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May 12, 2016

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 – May 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 2016.*

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/bs

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey Stirling Scales
Sheryl Nisenbaum – Praxair Canada Inc.
ecc: Roberta Frampton Benefiel – Grand Riverkeeper Labrador
Dennis Brown, Q.C. – Consumer Advocate
Thomas O' Reilly , Q.C. – Cox & Palmer
Danny Dumaresque

Accuracy of Nostradamus Load Forecasting at Newfoundland and Labrador Hydro November 2016 to April 2017

May 12, 2017

A Report to the Board of Commissioners of Public Utilities

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1.0 Nostradamus Load Forecasting

1.1 Nostradamus

Newfoundland and Labrador Hydro (Hydro) uses software called Nostradamus, by Ventyx, 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."[1]

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 Amec Foster Wheeler (Amec) to provide the weather parameters in the form of twice daily, hourly weather forecasts for a seven-day period. At the same time as the weather forecast data is provided, Amec also provides recent observed data at the same locations. The forecast and actual data are automatically retrieved from Amec and input to the Nostradamus database.

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

[1] Nostradamus User Guide, Release 8.2, Ventyx, an ABB Company, November 2014.

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 August 1, 2013, to June 30, 2016, is 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 daylight hours each day is input to Nostradamus.

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

During the process of training the Nostradamus model, the model 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.

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.

1.2.3 Supply and Demand Status Reporting

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 since December 2014. Directions further to the Board's Phase One Report provided on April 13, 2016, indicated that the reporting frequency should change to semi-annually[2], commencing in November 2016.

The forecast peak reported to the Board on the daily Supply and Demand Status Report is the forecast peak as of 7:20 am. 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 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.

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

1.3 Potential Sources of Variance

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

- Differences in the industrial load forecast due to unexpected changes in customer loads;
- Inaccuracies in the weather forecast, particularly temperature, wind speed or cloud cover; and
- Non-uniform customer behaviour which results in unpredictability.

2.0 Forecast Accuracy Summary

2.1 Analysis

This report examines the accuracy of Hydro's forecasting process for November 2016 through April 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 is also presented in Figure 1.

This reporting period covers the early winter 2016 to early spring 2017. The total peak load during the period varied between 907 MW (November 21, 2016) and 1708 MW (February 8, 2017). The available generation varied from 1410 MW to 2025 MW and Island system reserves were sufficient throughout. In this period peak loads are a function of heating load.

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 shows that the forecasting process consistently overestimates the peak of the total load. This is usually because of an overestimate in the industrial load forecast; often by 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

2.2.1 Voltage Reduction Adjustments

For the following hours and corresponding dates, Newfoundland Power had requested a short-term voltage reduction in order to reduce the peak. Therefore, System Operations increased the actual Avalon and Island utility load values in Nostradamus during these hours by 10 and 20 MW, respectively (estimated from the observed decrease in the load when the voltage reduction was put in place). These adjustments were made to the Nostradamus data so that in the future, when the data during these periods is used in training, Nostradamus will use a value that is not affected by the requested voltage reduction. The dates and times are as follows:

- January 14, 2017, between 5:00 pm and 7:00 pm;
- February 05, 2017, between 6:00 pm and 8:00 pm;
- February 07, 2017, between 5:00 pm and 7:00 pm; and
- February 08, 2017, between 8:00 am and 9:00 am.

2.2.2 Load Curtailment Adjustment

On February 7, 2017, Hydro requested that Newfoundland Power curtail load (under the Curtailable Load arrangements) to reduce both the afternoon peak by approximately 11 MW. Therefore, System Operations adjusted the Avalon and Island utility load values input to Nostradamus upwards by 11 MW to represent what the load would have been without curtailments. This adjustment was made to the Nostradamus data so that in the future, when February 2017 data is used in training the forecasting model, Nostradamus will use a value that is not affected by the curtailments. In addition to voltage reduction adjustment discussed in

section 2.2.1, the net adjustment for February 7, 2017 was a 21 MW and 31 MW increase in the Avalon and Island values respectively.

2.2.3 Other Adjustments

On March 11, Newfoundland Power customers on the Avalon and the Burin Peninsula experienced power outages when severe winds affected transmission lines[3] TL218, TL236, TL212, and TL219. Actual Avalon and Island loads for these two days were adjusted using the March 11, 2017 load forecast issued at 1320 hours as the last known good forecast before the power outage. This adjustment was made to the Nostradamus data so that in the future, when March 2017 data is used in training the forecasting model, Nostradamus will use a value that is not affected by this major event.

Between April 6, 2017 and April 10, 2017, Nostradamus encountered network issues that prevented importing the actual load values which resulted in a corrupted forecast. This was corrected by manually importing the missing actual values and adjusting the forecast to match the actual values. This improved the forecast for subsequent days.

2.3 Days of High Error

Shaded dates in Tables 2 and 3 indicate 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. This includes the days in 2016 of November 12, 21, 22, and December 17, 25, and the days in 2017 of January 5, 22, 23, February 9, 12, 25, March 11, 16, April 1, 6, and 29. The analysis for these days is provided in the following sections.

2.3.1 November 12, 2016

On November 12, 2016, the forecast peak at 7:20 am, as reported to the Board, was 1225 MW; the actual reported peak was 1145 MW. The absolute difference was 80 MW, 7.0% of the actual peak. Figure 4 includes an hourly plot of the load forecast for November 12, 2016, as well

[3] See power outage advisories 2017-H-014-a and 2017-H-015-a

as several charts which examine components of the load forecast 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 5:00 pm peak of 1224 MW; the peak was actually at 6:00 pm, and was 1123 MW.

Figure 4(b) shows the hourly distribution of the utility load forecast only. The error in the forecast of the utility load was almost as high as the error in the forecast of total load.

Figure 4(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 5:00 pm temperature was 2 degrees higher than forecast, so errors in the temperature forecast may explain some of the error in the load forecast.

Figure 4(d) shows the actual wind speed in St. John's compared to the forecast. For most of the day the wind forecast overestimated the wind speed which could also have contributed to an overestimate of the load. Figure 4(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for most of the day. At 5:00 pm, cloud cover was underestimated by 50%, but this would have not contributed to the error as the forecast would have predicted lower load.

The discrepancy between actual and forecast utility load for November 12, 2016, was most likely a result of errors in the temperature and wind forecast. An overestimate of the load results in more than enough reserve being available. The updates during the day improved the forecast somewhat; by mid-afternoon the error was 3.0%.

2.3.2 November 21, 2016

On November 21, 2016, the forecast peak at 7:20 am, as reported to the Board, was 985 MW; the actual reported peak was 907 MW. The absolute difference was 78 MW, 8.5% of the actual peak. Figure 5 includes an hourly plot of the load forecast for November 21, 2016, 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 a 5:00 pm peak of 983 MW; the actual peak was 906 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 50 MW below forecast on November 21, 2016.

The discrepancy between actual and forecast load for November 21, 2016, was a result of errors in the industrial load forecast. An overestimate of the load results in more than enough reserve being available. The updates during the day 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.

2.3.3 November 22, 2016

On November 22, 2016, the forecast peak at 7:20 am, as reported to the Board, was 990 MW; the actual reported peak was 921 MW. The absolute difference was 69 MW, 7.5% of the actual peak. Figure 6 includes an hourly plot of the load forecast for November 22, 2016, as well as actual load 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 5:00 pm peak of 989 MW; the peak was actually 917 MW, and was at 6:00 pm.

Figure 6(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 23 MW below forecast on November 22, 2016.

The discrepancy between actual and forecast load for November 22, 2016, was a result of errors in the industrial load forecast. An overestimate of the load results in more than enough reserve being available. The updates during the day improved the forecast somewhat; by late afternoon the error was 3.6%.

2.3.4 December 17, 2016

On December 17, 2016, the forecast peak at 7:20 am, as reported to the Board, was 1575 MW; the actual reported peak was 1672 MW. The absolute difference was 97 MW, 5.8% of the actual peak. Figure 7 includes an hourly plot of the load forecast for December 17, 2016, as well as actual load chart 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 1576 MW; the actual peak was 1664 MW.

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 5:00 pm temperature was 1 degree lower than forecast, so errors in the temperature forecast may explain some of the error in the load forecast.

Figure 7(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 5:00 pm wind speed was 8 km/h lower than forecast which could also have contributed to an underestimate of the load. Figure 7(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for most of the day. At 5:00 pm, cloud cover was overestimated by 40%, but this would have not contributed to the error as the forecast would have predicted higher load.

The discrepancy between actual and forecast load for December 17, 2016, was likely a result of multiple factors, including errors in the temperature and wind forecasts and non-uniform customer behaviour which results in unpredictability in the load. The updates during the day 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 December 25, 2016

On December 25, 2016, the forecast peak at 7:20 am, as reported to the Board, was 1410 MW; the actual reported peak was 1320 MW. The absolute difference was 90 MW, 6.8% of the actual peak. Figure 8 includes an hourly plot of the load forecast for December 25, 2016, 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 a 5:00 pm peak of 1409 MW; the actual peak was 1318 MW and was at 11:00 am.

Figure 8(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. It is apparent from the plot that the error in the load forecast only somewhat improved after excluding the industrial component and therefore, the error was not fully attributable due to discrepancies in the industrial forecast.

Figure 8(c) shows the actual temperature in St. John's compared to the forecast. The forecast was accurate for most of the day.

Figure 8(d) shows the actual wind speed in St. John's compared to the forecast. For most of the day the wind forecast overestimated the wind speed which could have contributed to an overestimate of the load. Actual 5:00 pm wind speed was 11 km/h higher than forecast which could also have contributed to an overestimate of the load. Figure 7(e) shows the actual cloud cover in St. John's compared to the forecast; it was accurate for the entire day.

The discrepancy between actual and forecast load for December 25, 2016, was likely, in part, a result of errors in the wind forecast. In addition, non-uniform customer behavior and the fact that the day was a holiday and a weekend may have contributed to the error. The actual load profile was relatively flat for a winter day while the forecast predicted strong peaks at 11:00 am and 4:00 pm. The updates during the day 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.

2.3.6 January 5, 2017

On January 5, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1430 MW; the actual reported peak was 1349 MW. The absolute difference was 81 MW, 6.0% of the actual peak. Figure 9 includes an hourly plot of the load forecast for January 5, 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 a 6:00 pm peak of 1431 MW; the actual peak was 1341 MW and was at 5:00 pm.

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 40 MW below forecast on January 5, 2017.
The discrepancy between actual and forecast load for January 5, 2017, was a result of errors in the industrial forecast. An overestimate of the load results in more than enough reserve being available. The updates during the day improved the forecast somewhat; by late afternoon the error was 1.8%.

2.3.7 January 22, 2017

On January 22, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1500 MW; the actual reported peak was 1406 MW. The absolute difference was 94 MW, 6.7% of the actual peak. Figure 10 includes an hourly plot of the load forecast for January 22, 2017, as well as actual load 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 a 5:00 pm peak of 1502 MW; the actual peak was 1400 MW.

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 trend predicted by the forecast was somewhat close to the actual trend throughout the day but the forecast consistently overestimated the temperature for most of the day. The actual 5:00 pm

temperature was 1 degree lower than 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. For most of the day the wind forecast overestimated the wind speed which could have contributed to an overestimate of the load. The actual 5:00 pm wind speed was 19 km/h lower than 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 January 22, 2017, was likely a result of multiple factors, including errors in the wind forecasts and non-uniform customer behaviour which results in unpredictability in the load. By mid afternoon, the forecast had improved and by late afternoon the error was 2.3%.

2.3.8 January 23, 2017

On January 23, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1620 MW; the actual reported peak was 1517 MW. The absolute difference was 103 MW, 6.8% of the actual peak. Figure 11 includes an hourly plot of the load forecast for January 23, 2017, 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 5:00 pm peak of 1621 MW; the actual peak was 1508 MW and was at 6:00 pm.

Figure 11(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 11(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 5:00 pm temperature was 1 degree higher than forecast, so errors in the temperature forecast may explain some of the error in the load forecast.

Figure 11(d) shows the actual wind speed in St. John's compared to the forecast; it was poor for the entire day. For the whole day the wind forecast overestimated the wind speed which could also have contributed to an overestimate of the load. Figure 11(e) shows the actual cloud cover in St. John's compared to the forecast; it was accurate for morning period but poor for most of the evening. At 5:00 pm, cloud cover was accurate.

The discrepancy between actual and forecast load for January 23, 2017, was a result of errors in the temperature and wind forecast. The updates during the day improved the forecast somewhat; by late afternoon the error was 2.0%.

2.3.9 February 9, 2017

On February 9, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1530 MW; the actual reported peak was 1415 MW. The absolute difference was 115 MW, 8.2% of the actual peak. Figure 12 includes an hourly plot of the load forecast for February 9, 2017, as well as actual load 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 6:00 pm peak of 1532 MW; the actual peak was 1407 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 higher 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 trend predicted by the forecast was somewhat close to the actual trend throughout the day with the forecast consistently underestimating the temperature for most of the day. The actual 6:00 pm temperature was 1 degree higher than forecast, so errors in the temperature forecast may explain some of the error in the load forecast.

Figure 12(d) shows the actual wind speed in St. John's compared to the forecast. For most of the day the wind forecast overestimated the wind speed which could also have contributed to an overestimate of the load. Actual 6:00 pm was 9 km/h lower than forecast. Figure 12(e) shows the actual cloud cover in St. John's compared to the forecast; it was relatively good for most of the day. At 6:00 pm, cloud cover was overestimated by 20%.

The discrepancy between actual and forecast utility load for February 9, 2017, was a result of errors in the weather forecast. An overestimate of the load results in more than enough reserve being available. The updates during the day improved the forecast somewhat; by mid-afternoon the error was 3.0%.

2.3.10 February 12, 2017

On February 12, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1570 MW; the actual reported peak was 1493 MW. The absolute difference was 77 MW, 5.1% of the actual peak. Figure 13 includes an hourly plot of the load forecast for February 12, 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 6:00 pm peak of 1569 MW; the actual peak was 1485 MW and was at 9:00 am.

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 trend predicted by the forecast was somewhat close to the actual trend throughout the day with the forecast consistently underestimating the temperature for almost the entire day. The actual 6:00 pm temperature was 1 degree higher than forecast, so errors in the temperature forecast may explain some of the error in the load forecast.

Figure 13(d) shows the actual wind speed in St. John's compared to the forecast. For most of the day the wind forecast overestimated the wind speed which could also have contributed to an overestimate of the load. Actual 6:00 pm wind speed was 17 km/h lower than forecast. Figure 4(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for most of the day. At 6:00 pm, cloud cover was underestimated by 10%, but this would have not contributed to the error as the forecast would have predicted lower load.

The discrepancy between actual and forecast load for February 12, 2017, was a result of errors in the temperature and wind forecast. The updates during the day 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 February 25, 2017

On February 25, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1370 MW; the actual reported peak was 1273 MW. The absolute difference was 97 MW, 7.6% of the actual peak. Figure 14 includes an hourly plot of the load forecast for February 25, 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 6:00 pm peak of 1370 MW; the actual peak was 1268 MW and was at 7:00 pm.

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 almost as high as 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 poor for most of the day with the forecast underestimating the temperature for a large portion of the day. The actual 6:00 pm temperature was more than 1 degree higher than forecast, so errors in the temperature forecast may explain some of the error in the load forecast.

Figure 14(d) shows the actual wind speed in St. John's compared to the forecast. For most of the day the wind forecast overestimated the wind speed which could also have contributed to an overestimate of the load. Actual 6:00 pm wind speed was 7 km/h lower than forecast. Figure 14(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 utility load for February 25, 2017, was a result of errors in the temperature and wind forecasts. An overestimate of the load results in more than enough reserve being available. The updates during the day improved the forecast somewhat; by mid-afternoon the error was 1.4%.

2.3.12 March 11, 2017

On March 11, 2017, the peak of the 7:20 am forecast was 1620 MW and was forecast to occur at 5:00 pm. However, because of the supply disruption noted in section 2.2, the actual peak was 1426 MW and occurred at 10:00 am, prior to when the customer interruptions began. As

noted in Section 2.2, Nostradamus will use the forecast peak and load data in future training using this period.

2.3.13 March 16, 2017

On March 16, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1300 MW; the actual reported peak was 1216 MW. The absolute difference was 84 MW, 6.9% of the actual peak. Figure 15 includes an hourly plot of the load forecast for March 16, 2017 as well as actual load chart 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 an 8:00 pm peak of 1299 MW; the actual peak was 1210 MW.

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 almost as high as the error in the forecast of total load.

Figure 15(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 with the forecast underestimating temperature for the earlier part of the day. The actual 8:00 pm temperature was correctly predicted by the forecast.

Figure 15(d) shows the actual wind speed in St. John's compared to the forecast. The wind forecast overestimated the wind speed in the afternoon and the evening which could have contributed to an overestimate of the load. Actual 8:00 pm wind speed was 3 km/h lower than forecast. Figure 4(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for most of the day. At 8:00 pm, cloud cover was overestimated by 20%.

The discrepancy between actual and forecast utility load for March 16, 2017, was a result of errors in the wind and cloud cover forecast and other factors not modelled by Nostradamus. It has been noted in the past that the Nostradamus forecasts tend to be less accurate when the peak is at an unusual time, in this case in mid evening. The updates during the day improved the forecast somewhat; by late afternoon the error was 1.6%.

2.3.14 April 1, 2017

On April 1, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1455 MW; the actual reported peak was 1360 MW. The absolute difference was 95 MW, 7.0% of the actual peak. Figure 16 includes an hourly plot of the load forecast for April 1, 2017, as well as actual load chart 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 11:00 am peak of 1453 MW; the actual peak was 1349 MW and was at 10:00 am.

Figure 16(b) shows the hourly distribution of the utility load forecast only, i.e., the load forecast with the industrial component removed. It is apparent from the plot that the error in the load forecast did not significantly improve after excluding the industrial component.

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 11:00 am temperature was correctly predicted by the forecast.

Figure 16(d) shows the actual wind speed in St. John's compared to the forecast. For most of the day the wind forecast overestimated the wind which could have contributed to an overestimate of the load. Actual 11:00 am wind speed was 12 km/h lower than forecast. Figure

4(e) shows the actual cloud cover in St. John's compared to the forecast; it was poor for most of the day. At 11:00 am, cloud cover was overestimated by 60%.

The discrepancy between actual and forecast utility load for April 1, 2017, was a result of errors in the wind and cloud cover forecast. The updates during the day 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.

2.3.15 April 6, 2017

On April 6, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1375 MW; the actual reported peak was 1283 MW. The absolute difference was 92 MW, 7.1% of the actual peak. Figure 17 includes an hourly plot of the load forecast for April 6, 2017, as well as actual load chart 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 an 8:00 am peak of 1364 MW; the actual peak was 1272 MW. The forecast was inaccurate between midnight and 5:00 am due to network issues that prevented the successful import of historical actual load values. This was corrected by manually importing the actual values and modifying the forecast values for these hours.

Figure 17(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 55 MW below forecast on April 6, 2016. In addition, Vale load was up to 24 MW below forecast.

The discrepancy between actual and forecast load for April 6, 2017, was a result of errors in the industrial load forecast. An overestimate of the load results in more than enough reserve being available.

2.3.16 April 29, 2017

On April 29, 2017, the forecast peak at 7:20 am, as reported to the Board, was 1070 MW; the actual reported peak was 993 MW. The absolute difference was 77 MW, 7.7% of the actual peak. Figure 18 includes an hourly plot of the load forecast for April 29, 2017, as well as actual load 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 a 10:00 am peak of 1070 MW; the actual peak was 992 MW. On April 29, load forecast was not generated between 3:00 am and 11:00 am due to a network issue. The forecast issued at 2:00 am was used to examine the error.

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 almost as high as the error in the forecast of total load.

Figure 18(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 with the forecast underestimating temperature for most of the day. The actual 10:00 am temperature was 2 degrees higher than forecast, so errors in the temperature forecast may explain some of the error in the load forecast.

Figure 18(d) shows the actual wind speed in St. John's compared to the forecast. For most of the day the wind forecast overestimated the wind speed which could also have contributed to an overestimate of the load. Actual 10:00 am was 2 km/h higher than the forecast which would not help to explain the error in 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. At 10:00 am, cloud cover was overestimated by 50%.

The discrepancy between actual and forecast utility load for April 29, 2017, was a result of errors in the temperature and cloud cover forecast. An overestimate of the load results in more than enough reserve being available.

3.0 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 2.4% and 2.7% with an average of 2.6%. There does not appear to be any trend with time. The maximum absolute error varied between 7.4% and 14.6%. The maximum error was lower during December 2016, January 2017, and February 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 between December 2016 and March 2017. Only one of the ten maximum loads was overestimated (January 16, 2017); nine were underestimated. The average error was negative (-2.8%). The absolute percent error varied from 0.3% to 5.6%, with an average of 3.1%. 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 weather forecast, most significantly errors in the wind speed and cloud cover forecast, or as a result of errors in the industrial load forecast. Some errors remain unexplained – they result from customer behavior not modelled by Nostradamus.

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-Nov-16	1115	1085	1565	450
2-Nov-16	1065	1031	1545	480
3-Nov-16	995	942	1580	585
4-Nov-16	1000	1024	1580	580
5-Nov-16	1085	1024	1585	500
6-Nov-16	1120	1140	1585	465
7-Nov-16	1180	1166	1485	305
8-Nov-16	1165	1129	1475	310
9-Nov-16	1135	1123	1410	275
10-Nov-16	1155	1126	1420	265
11-Nov-16	1080	1097	1430	350
12-Nov-16	1225	1145	1615	390
13-Nov-16	1150	1152	1610	460
14-Nov-16	1125	1101	1650	525
15-Nov-16	1065	1036	1630	565
16-Nov-16	1155	1103	1660	505
17-Nov-16	1035	998	1470	435
18-Nov-16	960	943	1480	520
19-Nov-16	1065	1075	1590	525
20-Nov-16	990	951	1600	610
21-Nov-16	985	907	1585	600
22-Nov-16	990	921	1660	670
23-Nov-16	1100	1111	1595	495
24-Nov-16	1260	1263	1605	345
25-Nov-16	1300	1249	1605	305
26-Nov-16	1305	1288	1640	335
27-Nov-16	1310	1347	1750	440
28-Nov-16	1270	1205	1740	470
29-Nov-16	1295	1217	1655	360
30-Nov-16	1335	1300	1820	485
Minimum	960	907	1410	265
Average	1134	1107	1587	454
Maximum	1335	1347	1820	670
1-Dec-16	1340	1348	1830	490
2-Dec-16	1335	1321	1855	520
3-Dec-16	1330	1298	1770	440

4-Dec-16	1350	1319	1835	485
5-Dec-16	1460	1456	1955	495
6-Dec-16	1505	1488	1930	425
7-Dec-16	1520	1490	1955	435
8-Dec-16	1450	1420	1775	325
9-Dec-16	1380	1372	1965	585
10-Dec-16	1450	1400	1970	520
11-Dec-16	1565	1565	1960	395
12-Dec-16	1590	1621	1975	385
13-Dec-16	1560	1563	1985	425
14-Dec-16	1535	1559	1945	410
15-Dec-16	1505	1443	2000	495
16-Dec-16	1575	1609	1935	360
17-Dec-16	1575	1672	1935	360
18-Dec-16	1430	1441	1830	400
19-Dec-16	1570	1551	2020	450
20-Dec-16	1605	1593	1975	370
21-Dec-16	1440	1444	2005	565
22-Dec-16	1430	1399	1920	490
23-Dec-16	1450	1479	1995	545
24-Dec-16	1480	1443	2005	525
25-Dec-16	1410	1320	2020	610
26-Dec-16	1650	1632	2015	365
27-Dec-16	1600	1584	1970	370
28-Dec-16	1515	1458	2020	505
29-Dec-16	1445	1478	1995	550
30-Dec-16	1485	1524	2000	515
31-Dec-16	1435	1418	1995	560
Minimum	1330	1298	1770	325
Average	1483	1475	1946	464
Maximum	1650	1672	2020	610
1-Jan-17	1420	1373	1985	565
2-Jan-17	1395	1453	2010	615
3-Jan-17	1580	1514	2015	435
4-Jan-17	1500	1527	1980	480
5-Jan-17	1430	1349	1805	375
6-Jan-17	1405	1363	2005	600
7-Jan-17	1540	1524	2005	465
8-Jan-17	1480	1490	1990	510
9-Jan-17	1595	1536	1965	370
10-Jan-17	1610	1649	1980	370
11-Jan-17	1560	1583	1960	400
12-Jan-17	1390	1350	1920	530

13-Jan-17	1300	1243	2025	725
14-Jan-17	1635	1686	2025	390
15-Jan-17	1585	1578	1995	410
16-Jan-17	1670	1636	2015	345
17-Jan-17	1555	1526	2020	465
18-Jan-17	1525	1498	2025	500
19-Jan-17	1525	1509	1980	455
20-Jan-17	1475	1426	2000	525
21-Jan-17	1495	1478	1980	485
22-Jan-17	1500	1406	1950	450
23-Jan-17	1620	1517	1965	345
24-Jan-17	1580	1582	1965	385
25-Jan-17	1505	1491	1960	455
26-Jan-17	1370	1356	1945	575
27-Jan-17	1390	1383	1845	455
28-Jan-17	1360	1348	1985	625
29-Jan-17	1385	1397	2000	615
30-Jan-17	1375	1345	1970	595
31-Jan-17	1450	1473	1840	390
Minimum	1300	1243	1805	345
Average	1490	1471	1971	481
Maximum	1670	1686	2025	725
1-Feb-17	1545	1539	1945	400
2-Feb-17	1525	1493	1965	440
3-Feb-17	1520	1526	1975	455
4-Feb-17	1560	1559	1975	415
5-Feb-17	1660	1671	1990	330
6-Feb-17	1570	1607	1965	395
7-Feb-17	1695	1682	1930	235
8-Feb-17	1725	1708	1895	170
9-Feb-17	1530	1415	1910	380
10-Feb-17	1470	1410	1945	475
11-Feb-17	1550	1512	1900	350
12-Feb-17	1570	1493	1770	200
13-Feb-17	1620	1603	1925	305
14-Feb-17	1520	1535	1760	240
15-Feb-17	1445	1447	1890	445
16-Feb-17	1390	1400	1880	490
17-Feb-17	1380	1358	1895	515
18-Feb-17	1415	1382	1910	495
19-Feb-17	1350	1356	1745	395
20-Feb-17	1440	1385	1925	485
21-Feb-17	1445	1423	1975	530

22-Feb-17	1450	1430	1930	480
23-Feb-17	1410	1408	1885	475
24-Feb-17	1315	1318	1900	585
25-Feb-17	1370	1273	1925	555
26-Feb-17	1245	1279	1810	565
27-Feb-17	1395	1365	1980	585
28-Feb-17	1495	1454	1990	495
Minimum	1245	1273	1745	170
Average	1486	1465	1910	424
Maximum	1725	1708	1990	585
1-Mar-17	1525	1479	1940	415
2-Mar-17	1305	1255	1940	635
3-Mar-17	1470	1469	1950	480
4-Mar-17	1565	1566	1985	420
5-Mar-17	1560	1522	1890	330
6-Mar-17	1475	1419	1950	475
7-Mar-17	1460	1433	1840	380
8-Mar-17	1445	1390	1930	485
9-Mar-17	1295	1253	1805	510
10-Mar-17	1425	1436	1935	510
11-Mar-17	1620	1432	1915	295
12-Mar-17	1600	1633	1715	115
13-Mar-17	1520	1531	1850	330
14-Mar-17	1450	1445	1865	415
15-Mar-17	1435	1443	1885	450
16-Mar-17	1300	1216	1910	610
17-Mar-17	1360	1329	1895	535
18-Mar-17	1350	1293	1895	545
19-Mar-17	1345	1306	1890	545
20-Mar-17	1385	1370	1915	530
21-Mar-17	1345	1321	1910	565
22-Mar-17	1335	1316	1935	600
23-Mar-17	1380	1335	1935	555
24-Mar-17	1545	1502	1910	365
25-Mar-17	1495	1454	1920	425
26-Mar-17	1580	1516	1940	360
27-Mar-17	1680	1659	1950	270
28-Mar-17	1560	1520	1950	390
29-Mar-17	1400	1376	1900	500
30-Mar-17	1345	1337	1920	575
31-Mar-17	1415	1400	1910	495
Minimum	1295	1216	1715	115
Average	1452	1419	1906	454

Maximum	1680	1659	1985	635
1-Apr-17	1455	1360	1935	480
2-Apr-17	1405	1338	1935	530
3-Apr-17	1440	1399	1910	470
4-Apr-17	1430	1357	1905	475
5-Apr-17	1430	1388	1920	490
6-Apr-17	1375	1283	1880	505
7-Apr-17	1360	1320	1905	545
8-Apr-17	1195	1200	1790	595
9-Apr-17	1095	1104	1780	685
10-Apr-17	1200	1178	1580	380
11-Apr-17	1185	1142	1655	470
12-Apr-17	1195	1171	1680	485
13-Apr-17	1280	1259	1675	395
14-Apr-17	1240	1185	1680	440
15-Apr-17	1285	1245	1600	315
16-Apr-17	1260	1188	1670	410
17-Apr-17	1280	1282	1705	425
18-Apr-17	1445	1416	1690	245
19-Apr-17	1415	1365	1705	290
20-Apr-17	1340	1328	1705	365
21-Apr-17	1320	1373	1695	375
22-Apr-17	1305	1268	1710	405
23-Apr-17	1240	1224	1825	585
24-Apr-17	1255	1207	1745	490
25-Apr-17	1220	1205	1765	545
26-Apr-17	1260	1250	1620	360
27-Apr-17	1235	1162	1665	430
28-Apr-17	1180	1172	1650	470
29-Apr-17	1070	993	1720	650
30-Apr-17	1220	1144	1710	490
Minimum	1070	993	1580	245
Average	1287	1250	1747	460
Maximum	1455	1416	1935	685

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-Nov-16	1085	1115	30	30	2.8%	2.8%	2.7%
2-Nov-16	1031	1065	34	34	3.3%	3.3%	3.2%
3-Nov-16	942	995	53	53	5.6%	5.6%	5.3%
4-Nov-16	1024	1000	-24	24	-2.4%	2.4%	-2.4%
5-Nov-16	1024	1085	61	61	6.0%	6.0%	5.7%
6-Nov-16	1140	1120	-20	20	-1.8%	1.8%	-1.8%
7-Nov-16	1166	1180	14	14	1.2%	1.2%	1.2%
8-Nov-16	1129	1165	36	36	3.2%	3.2%	3.1%
9-Nov-16	1123	1135	12	12	1.1%	1.1%	1.0%
10-Nov-16	1126	1155	29	29	2.5%	2.5%	2.5%
11-Nov-16	1097	1080	-17	17	-1.5%	1.5%	-1.6%
12-Nov-16	1145	1225	80	80	7.0%	7.0%	6.5%
13-Nov-16	1152	1150	-2	2	-0.2%	0.2%	-0.2%
14-Nov-16	1101	1125	24	24	2.2%	2.2%	2.2%
15-Nov-16	1036	1065	29	29	2.8%	2.8%	2.7%
16-Nov-16	1103	1155	52	52	4.8%	4.8%	4.5%
17-Nov-16	998	1035	37	37	3.7%	3.7%	3.5%
18-Nov-16	943	960	17	17	1.8%	1.8%	1.8%
19-Nov-16	1075	1065	-10	10	-1.0%	1.0%	-1.0%
20-Nov-16	951	990	39	39	4.0%	4.0%	3.9%
21-Nov-16	907	985	78	78	8.5%	8.5%	7.9%
22-Nov-16	921	990	69	69	7.5%	7.5%	7.0%
23-Nov-16	1111	1100	-11	11	-0.9%	0.9%	-1.0%
24-Nov-16	1263	1260	-3	3	-0.2%	0.2%	-0.2%
25-Nov-16	1249	1300	51	51	4.1%	4.1%	4.0%
26-Nov-16	1288	1305	17	17	1.3%	1.3%	1.3%
27-Nov-16	1347	1310	-37	37	-2.8%	2.8%	-2.8%
28-Nov-16	1205	1270	65	65	5.4%	5.4%	5.1%
29-Nov-16	1217	1295	78	78	6.5%	6.5%	6.1%
30-Nov-16	1300	1335	35	35	2.7%	2.7%	2.6%
Minimum	907	960	-37	2	-2.8%	0.2%	-2.8%
Average	1107	1134	27	35	2.6%	3.3%	2.4%
Maximum	1347	1335	80	80	8.5%	8.5%	7.9%
1-Dec-16	1348	1340	-8	8	-0.6%	0.6%	-0.6%
2-Dec-16	1321	1335	14	14	1.1%	1.1%	1.1%
3-Dec-16	1298	1330	32	32	2.4%	2.4%	2.4%
4-Dec-16	1319	1350	31	31	2.3%	2.3%	2.3%

5-Dec-16	1456	1460	4	4	0.2%	0.2%	0.2%
6-Dec-16	1488	1505	17	17	1.1%	1.1%	1.1%
7-Dec-16	1490	1520	30	30	2.0%	2.0%	2.0%
8-Dec-16	1420	1450	30	30	2.1%	2.1%	2.0%
9-Dec-16	1372	1380	8	8	0.6%	0.6%	0.6%
10-Dec-16	1400	1450	50	50	3.5%	3.5%	3.4%
11-Dec-16	1565	1565	0	0	0.0%	0.0%	0.0%
12-Dec-16	1621	1590	-31	31	-1.9%	1.9%	-2.0%
13-Dec-16	1563	1560	-3	3	-0.2%	0.2%	-0.2%
14-Dec-16	1559	1535	-24	24	-1.6%	1.6%	-1.6%
15-Dec-16	1443	1505	62	62	4.3%	4.3%	4.1%
16-Dec-16	1609	1575	-34	34	-2.1%	2.1%	-2.2%
17-Dec-16	1672	1575	-97	97	-5.8%	5.8%	-6.1%
18-Dec-16	1441	1430	-11	11	-0.7%	0.7%	-0.8%
19-Dec-16	1551	1570	19	19	1.2%	1.2%	1.2%
20-Dec-16	1593	1605	12	12	0.7%	0.7%	0.7%
21-Dec-16	1444	1440	-4	4	-0.3%	0.3%	-0.3%
22-Dec-16	1399	1430	31	31	2.2%	2.2%	2.2%
23-Dec-16	1479	1450	-29	29	-2.0%	2.0%	-2.0%
24-Dec-16	1443	1480	37	37	2.6%	2.6%	2.5%
25-Dec-16	1320	1410	90	90	6.8%	6.8%	6.4%
26-Dec-16	1632	1650	18	18	1.1%	1.1%	1.1%
27-Dec-16	1584	1600	16	16	1.0%	1.0%	1.0%
28-Dec-16	1458	1515	57	57	3.9%	3.9%	3.8%
29-Dec-16	1478	1445	-33	33	-2.2%	2.2%	-2.3%
30-Dec-16	1524	1485	-39	39	-2.6%	2.6%	-2.6%
31-Dec-16	1418	1435	17	17	1.2%	1.2%	1.2%
Minimum	1298	1330	-97	0	-5.8%	0.0%	-6.1%
Average	1475	1483	8	29	0.7%	2.0%	0.6%
Maximum	1672	1650	90	97	6.8%	6.8%	6.4%
1-Jan-17	1373	1420	47	47	3.4%	3.4%	3.3%
2-Jan-17	1453	1395	-58	58	-4.0%	4.0%	-4.1%
3-Jan-17	1514	1580	66	66	4.4%	4.4%	4.2%
4-Jan-17	1527	1500	-27	27	-1.8%	1.8%	-1.8%
5-Jan-17	1349	1430	81	81	6.0%	6.0%	5.7%
6-Jan-17	1363	1405	42	42	3.1%	3.1%	3.0%
7-Jan-17	1524	1540	16	16	1.1%	1.1%	1.1%
8-Jan-17	1490	1480	-10	10	-0.6%	0.6%	-0.7%
9-Jan-17	1536	1595	59	59	3.8%	3.8%	3.7%
10-Jan-17	1649	1610	-39	39	-2.3%	2.3%	-2.4%
11-Jan-17	1583	1560	-23	23	-1.5%	1.5%	-1.5%
12-Jan-17	1350	1390	40	40	3.0%	3.0%	2.9%
13-Jan-17	1243	1300	57	57	4.6%	4.6%	4.4%

14-Jan-17	1686	1635	-51	51	-3.0%	3.0%	-3.1%
15-Jan-17	1578	1585	7	7	0.4%	0.4%	0.4%
16-Jan-17	1636	1670	34	34	2.1%	2.1%	2.1%
17-Jan-17	1526	1555	29	29	1.9%	1.9%	1.9%
18-Jan-17	1498	1525	27	27	1.8%	1.8%	1.7%
19-Jan-17	1509	1525	16	16	1.1%	1.1%	1.0%
20-Jan-17	1426	1475	49	49	3.4%	3.4%	3.3%
21-Jan-17	1478	1495	17	17	1.2%	1.2%	1.2%
22-Jan-17	1406	1500	94	94	6.7%	6.7%	6.2%
23-Jan-17	1517	1620	103	103	6.8%	6.8%	6.3%
24-Jan-17	1582	1580	-2	2	-0.1%	0.1%	-0.1%
25-Jan-17	1491	1505	14	14	0.9%	0.9%	0.9%
26-Jan-17	1356	1370	14	14	1.1%	1.1%	1.1%
27-Jan-17	1383	1390	7	7	0.5%	0.5%	0.5%
28-Jan-17	1348	1360	12	12	0.9%	0.9%	0.9%
29-Jan-17	1397	1385	-12	12	-0.9%	0.9%	-0.9%
30-Jan-17	1345	1375	30	30	2.2%	2.2%	2.2%
31-Jan-17	1473	1450	-23	23	-1.5%	1.5%	-1.6%
Minimum	1243	1300	-58	2	-4.0%	0.1%	-4.1%
Average	1471	1490	20	36	1.4%	2.5%	1.3%
Maximum	1686	1670	103	103	6.8%	6.8%	6.3%
1-Feb-17	1539	1545	6	6	0.4%	0.4%	0.4%
2-Feb-17	1493	1525	32	32	2.2%	2.2%	2.1%
3-Feb-17	1526	1520	-6	6	-0.4%	0.4%	-0.4%
4-Feb-17	1559	1560	1	1	0.0%	0.0%	0.0%
5-Feb-17	1671	1660	-11	11	-0.6%	0.6%	-0.6%
6-Feb-17	1607	1570	-37	37	-2.3%	2.3%	-2.3%
7-Feb-17	1682	1695	13	13	0.8%	0.8%	0.8%
8-Feb-17	1708	1725	17	17	1.0%	1.0%	1.0%
9-Feb-17	1415	1530	115	115	8.2%	8.2%	7.5%
10-Feb-17	1410	1470	60	60	4.3%	4.3%	4.1%
11-Feb-17	1512	1550	38	38	2.5%	2.5%	2.4%
12-Feb-17	1493	1570	77	77	5.1%	5.1%	4.9%
13-Feb-17	1603	1620	17	17	1.0%	1.0%	1.0%
14-Feb-17	1535	1520	-15	15	-1.0%	1.0%	-1.0%
15-Feb-17	1447	1445	-2	2	-0.1%	0.1%	-0.1%
16-Feb-17	1400	1390	-10	10	-0.7%	0.7%	-0.7%
17-Feb-17	1358	1380	22	22	1.7%	1.7%	1.6%
18-Feb-17	1382	1415	33	33	2.4%	2.4%	2.3%
19-Feb-17	1356	1350	-6	6	-0.4%	0.4%	-0.4%
20-Feb-17	1385	1440	55	55	4.0%	4.0%	3.8%
21-Feb-17	1423	1445	22	22	1.6%	1.6%	1.5%
22-Feb-17	1430	1450	20	20	1.4%	1.4%	1.4%

23-Feb-17	1408	1410	2	2	0.2%	0.2%	0.2%
24-Feb-17	1318	1315	-3	3	-0.2%	0.2%	-0.2%
25-Feb-17	1273	1370	97	97	7.6%	7.6%	7.1%
26-Feb-17	1279	1245	-34	34	-2.6%	2.6%	-2.7%
27-Feb-17	1365	1395	30	30	2.2%	2.2%	2.1%
28-Feb-17	1454	1495	41	41	2.8%	2.8%	2.7%
Minimum	1273	1245	-37	1	-2.6%	0.0%	-2.7%
Average	1465	1486	21	29	1.5%	2.1%	1.4%
Maximum	1708	1725	115	115	8.2%	8.2%	7.5%
1-Mar-17	1479	1525	46	46	3.1%	3.1%	3.0%
2-Mar-17	1255	1305	50	50	4.0%	4.0%	3.8%
3-Mar-17	1469	1470	1	1	0.1%	0.1%	0.1%
4-Mar-17	1566	1565	-1	1	-0.1%	0.1%	-0.1%
5-Mar-17	1522	1560	38	38	2.5%	2.5%	2.5%
6-Mar-17	1419	1475	56	56	3.9%	3.9%	3.8%
7-Mar-17	1433	1460	27	27	1.9%	1.9%	1.8%
8-Mar-17	1390	1445	55	55	3.9%	3.9%	3.8%
9-Mar-17	1253	1295	42	42	3.4%	3.4%	3.3%
10-Mar-17	1436	1425	-11	11	-0.8%	0.8%	-0.8%
11-Mar-17	1432	1620	188	188	13.2%	13.2%	11.6%
12-Mar-17	1633	1600	-33	33	-2.0%	2.0%	-2.1%
13-Mar-17	1531	1520	-11	11	-0.7%	0.7%	-0.7%
14-Mar-17	1445	1450	5	5	0.4%	0.4%	0.4%
15-Mar-17	1443	1435	-8	8	-0.6%	0.6%	-0.6%
16-Mar-17	1216	1300	84	84	6.9%	6.9%	6.5%
17-Mar-17	1329	1360	31	31	2.3%	2.3%	2.3%
18-Mar-17	1293	1350	57	57	4.4%	4.4%	4.2%
19-Mar-17	1306	1345	39	39	3.0%	3.0%	2.9%
20-Mar-17	1370	1385	15	15	1.1%	1.1%	1.0%
21-Mar-17	1321	1345	24	24	1.8%	1.8%	1.8%
22-Mar-17	1316	1335	19	19	1.4%	1.4%	1.4%
23-Mar-17	1335	1380	45	45	3.3%	3.3%	3.2%
24-Mar-17	1502	1545	43	43	2.8%	2.8%	2.8%
25-Mar-17	1454	1495	41	41	2.8%	2.8%	2.7%
26-Mar-17	1516	1580	64	64	4.2%	4.2%	4.0%
27-Mar-17	1659	1680	21	21	1.3%	1.3%	1.3%
28-Mar-17	1520	1560	40	40	2.6%	2.6%	2.6%
29-Mar-17	1376	1400	24	24	1.7%	1.7%	1.7%
30-Mar-17	1337	1345	8	8	0.6%	0.6%	0.6%
31-Mar-17	1400	1415	15	15	1.1%	1.1%	1.1%
Minimum	1216	1295	-33	1	-2.0%	0.1%	-2.1%
Average	1419	1452	33	37	2.4%	2.7%	2.3%
Maximum	1659	1680	188	188	13.2%	13.2%	11.6%

1-Apr-17	1360	1455	95	95	7.0%	7.0%	6.5%
2-Apr-17	1338	1405	67	67	5.0%	5.0%	4.8%
3-Apr-17	1399	1440	41	41	2.9%	2.9%	2.9%
4-Apr-17	1357	1430	73	73	5.4%	5.4%	5.1%
5-Apr-17	1388	1430	42	42	3.0%	3.0%	3.0%
6-Apr-17	1283	1375	92	92	7.1%	7.1%	6.7%
7-Apr-17	1320	1360	40	40	3.1%	3.1%	3.0%
8-Apr-17	1200	1195	-5	5	-0.4%	0.4%	-0.4%
9-Apr-17	1104	1095	-9	9	-0.8%	0.8%	-0.8%
10-Apr-17	1178	1200	22	22	1.9%	1.9%	1.9%
11-Apr-17	1142	1185	43	43	3.7%	3.7%	3.6%
12-Apr-17	1171	1195	24	24	2.1%	2.1%	2.0%
13-Apr-17	1259	1280	21	21	1.6%	1.6%	1.6%
14-Apr-17	1185	1240	55	55	4.6%	4.6%	4.4%
15-Apr-17	1245	1285	40	40	3.2%	3.2%	3.1%
16-Apr-17	1188	1260	72	72	6.0%	6.0%	5.7%
17-Apr-17	1282	1280	-2	2	-0.2%	0.2%	-0.2%
18-Apr-17	1416	1445	29	29	2.1%	2.1%	2.0%
19-Apr-17	1365	1415	50	50	3.7%	3.7%	3.5%
20-Apr-17	1328	1340	12	12	0.9%	0.9%	0.9%
21-Apr-17	1373	1320	-53	53	-3.9%	3.9%	-4.0%
22-Apr-17	1268	1305	37	37	2.9%	2.9%	2.8%
23-Apr-17	1224	1240	16	16	1.3%	1.3%	1.3%
24-Apr-17	1207	1255	48	48	4.0%	4.0%	3.9%
25-Apr-17	1205	1220	15	15	1.2%	1.2%	1.2%
26-Apr-17	1250	1260	10	10	0.8%	0.8%	0.8%
27-Apr-17	1162	1235	73	73	6.3%	6.3%	5.9%
28-Apr-17	1172	1180	8	8	0.7%	0.7%	0.7%
29-Apr-17	993	1070	77	77	7.7%	7.7%	7.2%
30-Apr-17	1144	1220	76	76	6.6%	6.6%	6.2%
Minimum	993	1070	-53	2	-3.9%	0.2%	-4.0%
Average	1250	1287	37	42	3.0%	3.3%	2.8%
Maximum	1416	1455	95	95	7.7%	7.7%	7.2%

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-Nov-16	995	945	-50	50	-5.0%	5.0%	-5.3%
2-Nov-16	884	894	10	10	1.1%	1.1%	1.1%
3-Nov-16	792	825	33	33	4.1%	4.1%	4.0%
4-Nov-16	848	832	-16	16	-1.9%	1.9%	-2.0%
5-Nov-16	876	916	40	40	4.6%	4.6%	4.4%
6-Nov-16	963	952	-11	11	-1.1%	1.1%	-1.1%
7-Nov-16	994	1012	18	18	1.8%	1.8%	1.8%
8-Nov-16	970	994	25	25	2.6%	2.6%	2.5%
9-Nov-16	678	628	-50	50	-7.4%	7.4%	-8.0%
10-Nov-16	952	987	35	35	3.6%	3.6%	3.5%
11-Nov-16	928	911	-17	17	-1.8%	1.8%	-1.9%
12-Nov-16	962	1055	93	93	9.7%	9.7%	8.9%
13-Nov-16	982	983	1	1	0.1%	0.1%	0.1%
14-Nov-16	933	954	21	21	2.2%	2.2%	2.2%
15-Nov-16	894	894	0	0	0.0%	0.0%	0.0%
16-Nov-16	1006	984	-22	22	-2.1%	2.1%	-2.2%
17-Nov-16	826	865	40	40	4.8%	4.8%	4.6%
18-Nov-16	780	793	12	12	1.6%	1.6%	1.6%
19-Nov-16	729	750	21	21	2.9%	2.9%	2.8%
20-Nov-16	819	820	1	1	0.1%	0.1%	0.1%
21-Nov-16	789	814	25	25	3.2%	3.2%	3.1%
22-Nov-16	782	820	39	39	4.9%	4.9%	4.7%
23-Nov-16	942	931	-10	10	-1.1%	1.1%	-1.1%
24-Nov-16	1098	1093	-5	5	-0.5%	0.5%	-0.5%
25-Nov-16	1121	1130	9	9	0.8%	0.8%	0.8%
26-Nov-16	1124	1138	14	14	1.2%	1.2%	1.2%
27-Nov-16	1191	1142	-50	50	-4.2%	4.2%	-4.4%
28-Nov-16	1055	1103	48	48	4.6%	4.6%	4.4%
29-Nov-16	1122	1126	4	4	0.3%	0.3%	0.3%
30-Nov-16	1181	1172	-9	9	-0.8%	0.8%	-0.8%
Minimum	678	628	-50	0	-7.4%	0.0%	-8.0%
Average	940	949	8	24	0.9%	2.7%	0.8%
Maximum	1191	1172	93	93	9.7%	9.7%	8.9%
1-Dec-16	1207	1177	-30	30	-2.5%	2.5%	-2.5%
2-Dec-16	1202	1172	-30	30	-2.5%	2.5%	-2.6%
3-Dec-16	1160	1167	7	7	0.6%	0.6%	0.6%
4-Dec-16	1193	1185	-7	7	-0.6%	0.6%	-0.6%

5-Dec-16	1305	1294	-11	11	-0.9%	0.9%	-0.9%
6-Dec-16	1370	1341	-29	29	-2.1%	2.1%	-2.2%
7-Dec-16	1332	1353	22	22	1.6%	1.6%	1.6%
8-Dec-16	1287	1283	-4	4	-0.3%	0.3%	-0.3%
9-Dec-16	678	628	-50	50	-7.4%	7.4%	-8.0%
10-Dec-16	1246	1286	40	40	3.2%	3.2%	3.1%
11-Dec-16	1411	1402	-9	9	-0.6%	0.6%	-0.6%
12-Dec-16	1469	1425	-44	44	-3.0%	3.0%	-3.1%
13-Dec-16	1410	1395	-15	15	-1.1%	1.1%	-1.1%
14-Dec-16	1395	1372	-23	23	-1.7%	1.7%	-1.7%
15-Dec-16	1285	1339	53	53	4.1%	4.1%	4.0%
16-Dec-16	1471	1409	-62	62	-4.2%	4.2%	-4.4%
17-Dec-16	1495	1411	-84	84	-5.6%	5.6%	-6.0%
18-Dec-16	1273	1267	-6	6	-0.4%	0.4%	-0.4%
19-Dec-16	729	750	21	21	2.9%	2.9%	2.8%
20-Dec-16	1433	1439	6	6	0.4%	0.4%	0.4%
21-Dec-16	1293	1273	-20	20	-1.5%	1.5%	-1.5%
22-Dec-16	1255	1266	11	11	0.9%	0.9%	0.8%
23-Dec-16	1310	1287	-24	24	-1.8%	1.8%	-1.8%
24-Dec-16	1278	1314	37	37	2.9%	2.9%	2.8%
25-Dec-16	1159	1244	85	85	7.4%	7.4%	6.8%
26-Dec-16	570	1487	22	22	1.5%	1.5%	1.5%
27-Dec-16	630	1433	4	4	0.3%	0.3%	0.3%
28-Dec-16	603	1351	49	49	3.7%	3.7%	3.6%
29-Dec-16	1314	1280	-34	34	-2.6%	2.6%	-2.6%
30-Dec-16	1355	1318	-37	37	-2.8%	2.8%	-2.8%
31-Dec-16	1250	1272	22	22	1.8%	1.8%	1.7%
Minimum	570	628	-84	4	-7.4%	0.3%	-8.0%
Average	1205	1278	-5	29	-0.3%	2.4%	-0.4%
Maximum	1495	1487	85	85	7.4%	7.4%	6.8%
1-Jan-17	1204	1257	54	54	4.4%	4.4%	4.3%
2-Jan-17	1290	1230	-60	60	-4.6%	4.6%	-4.8%
3-Jan-17	1357	1414	57	57	4.2%	4.2%	4.0%
4-Jan-17	1372	1329	-43	43	-3.1%	3.1%	-3.3%
5-Jan-17	1214	1260	46	46	3.8%	3.8%	3.6%
6-Jan-17	1214	1234	20	20	1.7%	1.7%	1.6%
7-Jan-17	1348	1371	23	23	1.7%	1.7%	1.7%
8-Jan-17	1339	1309	-30	30	-2.2%	2.2%	-2.3%
9-Jan-17	678	628	-50	50	-7.4%	7.4%	-8.0%
10-Jan-17	1462	1441	-21	21	-1.4%	1.4%	-1.5%
11-Jan-17	1435	1391	-44	44	-3.1%	3.1%	-3.2%
12-Jan-17	1207	1218	11	11	0.9%	0.9%	0.9%
13-Jan-17	1106	1147	41	41	3.7%	3.7%	3.6%

14-Jan-17	1557	1483	-74	74	-4.7%	4.7%	-5.0%
15-Jan-17	1436	1434	-2	2	-0.1%	0.1%	-0.1%
16-Jan-17	1494	1516	22	22	1.5%	1.5%	1.4%
17-Jan-17	1393	1401	7	7	0.5%	0.5%	0.5%
18-Jan-17	1360	1372	11	11	0.8%	0.8%	0.8%
19-Jan-17	729	750	21	21	2.9%	2.9%	2.8%
20-Jan-17	1279	1322	43	43	3.4%	3.4%	3.2%
21-Jan-17	1321	1342	21	21	1.6%	1.6%	1.6%
22-Jan-17	1263	1349	87	87	6.9%	6.9%	6.4%
23-Jan-17	1366	1468	103	103	7.5%	7.5%	7.0%
24-Jan-17	1459	1428	-31	31	-2.1%	2.1%	-2.2%
25-Jan-17	1350	1351	1	1	0.0%	0.0%	0.0%
26-Jan-17	1201	1215	15	15	1.2%	1.2%	1.2%
27-Jan-17	1227	1239	13	13	1.0%	1.0%	1.0%
28-Jan-17	1193	1206	13	13	1.1%	1.1%	1.1%
29-Jan-17	1254	1233	-21	21	-1.6%	1.6%	-1.7%
30-Jan-17	1190	1221	30	30	2.6%	2.6%	2.5%
31-Jan-17	1309	1295	-13	13	-1.0%	1.0%	-1.0%
Minimum	678	628	-74	1	-7.4%	0.0%	-8.0%
Average	1278	1286	8	33	0.6%	2.7%	0.5%
Maximum	1557	1516	103	103	7.5%	7.5%	7.0%
1-Feb-17	1382	1393	11	11	0.8%	0.8%	0.8%
2-Feb-17	1341	1352	11	11	0.8%	0.8%	0.8%
3-Feb-17	1367	1365	-2	2	-0.1%	0.1%	-0.1%
4-Feb-17	1429	1404	-26	26	-1.8%	1.8%	-1.8%
5-Feb-17	1555	1500	-55	55	-3.5%	3.5%	-3.6%
6-Feb-17	1462	1414	-48	48	-3.3%	3.3%	-3.4%
7-Feb-17	1562	1525	-37	37	-2.4%	2.4%	-2.4%
8-Feb-17	1604	1556	-48	48	-3.0%	3.0%	-3.1%
9-Feb-17	1235	1363	128	128	10.4%	10.4%	9.4%
10-Feb-17	1262	1299	37	37	3.0%	3.0%	2.9%
11-Feb-17	1331	1379	48	48	3.6%	3.6%	3.5%
12-Feb-17	1329	1400	71	71	5.4%	5.4%	5.1%
13-Feb-17	1455	1452	-3	3	-0.2%	0.2%	-0.2%
14-Feb-17	1387	1348	-39	39	-2.8%	2.8%	-2.9%
15-Feb-17	1270	1273	2	2	0.2%	0.2%	0.2%
16-Feb-17	1225	1218	-8	8	-0.6%	0.6%	-0.6%
17-Feb-17	1185	1204	20	20	1.6%	1.6%	1.6%
18-Feb-17	1228	1243	16	16	1.3%	1.3%	1.3%
19-Feb-17	1177	1178	1	1	0.1%	0.1%	0.1%
20-Feb-17	1209	1267	58	58	4.8%	4.8%	4.6%
21-Feb-17	1241	1269	28	28	2.3%	2.3%	2.2%
22-Feb-17	1263	1274	12	12	0.9%	0.9%	0.9%

23-Feb-17	1236	1237	1	1	0.1%	0.1%	0.1%
24-Feb-17	1148	1143	-6	6	-0.5%	0.5%	-0.5%
25-Feb-17	1122	1196	75	75	6.7%	6.7%	6.3%
26-Feb-17	1102	1069	-32	32	-2.9%	2.9%	-3.0%
27-Feb-17	1194	1221	27	27	2.3%	2.3%	2.2%
28-Feb-17	1299	1321	22	22	1.7%	1.7%	1.7%
Minimum	1102	1069	-55	1	-3.5%	0.1%	-3.6%
Average	1307	1317	10	31	0.9%	2.4%	0.8%
Maximum	1604	1556	128	128	10.4%	10.4%	9.4%
1-Mar-17	1338	1350	13	13	0.9%	0.9%	0.9%
2-Mar-17	1110	1130	21	21	1.9%	1.9%	1.8%
3-Mar-17	1310	1294	-16	16	-1.2%	1.2%	-1.2%
4-Mar-17	1394	1388	-6	6	-0.4%	0.4%	-0.4%
5-Mar-17	1371	1382	11	11	0.8%	0.8%	0.8%
6-Mar-17	1275	1296	21	21	1.6%	1.6%	1.6%
7-Mar-17	1280	1282	2	2	0.2%	0.2%	0.2%
8-Mar-17	1232	1267	35	35	2.8%	2.8%	2.7%
9-Mar-17	678	628	-50	50	-7.4%	7.4%	-8.0%
10-Mar-17	1265	1247	-18	18	-1.4%	1.4%	-1.4%
11-Mar-17	1258	1441	183	183	14.6%	14.6%	12.7%
12-Mar-17	1470	1425	-44	44	-3.0%	3.0%	-3.1%
13-Mar-17	1342	1345	3	3	0.2%	0.2%	0.2%
14-Mar-17	1270	1272	2	2	0.2%	0.2%	0.2%
15-Mar-17	1292	1257	-36	36	-2.8%	2.8%	-2.8%
16-Mar-17	1059	1122	62	62	5.9%	5.9%	5.5%
17-Mar-17	1157	1182	25	25	2.2%	2.2%	2.1%
18-Mar-17	1121	1172	51	51	4.5%	4.5%	4.3%
19-Mar-17	729	750	21	21	2.9%	2.9%	2.8%
20-Mar-17	1209	1209	0	0	0.0%	0.0%	0.0%
21-Mar-17	1144	1168	24	24	2.1%	2.1%	2.1%
22-Mar-17	1141	1160	19	19	1.7%	1.7%	1.6%
23-Mar-17	1160	1205	45	45	3.9%	3.9%	3.8%
24-Mar-17	1328	1369	40	40	3.0%	3.0%	2.9%
25-Mar-17	1273	1318	45	45	3.6%	3.6%	3.4%
26-Mar-17	1338	1403	65	65	4.9%	4.9%	4.7%
27-Mar-17	1505	1501	-4	4	-0.3%	0.3%	-0.3%
28-Mar-17	1362	1385	23	23	1.7%	1.7%	1.7%
29-Mar-17	1202	1223	22	22	1.8%	1.8%	1.8%
30-Mar-17	1161	1166	5	5	0.5%	0.5%	0.4%
31-Mar-17	1226	1240	13	13	1.1%	1.1%	1.1%
Minimum	678	628	-50	0	-7.4%	0.0%	-8.0%
Average	1238	1255	22	34	1.5%	2.6%	1.4%
Maximum	1604	1556	183	183	14.6%	14.6%	12.7%

1-Apr-17	1186	1276	90	90	7.6%	7.6%	7.0%
2-Apr-17	1169	1226	57	57	4.9%	4.9%	4.7%
3-Apr-17	1241	1261	20	20	1.6%	1.6%	1.6%
4-Apr-17	1192	1251	58	58	4.9%	4.9%	4.7%
5-Apr-17	1219	1251	31	31	2.6%	2.6%	2.5%
6-Apr-17	1169	1187	18	18	1.5%	1.5%	1.5%
7-Apr-17	1152	1182	31	31	2.7%	2.7%	2.6%
8-Apr-17	1024	993	-31	31	-3.1%	3.1%	-3.2%
9-Apr-17	678	628	-50	50	-7.4%	7.4%	-8.0%
10-Apr-17	1022	1022	0	0	0.0%	0.0%	0.0%
11-Apr-17	988	1006	18	18	1.8%	1.8%	1.8%
12-Apr-17	1029	1018	-11	11	-1.1%	1.1%	-1.1%
13-Apr-17	1093	1093	0	0	0.0%	0.0%	0.0%
14-Apr-17	1014	1057	43	43	4.2%	4.2%	4.1%
15-Apr-17	1064	1100	36	36	3.4%	3.4%	3.2%
16-Apr-17	1013	1073	59	59	5.8%	5.8%	5.5%
17-Apr-17	1126	1095	-30	30	-2.7%	2.7%	-2.8%
18-Apr-17	1236	1261	25	25	2.0%	2.0%	2.0%
19-Apr-17	729	750	21	21	2.9%	2.9%	2.8%
20-Apr-17	1155	1136	-18	18	-1.6%	1.6%	-1.6%
21-Apr-17	1198	1133	-65	65	-5.5%	5.5%	-5.8%
22-Apr-17	1096	1121	25	25	2.3%	2.3%	2.3%
23-Apr-17	1069	1056	-13	13	-1.3%	1.3%	-1.3%
24-Apr-17	1041	1068	27	27	2.6%	2.6%	2.5%
25-Apr-17	1043	1037	-7	7	-0.7%	0.7%	-0.7%
26-Apr-17	1068	1077	9	9	0.8%	0.8%	0.8%
27-Apr-17	980	1049	69	69	7.0%	7.0%	6.6%
28-Apr-17	1004	997	-7	7	-0.7%	0.7%	-0.7%
29-Apr-17	822	884	62	62	7.5%	7.5%	7.0%
30-Apr-17	988	1034	45	45	4.6%	4.6%	4.4%
Minimum	678	628	-65	0	-7.4%	0.0%	-8.0%
Average	1060	1077	17	33	1.6%	3.2%	1.4%
Maximum	1241	1276	90	90	7.6%	7.6%	7.0%

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**				
November 2016	940	949	8	24	0.9%	2.7%	0.8%
December 2016	1205	1278	-5	29	-0.3%	2.4%	-0.4%
January 2017	1278	1286	8	33	0.6%	2.7%	0.5%
February 2017	1307	1317	10	31	0.9%	2.4%	0.8%
March 2017	1226	1244	19	30	1.5%	2.6%	1.4%
April 2017	1060	1077	17	33	1.6%	3.2%	1.4%
Six Month	1169	1192	9	30	0.9%	2.6%	0.7%
	Maximum Peak*		**Maximum Error**				
November 2016	1191	1172	93	93	9.7%	9.7%	8.9%
December 2016	1495	1487	85	85	7.4%	7.4%	6.8%
January 2017	1557	1516	103	103	7.5%	7.5%	7.0%
February 2017	1604	1556	128	128	10.4%	10.4%	9.4%
March 2017	1505	1501	183[4]	183	14.6%	14.6%	12.7%
April 2017	1241	1276	90	90	7.6%	7.6%	7.0%
Six Month	1604	1556	183	183	14.6%	14.6%	12.7%

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

[4] Attributed to March 11 power interruption caused by the wind storm

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
8-Feb-17	1604	1556	-48	48	-3.0%	3.0%	-3.1%
7-Feb-17	1562	1525	-37	37	-2.4%	2.4%	-2.4%
14-Jan-17	1557	1483	-74	74	-4.7%	4.7%	-5.0%
5-Feb-17	1555	1500	-55	55	-3.5%	3.5%	-3.6%
27-Mar-17	1505	1501	-4	4	-0.3%	0.3%	-0.3%
17-Dec-16	1495	1411	-84	84	-5.6%	5.6%	-6.0%
16-Jan-17	1494	1516	22	22	1.5%	1.5%	1.4%
16-Dec-16	1471	1409	-62	62	-4.2%	4.2%	-4.4%
12-Mar-17	1470	1425	-44	44	-3.0%	3.0%	-3.1%
12-Dec-16	1469	1425	-44	44	-3.0%	3.0%	-3.1%
Average	1518	1475	-43	47	-2.8%	3.1%	-3.0%

Table 6 - Summary of Forecast Issues

Date	Actual Utility Peak, MW	Forecast Utility Peak, MW	Error, MW	Absolute Error, MW	Absolute Percent Error	Explanation
12-Nov-16	962	1055	93	93	9.7%	Error in temperature and wind forecast
21-Nov-16	789	814	25	25	3.2%	Error in Industrial load forecast
22-Nov-16	782	820	39	39	4.9%	Error in Industrial load forecast
17-Dec-16	1495	1411	-84	84	5.6%	Error in temperature and wind forecast and non-uniform customer behavior
25-Dec-16	1159	1244	85	85	7.4%	Error in wind forecast and non-uniform customer behavior
5-Jan-17	1214	1260	46	46	3.8%	Error in Industrial load forecast
22-Jan-17	1263	1349	87	87	6.9%	Error in wind forecast and non-uniform customer behavior
23-Jan-17	1366	1468	103	103	7.5%	Error in temperature and wind forecast
9-Feb-17	1235	1363	128	128	10.4%	Error in weather forecast
12-Feb-17	1329	1400	71	71	5.4%	Error in temperature and wind forecast
25-Feb-17	1122	1196	75	75	6.7%	Error in temperature and wind forecast
11-Mar-17	1258	1441	183	183	14.6%	Power interruption
16-Mar-17	1059	1122	62	62	5.9%	Error in wind and cloud cover forecast and unknown factors
1-Apr-17	1186	1276	90	90	7.6%	Error in wind and cloud cover forecast
6-Apr-17	1283	1375	92	92	7.1%	Error in Industrial load forecast
29-Apr-17	993	1070	77	77	7.7%	Error in temperature and cloud cover forecast

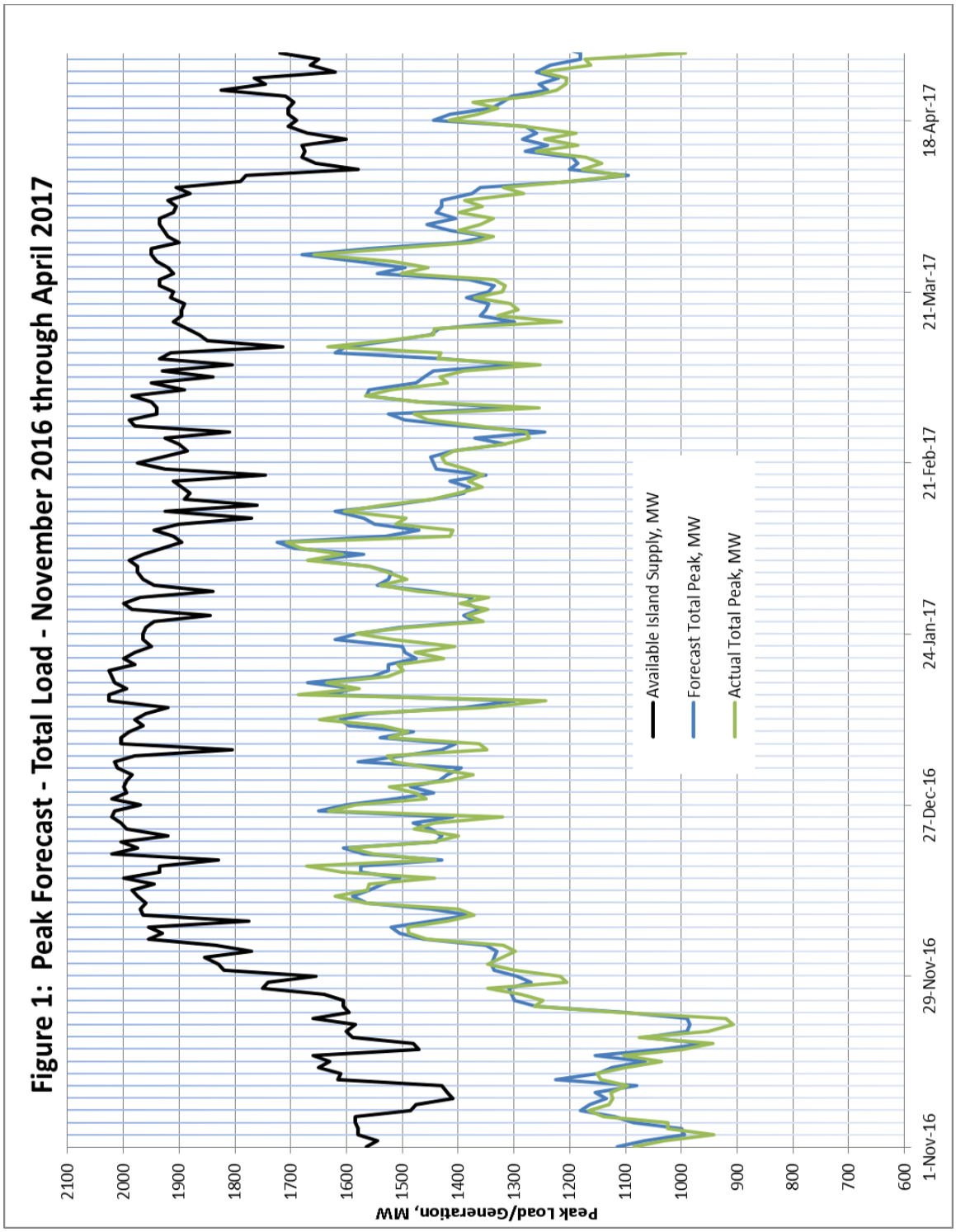
Figure 1: Peak Forecast - Total Load - November 2016 through April 2017
Peak Load/Generation, MW
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
1-Nov-16
29-Nov-16
27-Dec-16
24-Jan-17
21-Feb-17
21-Mar-17
18-Apr-17
Available Island Supply, MW
Forecast Total Peak, MW
Actual Total Peak, MW

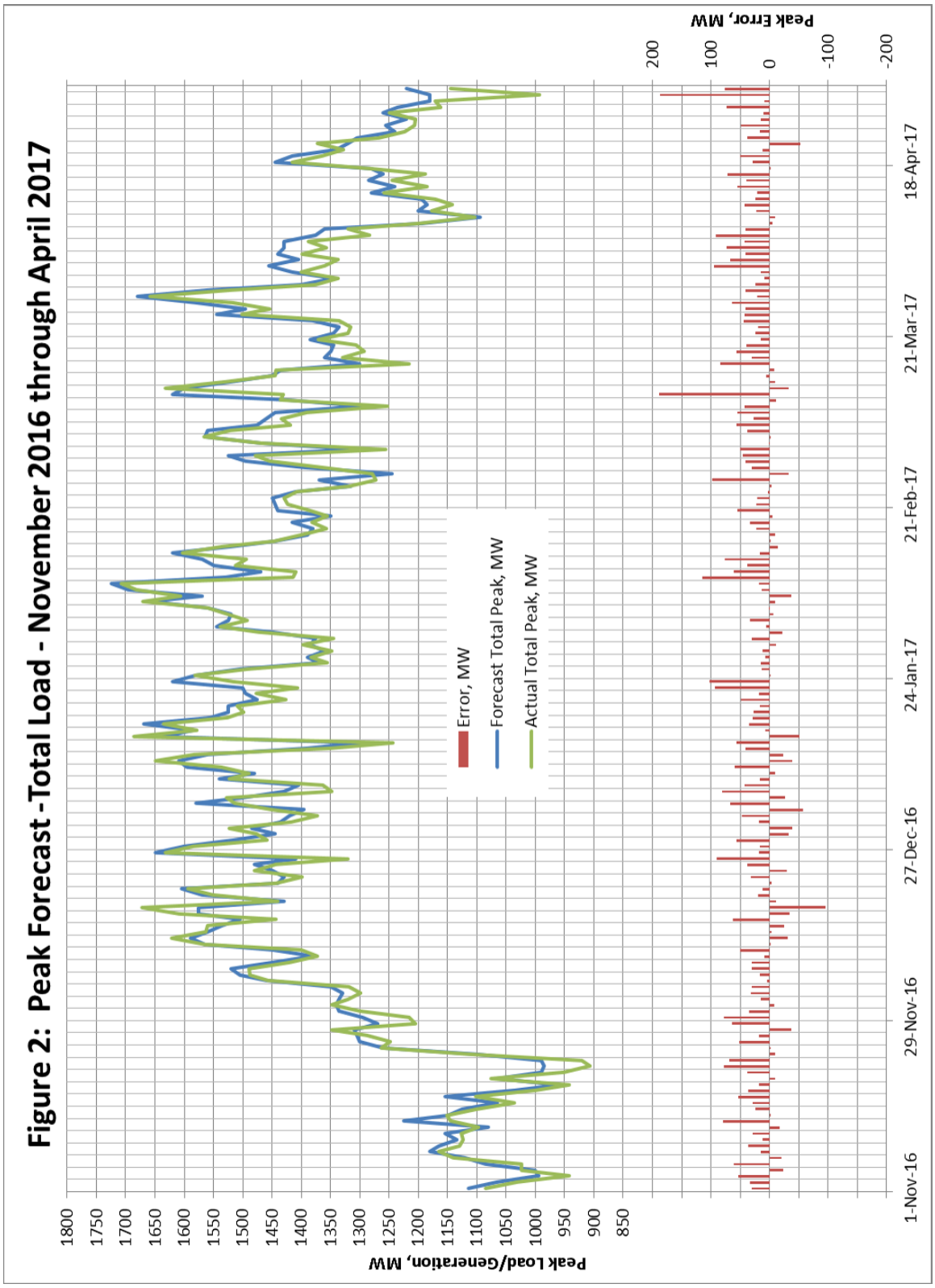
Figure 2: Peak Forecast -Total Load - November 2016 through April 2017
Peak Load/Generation, MW
Peak Error, MW
Error, MW
Forecast Total Peak, MW
Actual Total Peak, MW
1800
1750
1700
1650
1600
1550
1500
1450
1400
1350
1300
1250
1200
1150
1100
1050
1000
950
900
850
200
100
0
-100
-200
1-Nov-16
29-Nov-16
27-Dec-16
24-Jan-17
21-Feb-17
21-Mar-17
18-Apr-17

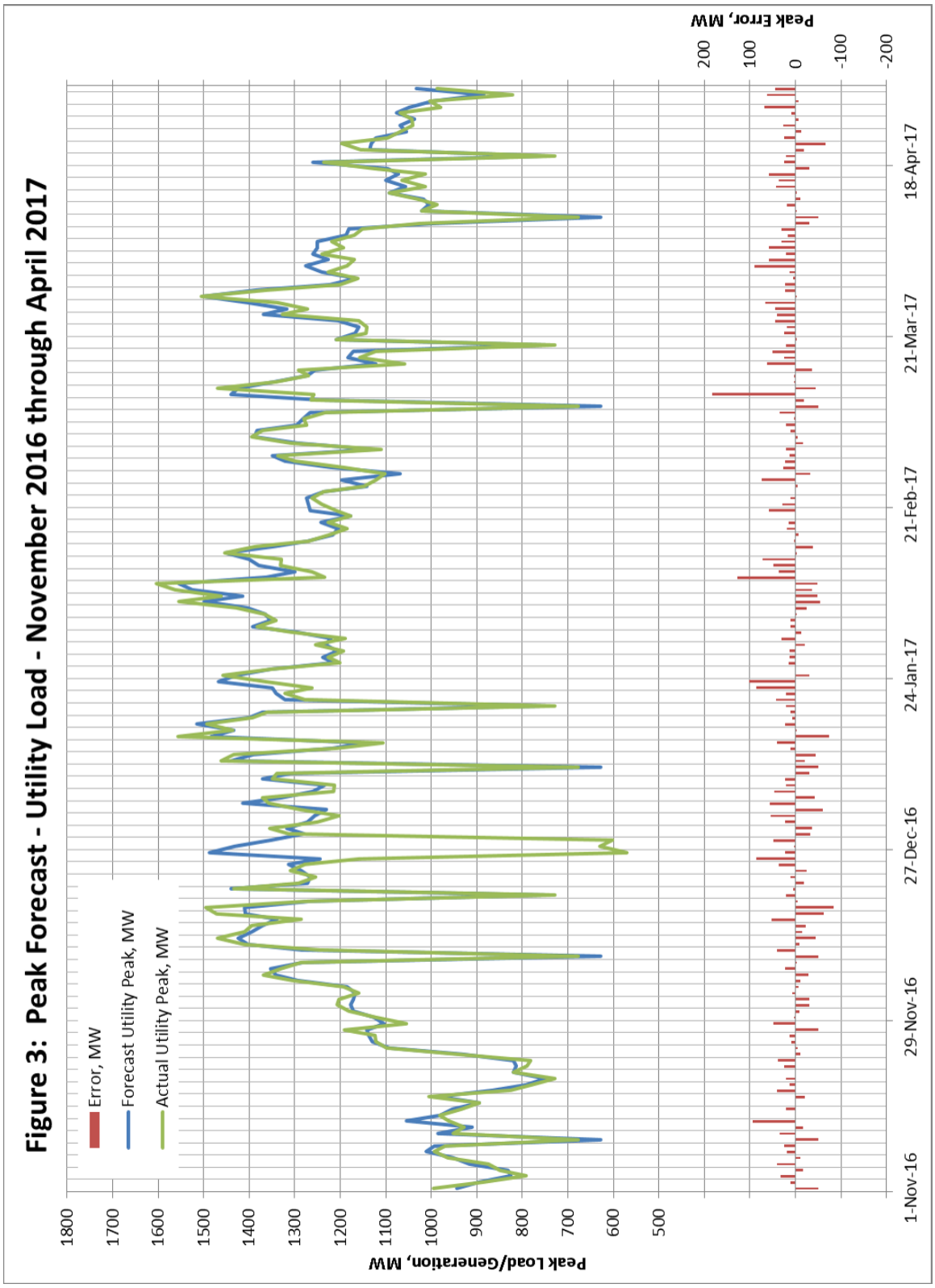
Figure 3: Peak Forecast - Utility Load - November 2016 through April 2017
Error, MW
Forecast Utility Peak, MW
Actual Utility Peak, MW
Peak Load/Generation, MW
Peak Error, MW
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
200
100
0
-100
-200
1-Nov-16
29-Nov-16
27-Dec-16
24-Jan-17
21-Feb-17
21-Mar-17
18-Apr-17

Figure 4 Accuracy Analysis - Nov 12, 2016

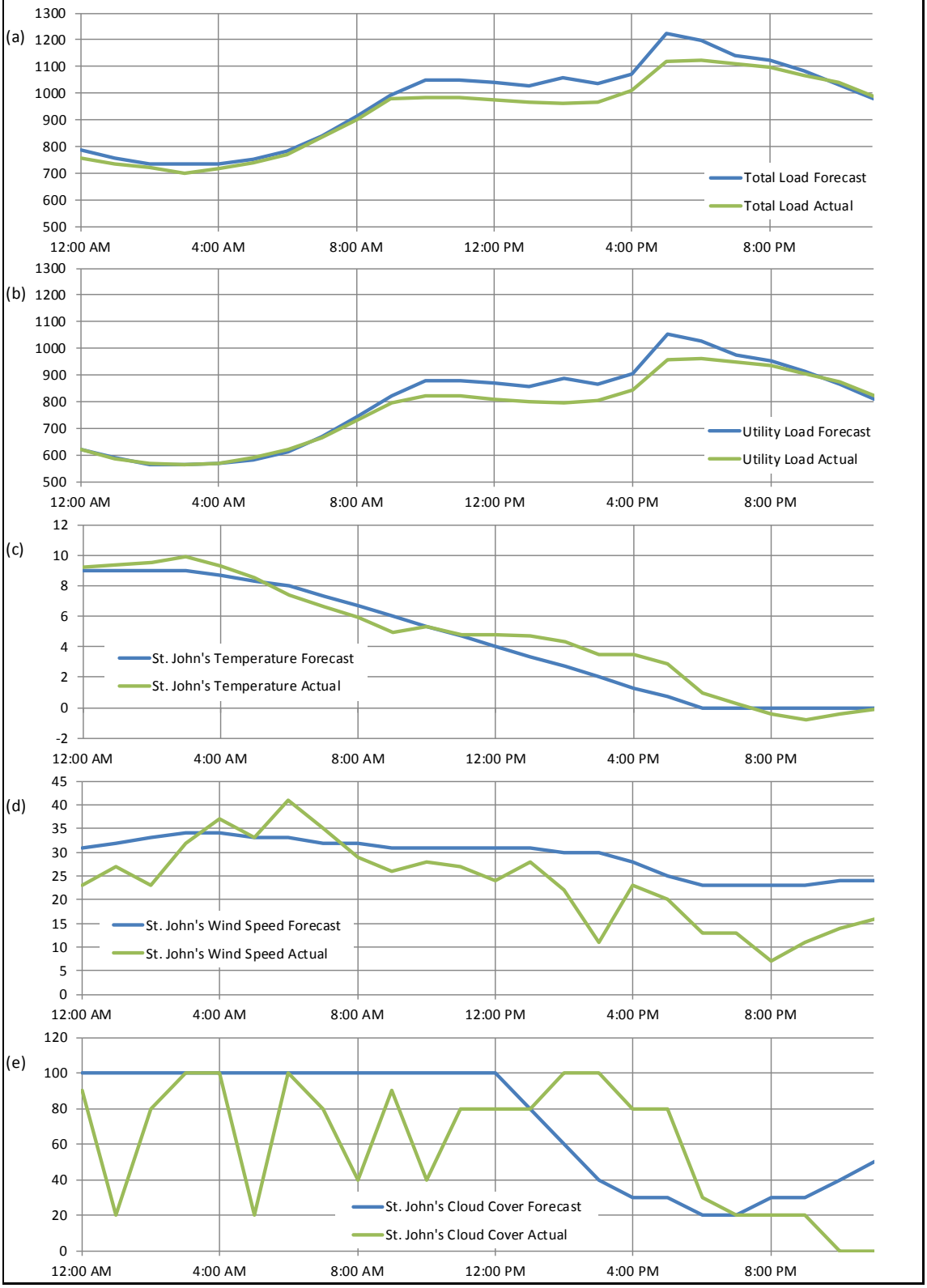

Figure 5 Accuracy Analysis - Nov 21, 2016

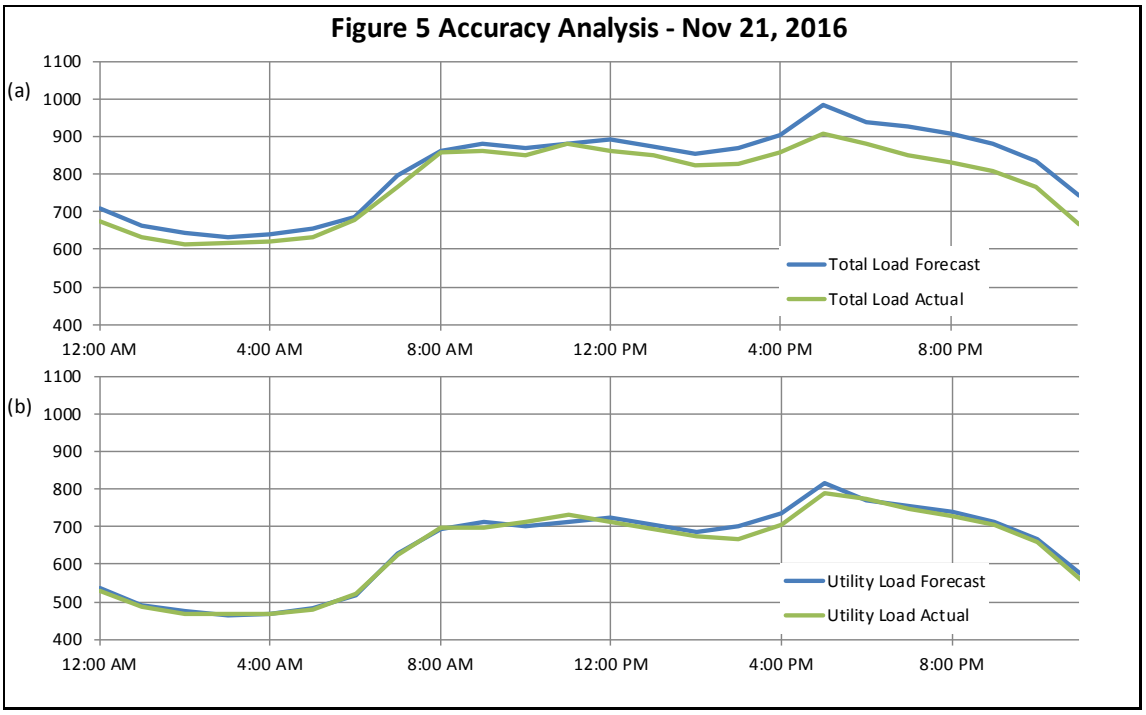

Figure 6 Accuracy Analysis - Nov 22, 2016

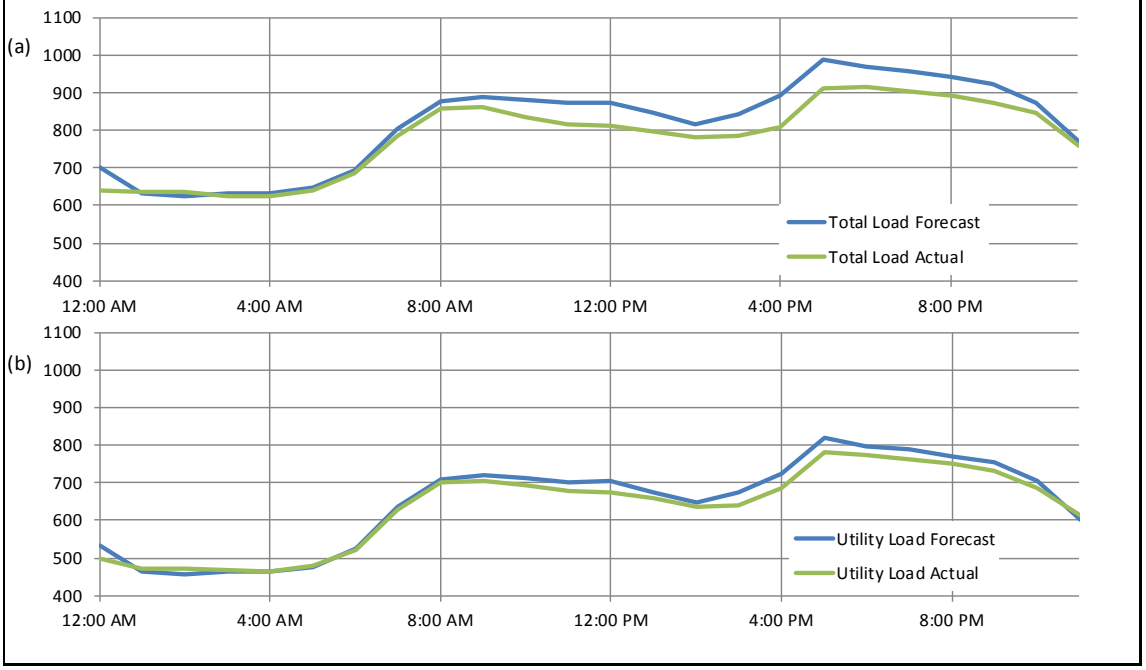

Figure 7 Accuracy Analysis - Dec 17, 2016

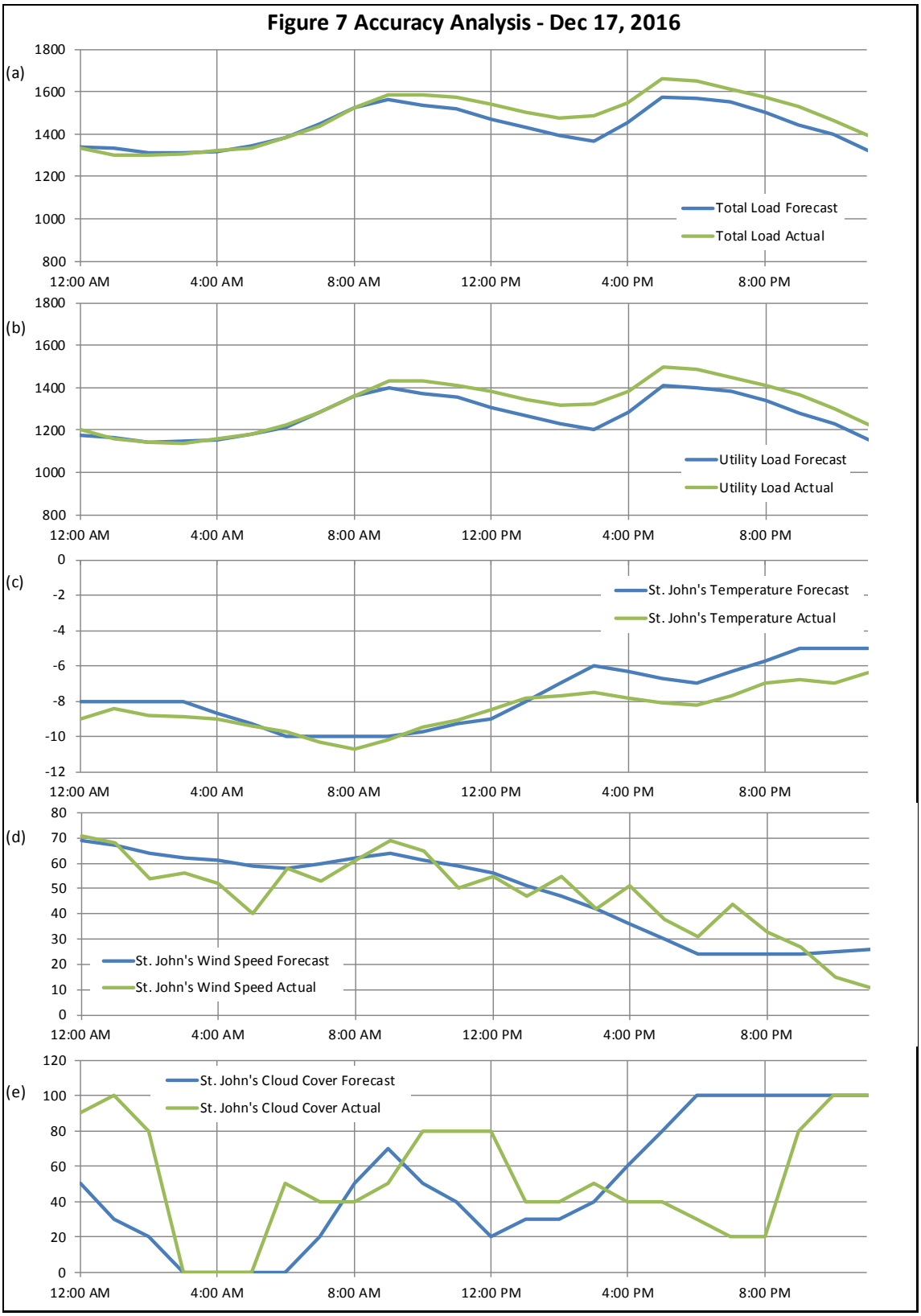

Figure 8 Accuracy Analysis - Dec 25, 2016

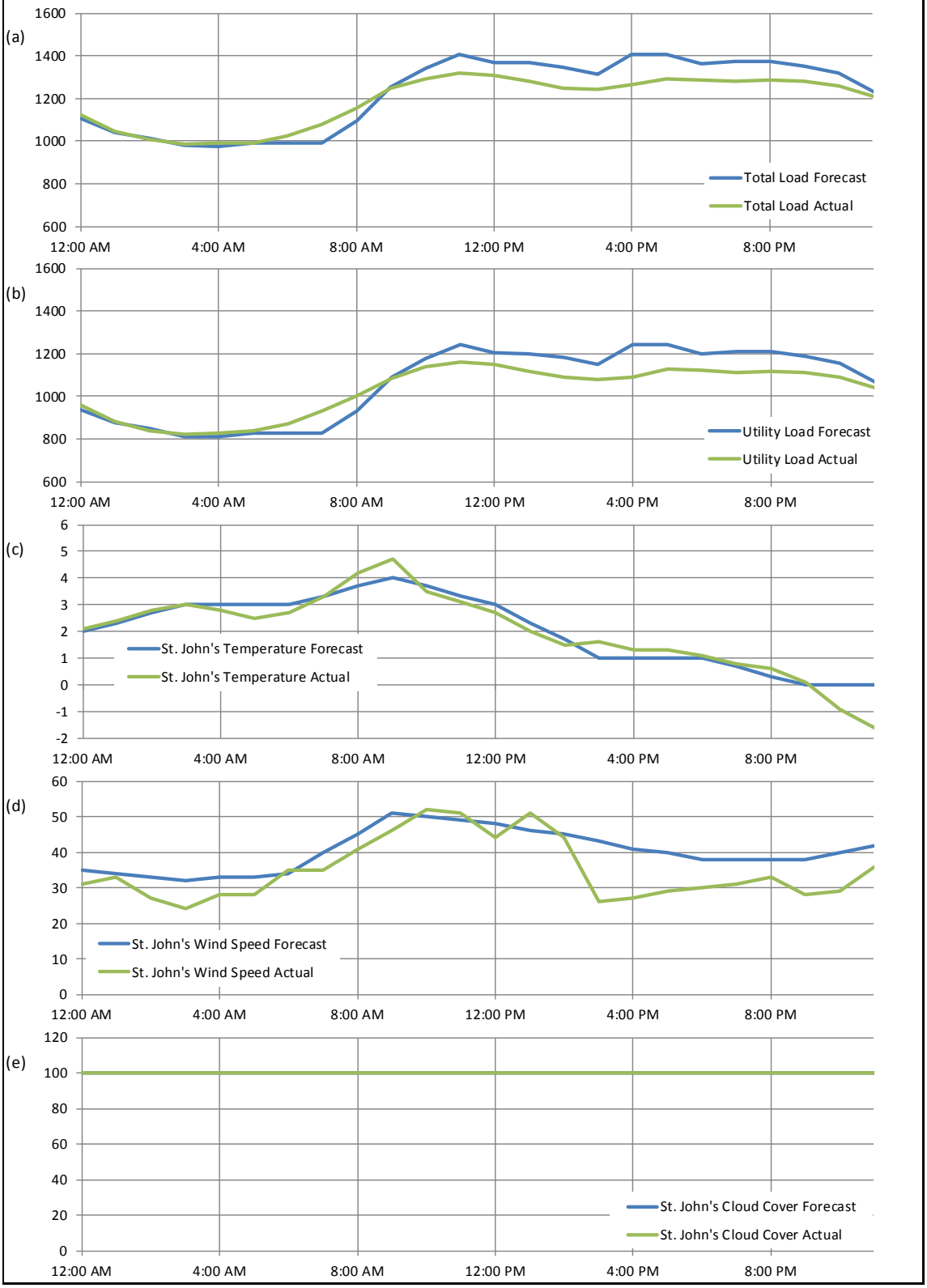

Figure 9 Accuracy Analysis - Jan 05, 2017

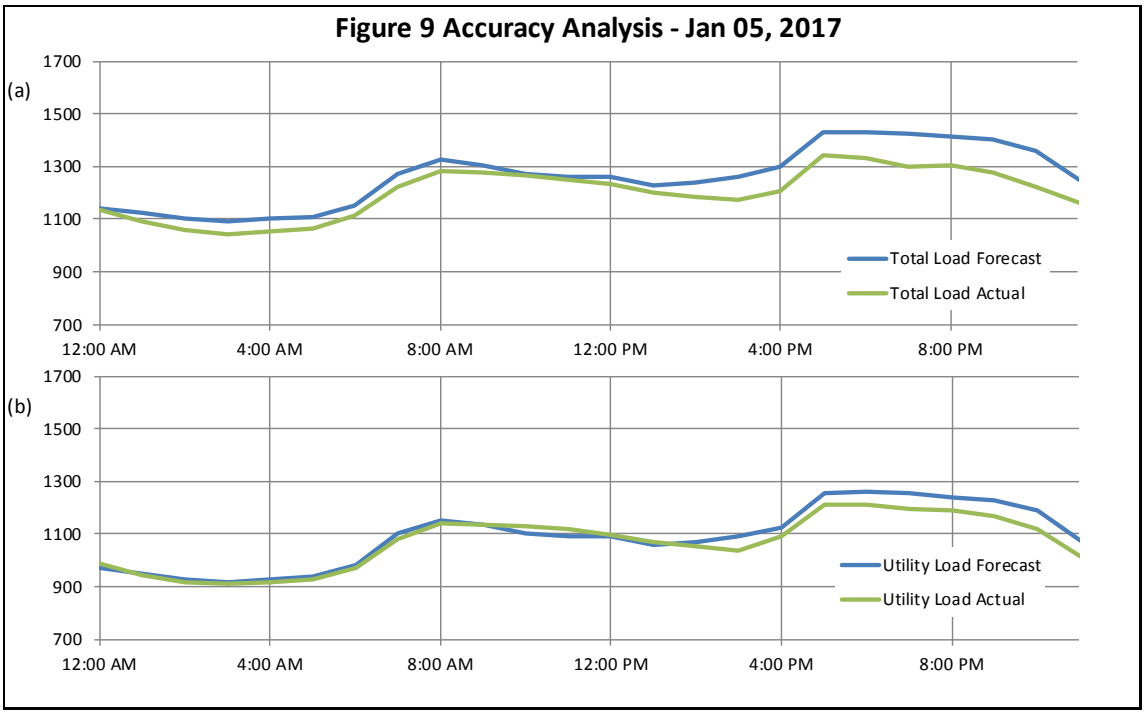

Figure 10 Accuracy Analysis - Jan 22, 2017

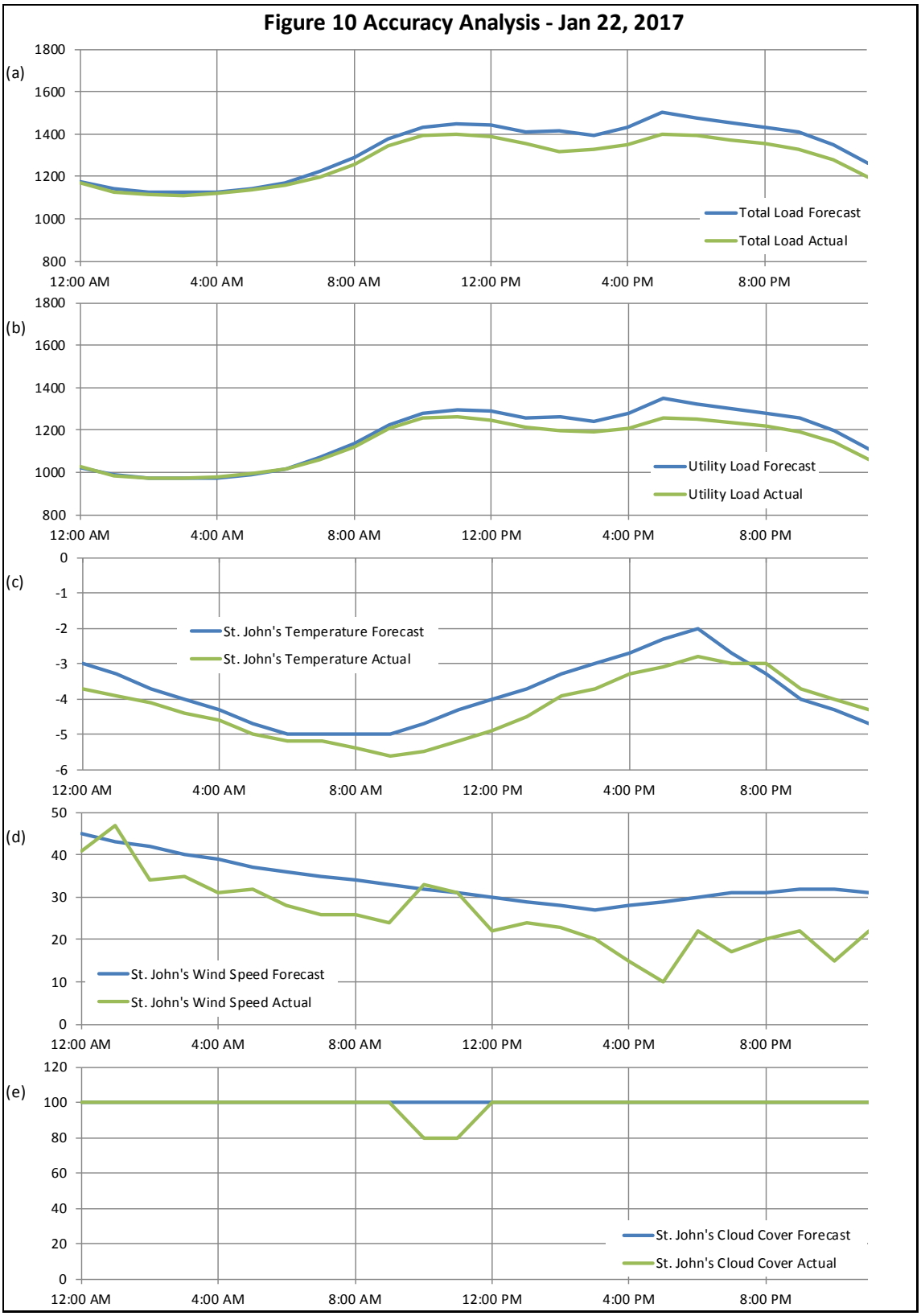

Figure 11 Accuracy Analysis - Jan 23, 2017

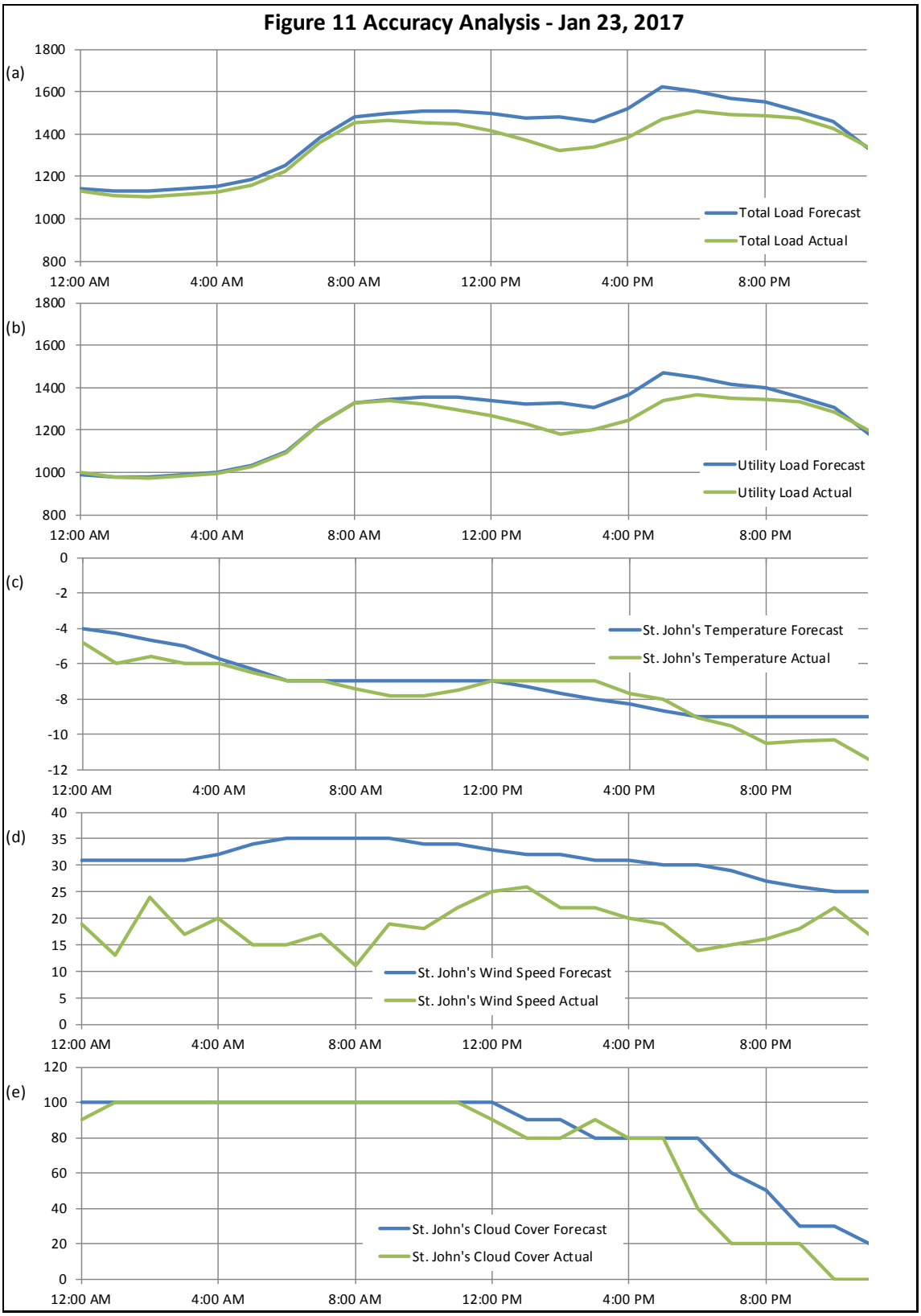

Figure 12 Accuracy Analysis - Feb 09, 2017

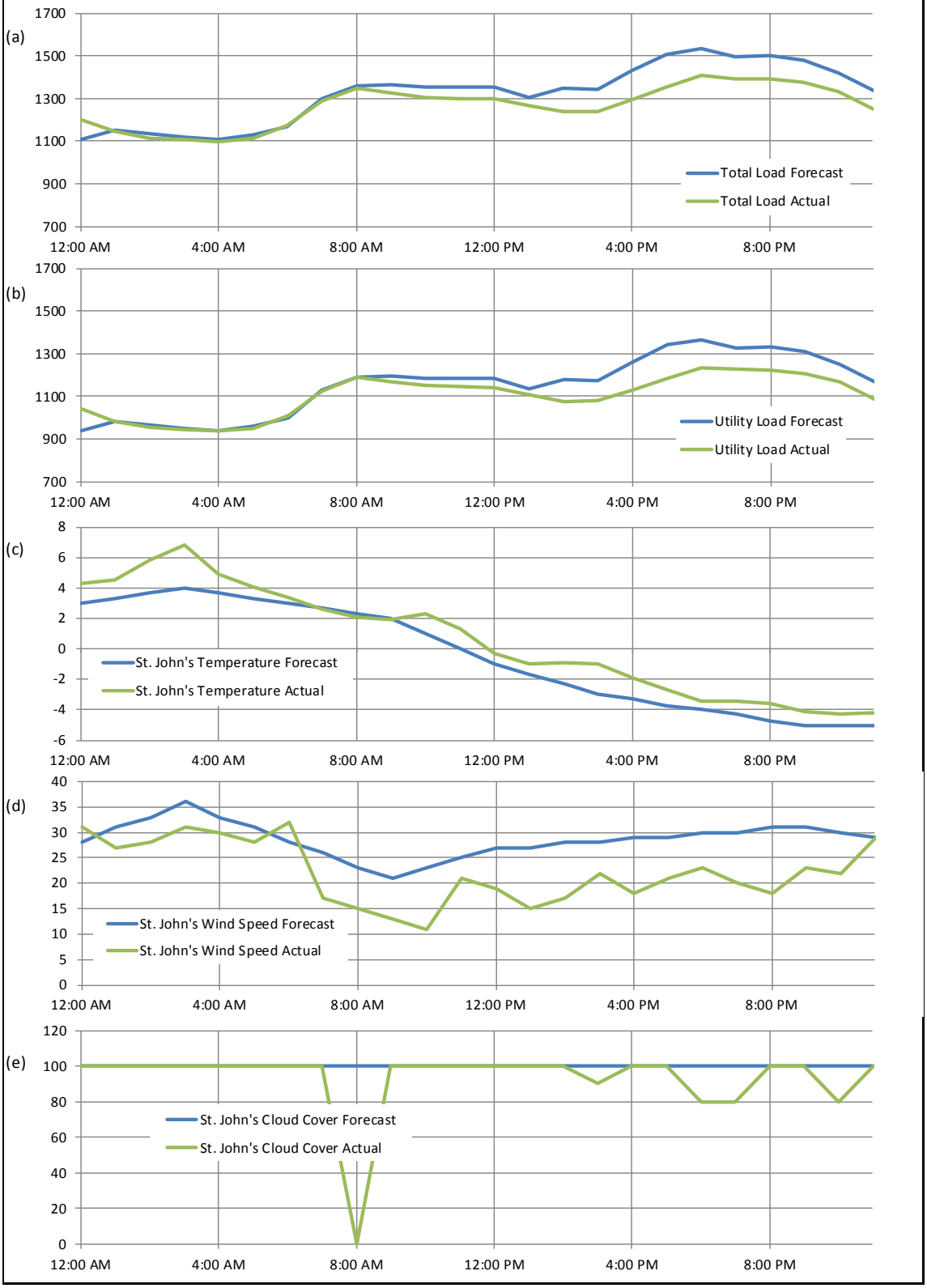

Figure 13 Accuracy Analysis - Feb 12, 2017

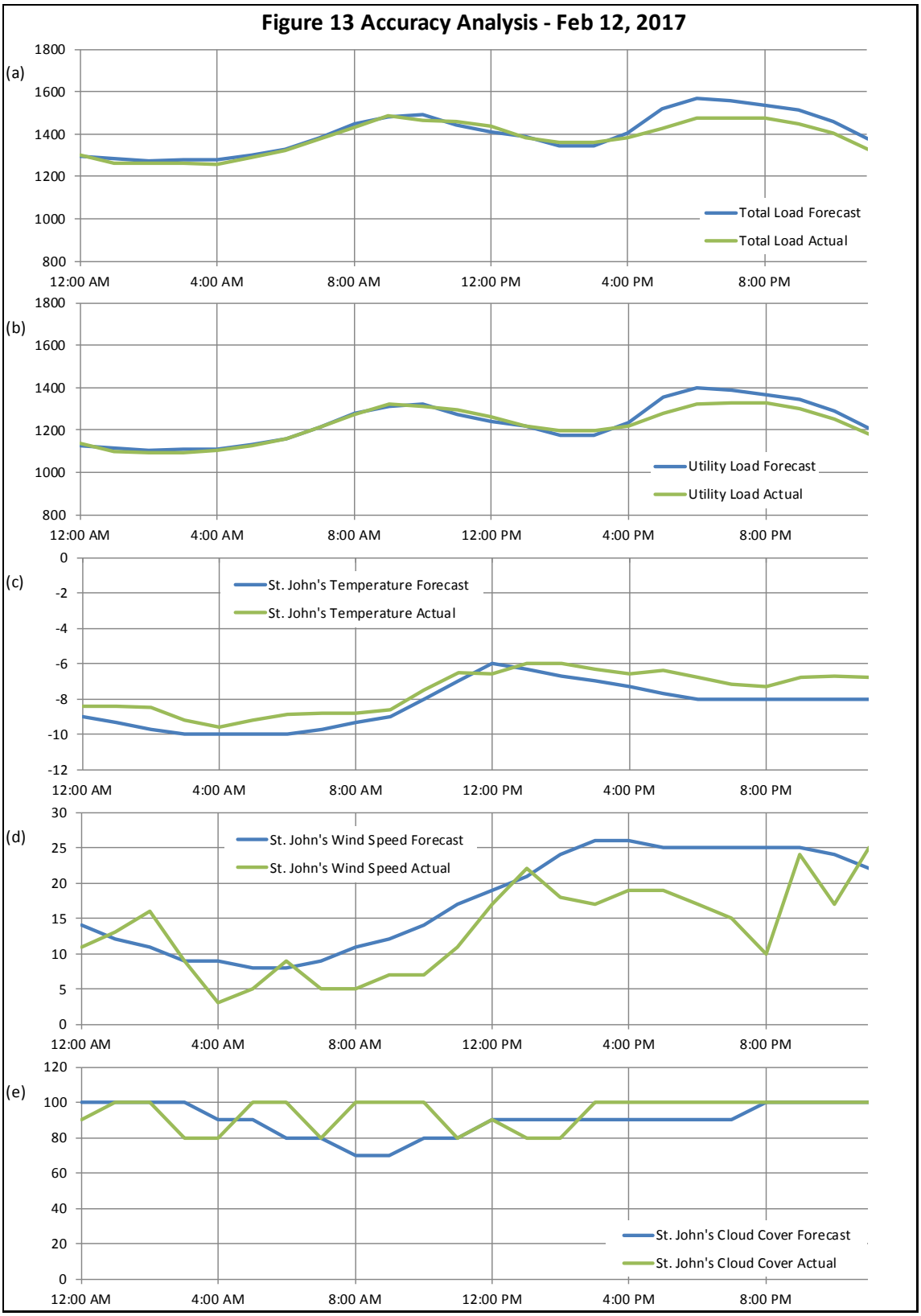

Figure 14 Accuracy Analysis - Feb 25, 2017

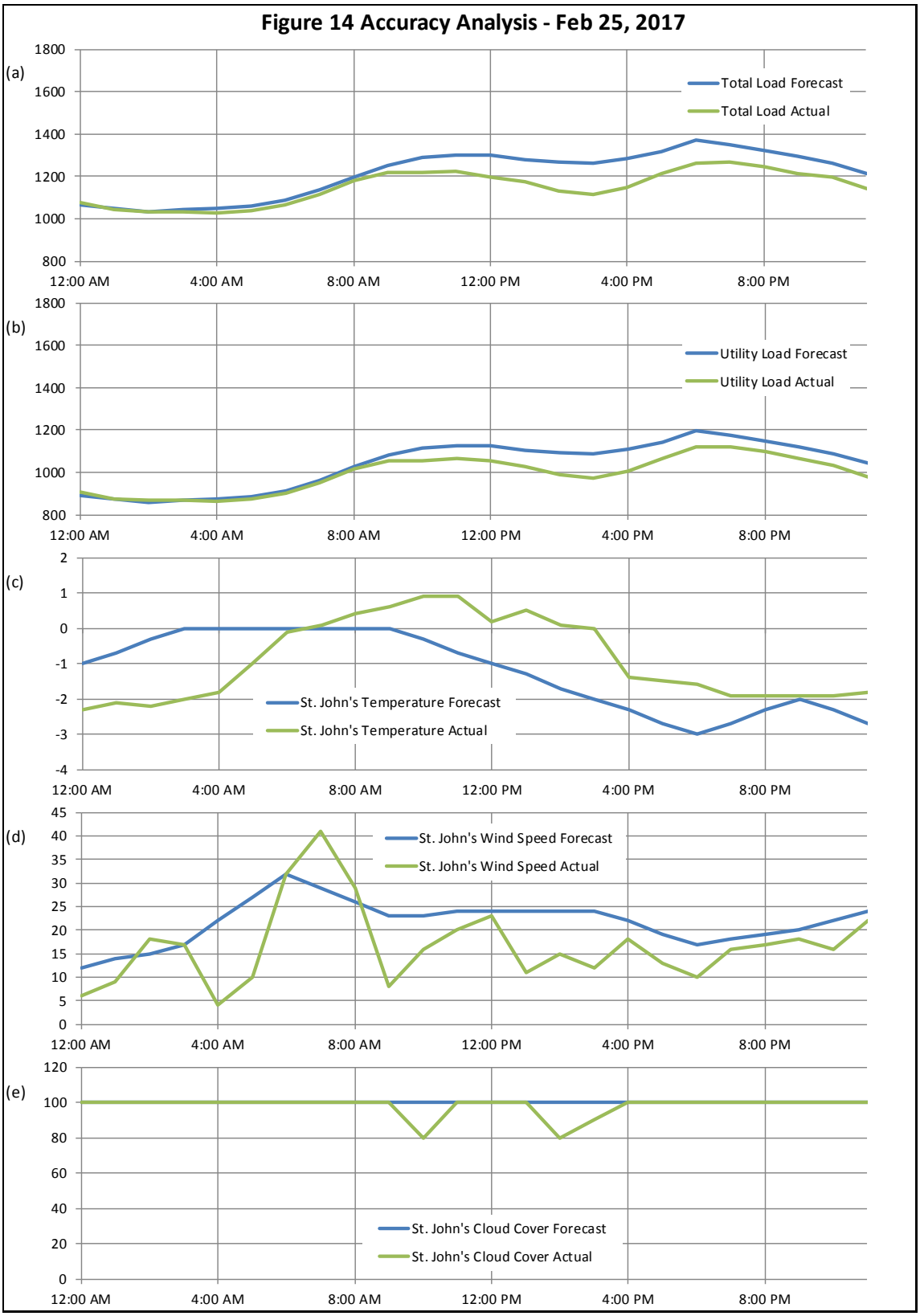

Figure 15 Accuracy Analysis - Mar 16, 2017

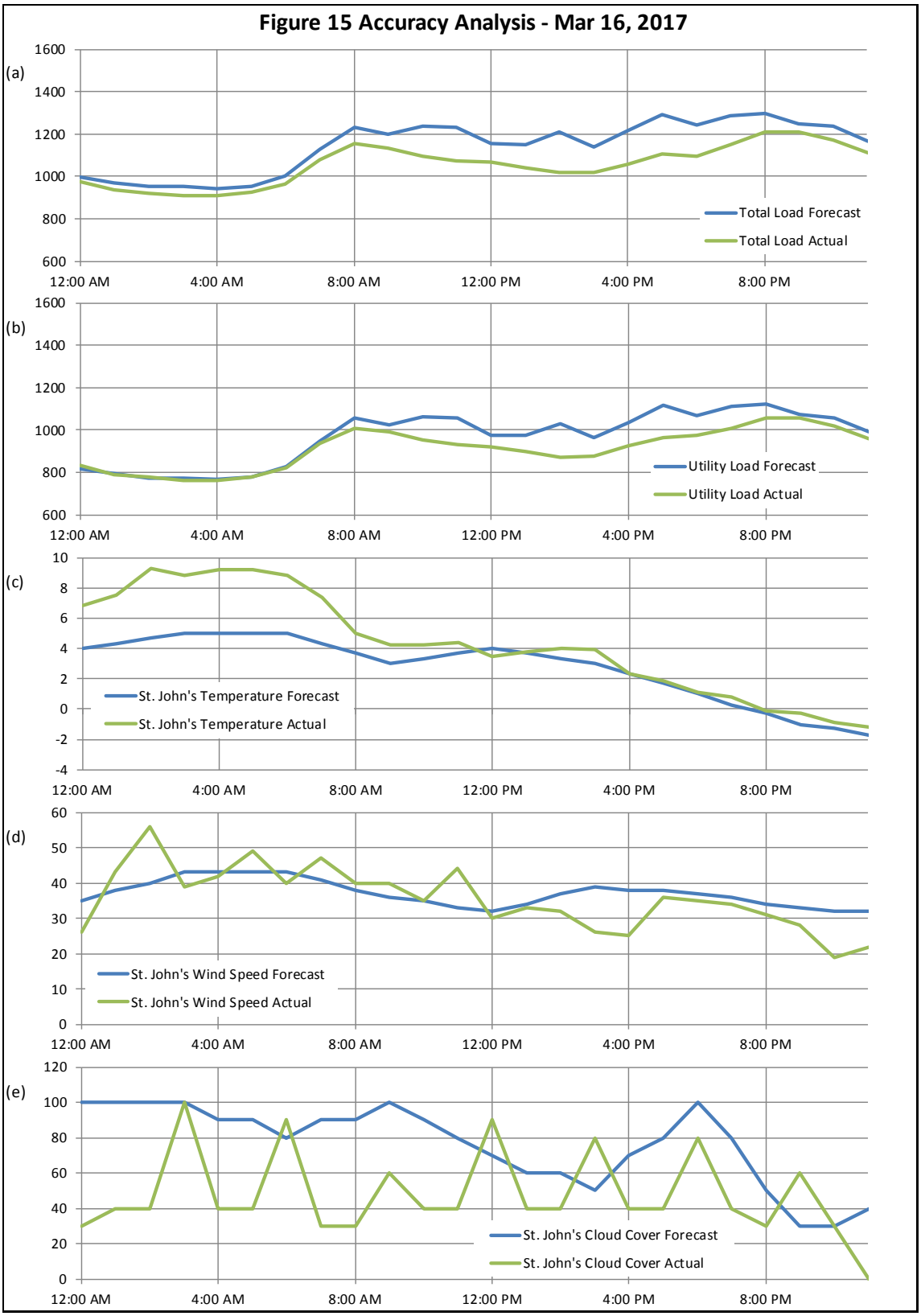

Figure 16 Accuracy Analysis - Apr 01, 2017

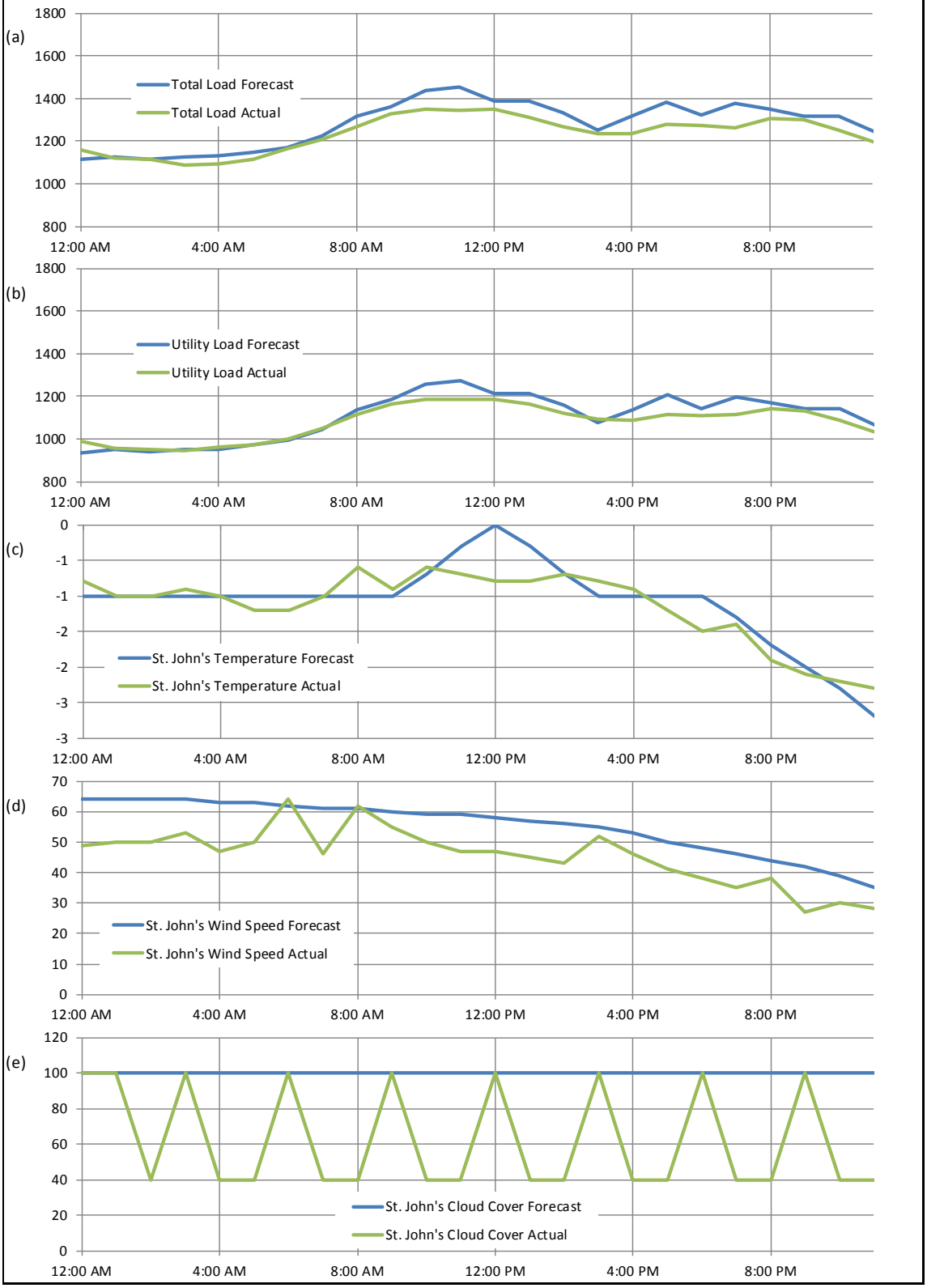

Figure 17 Accuracy Analysis - Apr 06, 2017

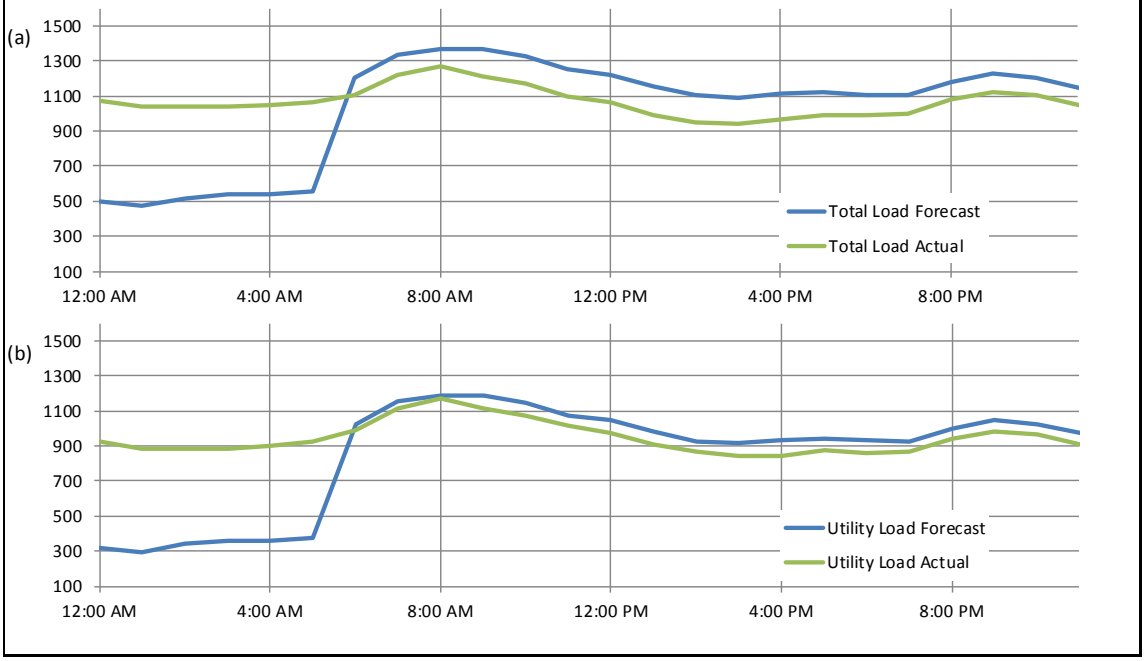

Figure 18 Accuracy Analysis - Apr 29, 2017