Q. Please describe the magnitude of the Nostradamus inaccuracies in early January 2014 and provide the adjustments, in terms of amount and timing, that were made by System Operations.

A. The Ventyx Nostradamus model is used for short term (one to seven days) load forecasting with an hourly time step. Three forecasts are created, one for the Avalon Peninsula, one for the Hydro System, and one for the Interconnected Island System. Nostradamus is a neural network algorithm which learns the pattern of load changes from weather variables, day of week, time of day, etc. by learning from historical data. The forecast is used by System Operations to assist in determination of generation reserves, unit commitment and scheduling, and equipment outage assessments.

In late December 2013 and early January 2014, System Operations noted that Nostradamus was not accurately predicting the load, likely because of the cold temperatures and high winds experienced at the time. Because the forecasts are based on historic patterns of weather and load, the model can have difficulty predicting load during conditions outside of its learning dataset. For parts of most days, the forecast was reasonable but there were occasional saw tooth patterns that System Operations determined to be inaccurate. Several examples are shown in the plots below. More detail on the source of the errors is provided in the Load Forecasting report in *A Review of Supply Disruptions and Rotating Outages: January 2-8, 2014 Volume II, Schedule 3*.

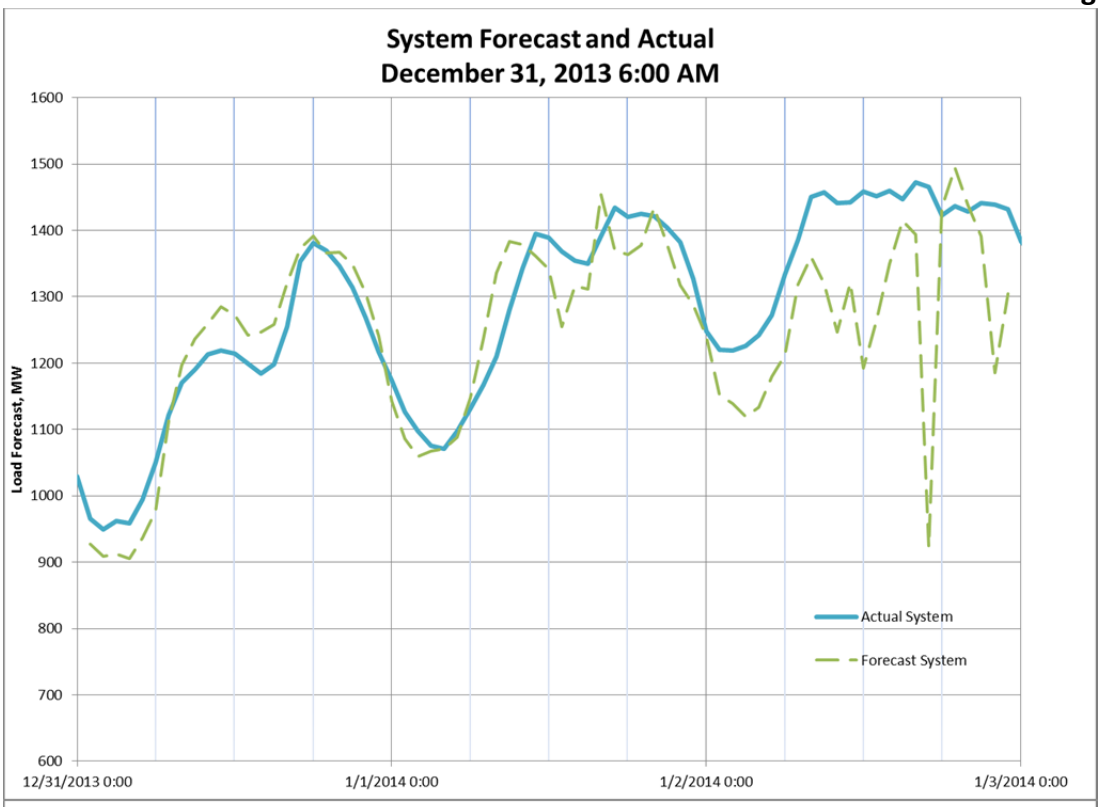
Each Nostradamus load profile (Avalon, System and Island) is made up of three models – Today, Tomorrow and Standard (days three to seven). The plots below

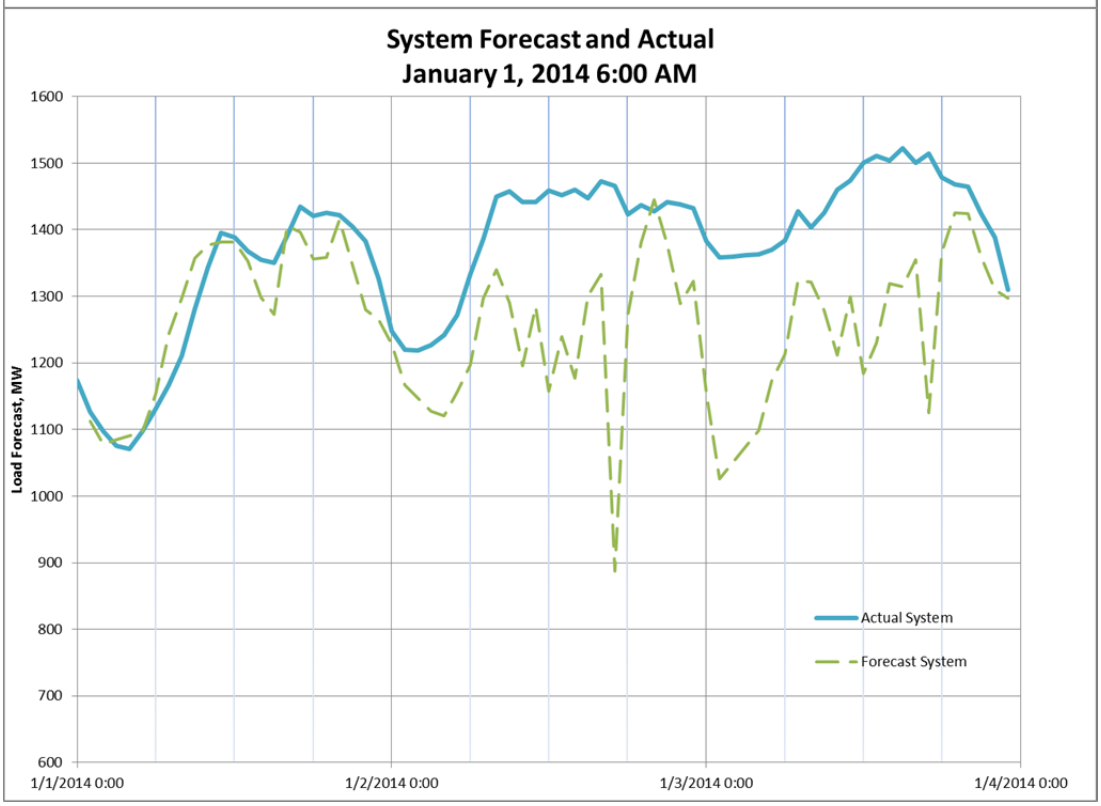
show the System forecast for the first three days of the seven-day forecast made at 6:00 a.m. on December 31, 2013 and January 1 to January 3, 2014. The actual System generation is plotted for comparison. The maximum error over the four-day period examined here was close to 900 MW, which occurred with the System Today forecast on January 2.

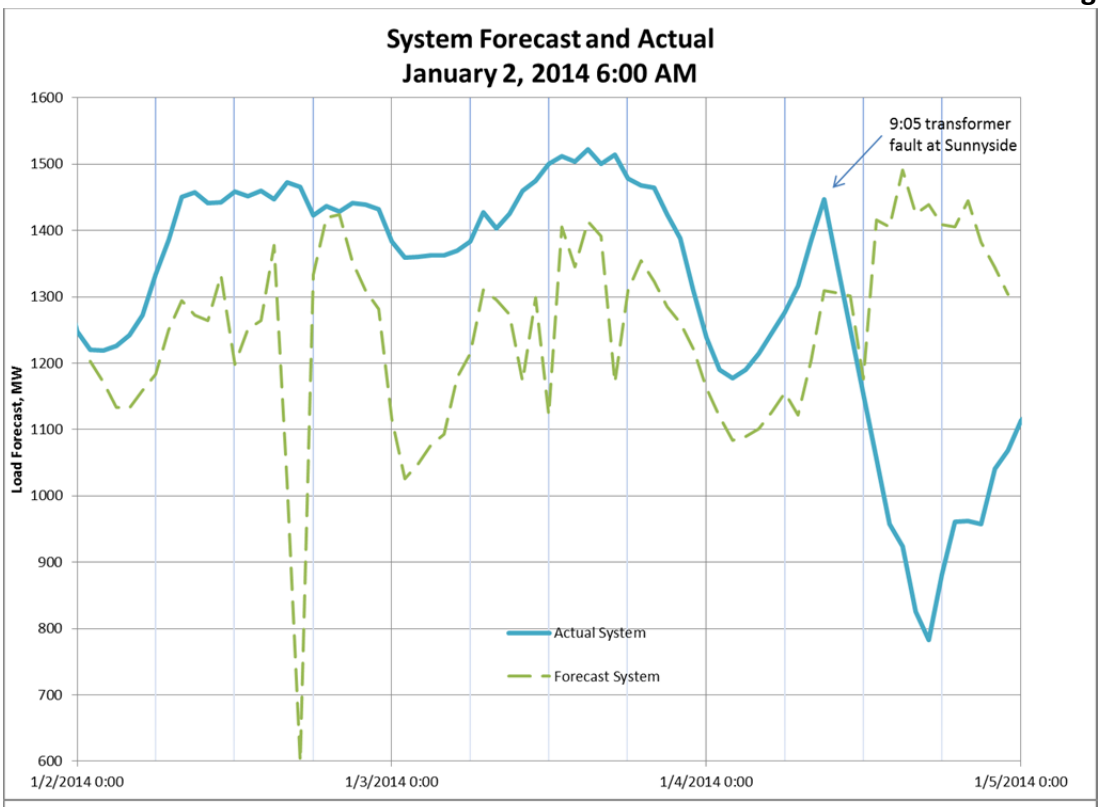
Forecasting for any one hour of generation starts seven days before that hour and the forecast will change multiple times each day until the actual hour occurs. For example, in the plots below, there are three different forecasts for January 3, those made on January 1 at 6:00 a.m., January 2 at 6:00 a.m. and January 3 at 6:00 a.m. In the normal course of events, the forecasts should improve as time gets closer.

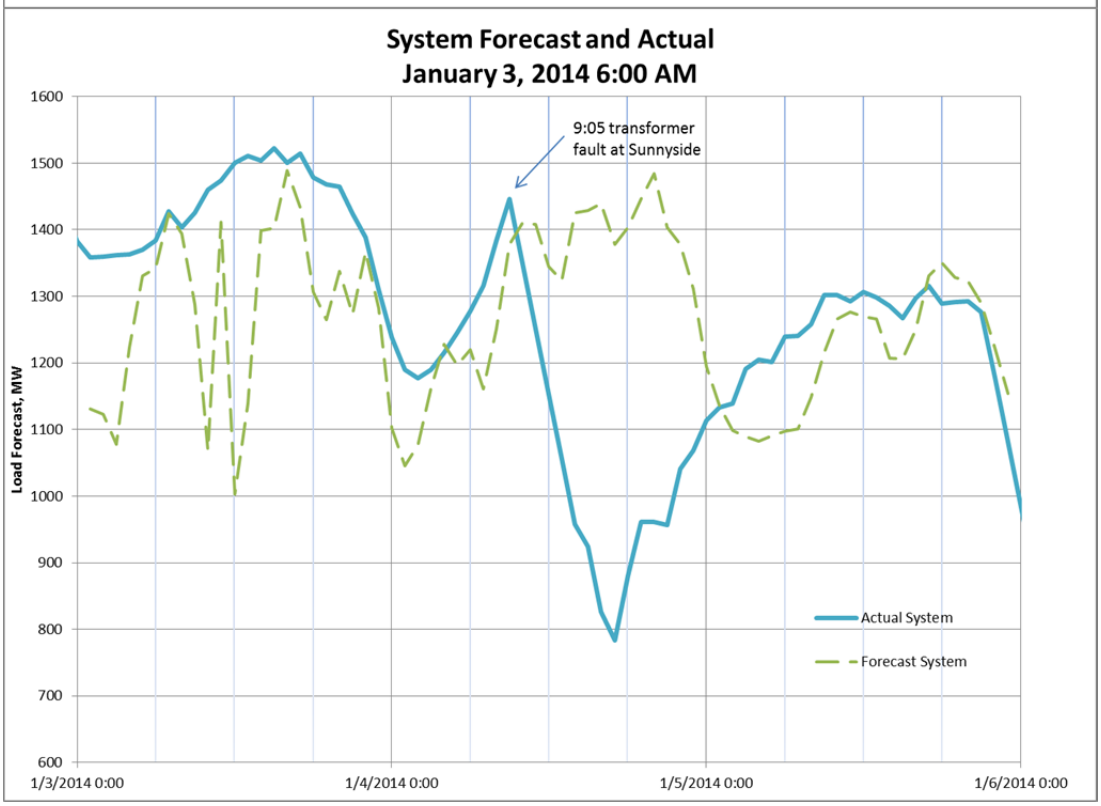
When the forecasts are clearly erroneous, System Operations engineers and Energy Control Centre operators will recognize that fact and will not rely on the erroneous forecast for determining reserves and dispatching generation. They will instead look at recent history of demand and weather and compare it to the weather forecast for the upcoming period to develop a peak forecast expectation outside of Nostradamus. This is done on a real time basis and not specifically tracked.

As indicated in the Load Forecasting report in *A Review of Supply Disruptions and Rotating Outages: January 2-8, 2014 Volume II, Schedule 3,* a more accurate forecast would not have prevented the supply disruptions in January 2014, but it may have been beneficial in managing the rotating outages. Hydro continues to evaluate an upgrade or a replacement to the version of the Nostradamus software that it currently uses for load forecasting.


System Forecast and Actual
December 31, 2013 6:00 AM
Load Forecast, MW
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
12/31/2013 0:00
1/1/2014 0:00
1/2/2014 0:00
1/3/2014 0:00
Actual System
Forecast System


System Forecast and Actual
January 1, 2014 6:00 AM
Load Forecast, MW
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
1/1/2014 0:00
1/2/2014 0:00
1/3/2014 0:00
1/4/2014 0:00
Actual System
Forecast System


System Forecast and Actual
January 2, 2014 6:00 AM
Load Forecast, MW
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
1/2/2014 0:00
1/3/2014 0:00
1/4/2014 0:00
1/5/2014 0:00
9:05 transformer fault at Sunnyside
Actual System
Forecast System


System Forecast and Actual
January 3, 2014 6:00 AM
Load Forecast, MW
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
1/3/2014 0:00
1/4/2014 0:00
1/5/2014 0:00
1/6/2014 0:00
9:05 transformer fault at Sunnyside
Actual System
Forecast System