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November 15, 2017

The Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL A1A 5B2

Attention: Ms. Cheryl Blundon
Director Corporate Services & Board Secretary

Dear Ms. Blundon:

Re: Newfoundland and Labrador Hydro - the Board's Investigation and Hearing into Supply Issues and Power Outages on the Island Interconnected System – Semi-annual Report – November 2017

Further to the Board's correspondence of October 13, 2016, wherein Hydro is required to provide the Board with "Semi-annual reports on its load forecasting tools (Nostradamus) to be filed each year on May 15 and November 15 with the first report commencing on November 15, 2016", please find enclosed the original plus 12 copies of Hydro's report entitled *Accuracy of Nostradamus Load Forecasting at Newfoundland and Labrador Hydro Semi-annual Report: November 2017.*

We trust the foregoing is satisfactory. If you have any questions or comments, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO

Michael Ladha
Legal Counsel & Assistant Corporate Secretary
ML/skc

Encl.

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey Stirling Scales
Dennis Brown, Q.C. – Consumer Advocate
Danny Dumaresque

ecc: Roberta Frampton Benefiel – Grand Riverkeeper® Labrador
Larry Bartlett – Teck Resources Limited
Denis Fleming – Cox & Palmer

Accuracy of Nostradamus Load Forecasting at Newfoundland and Labrador Hydro - May 2017 to October 2017

November 15, 2017

A Report to the Board of Commissioners of Public Utilities

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Appendicies

1 Nostradamus Load Forecasting

1.1 Nostradamus

Newfoundland and Labrador Hydro (Hydro) uses software called Nostradamus, from Ventyx, an ABB Company, for short-term load forecasting with a time frame of seven days. *The Nostradamus Neural Network Forecasting system is a flexible neural network based forecasting tool developed specifically for utility demand forecasting. Unlike conventional computing processes, which are programmed, neural networks use sophisticated mathematical techniques to train a network of inputs and outputs. Neural networks recognize and learn the joint relationships (linear or non-linear) between the ranges of variables considered. Once the network learns these intricate relationships, this knowledge can then easily be extended to produce accurate forecasts.*

The Nostradamus model is trained using a sequence of continuous historic periods of hourly weather and demand data, then forecasts system demand using predictions of those same weather parameters for the next seven days.

1.2 Short-Term Load Forecasting

Hydro uses its short-term load forecast to manage the power system and ensure adequate generating resources are available to meet customer demand.

1.2.1 Utility Load

Hydro contracts Wood (formerly Amec Foster Wheeler) to provide the weather parameters in the form of hourly weather forecasts that are provided twice daily for the next seven-days. At the same time as the weather forecast data are provided, Wood also provides recent observed data at the same locations as used in the forecasts.[1] The actuals and forecast data are automatically retrieved from Wood and input to the Nostradamus database.

[1] St. John's, Gander, and Deer Lake

Nostradamus can use a variety of weather parameters for forecasting as long as a historical record is available for training. Hydro currently uses: air temperature, wind speed, and cloud cover. Nostradamus can use each variable more than once, for example both the current and forecast air temperatures are used in forecasting load. Wind chill is not used explicitly as the neural network function of Nostradamus will form its own relationships between load, wind, and temperature, which should be superior to the one formula used by Environment Canada to derive wind chill.

Weather data for three locations are used in Nostradamus: St. John's, Gander, and Deer Lake. Data from July 1, 2014 to June 30, 2017 are being used for training and verification purposes. The training and verification periods are selected to provide a sufficiently long period to ensure that a range of weather parameters are included (e.g.: high and low temperatures), but short enough that the historic load is still representative of loads that can be expected in the future.

In addition to the weather and demand data, a parameter that indicates daily daylight hours is input in to Nostradamus.

Demand data for the Avalon Peninsula alone and for the Island Interconnected System as a whole are automatically input in to Nostradamus each hour. Only Newfoundland Power and Hydro's total utility load (conforming) is input in the Nostradamus model. Industrial load (non-conforming), which is not a function of weather, is forecast outside of the Nostradamus program and added to the forecasts provided by Nostradamus to derive the total load forecast.

During the process of training the Nostradamus model, it creates separate sub-models for weekdays, weekends, and holidays to account for the variation in customer use of electricity. Nostradamus has separate holiday groups for statutory holidays and also for days that are

known to have unusual loads, for instance, the days between Christmas and New Year's and the school Easter Break.[2]

1.2.2 Industrial Load

Industrial load tends to be almost constant, as industrial processes are independent of weather. Under the current procedure, the power-on-order for each Industrial Customer, plus the expected owned generation from Corner Brook Pulp and Paper (CBPP), is used as the industrial load forecasts unless System Operations engineers modify the forecast based on some knowledge of customer loads, for instance a decrease due to reduced production at CBPP or a ramp up in the load expected at Vale. Engineers can change the expected load in one or more cells of a seven by twenty-four hour grid, or can change the default value to be used indefinitely.[3]

1.2.3 Supply and Demand Status Reporting

Since December 2014, Hydro has submitted monthly reports on the accuracy of Nostradamus load forecasting in relation to the Board of Commissioners of Public Utilities (the Board's) Investigation and Hearing into Supply Issues and Power Outages on the Island Interconnected System. Further directions to the Board's Phase One Report, provided on October 13, 2016, indicated that the reporting frequency should change to semi-annually[4], commencing in November 2016.

[2] Training the Nostradamus Model is a process that is performed on an annual basis. The goal is to improve the forecasting accuracy by providing Nostradamus with updated data and trends of recent loads and weather data. This helps ensure that variables such as load growth and extreme weather are properly taken into account when predicting future load requirements. Past experience indicates that Nostradamus is better at predicting loads based on load and weather ranges that it was trained for.

[3] In Hydro's Energy Management System, there is functionality to modify the industrial load value when System Operations or the Energy Control Center is aware of circumstances where an industrial customer will be reducing load. For example, if an industrial customer is completing maintenance, their forecasted load can be modified to provide a more accurate load forecast.

[4] Semi-annual reporting periods are November to April and May to October inclusive.

The forecast peak as of 7:20 am is reported to the Board on the daily Supply and Demand Status Report. The weather forecast for the next seven days and the observed weather data for the previous day are input at approximately 5:00 am. Nostradamus is then run every hour of the day and the most recent forecast is available for reference by System Operations engineers and the Energy Control Centre operators for monitoring and managing the available spinning reserves. The within day forecast updates are used by operators to decide if additional spinning reserve is required in advance of forecast system peaks.

1.3 Potential Sources of Variance

As with any forecasting analysis, there will be discrepancies between the forecasted and actual values. Typical sources of variance in the load forecasting are as follows:

- Differences in the industrial load forecast due to unexpected changes in industrial customer loads. For example, if an industrial customer were to undergo maintenance or increase production to meet customer demand, their actual load would deviate from the scheduled load ;
- Inaccuracies in the weather forecast, particularly temperature, wind speed, or cloud cover; and
- Non-uniform customer behaviour which results in unpredictability.

2 Forecast Accuracy Summary

2.1 Analysis

This report examines the accuracy of the Newfoundland and Labrador Hydro (Hydro) forecasting process for May 2017 through October 2017. Table 1 presents the daily forecast peak, the observed peak, and the available system capacity, as included in Hydro's daily Supply and Demand Status Reports submitted to the Board. The data are also presented in Figure 1.

This reporting period covers the late spring, summer, and early fall 2017. The total peak load during the period varied between 699 MW (August 5, 2017) and 1224 MW (May 22, 2017). The available generation varied from 1145 MW to 1800 MW; Island system reserves were sufficient throughout. In summer, there is little or no heating load and there is not yet sufficient air conditioning in the Province to see a significant increase in load as temperature increases.

Table 2 presents error statistics for the total peak forecasts for the forecast period. Figure 2 is a plot of the forecast and actual peaks, as shown in Figure 1, but with the addition of a bar chart showing the difference between the two data series, in MW. In both the tables and the figures, a positive error is an overestimate; a negative error is an underestimate.

Figure 2 reveals that the forecasting process consistently overestimates the peak of the total load. This is typically a result of an overestimate in the industrial load forecast; often CBPP.

Table 3 presents error statistics for the peak utility forecast, i.e. the portion of the forecast actually determined by the Nostradamus model. The industrial forecast is not included in the values of this table. Figure 3 plots the data and error for the utility peak. Examination of the utility forecast focusses more clearly on the accuracy of Nostradamus; error in the industrial forecast introduces error to the total forecast which makes the total forecast look worse, or at times better, than it is.

2.2 Data Adjustments and Forecast Issues

On July 7, 2017 a network problem prevented the forecast updates starting at 6:00 pm. This problem persisted through the long weekend and into July 11, 2017 when it was corrected. This meant that the 7:20 am forecast for July 8, 9, and 10, 2017 were unavailable. Energy Control Center (ECC) operators used the last forecast generated at 6:20 pm on July 7, 2017 during these days and would have responded accordingly to maintain sufficient reserves throughout the peak periods.

On August 23, 2017 a Remote Terminal Unit problem at the Western Avalon Terminal Station resulted in erroneous data being calculated for the Avalon Peninsula between 2:00 pm and 5:00 pm. Actual Avalon Peninsula data was adjusted using the last accurate forecast issued at 1:20 pm.

During the month of September 2017, there was an issue in the intra-day forecasting profile in Nostradamus that prevented the hourly forecast updates from utilizing the most recent actual load values when predicting the load for next daily time period. This problem may have affected the forecast accuracy for the month of September. The problem was fixed on September 25, 2017, a few days after training Nostradamus was completed.[5]

2.3 Days of High Error

The shaded dates in Tables 2 and 3 indicate that the days of higher error in the load forecast. The days with the highest error (up to three days per month) are selected for more detailed analysis, which includes the days of:

- May 4, 5, and 7 2017;
- June 14, 15, and 17, 2017;
- July 1 and 23, 2017;
- August 5, 26, and 30, 2017;

[5] See footnote 3.

- September 2, 21, and 25, 2017; and
- October 11, 2017.

The analysis for these days is provided in the following sections.

2.3.1 May 4, 2017

On May 4, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1110 MW; the actual reported peak was 1021 MW. The absolute difference was 89 MW, 8.7% of the actual peak. Figure 4 includes an hourly plot of the load forecast for May 4, 2017 as well as actual load to assist in determining the sources of the differences between actual and forecast loads.

Figure 4(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted a 9:00 pm peak of 1110 MW; the actual peak was 1017 MW and it occurred earlier at 8:00 am.[6]

Figure 4(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The forecast utility load was much closer to the actual utility load because the CBPP load was up to 90 MW below forecast on May 4, 2017.

The discrepancy between actual and forecast load for May 4, 2017 was a result of errors in the industrial load forecast. CBPP's actual load was 90 MW below their Power-on-Order forecast amount. An overestimate of the load results in more than enough reserve being available. ECC operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

[6] The reason for slightly different peaks between the daily Supply and Demand Report and the Nostradamus data is a result of the sampling resolution. The Supply and Demand Report uses a five minute interval for sampling, whereas Nostradamus uses an hourly interval for both its forecasted and actual values. This sampling resolution difference can be seen throughout the Days of High Error analysis.

2.3.2 May 5, 2017

On May 5, 2017 , the forecast peak at 7:20 am as reported to the Board, was 1110 MW; the actual reported peak was 1027 MW. The absolute difference was 83 MW, 8.1% of the actual peak. Figure 5 includes an hourly plot of the load forecast for May 5, 2017 as well as actual load to assist in determining the sources of the differences between actual and forecast loads.

Figure 5(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted an 8:00 am peak of 1111 MW; the actual peak was 1020 MW.

Figure 5(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The forecast utility load was much closer to the actual utility load because the CBPP load was up to 65 MW below forecast on May 5.

The discrepancy between actual and forecast load for May 5 was a result of errors in the industrial load forecast. An overestimate of the load results in more than enough reserve being available. Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.3 May 7, 2017

On May 7, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1100 MW; the actual reported peak was 1006 MW. The absolute difference was 94 MW, 9.3% of the actual peak. Figure 6 includes an hourly plot of the load forecast for May 7, 2017 as well as several plots to assist in determining the sources of the differences between actual and forecast loads.

Figure 6(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted a 10:00 am peak of 1100 MW; the actual peak was 999 MW.

Figure 6(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The error in the forecast of the utility load was slightly lower than the error in the forecast of total load.

Figure 6(c) shows the actual temperature in St. John's compared to the forecast. The trend predicted by the forecast was somewhat close to the actual trend throughout the day. The actual 10:00 am temperature was one degree lower than forecast. This should have resulted in a lower peak forecast, so errors in the temperature forecast would have not contributed to the error in the load forecast.

Figure 6(d) shows the actual wind speed in St. John's compared to the forecast. For most of the day the wind forecast was poor. Actual 10:00 am wind speed was 5 km/h lower than forecast which could have contributed to an overestimate of the load. Figure 6(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for most of the day.

The discrepancy between actual and forecast load for May 7 was likely a result of multiple factors, including wind forecasts and non-uniform customer behaviour which results in unpredictability in the load as this was a weekend day. The morning updates did not improve the forecast but Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.4 June 14, 2017

On June 14, the forecast peak at 7:20 am, as reported to the Board, was 1015 MW; the actual reported peak was 871 MW. The absolute difference was 144 MW, 16.5% of the actual peak. Figure 7 includes an hourly plot of the load forecast for June 14 as well as several charts to assist in determining the sources of the differences between actual and forecast loads.

Figure 7(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted a 5:00 pm peak of 1016 MW; the actual peak was 864 MW and it occurred earlier at 9:00 am.

Figure 7(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The error in the forecast of the utility load was almost as high as the error in the forecast of total load.

Figure 7(c) shows the actual temperature in St. John's compared to the forecast. The trend predicted by the forecast was somewhat close to the actual trend throughout the day. The actual 9:00 am temperature was equal to forecast, so it is less likely that temperature forecast has contributed to the error in the load forecast.

Figure 7(d) shows the actual wind speed in St. John's compared to the forecast. For almost the entire day, the wind forecast was poor. Actual 9:00 am wind speed was 9 km/h lower than forecast. Due to the low temperatures experience on this day, errors in the wind forecast may have been a factor in the load forecast error.

Figure 7(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for most of the day. The forecast has consistently overestimated cloud cover for most of the day.

The discrepancy between actual and forecast load for June 14 was likely a result of errors in the wind forecast. An overestimate of the load results in more than enough reserve being available. The 8:20 am update did not improve the forecast but Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.5 June 15, 2017

On June 15, 2017 , the forecast peak at 7:20 am, as reported to the Board, was 1000 MW; the actual reported peak was 922 MW. The absolute difference was 78 MW, 8.4% of the actual

peak. Figure 8 includes an hourly plot of the load forecast for June 15 as well as actual load chart to assist in determining the sources of the differences between actual and forecast loads.

Figure 8(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted an 8:00 am peak of 1000 MW; the actual peak was 918 MW.

Figure 8(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The forecast utility load was much closer to the actual utility load because the CBPP load was up to 50 MW below forecast on June 15.

The discrepancy between actual and forecast load for June 15 was a result of errors in the industrial load forecast. An overestimate of the load results in more than enough reserve being available. Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.6 June 17, 2017

On June 17, 2017, the forecast peak at 7:20 am, as reported to the Board, was 805 MW; the actual reported peak was 719 MW. The absolute difference was 86 MW, 11.9% of the actual peak. Figure 9 includes an hourly plot of the load forecast for June 17, 2017 as well as actual load chart to assist in determining the sources of the differences between actual and forecast loads.

Figure 9(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted an 11:00 am peak of 806 MW; the actual peak was 714 MW and was at 10:00 am.

Figure 9(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The forecast utility load was much closer to the actual utility load because the CBPP load was up to 60 MW below forecast on June 17, 2017.

The discrepancy between actual and forecast load for June 17, 2017 was a result of errors in the industrial forecast. An overestimate of the load results in more than enough reserve being available. The morning updates during the day did not improve the forecast somewhat, but Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period

2.3.7 July 1, 2017

On July 1, 2017, the forecast peak at 7:20 am, as reported to the Board, was 860 MW; the actual reported peak was 754 MW. The absolute difference was 106 MW, 14.1% of the actual peak. Figure 10 includes an hourly plot of the load forecast for July 1, 2017 as well as several plots to assist in determining the sources of the differences between actual and forecast loads. Figure 10(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted an 11:00 am peak of 859 MW; the actual peak was 752 MW and was at 1:00 pm.

Figure 10(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The error in the forecast of the utility load was almost as high as the error in the forecast of total load.

Figure 10(c) shows the actual temperature in St. John's compared to the forecast. The forecast was reasonable in the morning but poor in the afternoon and the evening. The actual 1:00 pm temperature was four degrees lower than forecast. This should have resulted in a lower peak forecast, so errors in the temperature forecast would have not contributed to the error in the load forecast.

Figure 10(d) shows the actual wind speed in St. John's compared to the forecast. The forecast was poor for the entire day. The forecast overestimated wind speed for most of the afternoon by up to 9 km/h. Due to the relatively warmer temperatures on July 1, 2017, the error in the wind speed does not fully explain the error in the load forecast. Figure 10(e) shows the actual

cloud cover in St. John's compared to the forecast; it was relatively accurate for most of the day.

The discrepancy between actual and forecast load for July 1, 2017 was likely a result of non-uniform customer behaviour which results in unpredictability in the load as the day was a statuary holiday. Updates throughout the day improved the forecast and by noon the error was 4.5%.

2.3.8 July 23, 2017

On July 23, 2017, the forecast peak at 7:20 am, as reported to the Board, was 760 MW; the actual reported peak was 703 MW. The absolute difference was 57 MW, 8.1% of the actual peak. Figure 11 includes an hourly plot of the load forecast for July 23 as well as actual load chart to assist in determining the sources of the differences between actual and forecast loads.

Figure 11(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted a 12:00 pm peak of 760 MW; the actual peak was 701 MW.

Figure 11(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The forecast utility load was much closer to the actual utility load because the CBPP load was up to 40 MW below forecast on July 23, 2017.

The discrepancy between actual and forecast load for July 23, 2017 was a result of errors in the industrial load forecast. An overestimate of the load results in more than enough reserve being available. Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.9 August 5, 2017

On August 5, 2017, the forecast peak at 7:20 am, as reported to the Board, was 770 MW; the actual reported peak was 699 MW. The absolute difference was 71 MW, 10.2% of the actual

peak. Figure 12 includes an hourly plot of the load forecast for August 5, 2017 as well as several plots to assist in determining the sources of the differences between actual and forecast loads.

Figure 12(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted a 12:00 pm peak of 770 MW; the actual peak was 698 MW.

Figure 12(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The error in the forecast of the utility load was slightly lower than the error in the forecast of total load.

Figure 12(c) shows the actual temperature in St. John's compared to the forecast. The forecast was reasonable for the late morning, the afternoon and the evening, but poor for the early morning. The actual noon temperature was equal to forecast and the forecast consistently overestimated the temperature in the afternoon, so it is less likely that errors in the temperature forecast have contributed to the error in the load forecast.

Figure 12(d) shows the actual wind speed in St. John's compared to the forecast. The wind forecast was poor for entire day. Wind speed would not have contributed to the error in the load forecast due to the warm temperature. Figure 12(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for the entire day.

The discrepancy between actual and forecast load for August 5, 2017 was likely a result of non-uniform customer behaviour which results in unpredictability in the load as this was a weekend day. The morning updates did not improve the forecast but Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.10 August 26, 2017

On August 26, 2017 the forecast peak at 7:20 am, as reported to the Board, was 820 MW; the actual reported peak was 745 MW. The absolute difference was 75 MW, 10% of the actual peak. Figure 13 includes an hourly plot of the load forecast for August 26, 2017 as well as actual load chart to assist in determining the sources of the differences between actual and forecast loads.

Figure 13(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted a 1:00 pm peak of 818 MW; the actual peak was 742 MW and it occurred earlier at 12:00 pm.

Figure 13(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The error in the forecast of the utility load was as high as the error in the forecast of total load.

Figure 13(c) shows the actual temperature in St. John's compared to the forecast. The forecast underestimated the temperature for the early morning and overestimated the temperature for almost the remainder of the day. The actual 1:00 pm temperature was one degree lower than forecast, so it is unlikely that errors in the temperature have contributed to the error in the load forecast.

Figure 13(d) shows the actual wind speed in St. John's compared to the forecast. For almost the entire day the wind forecast overestimated the wind speed. Actual 6:00 pm wind speed was 9 km/h lower than forecast. Due to the warm temperatures on August 26, wind speed would not have been factor in the load forecast error. Figure 4(e) shows the actual cloud cover in St. John's compared to the forecast; it was accurate for most of the day.

The discrepancy between actual and forecast load for August 26 was likely a result of non-uniform customer behaviour which results in unpredictability in the load as this was a weekend

day. The morning updates did not improve the forecast but Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.11 August 30, 2017

On August 30, 2017, the forecast peak at 7:20 am, as reported to the Board, was 790 MW; the actual reported peak was 731 MW. The absolute difference was 59 MW, 8.1% of the actual peak. Figure 14 includes an hourly plot of the load forecast for August 30, 2017 as well as actual load chart to assist in determining the sources of the differences between actual and forecast loads.

Figure 14(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted a 12:00 pm peak of 792 MW; the actual peak was 731 MW.

Figure 14(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The error in the forecast of the utility load was slightly lower the error in the forecast of total load.

Figure 14(c) shows the actual temperature in St. John's compared to the forecast; it was reasonable for most of the day. The actual 12:00 pm temperature was equal to forecast,

Figure 14(d) shows the actual wind speed in St. John's compared to the forecast. The forecast was poor for most of the day. Due to the warm temperatures on August 30, 2017, wind speed would not have been factor in the load forecast error. Figure 14(e) shows the actual cloud cover in St. John's compared to the forecast; it was accurate for the early morning, but poor for the remainder of the day.

It is difficult to know why the forecast was erroneous on August 30, 2017. Factors not modelled by Nostradamus may have influenced the result. An overestimate of the load results in more

than enough reserve being available. The forecast updates did not improve the forecast but Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.12 September 2, 2017

On September 2, 2017, the forecast peak at 7:20 am, as reported to the Board, was 840 MW; the actual reported peak was 727 MW. The absolute difference was 113 MW, 15.6% of the actual peak. Figure 15 includes an hourly plot of the load forecast for September 2, 2017 as well as several plots to assist in determining the sources of the differences between actual and forecast loads.

Figure 15(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted a 6:00 pm peak of 841 MW; the actual peak was 727 MW and it occurred earlier at 12:00 pm.

Figure 15(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The error in the forecast of the utility load was slightly higher than the error in the forecast of total load.

Figure 15(c) shows the actual temperature in St. John's compared to the forecast; it was reasonable for most of the day. The forecast overestimated the temperature for the early morning and the early evening. The actual 6:00 pm temperature was three degrees lower than forecast. This should have resulted in a lower peak forecast, so errors in the temperature forecast would have not contributed to the error in the load forecast.

Figure 15(d) shows the actual wind speed in St. John's compared to the forecast. It was reasonable for the early morning but poor for the remainder of the day. For almost the entire day the wind forecast overestimated the wind speed. Actual 6:00 pm wind speed was 9 km/h lower than forecast. Due to the warmer temperatures on September 2, wind speed would not

have been factor in the load forecast error. Figure 15(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for the entire day.

The discrepancy between actual and forecast load for September 2, 2017 was likely due to the forecast update problem described in Section 2.2. Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.13 September 21, 2017

On September 21, the forecast peak at 7:20 am, as reported to the Board, was 835 MW; the actual reported peak was 744 MW. The absolute difference was 91 MW, 12.3% of the actual peak. Figure 16 includes an hourly plot of the load forecast for September 21 as well as several plots to assist in determining the sources of the differences between actual and forecast loads.

Figure 16(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted an 8:00 pm peak of 837 MW; the actual peak was 744 MW.

Figure 16(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The error in the forecast of the utility load was slightly lower than the error in the forecast of total load.

Figure 16(c) shows the actual temperature in St. John's compared to the forecast. The trend predicted by the forecast was somewhat close to the actual trend throughout the day. The actual 8:00 pm temperature was correctly predicted by the forecast.

Figure 16(d) shows the actual wind speed in St. John's compared to the forecast. The forecast was poor for the entire day, overestimating the wind speed for most of the day. Due to the warmer temperatures on September 21, errors in the wind speed forecast would not have

contributed to the error in the load forecast. Figure 16(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for the entire day.

The discrepancy between actual and forecast load for September 21 was likely due to the forecast update problem described in Section 2.2. Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.14 September 25, 2017

On September 25, 2017, the forecast peak at 7:20 am, as reported to the Board, was 900 MW; the actual reported peak was 800 MW. The absolute difference was 100 MW, 12.5% of the actual peak. Figure 17 includes an hourly plot of the load forecast for September 25 as well as several plots to assist in determining the sources of the differences between actual and forecast loads.

Figure 17(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted a 12:00 pm peak of 883 MW; the actual peak was 800 MW and it occurred earlier at 8:00 am.

Figure 17(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The error in the forecast of the utility load was slightly lower than the error in the forecast of total load.

Figure 17(c) shows the actual temperature in St. John's compared to the forecast. The forecast was reasonable for the morning and the afternoon. The actual 8:00 am temperature was correctly predicted by the forecast.

Figure 16(d) shows the actual wind speed in St. John's compared to the forecast. The forecast was poor for the entire day. Due to the warm temperatures on September 25, wind speed

would not have been factor in the load forecast error. Figure 4(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for the entire day.

The discrepancy between actual and forecast load for September 25 was likely due to the forecast update problem described in Section 2.2. Energy Control Centre operators would have been aware of the error and would have responded accordingly to maintain sufficient reserves throughout the peak period.

2.3.15 October 11, 2017

On October 11, 2017, the forecast peak at 7:20 am, as reported to the Board, was 900 MW; the actual reported peak was 854 MW. The absolute difference was 46 MW, 5.4% of the actual peak. Figure 18 includes an hourly plot of the load forecast for October 11, 2017 as well as several plots to assist in determining the sources of the differences between actual and forecast loads.

Figure 18(a) shows the hourly distribution of the load forecast compared to the actual load. The hourly forecast predicted an 8:00 pm peak of 899 MW; the actual peak was 849 MW.

Figure 18(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. The error in the forecast of the utility load was slightly higher than the error in the forecast of total load.

Figure 18(c) shows the actual temperature in St. John's compared to the forecast. The forecast was reasonable for most of the day. The actual 8:00 pm temperature was correctly predicted by the forecast.

Figure 18(d) shows the actual wind speed in St. John's compared to the forecast. The forecast was poor for the entire day, consistently overestimating wind speed. The actual 8:00 pm wind

speed was 24 km/h lower than forecast. Figure 18(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for most of the day.

The discrepancy between actual and forecast load for October 11 was likely a result of errors in the wind forecast. An overestimate of the load results in more than enough reserve being available. Updates throughout the day improved the forecast accuracy and by the early evening the error was 1.5%.

3 Forecast Accuracy Review

Table 4 summarizes the average and maximum error in the peak of the utility load forecast by month for the six months of the reporting period. The average error varied between 1.7% and 4.5% with an average of 2.6%. There does not appear to be any trend with time. The maximum absolute error varied between 6.5% and 16.4%. The maximum error was lower during May 2017 and October 2017. The average and maximum errors are all positive, i.e., the forecast overestimates the load. Overestimate of the load results in a conservative calculation of required reserve.

Table 5 summarizes the error at the ten highest loads during the reporting period. The highest loads in this reporting period all occurred either in May or October 2017. Six of the ten maximum loads were overestimated (five in May and one in October); four were underestimated. The average error was positive (0.6%). The absolute percent error varied from 0.2% to 3.9%, with an average of 1.2%. This confirms that the forecasting error is not necessarily high at higher loads.

Table 6 summarizes the result of the investigations into instances of high forecast error. Most errors occur as a result of errors in the industrial forecast, temperature, and wind forecast. Some errors remain unexplained; they result from unpredictable customer behavior that is not modelled by Nostradamus.

Appendix A

Tables and Figures

Table 1 Load Forecasting Data

Date	Forecast Total Peak, MW	Actual Total Peak, MW	Available Island Supply, MW	Forecast Reserve, MW
1-May-17	1265	1213	1710	445
2-May-17	1200	1112	1535	335
3-May-17	1180	1209	1570	390
4-May-17	1110	1021	1655	545
5-May-17	1110	1027	1680	570
6-May-17	1055	1009	1650	595
7-May-17	1100	1006	1660	560
8-May-17	1110	1090	1575	465
9-May-17	1155	1116	1580	425
10-May-17	1145	1107	1565	420
11-May-17	1125	1075	1575	450
12-May-17	1155	1124	1570	415
13-May-17	1145	1106	1580	435
14-May-17	1055	1054	1565	510
15-May-17	1045	1018	1575	530
16-May-17	1065	1062	1545	480
17-May-17	1030	994	1565	535
18-May-17	1045	1017	1585	540
19-May-17	980	994	1575	595
20-May-17	1060	1094	1615	555
21-May-17	1195	1199	1585	390
22-May-17	1245	1224	1600	355
23-May-17	1160	1103	1570	410
24-May-17	1025	1005	1580	555
25-May-17	1100	1087	1505	405
26-May-17	1085	1034	1450	365
27-May-17	1065	1081	1500	435
28-May-17	1110	1040	1485	375
29-May-17	1095	1064	1455	360
30-May-17	1055	1048	1605	550
31-May-17	920	898	1625	705
Minimum	920	898	1450	335
Average	1103	1072	1577	474
Maximum	1265	1224	1710	705

Date	Forecast Total Peak, MW	Actual Total Peak, MW	Available Island Supply, MW	Forecast Reserve, MW
1-Jun-17	935	892	1385	450
2-Jun-17	930	901	1520	590
3-Jun-17	895	880	1395	500
4-Jun-17	960	926	1360	400
5-Jun-17	1080	1074	1510	430
6-Jun-17	1100	1062	1490	390
7-Jun-17	1020	967	1480	460
8-Jun-17	1040	1034	1470	430
9-Jun-17	855	808	1430	575
10-Jun-17	880	857	1455	575
11-Jun-17	810	805	1445	635
12-Jun-17	835	796	1570	735
13-Jun-17	855	875	1555	700
14-Jun-17	1015	871	1590	575
15-Jun-17	1000	922	1590	590
16-Jun-17	890	859	1565	675
17-Jun-17	805	719	1480	675
18-Jun-17	800	811	1490	690
19-Jun-17	795	766	1325	530
20-Jun-17	770	741	1325	555
21-Jun-17	770	743	1145	375
22-Jun-17	770	739	1250	480
23-Jun-17	765	770	1440	675
24-Jun-17	785	799	1440	655
25-Jun-17	740	723	1435	695
26-Jun-17	765	732	1410	645
27-Jun-17	760	735	1410	650
28-Jun-17	800	774	1415	615
29-Jun-17	805	754	1415	610
30-Jun-17	785	746	1440	655
Minimum	740	719	1145	375
Average	867	836	1441	574
Maximum	1100	1074	1590	735

Date	Forecast Total Peak, MW	Actual Total Peak, MW	Available Island Supply, MW	Forecast Reserve, MW
1-Jul-17	860	754	1490	630
2-Jul-17	850	843	1500	650
3-Jul-17	795	770	1515	720
4-Jul-17	780	789	1360	580
5-Jul-17	815	789	1355	540
6-Jul-17	800	763	1315	515
7-Jul-17	770	788	1360	590
8-Jul-17	620	764	1320	700
9-Jul-17	570	750	1310	740
10-Jul-17	615	763	1465	850
11-Jul-17	775	751	1475	700
12-Jul-17	775	755	1480	705
13-Jul-17	765	752	1485	720
14-Jul-17	770	747	1465	695
15-Jul-17	745	729	1450	705
16-Jul-17	735	734	1450	715
17-Jul-17	775	764	1455	680
18-Jul-17	790	768	1460	670
19-Jul-17	790	753	1330	540
20-Jul-17	780	782	1400	620
21-Jul-17	780	779	1380	600
22-Jul-17	760	752	1460	700
23-Jul-17	760	703	1475	715
24-Jul-17	785	760	1400	615
25-Jul-17	790	785	1365	575
26-Jul-17	765	768	1370	605
27-Jul-17	775	750	1375	600
28-Jul-17	770	778	1525	755
29-Jul-17	760	735	1515	755
30-Jul-17	790	772	1360	570
31-Jul-17	785	792	1365	580
Minimum	570	703	1310	515
Average	764	764	1420	656
Maximum	860	843	1525	850

Date	Forecast Total Peak, MW	Actual Total Peak, MW	Available Island Supply, MW	Forecast Reserve, MW
1-Aug-17	825	783	1305	480
2-Aug-17	810	765	1260	450
3-Aug-17	785	776	1325	540
4-Aug-17	790	764	1355	565
5-Aug-17	770	699	1345	575
6-Aug-17	755	709	1350	595
7-Aug-17	815	801	1285	470
8-Aug-17	785	757	1250	465
9-Aug-17	775	752	1275	500
10-Aug-17	770	744	1265	495
11-Aug-17	775	760	1275	500
12-Aug-17	745	713	1275	530
13-Aug-17	790	757	1285	495
14-Aug-17	785	787	1410	625
15-Aug-17	780	750	1405	625
16-Aug-17	800	774	1375	575
17-Aug-17	805	768	1320	515
18-Aug-17	825	807	1390	565
19-Aug-17	795	765	1370	575
20-Aug-17	800	773	1525	725
21-Aug-17	810	798	1530	720
22-Aug-17	785	749	1525	740
23-Aug-17	805	789	1325	520
24-Aug-17	795	770	1540	745
25-Aug-17	790	755	1500	710
26-Aug-17	820	745	1615	795
27-Aug-17	800	770	1600	800
28-Aug-17	795	776	1440	645
29-Aug-17	790	732	1400	610
30-Aug-17	790	731	1420	630
31-Aug-17	780	807	1425	645
Minimum	745	699	1250	450
Average	792	762	1386	594
Maximum	825	807	1615	800

Date	Forecast Total Peak, MW	Actual Total Peak, MW	Available Island Supply, MW	Forecast Reserve, MW
1-Sep-17	805	799	1460	655
2-Sep-17	840	727	1425	585
3-Sep-17	775	736	1445	670
4-Sep-17	845	838	1430	585
5-Sep-17	785	786	1440	655
6-Sep-17	800	758	1460	660
7-Sep-17	810	779	1445	635
8-Sep-17	820	771	1475	655
9-Sep-17	785	754	1440	655
10-Sep-17	815	807	1445	630
11-Sep-17	895	869	1440	545
12-Sep-17	865	833	1420	555
13-Sep-17	865	832	1420	555
14-Sep-17	810	773	1420	610
15-Sep-17	795	752	1425	630
16-Sep-17	795	777	1450	655
17-Sep-17	805	784	1425	620
18-Sep-17	820	782	1690	870
19-Sep-17	830	821	1565	735
20-Sep-17	845	786	1585	740
21-Sep-17	835	744	1605	770
22-Sep-17	870	775	1705	835
23-Sep-17	805	726	1585	780
24-Sep-17	900	825	1575	675
25-Sep-17	900	800	1575	675
26-Sep-17	850	810	1630	780
27-Sep-17	870	883	1475	605
28-Sep-17	835	826	1595	760
29-Sep-17	865	824	1575	710
30-Sep-17	930	884	1570	640
Minimum	775	726	1420	545
Average	836	795	1507	671
Maximum	930	884	1705	870

Date	Forecast Total Peak, MW	Actual Total Peak, MW	Available Island Supply, MW	Forecast Reserve, MW
1-Oct-17	890	890	1575	685
2-Oct-17	965	922	1490	525
3-Oct-17	975	974	1530	555
4-Oct-17	1000	977	1645	645
5-Oct-17	855	815	1495	640
6-Oct-17	845	816	1490	645
7-Oct-17	820	800	1490	670
8-Oct-17	860	860	1535	675
9-Oct-17	780	789	1535	755
10-Oct-17	800	789	1500	700
11-Oct-17	900	854	1675	775
12-Oct-17	955	928	1665	710
13-Oct-17	990	968	1660	670
14-Oct-17	965	978	1730	765
15-Oct-17	915	875	1745	830
16-Oct-17	895	857	1760	865
17-Oct-17	985	997	1660	675
18-Oct-17	1065	1058	1645	580
19-Oct-17	1000	992	1670	670
20-Oct-17	940	938	1750	810
21-Oct-17	1025	992	1720	695
22-Oct-17	1120	1132	1800	680
23-Oct-17	1165	1168	1680	515
24-Oct-17	1130	1110	1670	540
25-Oct-17	1000	967	1665	665
26-Oct-17	925	893	1710	785
27-Oct-17	910	936	1705	795
28-Oct-17	945	967	1770	825
29-Oct-17	960	970	1735	775
30-Oct-17	1020	1005	1700	680
31-Oct-17	955	952	1520	565
Minimum	780	789	1490	515
Average	953	941	1643	689
Maximum	1165	1168	1800	865

Table 2 Analysis of Total Forecast Error

Date	Actual Total Peak, MW	Forecast Total Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-May-17	1213	1265	52	52	4.3%	4.3%	4.1%
2-May-17	1112	1200	88	88	7.9%	7.9%	7.3%
3-May-17	1209	1180	-29	29	-2.4%	2.4%	-2.5%
4-May-17	1021	1110	89	89	8.7%	8.7%	8.0%
5-May-17	1027	1110	83	83	8.1%	8.1%	7.5%
6-May-17	1009	1055	46	46	4.6%	4.6%	4.4%
7-May-17	1006	1100	94	94	9.3%	9.3%	8.5%
8-May-17	1090	1110	20	20	1.8%	1.8%	1.8%
9-May-17	1116	1155	39	39	3.5%	3.5%	3.3%
10-May-17	1107	1145	38	38	3.4%	3.4%	3.3%
11-May-17	1075	1125	50	50	4.6%	4.6%	4.4%
12-May-17	1124	1155	31	31	2.8%	2.8%	2.7%
13-May-17	1106	1145	39	39	3.6%	3.6%	3.4%
14-May-17	1054	1055	1	1	0.1%	0.1%	0.1%
15-May-17	1018	1045	27	27	2.7%	2.7%	2.6%
16-May-17	1062	1065	3	3	0.3%	0.3%	0.3%
17-May-17	994	1030	36	36	3.6%	3.6%	3.5%
18-May-17	1017	1045	28	28	2.8%	2.8%	2.7%
19-May-17	994	980	-14	14	-1.4%	1.4%	-1.4%
20-May-17	1094	1060	-34	34	-3.1%	3.1%	-3.2%
21-May-17	1199	1195	-4	4	-0.3%	0.3%	-0.3%
22-May-17	1224	1245	21	21	1.7%	1.7%	1.7%
23-May-17	1103	1160	57	57	5.2%	5.2%	4.9%
24-May-17	1005	1025	20	20	2.0%	2.0%	1.9%
25-May-17	1087	1100	13	13	1.2%	1.2%	1.2%
26-May-17	1034	1085	51	51	4.9%	4.9%	4.7%
27-May-17	1081	1065	-16	16	-1.5%	1.5%	-1.5%
28-May-17	1040	1110	70	70	6.8%	6.8%	6.3%
29-May-17	1064	1095	31	31	2.9%	2.9%	2.9%
30-May-17	1048	1055	7	7	0.7%	0.7%	0.7%
31-May-17	898	920	22	22	2.4%	2.4%	2.3%
Minimum	898	920	-34	1	-3.1%	0.1%	-3.2%
Average	1072	1103	31	37	2.9%	3.5%	2.8%
Maximum	1224	1265	94	94	9.3%	9.3%	8.5%

Notes: Shading means further examination of the hourly forecast was provided in this report

Date	Actual Total Peak, MW	Forecast Total Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-Jun-17	892	935	43	43	4.8%	4.8%	4.6%
2-Jun-17	901	930	29	29	3.2%	3.2%	3.1%
3-Jun-17	880	895	15	15	1.7%	1.7%	1.7%
4-Jun-17	926	960	34	34	3.7%	3.7%	3.5%
5-Jun-17	1074	1080	6	6	0.5%	0.5%	0.5%
6-Jun-17	1062	1100	38	38	3.6%	3.6%	3.5%
7-Jun-17	967	1020	53	53	5.5%	5.5%	5.2%
8-Jun-17	1034	1040	6	6	0.5%	0.5%	0.5%
9-Jun-17	808	855	47	47	5.8%	5.8%	5.5%
10-Jun-17	857	880	23	23	2.7%	2.7%	2.6%
11-Jun-17	805	810	5	5	0.6%	0.6%	0.6%
12-Jun-17	796	835	39	39	4.8%	4.8%	4.6%
13-Jun-17	875	855	-20	20	-2.3%	2.3%	-2.3%
14-Jun-17	871	1015	144	144	16.5%	16.5%	14.1%
15-Jun-17	922	1000	78	78	8.4%	8.4%	7.8%
16-Jun-17	859	890	31	31	3.6%	3.6%	3.5%
17-Jun-17	719	805	86	86	11.9%	11.9%	10.6%
18-Jun-17	811	800	-11	11	-1.4%	1.4%	-1.4%
19-Jun-17	766	795	29	29	3.8%	3.8%	3.6%
20-Jun-17	741	770	29	29	3.9%	3.9%	3.8%
21-Jun-17	743	770	27	27	3.6%	3.6%	3.5%
22-Jun-17	739	770	31	31	4.3%	4.3%	4.1%
23-Jun-17	770	765	-5	5	-0.6%	0.6%	-0.6%
24-Jun-17	799	785	-14	14	-1.7%	1.7%	-1.7%
25-Jun-17	723	740	17	17	2.3%	2.3%	2.2%
26-Jun-17	732	765	33	33	4.5%	4.5%	4.3%
27-Jun-17	735	760	25	25	3.3%	3.3%	3.2%
28-Jun-17	774	800	26	26	3.3%	3.3%	3.2%
29-Jun-17	754	805	51	51	6.8%	6.8%	6.4%
30-Jun-17	746	785	39	39	5.3%	5.3%	5.0%
Minimum	719	740	-20	5	-2.3%	0.5%	-2.3%
Average	836	867	31	34	3.8%	4.2%	3.5%
Maximum	1074	1100	144	144	16.5%	16.5%	14.1%

Notes: Shading means further examination of the hourly forecast was provided in this report

Date	Actual Total Peak, MW	Forecast Total Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-Jul-17	754	860	106	106	14.1%	14.1%	12.4%
2-Jul-17	843	850	7	7	0.8%	0.8%	0.8%
3-Jul-17	770	795	25	25	3.2%	3.2%	3.1%
4-Jul-17	789	780	-9	9	-1.1%	1.1%	-1.1%
5-Jul-17	789	815	26	26	3.2%	3.2%	3.1%
6-Jul-17	763	800	37	37	4.8%	4.8%	4.6%
7-Jul-17	788	770	-18	18	-2.2%	2.2%	-2.3%
8-Jul-17[3]	764	620	-144	144	-18.9%	18.9%	-23.3%
9-Jul-17[3]	750	570	-180	180	-24.0%	24.0%	-31.6%
10-Jul-17[7]	763	615	-148	148	-19.4%	19.4%	-24.0%
11-Jul-17	751	775	24	24	3.2%	3.2%	3.1%
12-Jul-17	755	775	20	20	2.7%	2.7%	2.6%
13-Jul-17	752	765	13	13	1.7%	1.7%	1.6%
14-Jul-17	747	770	23	23	3.1%	3.1%	3.0%
15-Jul-17	729	745	16	16	2.2%	2.2%	2.1%
16-Jul-17	734	735	1	1	0.1%	0.1%	0.1%
17-Jul-17	764	775	11	11	1.4%	1.4%	1.4%
18-Jul-17	768	790	22	22	2.9%	2.9%	2.8%
19-Jul-17	753	790	37	37	5.0%	5.0%	4.7%
20-Jul-17	782	780	-2	2	-0.3%	0.3%	-0.3%
21-Jul-17	779	780	1	1	0.1%	0.1%	0.1%
22-Jul-17	752	760	8	8	1.1%	1.1%	1.1%
23-Jul-17	703	760	57	57	8.1%	8.1%	7.5%
24-Jul-17	760	785	25	25	3.3%	3.3%	3.2%
25-Jul-17	785	790	5	5	0.6%	0.6%	0.6%
26-Jul-17	768	765	-3	3	-0.4%	0.4%	-0.4%
27-Jul-17	750	775	25	25	3.3%	3.3%	3.2%
28-Jul-17	778	770	-8	8	-1.0%	1.0%	-1.0%
29-Jul-17	735	760	25	25	3.4%	3.4%	3.2%
30-Jul-17	772	790	18	18	2.4%	2.4%	2.3%
31-Jul-17	792	785	-7	7	-0.8%	0.8%	-0.8%
Minimum	703	570	-180	1	-24.0%	0.1%	-31.6%
Average	764	764	0	34	0.1%	4.5%	-0.6%
Maximum	843	860	106	180	14.1%	24.0%	12.4%

Notes: Shading means further examination of the hourly forecast was provided in this report

[7] See Section 2.2 for an explanation of these errors.

Date	Actual Total Peak, MW	Forecast Total Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-Aug-17	783	825	42	42	5.4%	5.4%	5.1%
2-Aug-17	765	810	45	45	5.8%	5.8%	5.5%
3-Aug-17	776	785	9	9	1.1%	1.1%	1.1%
4-Aug-17	764	790	26	26	3.4%	3.4%	3.2%
5-Aug-17	699	770	71	71	10.2%	10.2%	9.3%
6-Aug-17	709	755	46	46	6.4%	6.4%	6.1%
7-Aug-17	801	815	14	14	1.8%	1.8%	1.7%
8-Aug-17	757	785	28	28	3.7%	3.7%	3.6%
9-Aug-17	752	775	23	23	3.1%	3.1%	3.0%
10-Aug-17	744	770	26	26	3.5%	3.5%	3.4%
11-Aug-17	760	775	15	15	1.9%	1.9%	1.9%
12-Aug-17	713	745	32	32	4.5%	4.5%	4.3%
13-Aug-17	757	790	33	33	4.4%	4.4%	4.2%
14-Aug-17	787	785	-2	2	-0.3%	0.3%	-0.3%
15-Aug-17	750	780	30	30	4.0%	4.0%	3.9%
16-Aug-17	774	800	26	26	3.3%	3.3%	3.2%
17-Aug-17	768	805	37	37	4.8%	4.8%	4.6%
18-Aug-17	807	825	18	18	2.2%	2.2%	2.2%
19-Aug-17	765	795	30	30	4.0%	4.0%	3.8%
20-Aug-17	773	800	27	27	3.5%	3.5%	3.4%
21-Aug-17	798	810	12	12	1.6%	1.6%	1.5%
22-Aug-17	749	785	36	36	4.8%	4.8%	4.6%
23-Aug-17	789	805	16	16	2.0%	2.0%	2.0%
24-Aug-17	770	795	25	25	3.2%	3.2%	3.1%
25-Aug-17	755	790	35	35	4.6%	4.6%	4.4%
26-Aug-17	745	820	75	75	10.0%	10.0%	9.1%
27-Aug-17	770	800	30	30	4.0%	4.0%	3.8%
28-Aug-17	776	795	19	19	2.4%	2.4%	2.4%
29-Aug-17	732	790	58	58	8.0%	8.0%	7.4%
30-Aug-17	731	790	59	59	8.1%	8.1%	7.5%
31-Aug-17	807	780	-27	27	-3.4%	3.4%	-3.5%
Minimum	699	745	-27	2	-3.4%	0.3%	-3.5%
Average	762	792	29	31	3.9%	4.2%	3.7%
Maximum	807	825	75	75	10.2%	10.2%	9.3%

Notes: Shading means further examination of the hourly forecast was provided in this report

Date	Actual Total Peak, MW	Forecast Total Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-Sep-17	799	805	6	6	0.7%	0.7%	0.7%
2-Sep-17	727	840	113	113	15.6%	15.6%	13.5%
3-Sep-17	736	775	39	39	5.4%	5.4%	5.1%
4-Sep-17	838	845	7	7	0.9%	0.9%	0.9%
5-Sep-17	786	785	-1	1	-0.1%	0.1%	-0.1%
6-Sep-17	758	800	42	42	5.6%	5.6%	5.3%
7-Sep-17	779	810	31	31	4.0%	4.0%	3.9%
8-Sep-17	771	820	49	49	6.4%	6.4%	6.0%
9-Sep-17	754	785	31	31	4.1%	4.1%	3.9%
10-Sep-17	807	815	8	8	1.0%	1.0%	0.9%
11-Sep-17	869	895	26	26	3.0%	3.0%	2.9%
12-Sep-17	833	865	32	32	3.8%	3.8%	3.7%
13-Sep-17	832	865	33	33	4.0%	4.0%	3.8%
14-Sep-17	773	810	37	37	4.8%	4.8%	4.6%
15-Sep-17	752	795	43	43	5.7%	5.7%	5.4%
16-Sep-17	777	795	18	18	2.3%	2.3%	2.2%
17-Sep-17	784	805	21	21	2.6%	2.6%	2.6%
18-Sep-17	782	820	38	38	4.8%	4.8%	4.6%
19-Sep-17	821	830	9	9	1.1%	1.1%	1.1%
20-Sep-17	786	845	59	59	7.5%	7.5%	7.0%
21-Sep-17	744	835	91	91	12.3%	12.3%	11.0%
22-Sep-17	775	870	95	95	12.2%	12.2%	10.9%
23-Sep-17	726	805	79	79	10.8%	10.8%	9.8%
24-Sep-17	825	900	75	75	9.1%	9.1%	8.3%
25-Sep-17	800	900	100	100	12.5%	12.5%	11.1%
26-Sep-17	810	850	40	40	5.0%	5.0%	4.8%
27-Sep-17	883	870	-13	13	-1.5%	1.5%	-1.5%
28-Sep-17	826	835	9	9	1.1%	1.1%	1.1%
29-Sep-17	824	865	41	41	5.0%	5.0%	4.8%
30-Sep-17	884	930	46	46	5.1%	5.1%	4.9%
Minimum	726	775	-13	1	-1.5%	0.1%	-1.5%
Average	795	836	40	41	5.2%	5.3%	4.8%
Maximum	884	930	113	113	15.6%	15.6%	13.5%

Notes: Shading means further examination of the hourly forecast was provided in this report

Date	Actual Total Peak, MW	Forecast Total Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-Oct-17	890	890	0	0	0.0%	0.0%	0.0%
2-Oct-17	922	965	43	43	4.6%	4.6%	4.4%
3-Oct-17	974	975	1	1	0.1%	0.1%	0.1%
4-Oct-17	977	1000	23	23	2.3%	2.3%	2.3%
5-Oct-17	815	855	40	40	4.9%	4.9%	4.7%
6-Oct-17	816	845	29	29	3.5%	3.5%	3.4%
7-Oct-17	800	820	20	20	2.5%	2.5%	2.4%
8-Oct-17	860	860	0	0	0.0%	0.0%	0.0%
9-Oct-17	789	780	-9	9	-1.2%	1.2%	-1.2%
10-Oct-17	789	800	11	11	1.4%	1.4%	1.3%
11-Oct-17	854	900	46	46	5.4%	5.4%	5.1%
12-Oct-17	928	955	27	27	2.9%	2.9%	2.8%
13-Oct-17	968	990	22	22	2.2%	2.2%	2.2%
14-Oct-17	978	965	-13	13	-1.3%	1.3%	-1.4%
15-Oct-17	875	915	40	40	4.6%	4.6%	4.4%
16-Oct-17	857	895	38	38	4.4%	4.4%	4.3%
17-Oct-17	997	985	-12	12	-1.2%	1.2%	-1.2%
18-Oct-17	1058	1065	7	7	0.7%	0.7%	0.7%
19-Oct-17	992	1000	8	8	0.8%	0.8%	0.8%
20-Oct-17	938	940	2	2	0.2%	0.2%	0.2%
21-Oct-17	992	1025	33	33	3.3%	3.3%	3.2%
22-Oct-17	1132	1120	-12	12	-1.0%	1.0%	-1.0%
23-Oct-17	1168	1165	-3	3	-0.3%	0.3%	-0.3%
24-Oct-17	1110	1130	20	20	1.8%	1.8%	1.8%
25-Oct-17	967	1000	33	33	3.4%	3.4%	3.3%
26-Oct-17	893	925	32	32	3.6%	3.6%	3.4%
27-Oct-17	936	910	-26	26	-2.8%	2.8%	-2.9%
28-Oct-17	967	945	-22	22	-2.3%	2.3%	-2.3%
29-Oct-17	970	960	-10	10	-1.0%	1.0%	-1.0%
30-Oct-17	1005	1020	15	15	1.5%	1.5%	1.5%
31-Oct-17	952	955	3	3	0.3%	0.3%	0.3%
Minimum	789	780	-26	0	-2.8%	0.0%	-2.9%
Average	941	953	12	19	1.4%	2.1%	1.3%
Maximum	1168	1165	46	46	5.4%	5.4%	5.1%

Notes: Shading means further examination of the hourly forecast was provided in this report

Table 3 Analysis of Utility Forecast Error

Date	Actual Utility Peak, MW	Forecast Utility Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-May-17	1045	1086	41	41	3.9%	3.9%	3.7%
2-May-17	1040	1038	-2	2	-0.2%	0.2%	-0.2%
3-May-17	1117	1098	-19	19	-1.7%	1.7%	-1.7%
4-May-17	923	945	22	22	2.4%	2.4%	2.3%
5-May-17	915	924	9	9	0.9%	0.9%	0.9%
6-May-17	844	866	21	21	2.5%	2.5%	2.5%
7-May-17	857	913	56	56	6.5%	6.5%	6.1%
8-May-17	927	923	-4	4	-0.4%	0.4%	-0.4%
9-May-17	965	967	2	2	0.2%	0.2%	0.2%
10-May-17	945	959	13	13	1.4%	1.4%	1.4%
11-May-17	920	939	19	19	2.0%	2.0%	2.0%
12-May-17	950	968	18	18	1.9%	1.9%	1.9%
13-May-17	946	957	10	10	1.1%	1.1%	1.1%
14-May-17	883	865	-17	17	-1.9%	1.9%	-2.0%
15-May-17	863	858	-5	5	-0.6%	0.6%	-0.6%
16-May-17	891	878	-13	13	-1.5%	1.5%	-1.5%
17-May-17	823	841	18	18	2.2%	2.2%	2.1%
18-May-17	872	859	-14	14	-1.6%	1.6%	-1.6%
19-May-17	844	792	-51	51	-6.1%	6.1%	-6.5%
20-May-17	917	873	-44	44	-4.8%	4.8%	-5.0%
21-May-17	1012	1008	-4	4	-0.4%	0.4%	-0.4%
22-May-17	1045	1056	11	11	1.0%	1.0%	1.0%
23-May-17	924	973	49	49	5.3%	5.3%	5.0%
24-May-17	847	836	-10	10	-1.2%	1.2%	-1.2%
25-May-17	911	913	2	2	0.2%	0.2%	0.2%
26-May-17	852	898	45	45	5.3%	5.3%	5.0%
27-May-17	915	879	-36	36	-4.0%	4.0%	-4.1%
28-May-17	872	924	52	52	5.9%	5.9%	5.6%
29-May-17	890	908	18	18	2.0%	2.0%	2.0%
30-May-17	896	868	-28	28	-3.1%	3.1%	-3.2%
31-May-17	729	733	4	4	0.6%	0.6%	0.6%
Minimum	729	733	-51	2	-6.1%	0.2%	-6.5%
Average	916	921	5	21	0.6%	2.4%	0.5%
Maximum	1117	1098	56	56	6.5%	6.5%	6.1%

Notes: Shading means further examination of the hourly forecast was provided in this report

Date	Actual Utility Peak, MW	Forecast Utility Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-Jun-17	734	752	18	18	2.5%	2.5%	2.4%
2-Jun-17	751	749	-2	2	-0.3%	0.3%	-0.3%
3-Jun-17	717	715	-1	1	-0.2%	0.2%	-0.2%
4-Jun-17	767	776	9	9	1.2%	1.2%	1.2%
5-Jun-17	908	898	-10	10	-1.1%	1.1%	-1.1%
6-Jun-17	907	918	11	11	1.2%	1.2%	1.2%
7-Jun-17	813	836	23	23	2.8%	2.8%	2.7%
8-Jun-17	851	855	4	4	0.5%	0.5%	0.5%
9-Jun-17	654	672	18	18	2.8%	2.8%	2.7%
10-Jun-17	686	698	12	12	1.8%	1.8%	1.7%
11-Jun-17	636	627	-9	9	-1.4%	1.4%	-1.4%
12-Jun-17	628	651	23	23	3.7%	3.7%	3.6%
13-Jun-17	730	673	-57	57	-7.8%	7.8%	-8.4%
14-Jun-17	724	833	110	110	15.2%	15.2%	13.2%
15-Jun-17	814	818	4	4	0.5%	0.5%	0.5%
16-Jun-17	725	737	12	12	1.6%	1.6%	1.6%
17-Jun-17	625	651	25	25	4.1%	4.1%	3.9%
18-Jun-17	664	646	-18	18	-2.7%	2.7%	-2.8%
19-Jun-17	636	639	3	3	0.5%	0.5%	0.5%
20-Jun-17	611	616	4	4	0.7%	0.7%	0.7%
21-Jun-17	615	617	2	2	0.3%	0.3%	0.3%
22-Jun-17	608	614	6	6	1.0%	1.0%	1.0%
23-Jun-17	629	611	-18	18	-2.9%	2.9%	-2.9%
24-Jun-17	649	631	-18	18	-2.7%	2.7%	-2.8%
25-Jun-17	596	587	-9	9	-1.5%	1.5%	-1.5%
26-Jun-17	570	608	0	0	0.0%	0.0%	0.0%
27-Jun-17	630	604	9	9	1.6%	1.6%	1.5%
28-Jun-17	603	617	-30	30	-4.7%	4.7%	-4.9%
29-Jun-17	621	621	-1	1	-0.1%	0.1%	-0.1%
30-Jun-17	606	604	-3	3	-0.4%	0.4%	-0.4%
Minimum	570	587	-57	0	-7.8%	0.0%	-8.4%
Average	690	696	4	16	0.5%	2.3%	0.4%
Maximum	908	918	110	110	15.2%	15.2%	13.2%

Notes: Shading means further examination of the hourly forecast was provided in this report

Date	Actual Utility Peak, MW	Forecast Utility Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-Jul-17	609	677	67	67	11.0%	11.0%	9.9%
2-Jul-17	671	670	0	0	0.0%	0.0%	0.0%
3-Jul-17	615	615	0	0	0.0%	0.0%	0.0%
4-Jul-17	611	599	-12	12	-1.9%	1.9%	-1.9%
5-Jul-17	635	633	-2	2	-0.3%	0.3%	-0.3%
6-Jul-17	603	618	15	15	2.5%	2.5%	2.5%
7-Jul-17	603	588	-14	14	-2.4%	2.4%	-2.5%
8-Jul-17	629	620	-10	10	-1.5%	1.5%	-1.5%
9-Jul-17	578	572	-5	5	-0.9%	0.9%	-0.9%
10-Jul-17	602	616	15	15	2.4%	2.4%	2.4%
11-Jul-17	589	592	3	3	0.5%	0.5%	0.5%
12-Jul-17	594	590	-4	4	-0.7%	0.7%	-0.7%
13-Jul-17	591	581	-10	10	-1.7%	1.7%	-1.8%
14-Jul-17	583	587	5	5	0.8%	0.8%	0.8%
15-Jul-17	550	565	15	15	2.7%	2.7%	2.6%
16-Jul-17	553	554	2	2	0.3%	0.3%	0.3%
17-Jul-17	605	595	-10	10	-1.7%	1.7%	-1.7%
18-Jul-17	599	616	17	17	2.9%	2.9%	2.8%
19-Jul-17	595	608	12	12	2.1%	2.1%	2.0%
20-Jul-17	609	597	-12	12	-1.9%	1.9%	-1.9%
21-Jul-17	601	600	-1	1	-0.2%	0.2%	-0.2%
22-Jul-17	574	579	5	5	0.8%	0.8%	0.8%
23-Jul-17	562	577	15	15	2.6%	2.6%	2.6%
24-Jul-17	589	601	11	11	1.9%	1.9%	1.9%
25-Jul-17	612	608	-4	4	-0.6%	0.6%	-0.6%
26-Jul-17	591	581	-11	11	-1.8%	1.8%	-1.8%
27-Jul-17	590	594	4	4	0.7%	0.7%	0.7%
28-Jul-17	595	585	-9	9	-1.6%	1.6%	-1.6%
29-Jul-17	571	577	6	6	1.0%	1.0%	1.0%
30-Jul-17	594	607	12	12	2.1%	2.1%	2.1%
31-Jul-17	613	601	-12	12	-1.9%	1.9%	-2.0%
Minimum	550	554	-14	0	-2.4%	0.0%	-2.5%
Average	597	600	3	10	0.5%	1.7%	0.4%
Maximum	671	677	67	67	11.0%	11.0%	9.9%

Notes: Shading means further examination of the hourly forecast was provided in this report

Date	Actual Utility Peak, MW	Forecast Utility Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-Aug-17	613	641	28	28	4.6%	4.6%	4.4%
2-Aug-17	604	624	20	20	3.3%	3.3%	3.2%
3-Aug-17	600	596	-3	3	-0.6%	0.6%	-0.6%
4-Aug-17	592	606	14	14	2.4%	2.4%	2.4%
5-Aug-17	548	584	36	36	6.6%	6.6%	6.2%
6-Aug-17	555	571	16	16	2.8%	2.8%	2.7%
7-Aug-17	613	628	14	14	2.3%	2.3%	2.3%
8-Aug-17	585	597	11	11	2.0%	2.0%	1.9%
9-Aug-17	594	603	9	9	1.6%	1.6%	1.5%
10-Aug-17	589	596	7	7	1.2%	1.2%	1.2%
11-Aug-17	590	591	1	1	0.2%	0.2%	0.2%
12-Aug-17	545	559	14	14	2.6%	2.6%	2.5%
13-Aug-17	573	604	31	31	5.4%	5.4%	5.2%
14-Aug-17	602	597	-5	5	-0.8%	0.8%	-0.8%
15-Aug-17	582	593	11	11	1.9%	1.9%	1.8%
16-Aug-17	585	612	27	27	4.6%	4.6%	4.4%
17-Aug-17	606	621	15	15	2.5%	2.5%	2.5%
18-Aug-17	631	639	8	8	1.3%	1.3%	1.2%
19-Aug-17	613	611	-3	3	-0.4%	0.4%	-0.4%
20-Aug-17	586	614	29	29	4.9%	4.9%	4.6%
21-Aug-17	615	623	8	8	1.3%	1.3%	1.2%
22-Aug-17	603	600	-3	3	-0.6%	0.6%	-0.6%
23-Aug-17	631	617	-14	14	-2.1%	2.1%	-2.2%
24-Aug-17	599	610	11	11	1.8%	1.8%	1.7%
25-Aug-17	587	603	16	16	2.8%	2.8%	2.7%
26-Aug-17	573	632	59	59	10.3%	10.3%	9.3%
27-Aug-17	591	612	21	21	3.6%	3.6%	3.5%
28-Aug-17	607	609	2	2	0.3%	0.3%	0.3%
29-Aug-17	589	604	15	15	2.6%	2.6%	2.5%
30-Aug-17	574	606	32	32	5.5%	5.5%	5.2%
31-Aug-17	627	614	-13	13	-2.1%	2.1%	-2.2%
Minimum	545	559	-14	1	-2.1%	0.2%	-2.2%
Average	594	607	13	16	2.3%	2.7%	2.2%
Maximum	631	641	59	59	10.3%	10.3%	9.3%

Notes: Shading means further examination of the hourly forecast was provided in this report

Date	Actual Utility Peak, MW	Forecast Utility Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-Sep-17	629	623	-6	6	-1.0%	1.0%	-1.0%
2-Sep-17	565	658	93	93	16.4%	16.4%	14.1%
3-Sep-17	560	593	33	33	5.8%	5.8%	5.5%
4-Sep-17	651	663	12	12	1.9%	1.9%	1.9%
5-Sep-17	592	600	9	9	1.5%	1.5%	1.5%
6-Sep-17	592	612	20	20	3.3%	3.3%	3.2%
7-Sep-17	610	619	10	10	1.6%	1.6%	1.6%
8-Sep-17	605	634	29	29	4.8%	4.8%	4.6%
9-Sep-17	584	596	12	12	2.1%	2.1%	2.0%
10-Sep-17	626	626	0	0	0.0%	0.0%	0.0%
11-Sep-17	791	705	-87	87	-11.0%	11.0%	-12.3%
12-Sep-17	662	677	15	15	2.2%	2.2%	2.2%
13-Sep-17	655	678	23	23	3.5%	3.5%	3.4%
14-Sep-17	609	621	12	12	2.0%	2.0%	2.0%
15-Sep-17	575	609	34	34	5.9%	5.9%	5.6%
16-Sep-17	598	608	9	9	1.6%	1.6%	1.6%
17-Sep-17	613	614	2	2	0.3%	0.3%	0.3%
18-Sep-17	626	629	3	3	0.5%	0.5%	0.5%
19-Sep-17	648	640	-8	8	-1.3%	1.3%	-1.3%
20-Sep-17	615	654	39	39	6.3%	6.3%	6.0%
21-Sep-17	599	648	49	49	8.3%	8.3%	7.6%
22-Sep-17	614	681	67	67	10.9%	10.9%	9.8%
23-Sep-17	568	614	46	46	8.2%	8.2%	7.6%
24-Sep-17	663	711	48	48	7.2%	7.2%	6.7%
25-Sep-17	644	714	69	69	10.8%	10.8%	9.7%
26-Sep-17	653	681	27	27	4.2%	4.2%	4.0%
27-Sep-17	719	699	-20	20	-2.7%	2.7%	-2.8%
28-Sep-17	678	662	-16	16	-2.4%	2.4%	-2.4%
29-Sep-17	648	679	30	30	4.6%	4.6%	4.4%
30-Sep-17	713	742	29	29	4.1%	4.1%	3.9%
Minimum	560	593	-87	0	-11.0%	0.0%	-12.3%
Average	630	649	21	30	3.3%	4.5%	3.0%
Maximum	791	742	93	93	16.4%	16.4%	14.1%

Notes: Shading means further examination of the hourly forecast was provided in this report

Date	Actual Utility Peak, MW	Forecast Utility Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
1-Oct-17	732	702	-31	31	-4.2%	4.2%	-4.4%
2-Oct-17	759	775	15	15	2.0%	2.0%	2.0%
3-Oct-17	832	825	-7	7	-0.8%	0.8%	-0.8%
4-Oct-17	825	827	2	2	0.2%	0.2%	0.2%
5-Oct-17	665	665	0	0	0.1%	0.1%	0.1%
6-Oct-17	666	656	-10	10	-1.6%	1.6%	-1.6%
7-Oct-17	630	632	3	3	0.4%	0.4%	0.4%
8-Oct-17	701	672	-29	29	-4.2%	4.2%	-4.3%
9-Oct-17	619	607	-12	12	-1.9%	1.9%	-2.0%
10-Oct-17	633	626	-7	7	-1.1%	1.1%	-1.1%
11-Oct-17	676	726	50	50	7.4%	7.4%	6.9%
12-Oct-17	767	781	14	14	1.9%	1.9%	1.8%
13-Oct-17	830	816	-14	14	-1.6%	1.6%	-1.7%
14-Oct-17	809	791	-18	18	-2.2%	2.2%	-2.3%
15-Oct-17	721	741	20	20	2.8%	2.8%	2.7%
16-Oct-17	695	721	26	26	3.7%	3.7%	3.5%
17-Oct-17	844	812	-32	32	-3.8%	3.8%	-4.0%
18-Oct-17	885	890	5	5	0.6%	0.6%	0.6%
19-Oct-17	809	824	14	14	1.8%	1.8%	1.8%
20-Oct-17	768	765	-3	3	-0.4%	0.4%	-0.4%
21-Oct-17	825	851	26	26	3.2%	3.2%	3.1%
22-Oct-17	951	946	-5	5	-0.6%	0.6%	-0.6%
23-Oct-17	984	989	5	5	0.5%	0.5%	0.5%
24-Oct-17	930	950	20	20	2.2%	2.2%	2.1%
25-Oct-17	804	821	17	17	2.2%	2.2%	2.1%
26-Oct-17	747	745	-2	2	-0.2%	0.2%	-0.2%
27-Oct-17	739	733	-6	6	-0.8%	0.8%	-0.8%
28-Oct-17	775	759	-15	15	-1.9%	1.9%	-2.0%
29-Oct-17	779	771	-8	8	-1.1%	1.1%	-1.1%
30-Oct-17	821	832	11	11	1.3%	1.3%	1.3%
31-Oct-17	762	768	6	6	0.8%	0.8%	0.8%
Minimum	619	607	-32	0	-4.2%	0.1%	-4.4%
Average	774	775	1	14	0.1%	1.9%	0.1%
Maximum	984	989	50	50	7.4%	7.4%	6.9%

Notes: Shading means further examination of the hourly forecast was provided in this report

Table 4 Monthly Peak Utility Load Error Summary

Summary	Actual Utility Peak, MW	Forecast Utility Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
	Average Peak		**Average Error**				
May 2017	916	921	5	21	0.6%	2.4%	0.5%
June 2017	690	696	4	16	0.5%	2.3%	0.4%
July 2017	597	600	3	10	0.5%	1.7%	0.4%
August 2017	594	607	13	16	2.3%	2.7%	2.2%
September 2017	630	649	21	30	3.3%	4.5%	3.0%
October 2017	774	775	1	14	0.1%	1.9%	0.1%
Six Month	701	708	8	18	1.2%	2.6%	1.1%
	Maximum Peak*		**Maximum Error**				
May 2017	1117	1098	56	56	6.5%	6.5%	6.1%
June 2017	908	918	110	110	15.2%	15.2%	13.2%
July 2017	671	677	67	67	11.0%	11.0%	9.9%
August 2017	631	641	59	59	10.3%	10.3%	9.3%
September 2017	791	742	93	93	16.4%	16.4%	14.1%
October 2017	984	989	50	50	7.4%	7.4%	6.9%
Six Month	1117	1098	110	110	16.4%	16.4%	14.1%

Note that the maximum forecast, the maximum peak and the maximum error do not necessarily occur on the same day

Table 5 Error in Ten Highest Utility Loads

Date	Actual Utility Peak, MW	Forecast Utility Peak, MW	Error, MW	Absolute Error, MW	Percent Error	Absolute Percent Error	Actual/ Forecast
3-May-17	1117	1098	-19	19	-1.7%	1.7%	-1.7%
22-May-17	1045	1056	11	11	1.0%	1.0%	1.0%
1-May-17	1045	1086	41	41	3.9%	3.9%	3.7%
2-May-17	1040	1038	-2	2	-0.2%	0.2%	-0.2%
21-May-17	1012	1008	-4	4	-0.4%	0.4%	-0.4%
23-Oct-17	984	989	5	5	0.5%	0.5%	0.5%
9-May-17	965	967	2	2	0.2%	0.2%	0.2%
22-Oct-17	951	946	-5	5	-0.6%	0.6%	-0.6%
12-May-17	950	968	18	18	1.9%	1.9%	1.9%
13-May-17	946	957	10	10	1.1%	1.1%	1.1%
Average	1006	1011	6	12	0.6%	1.2%	0.6%

Table 6 Summary of Forecast Issues

Date	Actual Utility Peak, MW	Forecast Utility Peak, MW	Error, MW	Absolute Error, MW	Absolute Percent Error	Explanation
4-May-17	923	945	22	22	2.4%	Error in industrial load forecast
5-May-17	915	924	9	9	1.0%	Error in industrial load forecast
7-May-17	857	913	56	56	6.5%	Error in wind forecast and non-uniform customer behavior
14-Jun-17	724	833	109	109	15.1%	Error in wind forecast
15-Jun-17	814	818	4	4	0.5%	Error in industrial load forecast
17-Jun-17	625	651	26	26	4.2%	Error in industrial load forecast
1-Jul-17	609	677	68	68	11.2%	Non-uniform customer behavior
23-Jul-17	562	577	15	15	2.7%	Error in industrial load forecast
5-Aug-17	548	584	36	36	6.6%	Non-uniform customer behavior
26-Aug-17	573	632	59	59	10.3%	Non-uniform customer behavior
30-Aug-17	574	606	32	32	5.6%	unknown factors
2-Sep-17	565	658	93	93	16.5%	Load forecast updated problem
21-Sep-17	599	648	49	49	8.2%	Load forecast updated problem
25-Sep-17	644	714	70	70	10.9%	Load forecast updated problem
11-Oct-17	676	726	50	50	7.4%	Error in wind forecast

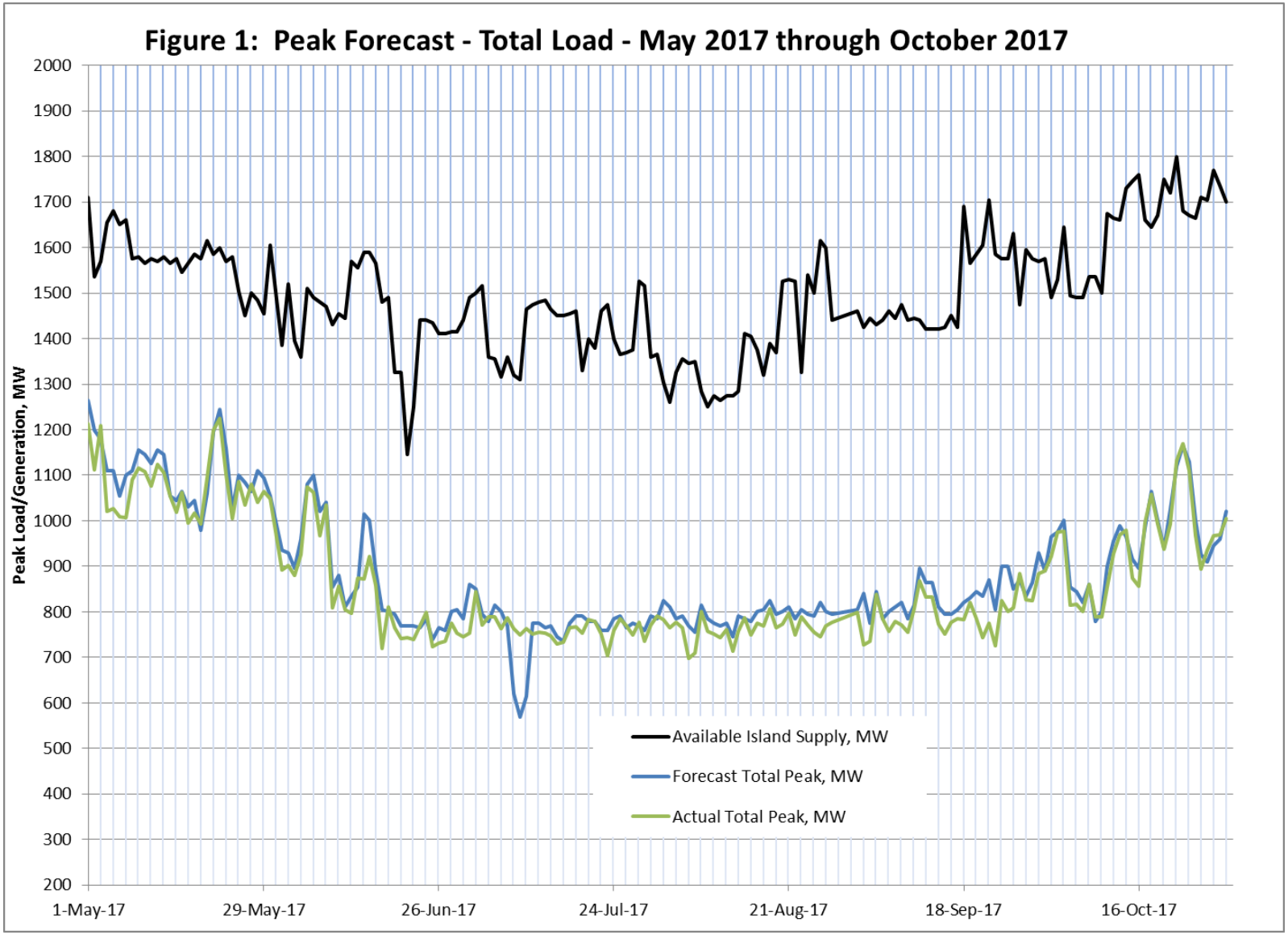


Figure 1: Peak Forecast - Total Load - May 2017 through October 2017
Peak Load/Generation, MW
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
1-May-17
29-May-17
26-Jun-17
24-Jul-17
21-Aug-17
18-Sep-17
16-Oct-17
Available Island Supply, MW
Forecast Total Peak, MW
Actual Total Peak, MW

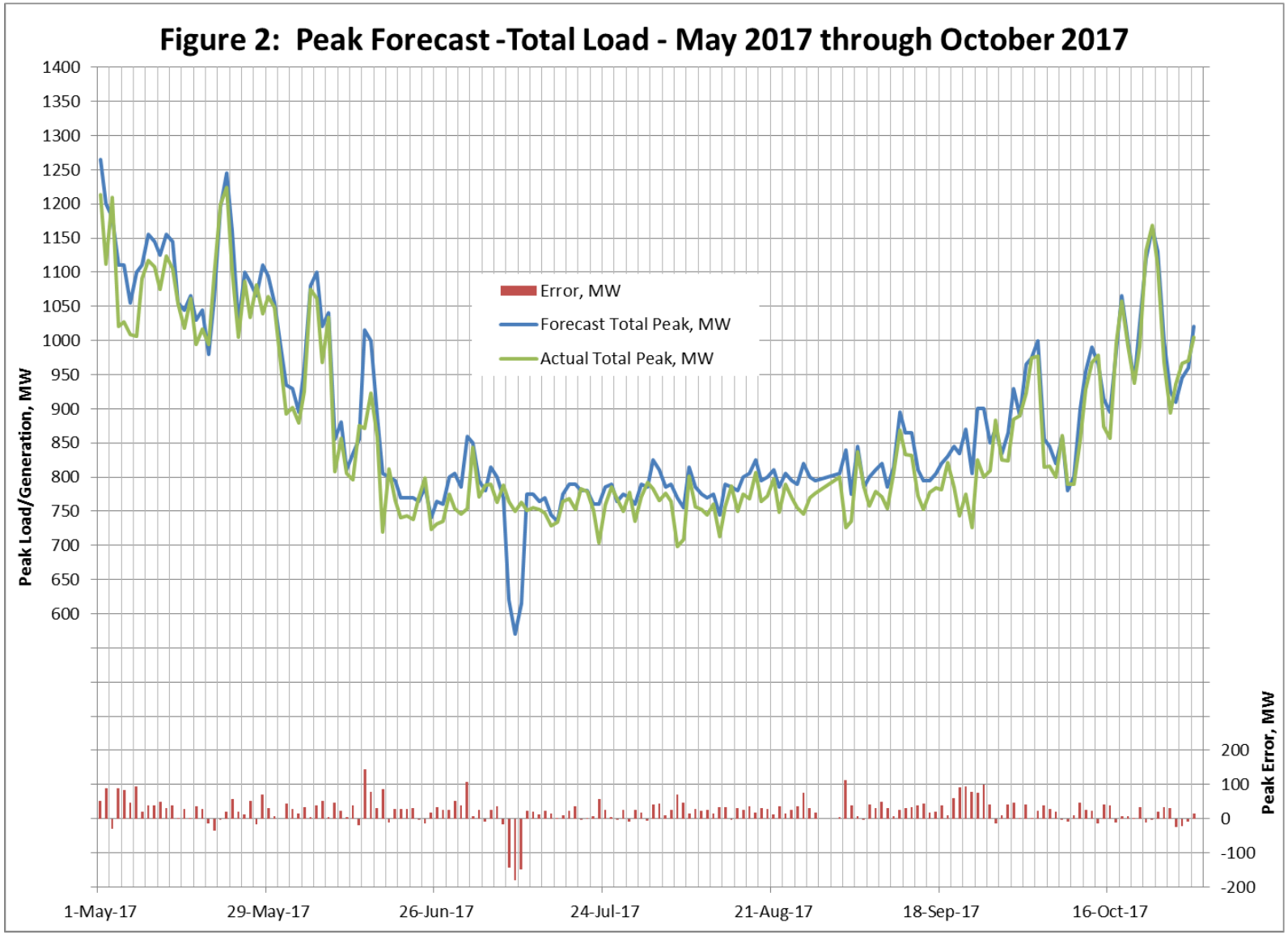


Figure 2: Peak Forecast -Total Load - May 2017 through October 2017
Peak Load/Generation, MW
Peak Error, MW
Error, MW
Forecast Total Peak, MW
Actual Total Peak, MW
1400
1350
1300
1250
1200
1150
1100
1050
1000
950
900
850
800
750
700
650
600
200
100
0
-100
-200
1-May-17
29-May-17
26-Jun-17
24-Jul-17
21-Aug-17
18-Sep-17
16-Oct-17

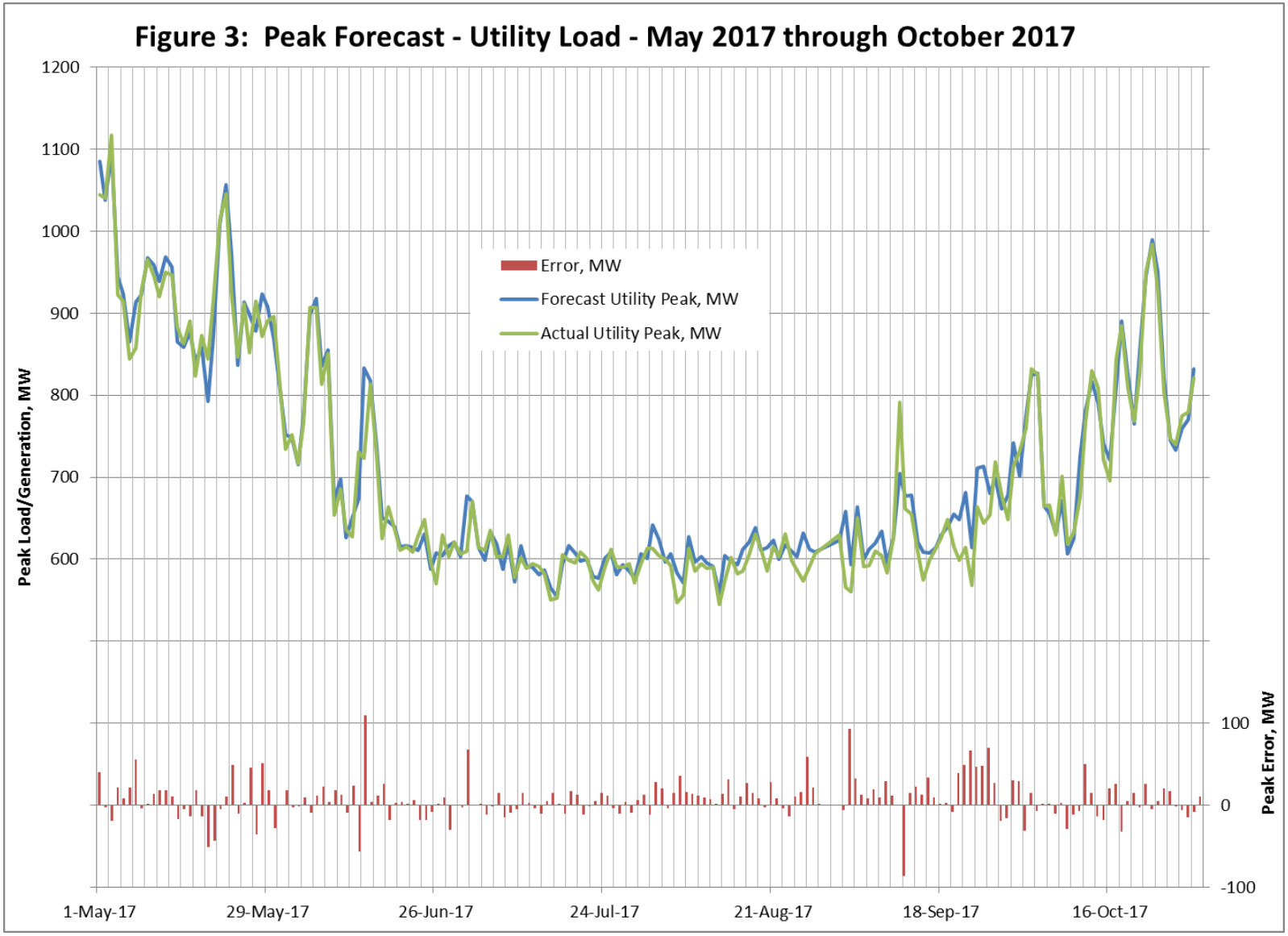


Figure 3: Peak Forecast - Utility Load - May 2017 through October 2017
Peak Load/Generation, MW
1200
1100
1000
900
800
700
600
Error, MW
Forecast Utility Peak, MW
Actual Utility Peak, MW
100
0
-100
Peak Error, MW
1-May-17
29-May-17
26-Jun-17
24-Jul-17
21-Aug-17
18-Sep-17
16-Oct-17

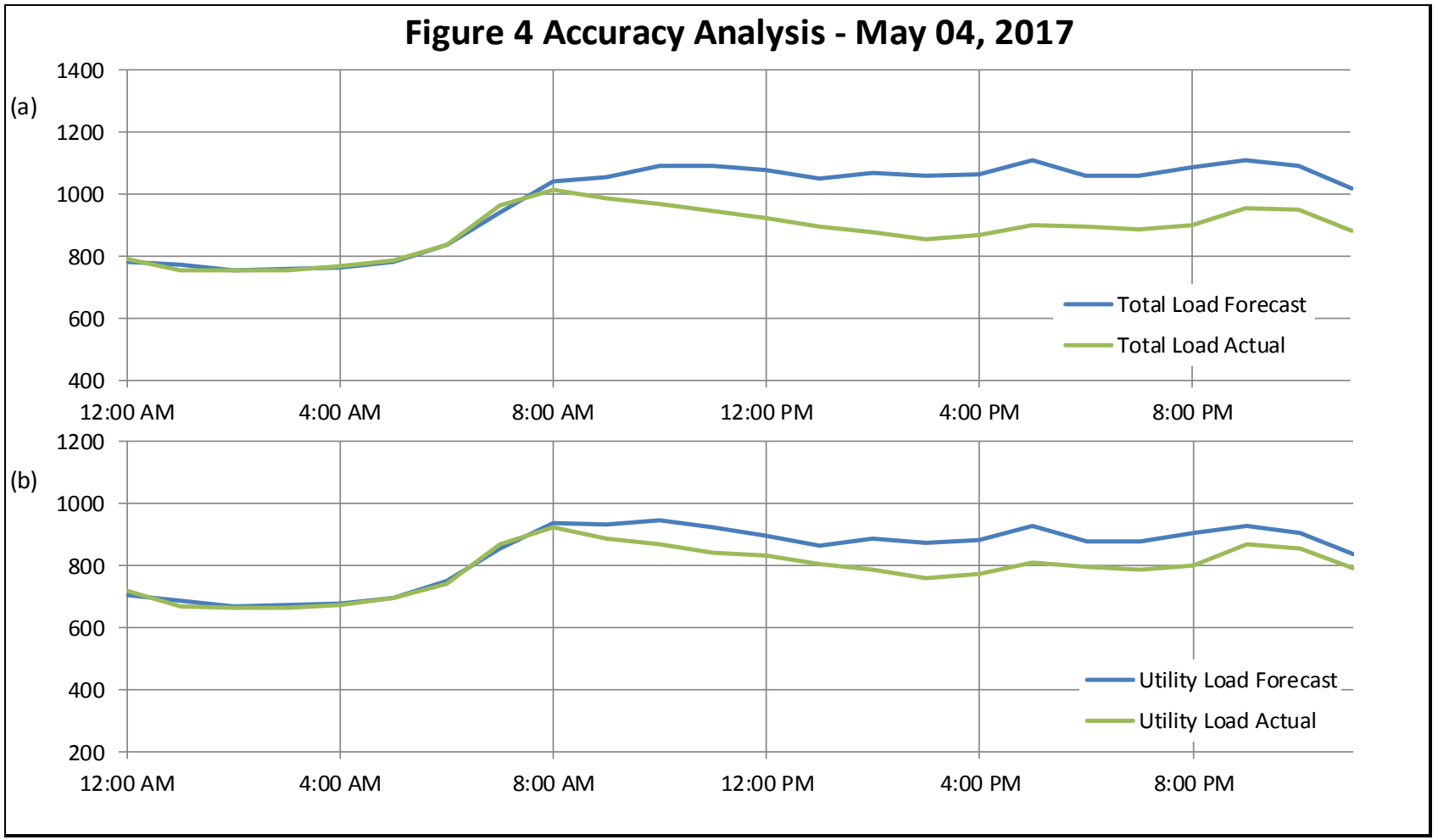


Figure 4 Accuracy Analysis - May 04, 2017
(a)
1400
1200
1000
800
600
400
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
Total Load Forecast
Total Load Actual
(b)
1200
1000
800
600
400
200
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
Utility Load Forecast
Utility Load Actual

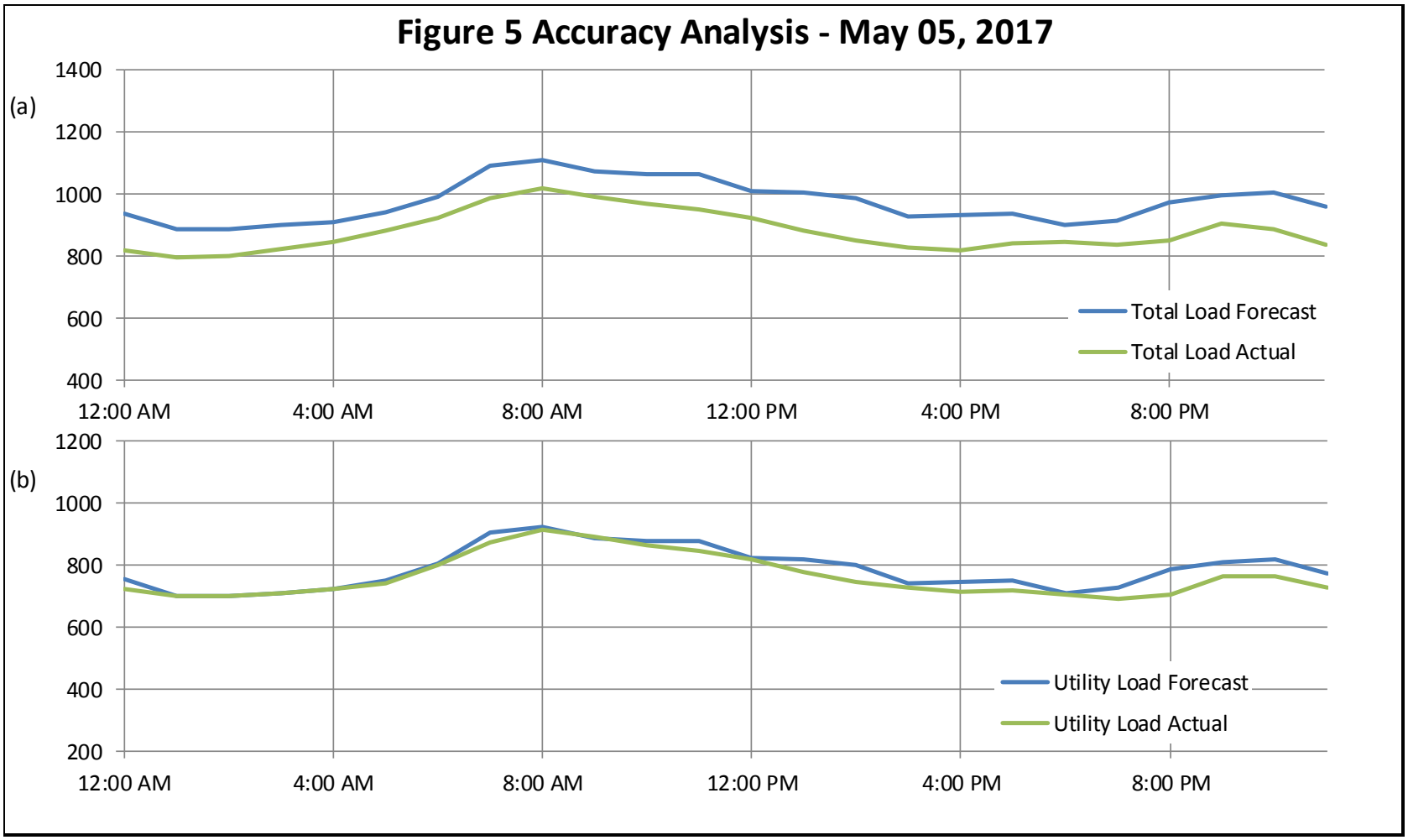


Figure 5 Accuracy Analysis - May 05, 2017
(a)
1400
1200
1000
800
600
400
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
Total Load Forecast
Total Load Actual
(b)
1200
1000
800
600
400
200
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
Utility Load Forecast
Utility Load Actual

Figure 6 Accuracy Analysis - May 07, 2017

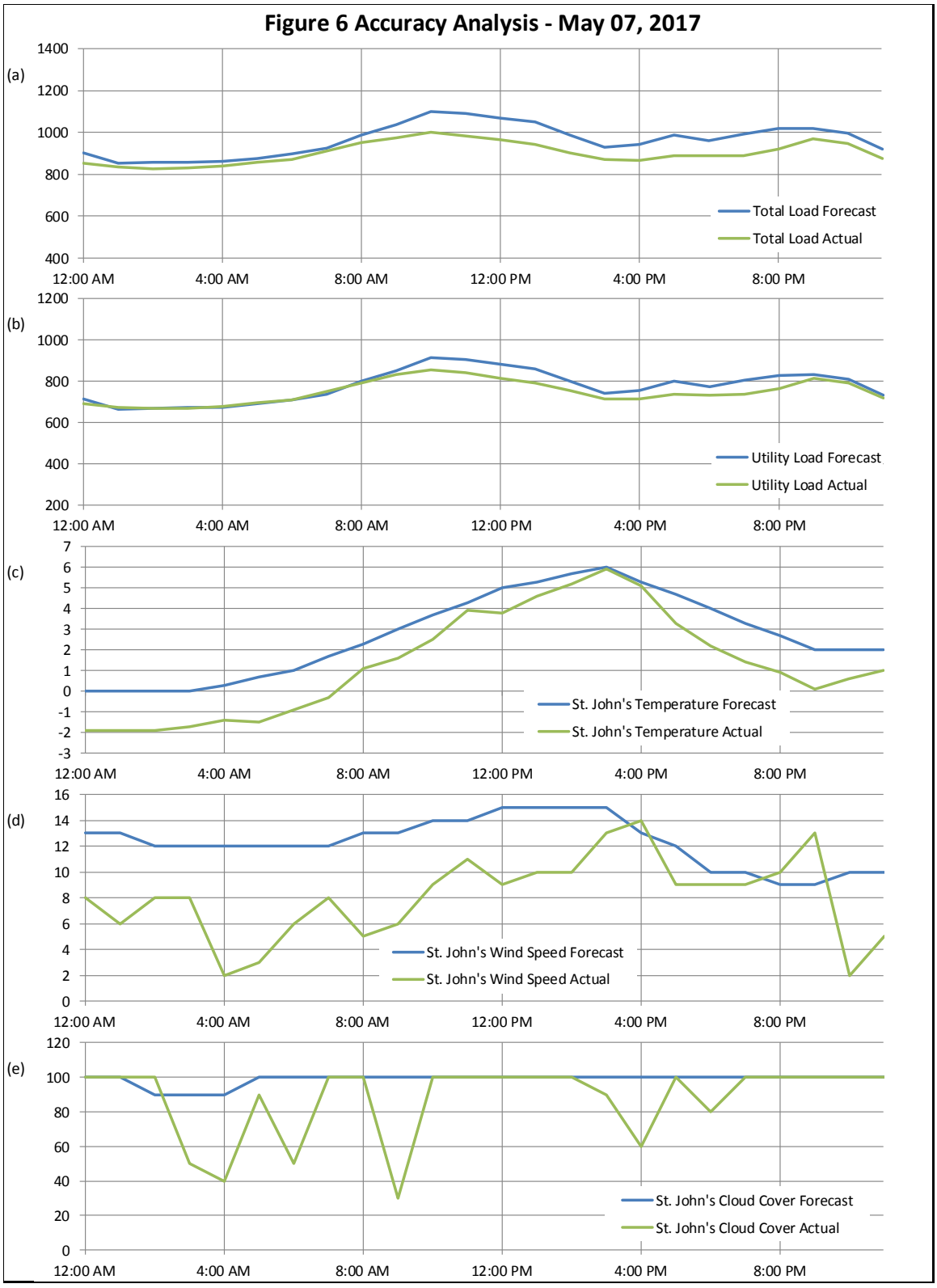


Figure 7 Accuracy Analysis - Jun 14, 2017

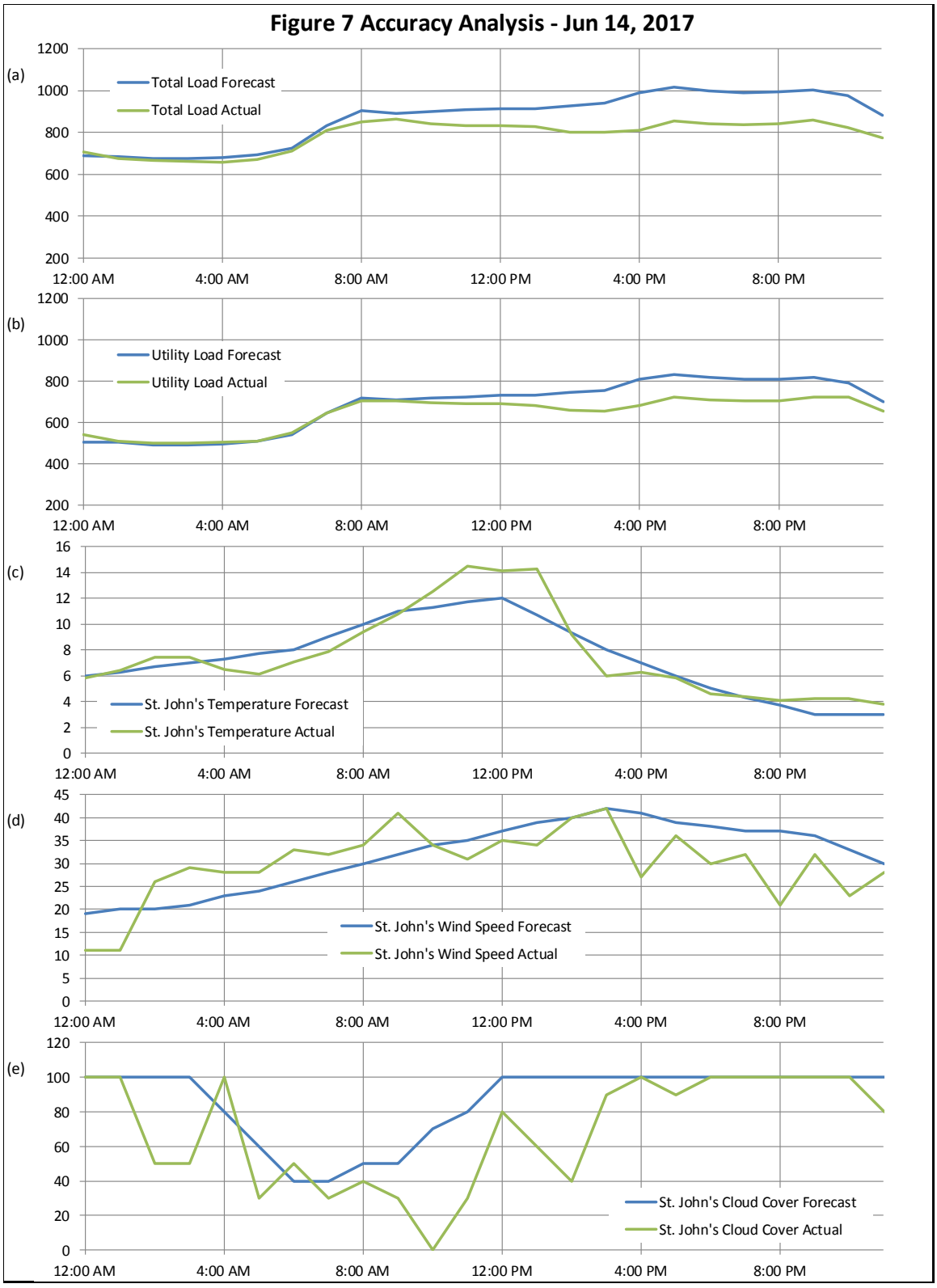
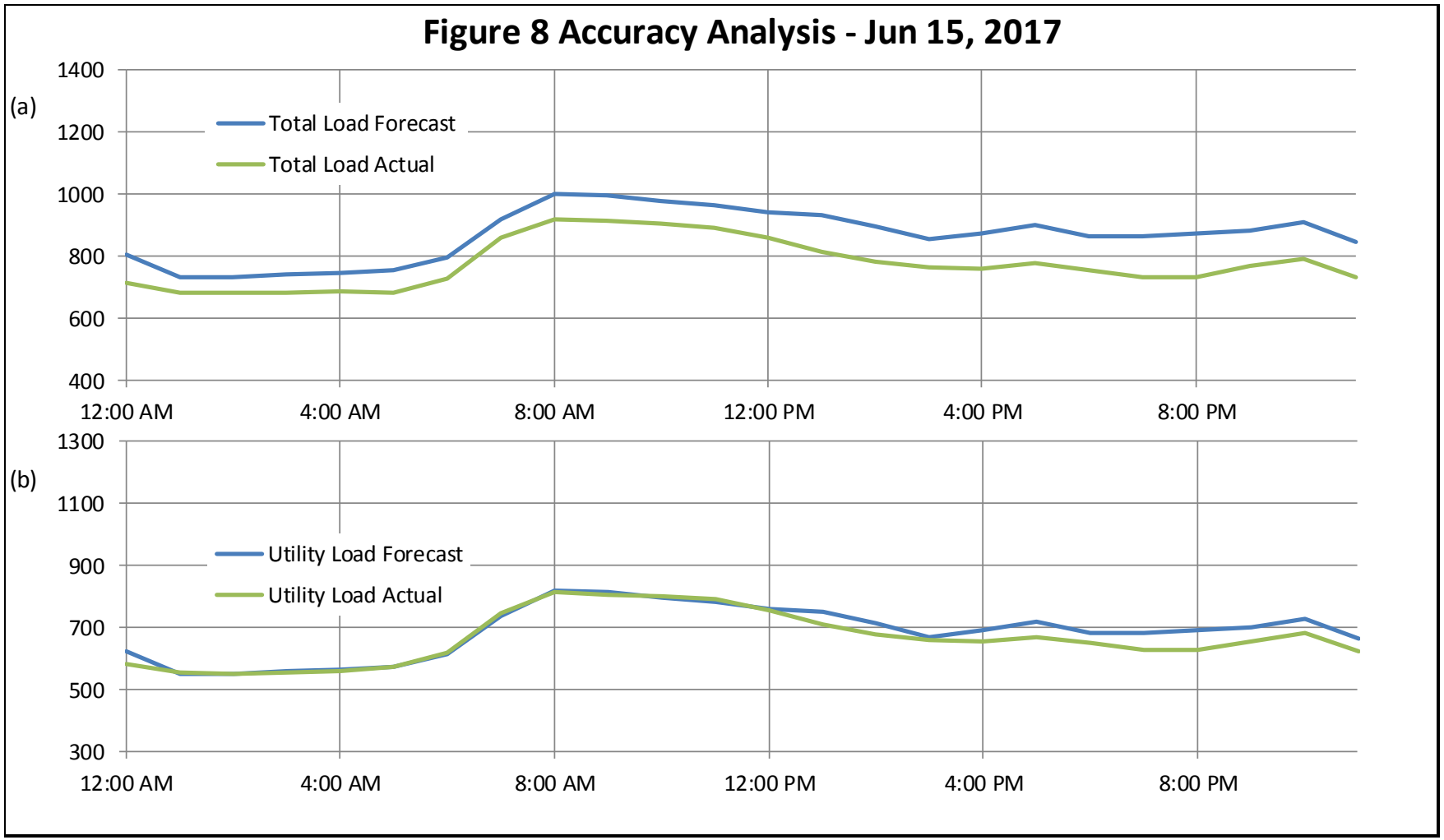


Figure 8 Accuracy Analysis - Jun 15, 2017



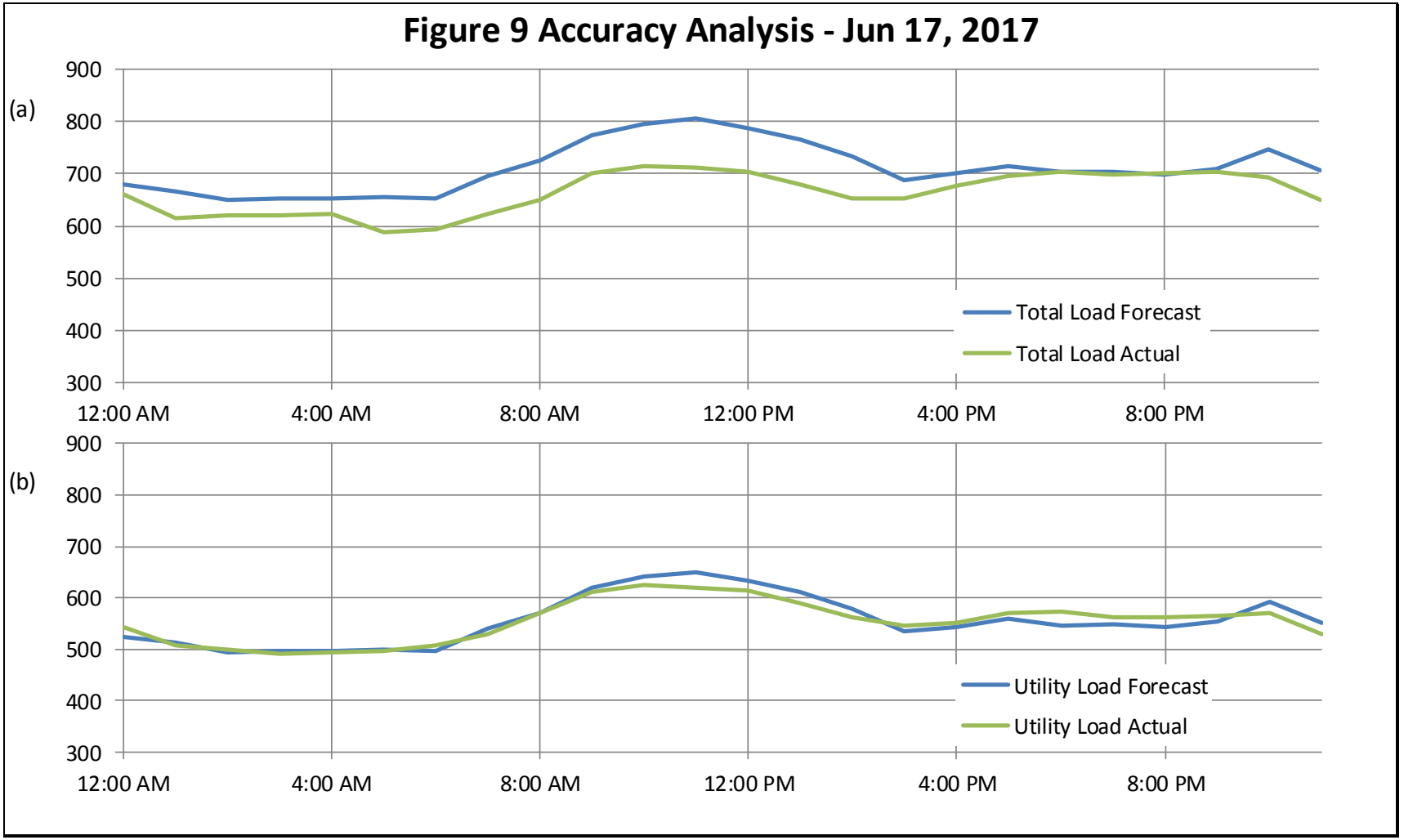


Figure 9 Accuracy Analysis - Jun 17, 2017
(a)
900
800
700
600
500
400
300
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
Total Load Forecast
Total Load Actual
(b)
900
800
700
600
500
400
300
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
Utility Load Forecast
Utility Load Actual

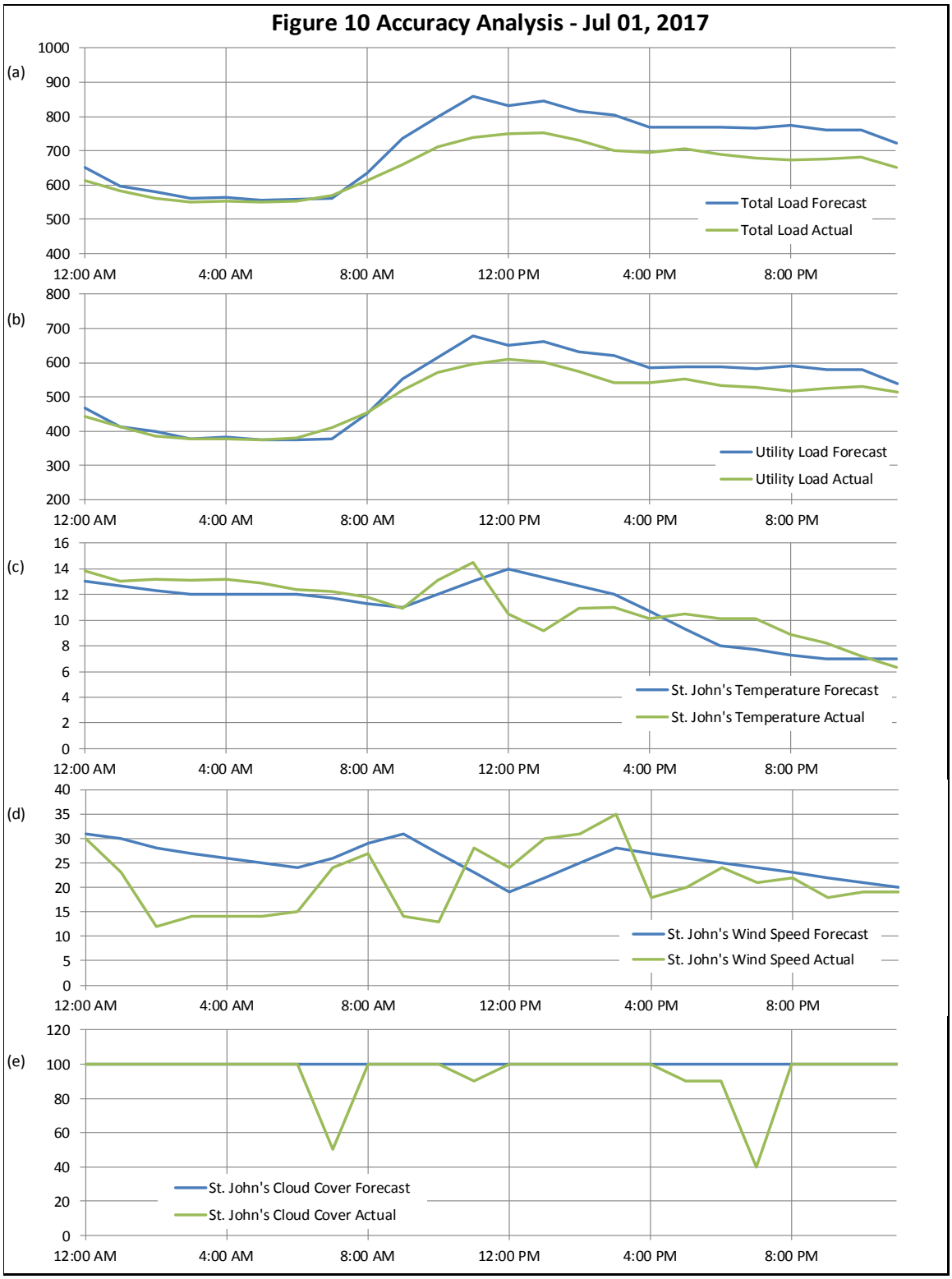


Figure 10 Accuracy Analysis - Jul 01, 2017
(a)
1000
900
800
700
600
500
400
Total Load Forecast
Total Load Actual
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
(b)
800
700
600
500
400
300
200
Utility Load Forecast
Utility Load Actual
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
(c)
16
14
12
10
8
6
4
2
0
St. John's Temperature Forecast
St. John's Temperature Actual
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
(d)
40
35
30
25
20
15
10
5
0
St. John's Wind Speed Forecast
St. John's Wind Speed Actual
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
(e)
120
100
80
60
40
20
0
St. John's Cloud Cover Forecast
St. John's Cloud Cover Actual
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM

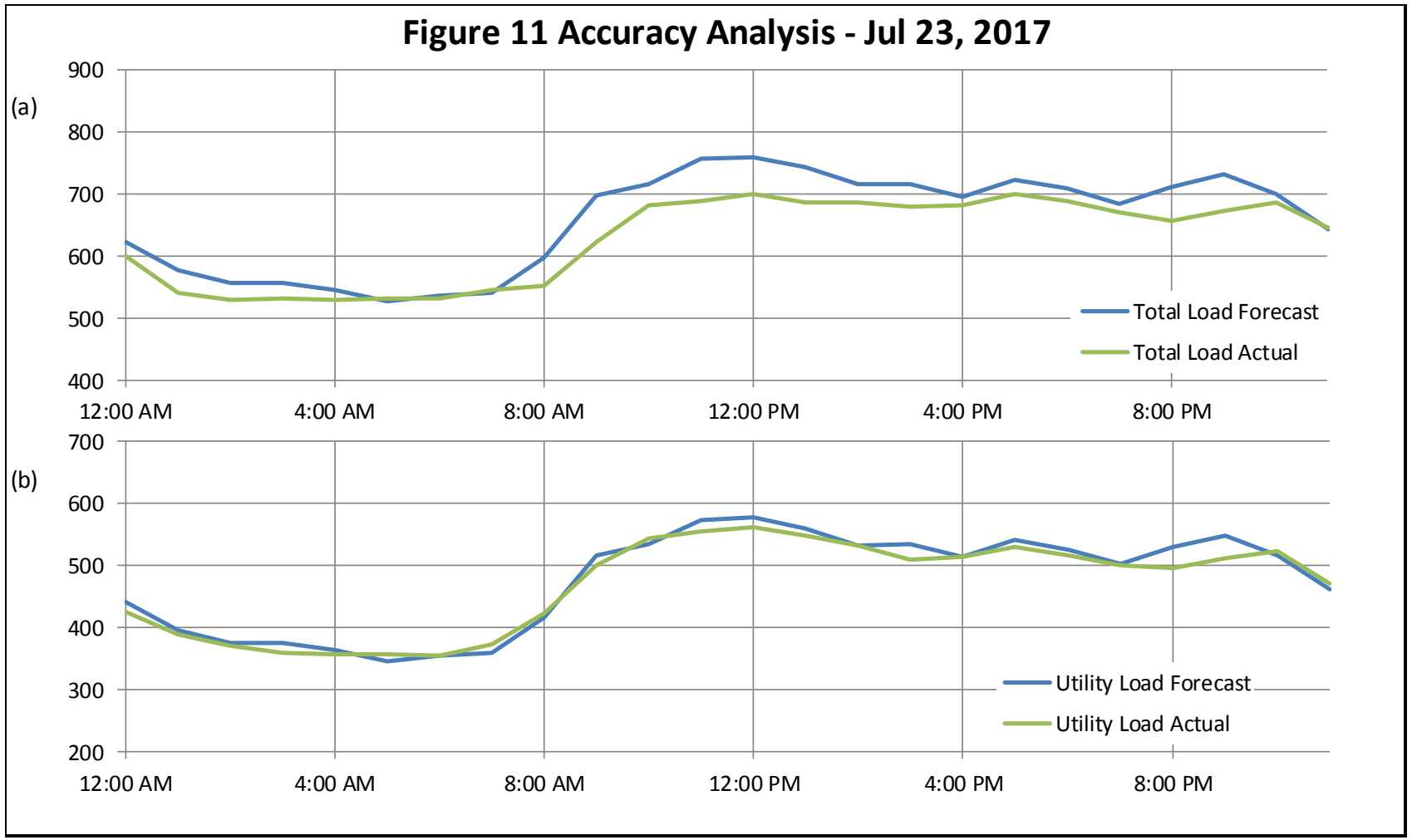


Figure 11 Accuracy Analysis - Jul 23, 2017
(a)
900
800
700
600
500
400
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
Total Load Forecast
Total Load Actual
(b)
700
600
500
400
300
200
12:00 AM
4:00 AM
8:00 AM
12:00 PM
4:00 PM
8:00 PM
Utility Load Forecast
Utility Load Actual

Figure 12 Accuracy Analysis - Aug 05, 2017

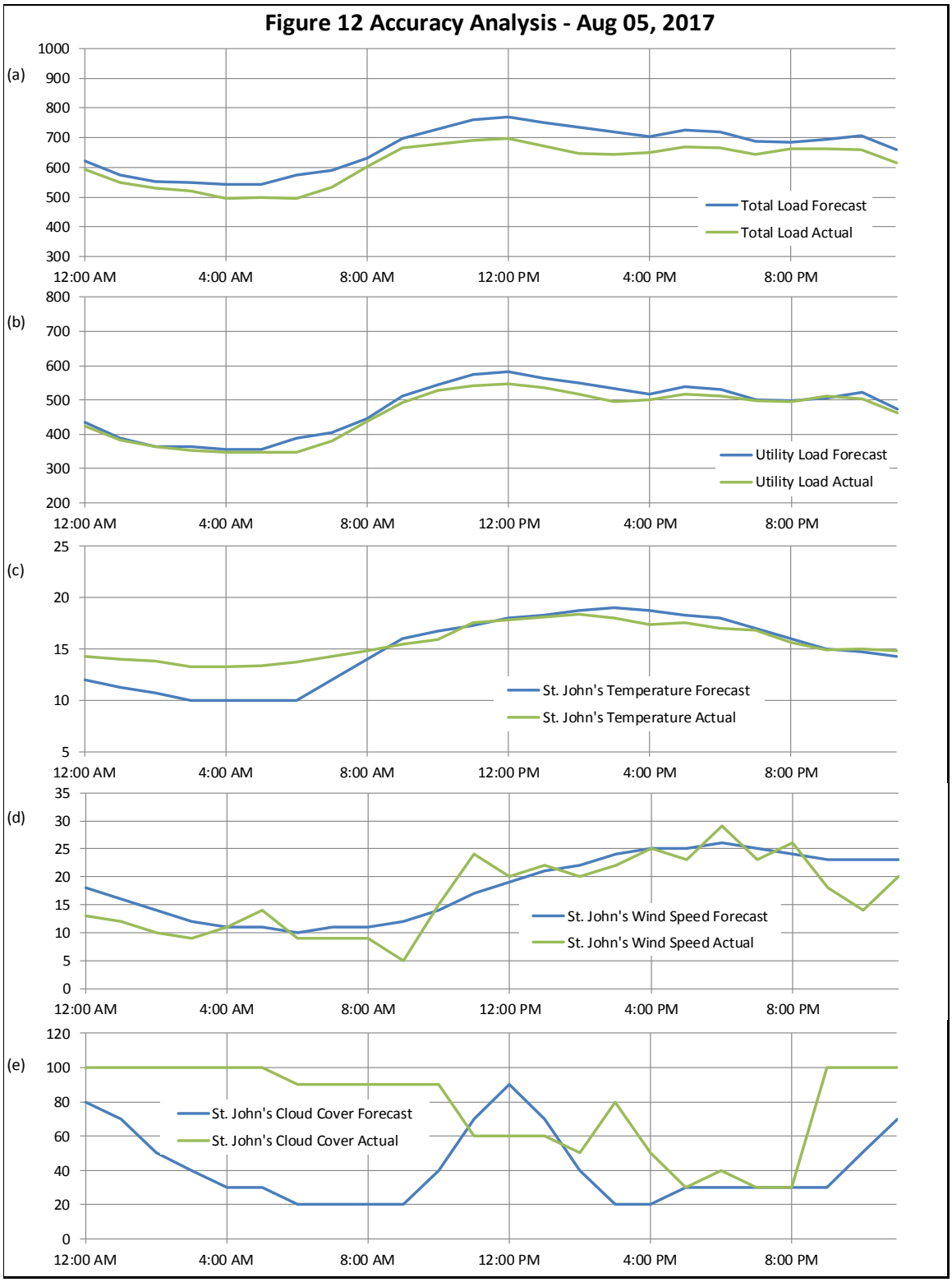


Figure 13 Accuracy Analysis - Aug 26, 2017

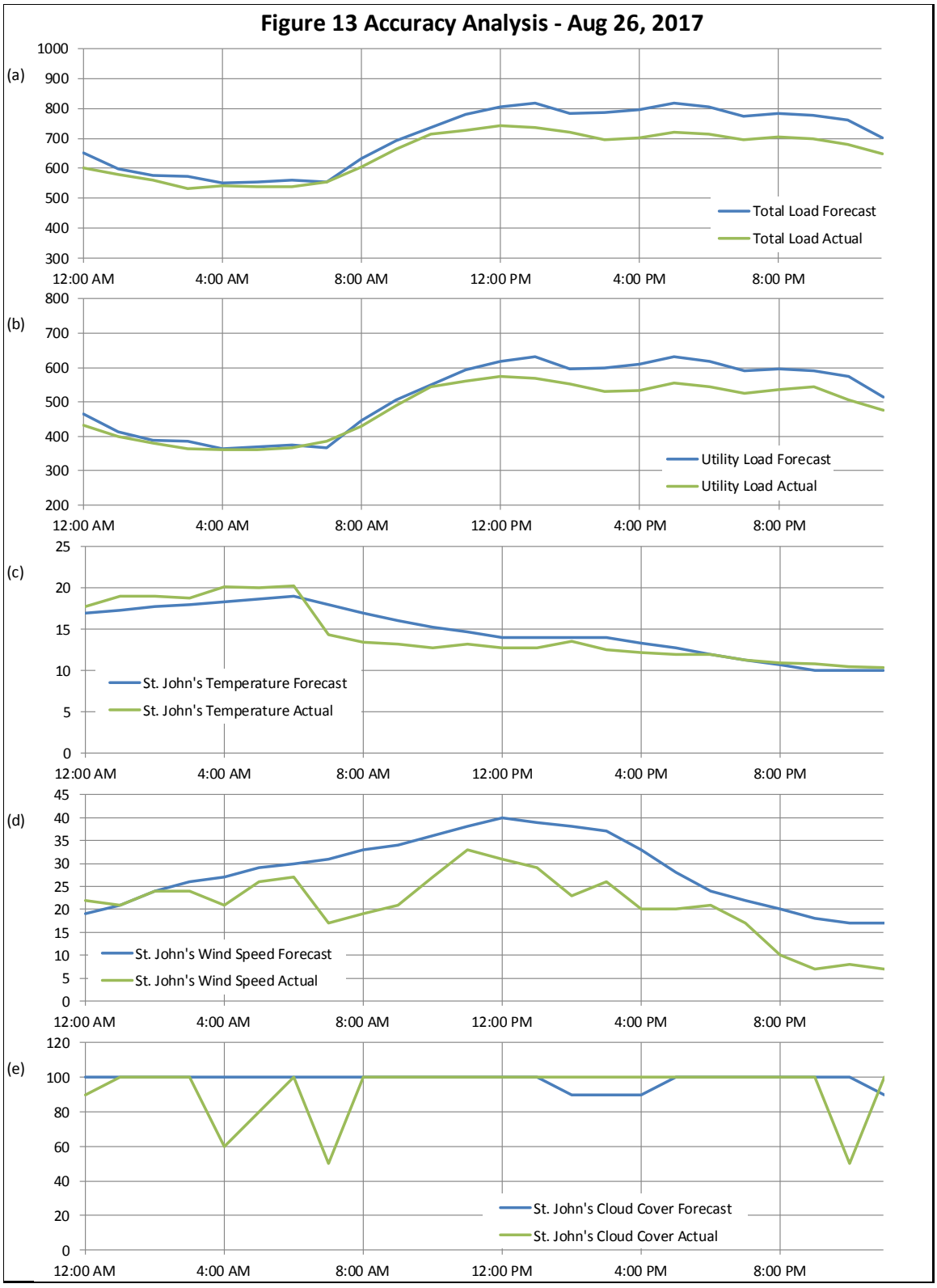


Figure 14 Accuracy Analysis - Aug 30, 2017

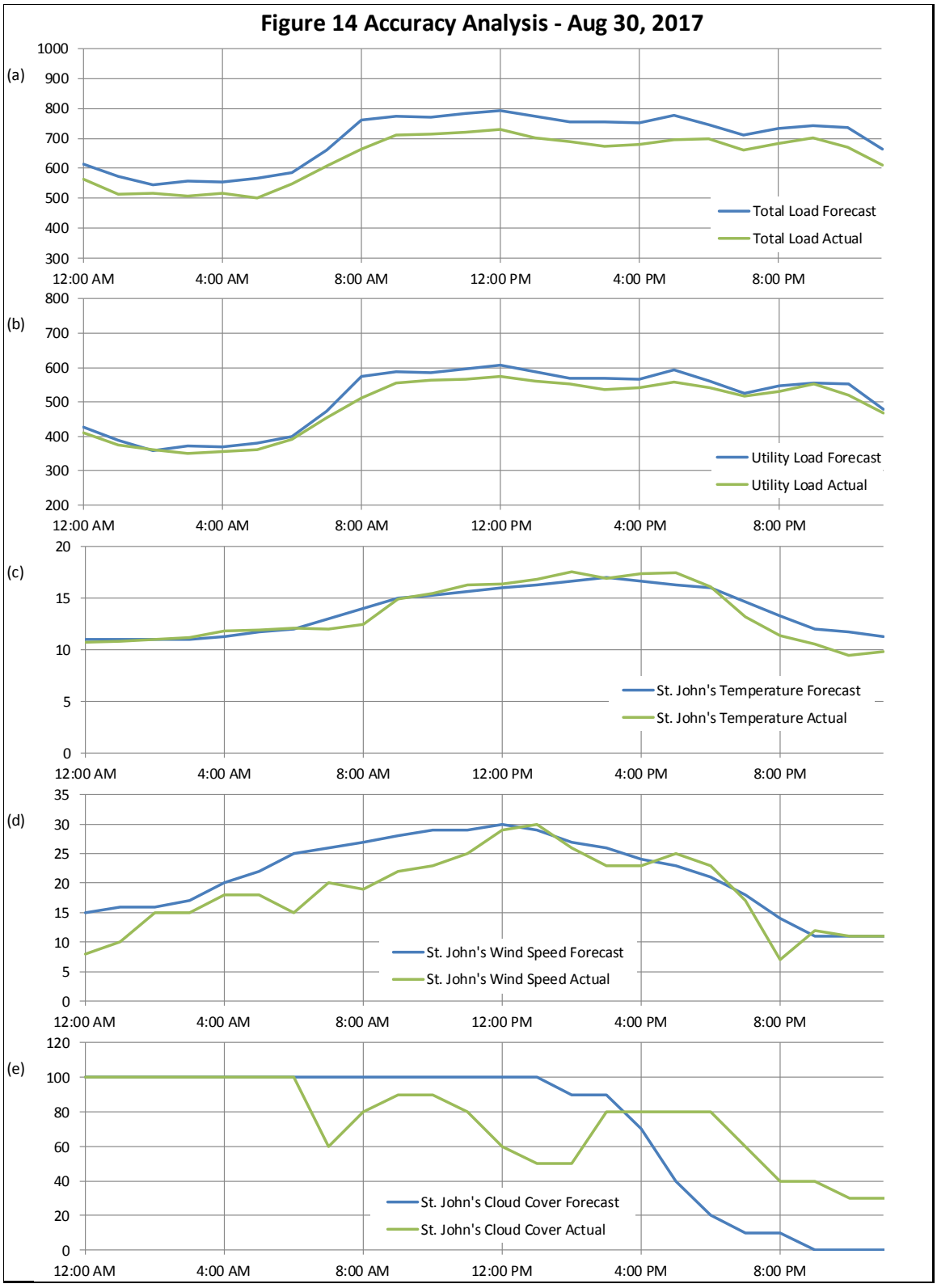


Figure 15 Accuracy Analysis - Sep 02, 2017

Figure 16 Accuracy Analysis - Sep 21, 2017

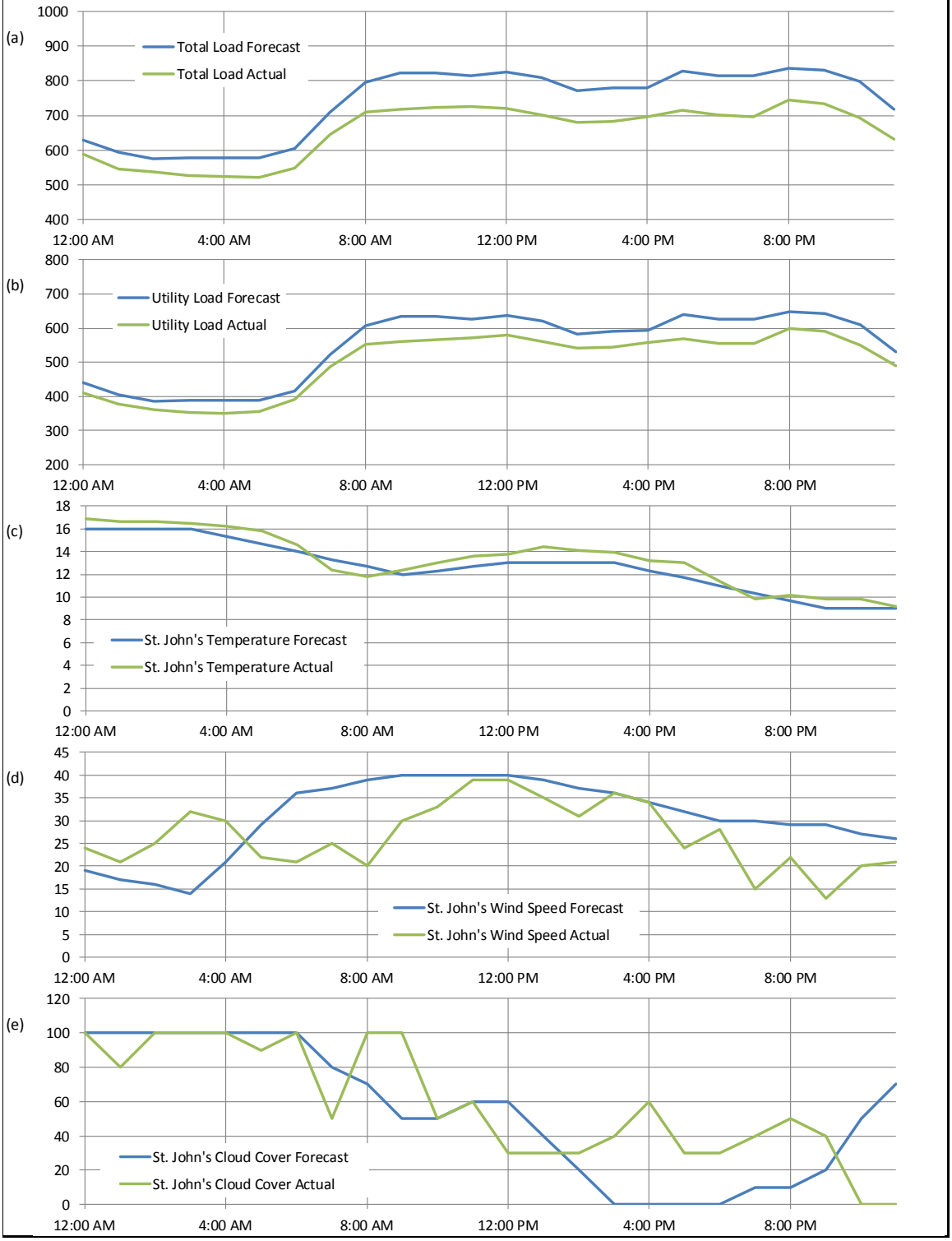


Figure 17 Accuracy Analysis - Sep 25, 2017

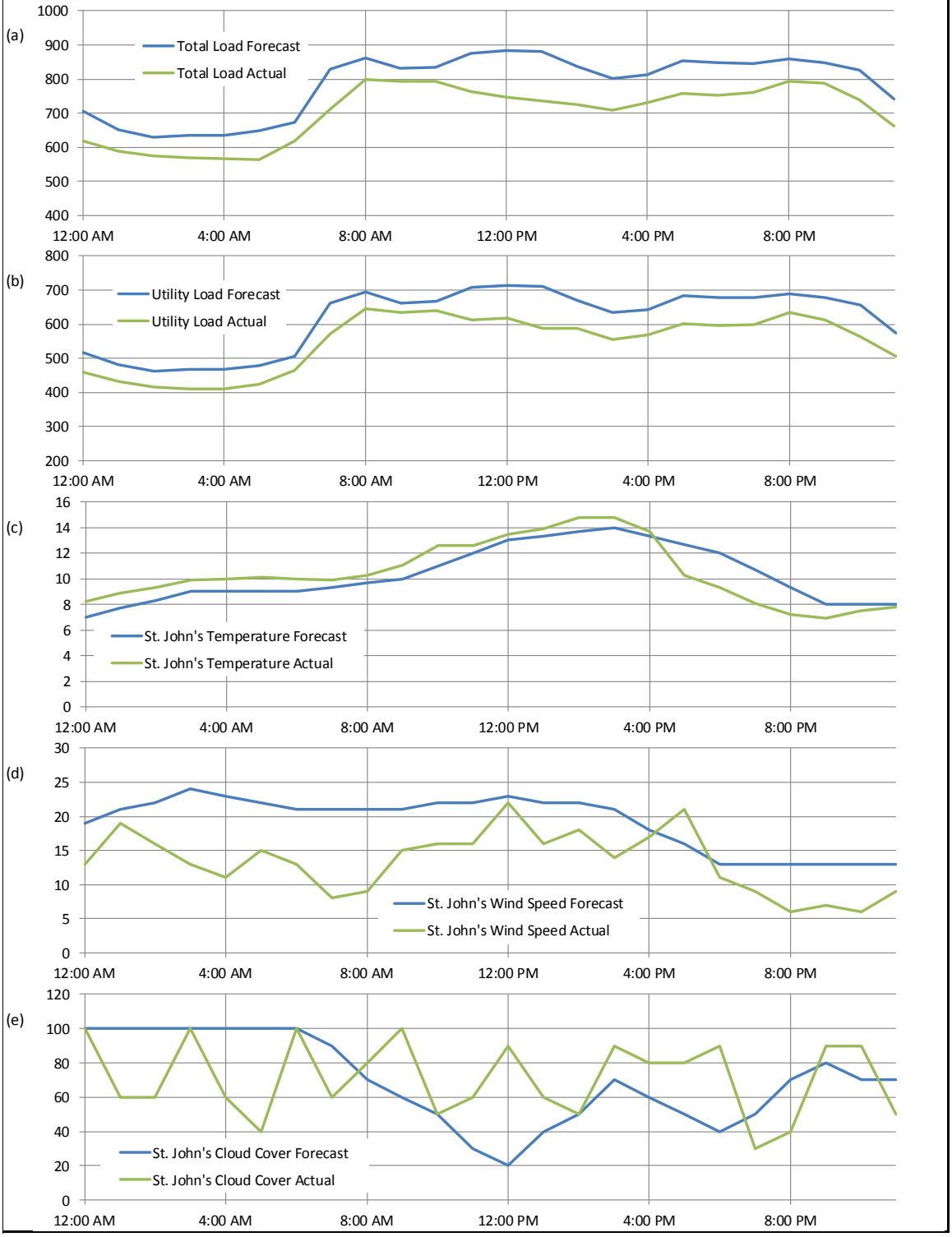


Figure 18 Accuracy Analysis - Oct 11, 2017