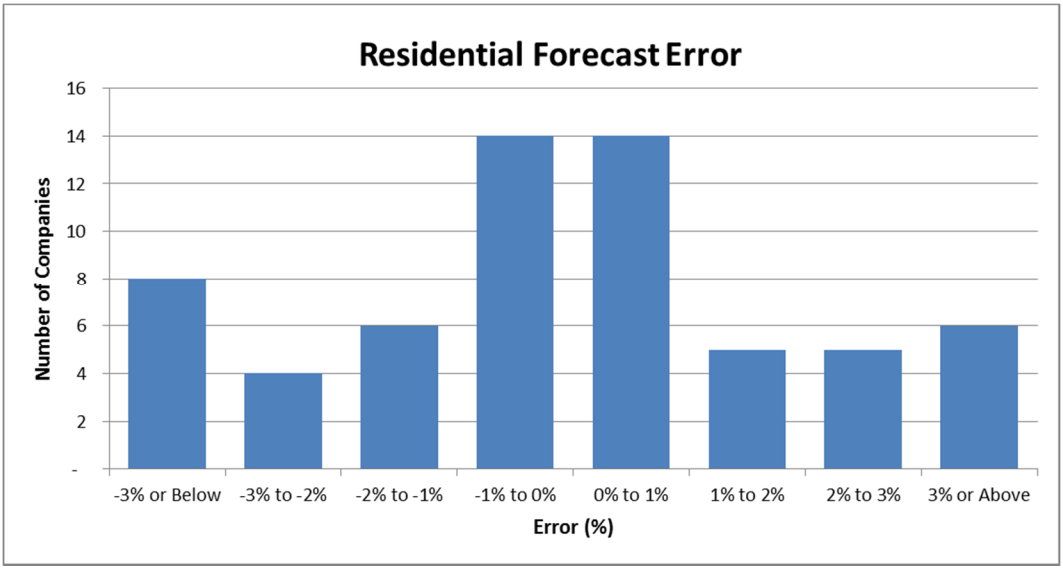


Figure 21: Commercial Electric Error Distribution

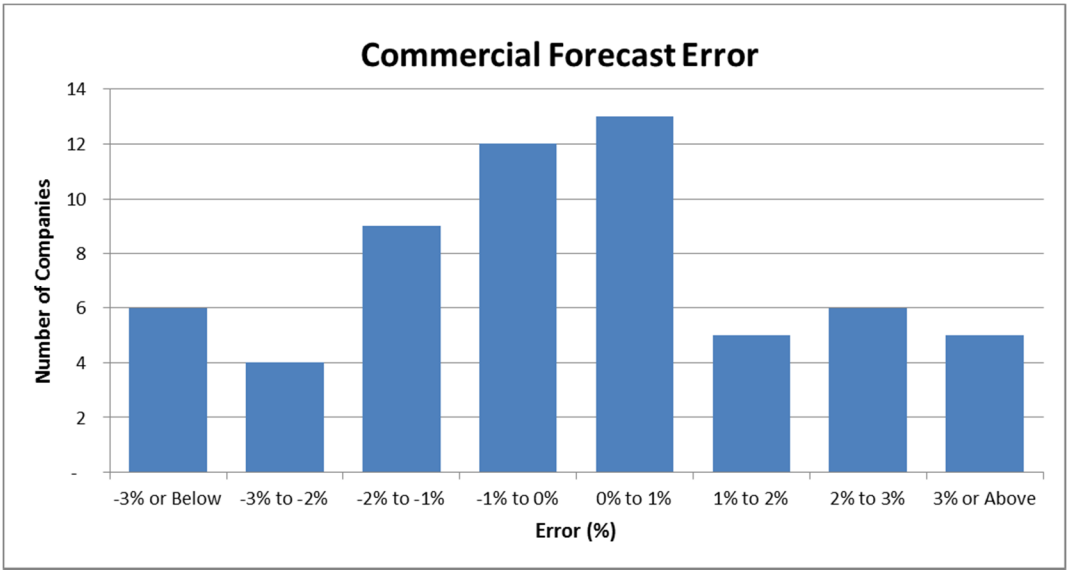


Figure 22: Industrial Electric Error Distribution

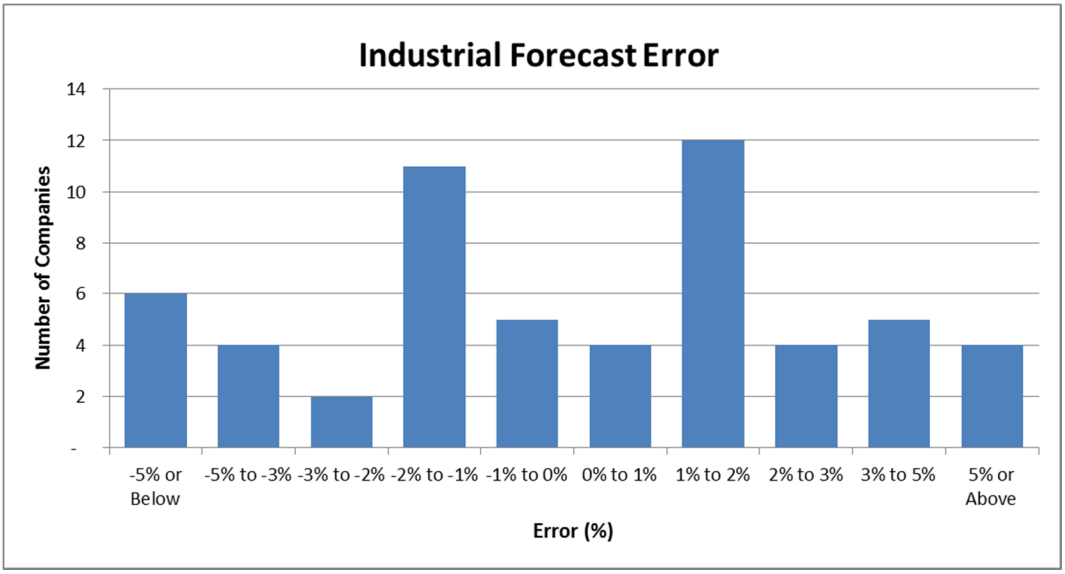


Figure 23: Electric System Error Distribution

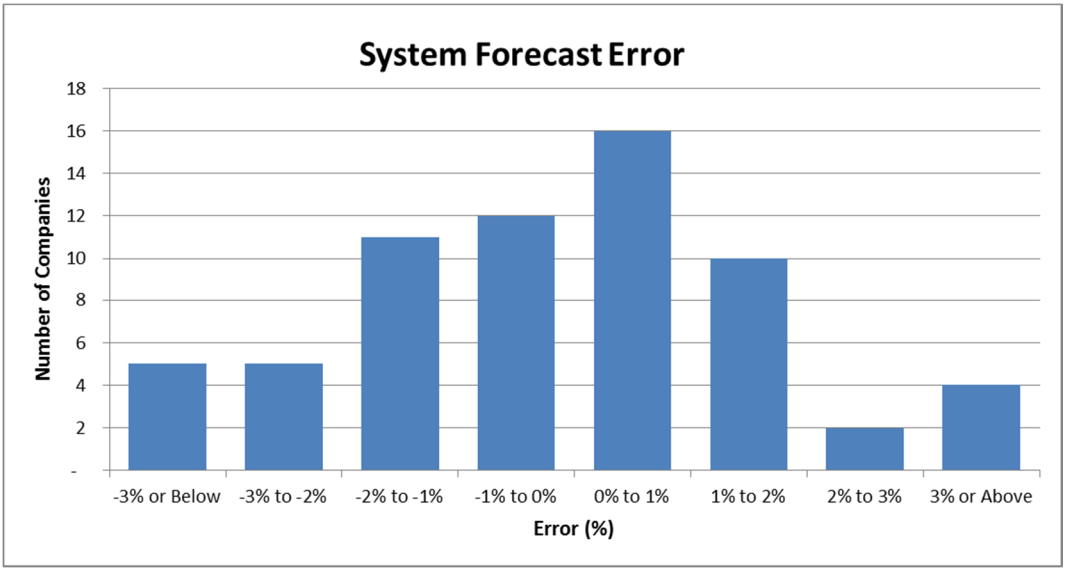
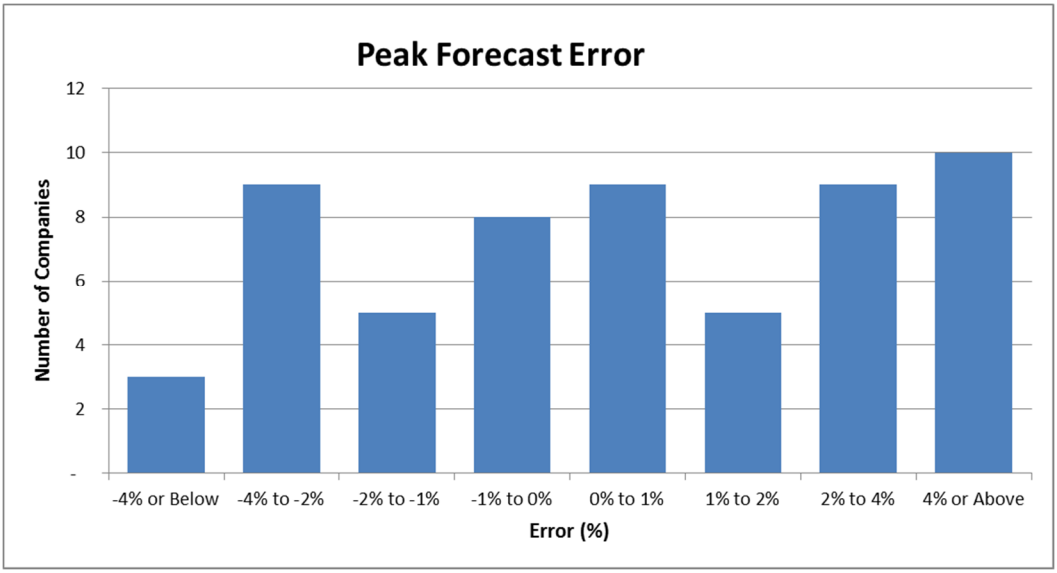


Figure 24: Peak Error Distribution



Distribution of Natural Gas Forecast Errors

Similar to the electric errors, natural gas companies were asked to compare their forecast for 2013 (generated in 2012) against weather normalized sales in 2013. The unweighted average forecast errors calculated as the Mean Absolute Percent Error (MAPE) are shown in Figure 25 and their distributions are shown in Figure 26 to Figure 29.

In the error distribution graphs, a negative error value represents an under-forecast (forecasts below the actual values). System, residential class, and commercial class show distributions skewed to the right meaning that forecasts were high, relative to actual values.

Figure 25: Natural Gas Error Results (Unweighted)

Class	Average (%)
Residential	2.90
Commercial	3.95
Industrial	6.44
System	2.31

Figure 26: Natural Gas System Error Distribution

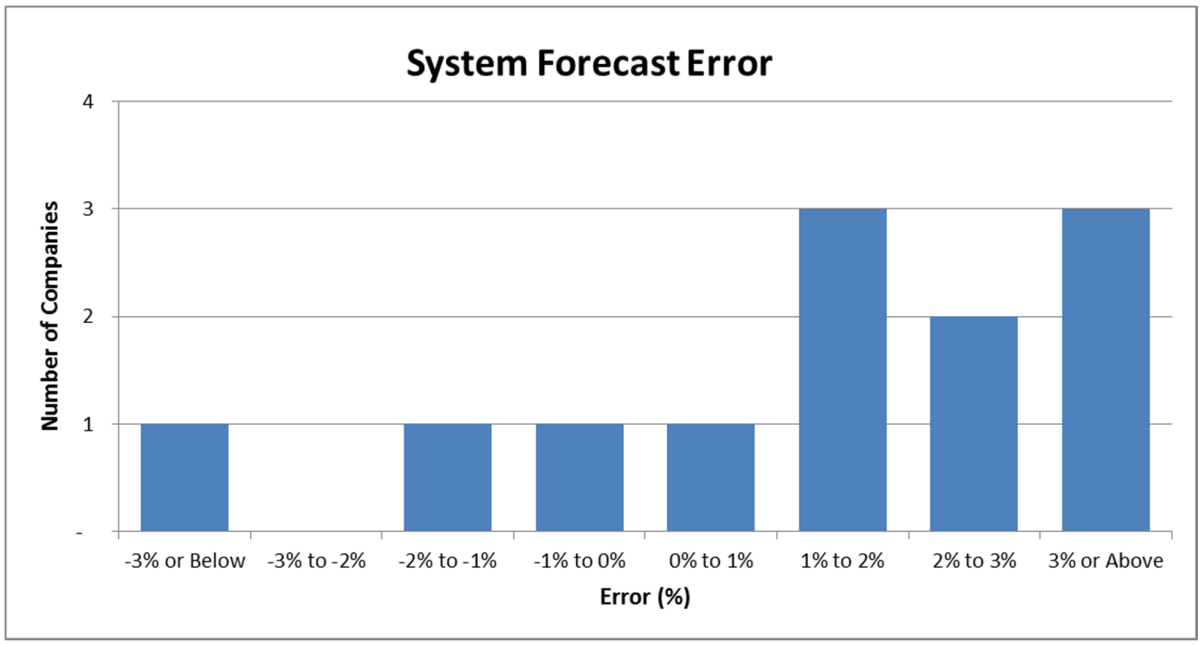


Figure 27: Residential Natural Gas Error Distribution

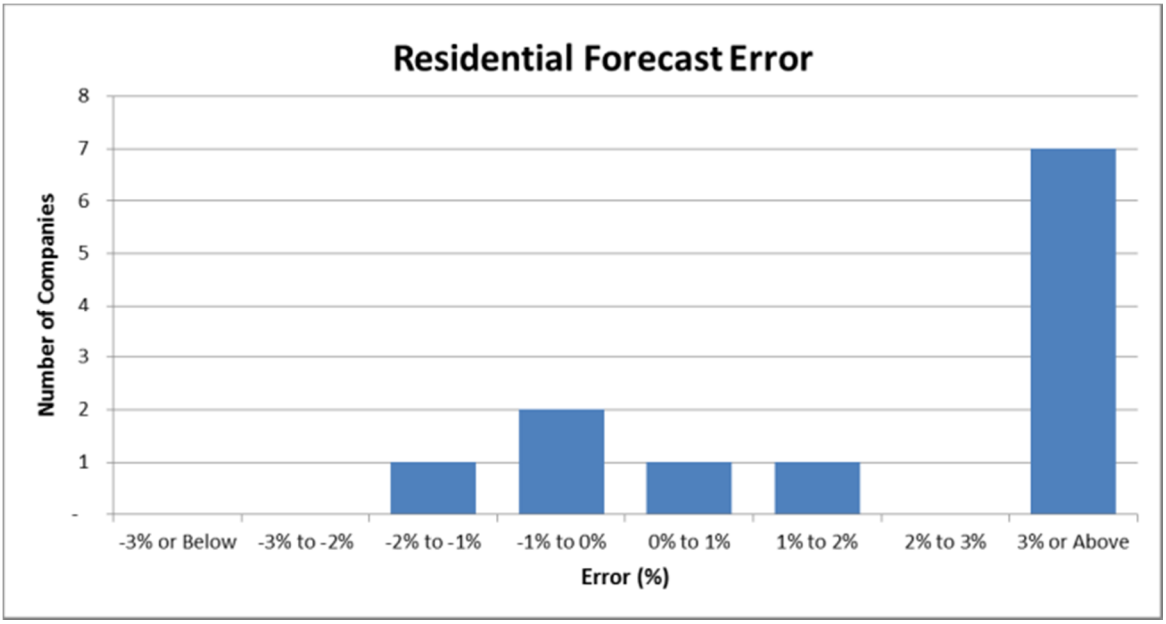


Figure 28: Commercial Natural Gas Error Distribution

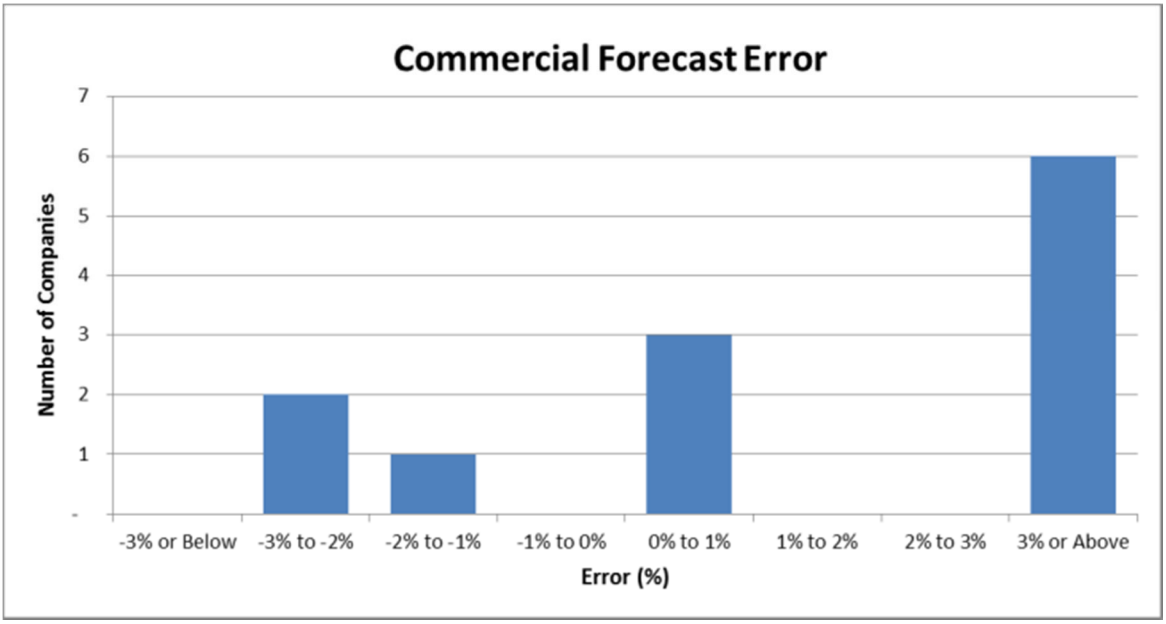
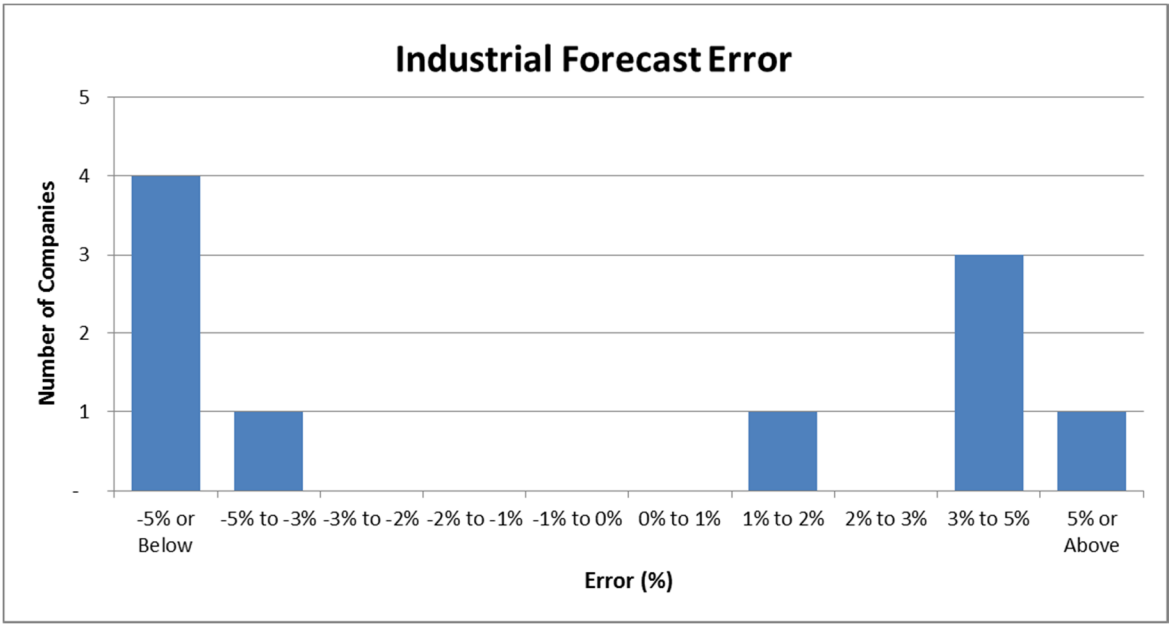


Figure 29: Industrial Natural Gas Error Distribution



Key Forecast Drivers

The 2014 Survey continues to monitor key components included in the forecasting process. The components include electric vehicles, photovoltaics, and prices.

Electric Vehicles.

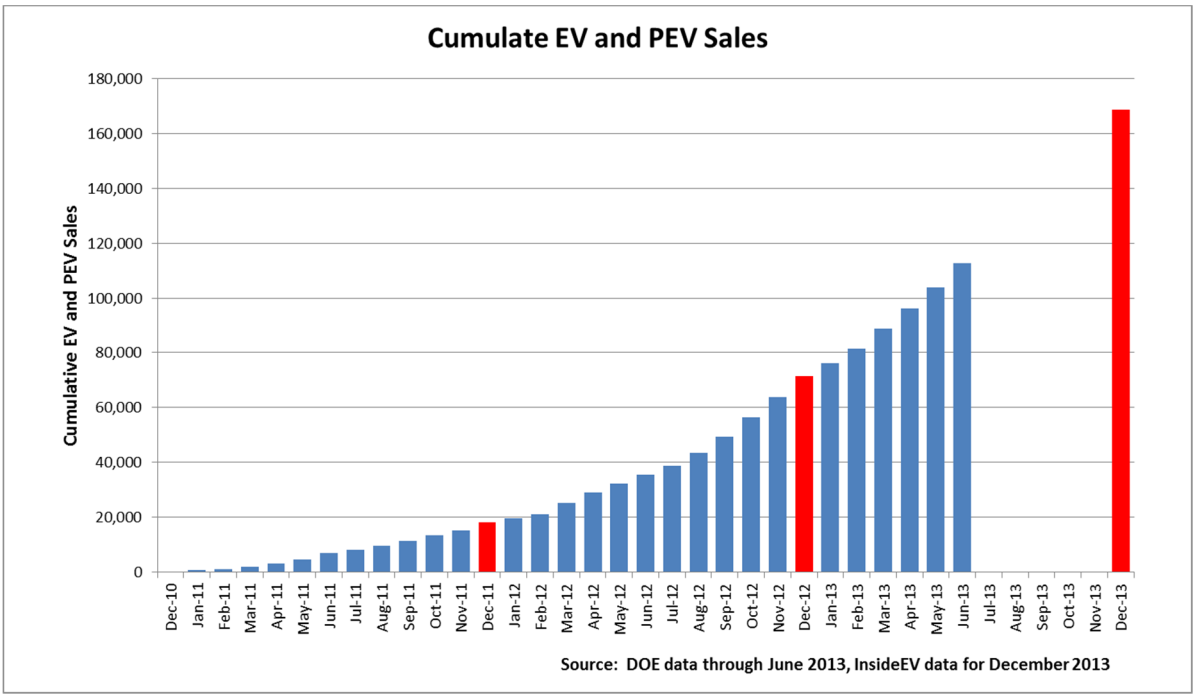
The percentage of respondents who include electric vehicles (EVs) in their forecast remains consistent with the 2012 and 2013 survey results. In 2014, 30% of respondents explicitly include EVs in their forecast. Figure 30 shows the 2014 survey result compared to prior year results.

Figure 30: Include Electric Vehicles in the Forecast

Response	2012	2013	2014
Include	28%	23%	30%
Do Not Include	72%	77%	70%

While the numbers of EVs continue to represent less that 1% of all car sales, the industry is quickly gaining traction as seen in Figure 31. In this figure, historical EV and plug-in EV sales, compiled from the Department of Energy (blue) and Inside EV data reports (red), show the acceleration of sales which will impact electric sales forecasts in the near future.

Figure 31: Electric and Plug-In Electric Vehicles Sales



Photovoltaics.

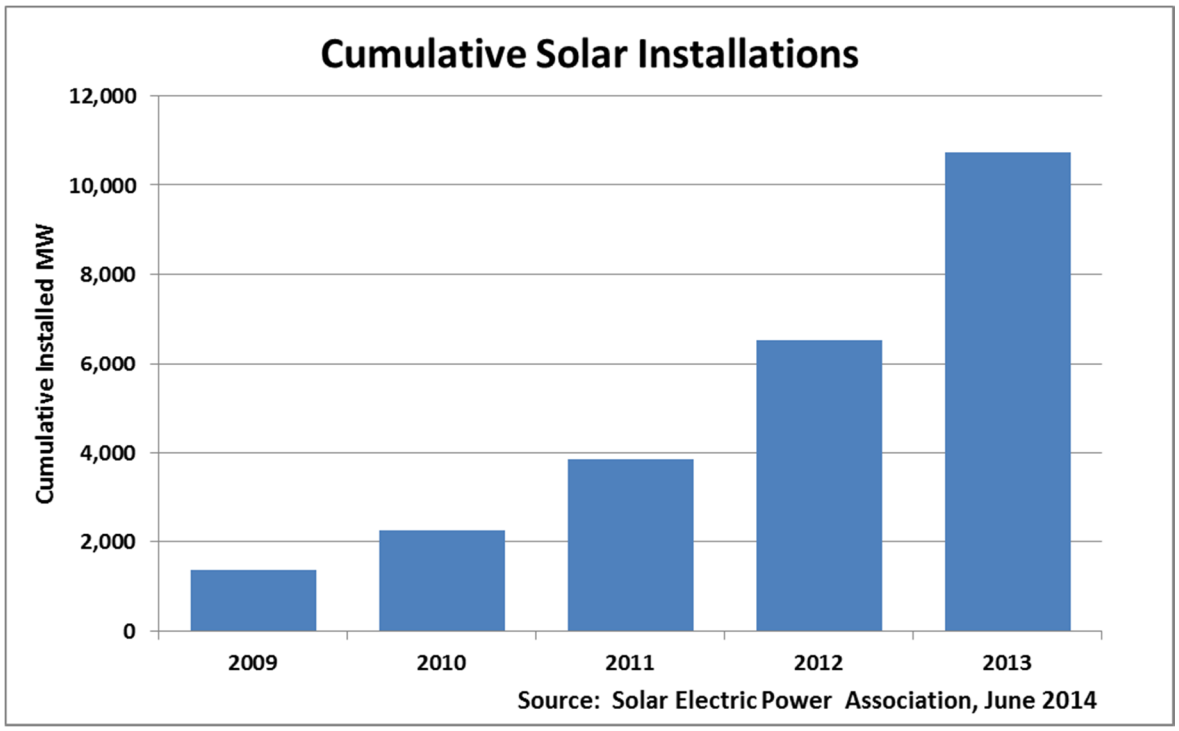
Figure 32 shows 34% of respondents explicitly include photovoltaics in their forecasting process. The While the West region leads the results with 45% including photovoltaics, all remaining regions show results close to 30%.

Figure 32: Include Photovoltaics in the Forecast

Response	2012	2013	2014
Include	21%	20%	34%
Do Not Include	79%	80%	66%

Figure 33 shows the cumulative growth in installed solar capacity across the United States. The rapid growth of the solar industry continues to put pressure on companies to account for the emerging solar industries in their service territories.

Figure 33: Solar Installations



Price.

Including energy prices in forecast models is challenging due to weak price responses and complex pricing structures. In the 2014 Survey, 56% of electric respondents and 80% of gas respondents include price in their forecasting models. The electric response is lower than the 2012 and 2013 responses and reflects a different mix of electric utility responses. Figure 34 shows the responses from the 2014 survey.

Figure 34: Include Price in the Forecast

Response	Electric 2012	Electric 2013	Electric 2014	Gas 2014
Include	78%	71%	56%	80%
Do Not Include	22%	29%	44%	20%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