January 2014
FERC Data Request

ISO New England

System Operations
January 10, 2014

Contents

****NOTE: All data contained within this report is preliminary and subject to revision.*

Figures

1. Weather Conditions

In New England, January 2014 started with a three-day cold spell from the 2nd to the 4th, with very cold temperatures and snow on Friday the 3rd. Preliminary peak load was 21,093 MW at hour ending 18:00 with temperatures at 6.8 F, but due to the snowstorm, particularly in eastern Massachusetts, many public and commercial closures kept the peak just below the 50/50 forecast peak of 21,300 MW.

Mild air from the south worked its way into the region, with temperatures in the low 50's on Monday the 6th.

By early Tuesday morning, the Polar Vortex that brought sub zero temperatures throughout the mid West pushed into New England with temperatures plummeting into the low teens. Although not as cold as Friday the 3rd, the preliminary peak load for Tuesday the 7th was 21,320 MW at 7.9° F.

Temperatures began to return to normal Thursday afternoon, approaching 30° F.

Figure 1 below shows a graph of the average daily temperature for the winter periods from 2004 to 2014. The January 15, 2004 "Cold Snap" had the lowest average temperature in the last twenty years and the all time winter peak of 22,818 MW. The January 2014 days were among the coldest 5% of days in the last 20 years, with daily average temperatures between 5-12 degrees F. The median daily average temperature is about 30° F.

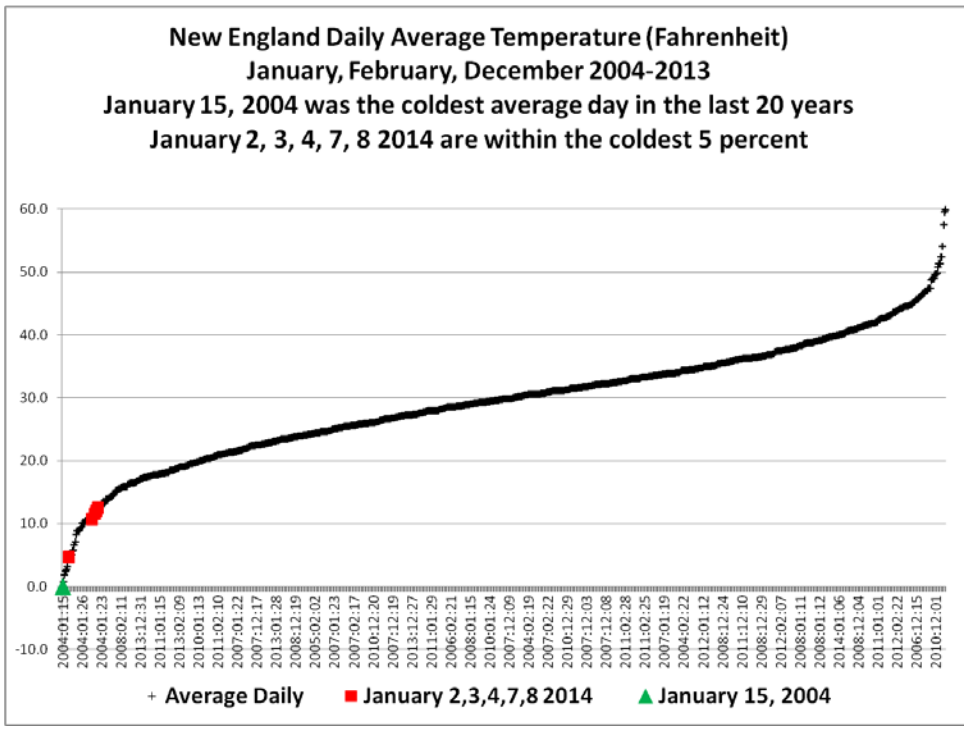

Figure 1 - Temperature Analysis

2. Generation Performance

2.1 Forced Outages and Failures to Start

During the afternoon load pickup on the day of January 7, 2014, the New England system experienced 15 forced generation outages, totaling approximately 1,500 MW of capacity.

2.2 Fuel Supply Issues

A total of six natural-gas fired generators on the New England system reported to ISO-NE that they were unable to affirm whether they would be able to procure fuel when called intraday during the period from January 7 – 8, 2014. Each generator was called in economic merit order, and was requested to advise if they could procure fuel to operate in accordance with their offer parameters. If the generator was not able to make a determination in a timely fashion, the ISO moved on to the next generator to procure the additional MW needed for the balance of the day. Table 1 below shows the cumulative capacity lost due to the inability of natural gas generators to confirm a procurement of fuel throughout the day of January 7. Note that these resources were being called in order to meet the Emergency request of 500 MW from PJM so time was of the essence. Many of the resources that could not provide gas procurement answers in a timely way later called and advised they were available. This is an indication of the difficulty in arranging for gas during tight pipeline conditions.

January 7 Hour Ending	Cumulative Capacity Reduction [MW]
12	284
13	848
14	1,473
15	1,473
16	1,473
17	1,189
18	1,189
19	1,189
20	1,189
21	1,212
22	1,280
23	1,280
24	1,280

Table 1 – Cumulative capacity reductions due to natural gas procurement problems

The five interstate pipelines serving New England are the Tennessee Gas Pipeline, the Algonquin Gas Transmission System, the Iroquois Gas Transmission System, the Portland Natural Gas Transmission System, and the Maritimes and Northeast Pipeline, U.S. ISO-NE maintains daily communication with all of the five interstate pipelines serving New England in order to assess system conditions.

ISO-NE requested and was granted a conference call on Thursday, January 2, with the Northeast Gas Association (NGA) to discuss the upcoming cold weather and areas of concern to both industries. On Friday, January 3, 2014, all of the interstate pipelines were contacted individually to discuss the upcoming cold weather for the week of January 5 – 11, 2014 and the various

operational flow orders (OFO) and imbalance warnings that were posted prior to the inception of the cold weather on January 6. This communication continued daily from Monday, January 6 through Thursday January 9. Note that these communications with the natural gas pipelines are routine and constant in New England due to the pipeline infrastructure constraints.

On Tuesday, January 7, ISO-NE learned of a compressor failure on the Texas Eastern system at Delmont, PA, with a force majeure declaration and gas nominations were subsequently reduced by 575,000 MMBtus. Numerous intra-day discussions took place between ISO-NE and the five interstate pipelines assessing the effects of the Force Majeure incident on Texas Eastern, the subsequent system wide Critical OFO placed on all market operators in Texas Eastern Zone 3, the Critical Capacity Constraint posted by Iroquois and the Critical Day OFO posted by Tennessee Gas Co. In addition, ISO-NE communicated the capacity situation and efforts to assist other Balancing Authority Areas. The inter-industry communications were extremely beneficial for ISO-NE in order to be able to understand the abilities of the pipeline systems in real time and the immediate future.

Although most of the area pipelines were operating at or near capacity, with some recording record throughputs, a significant amount of the ISO-NE gas fleet was either off line due to economics or burning alternate fuel.

Figure 2 shows the mix of generation by fuel type in New England during the morning peak load hour (hour ending 11) of January 7, 2014 arranged by percent of total generation. Natural gas includes generation fueled by LNG.

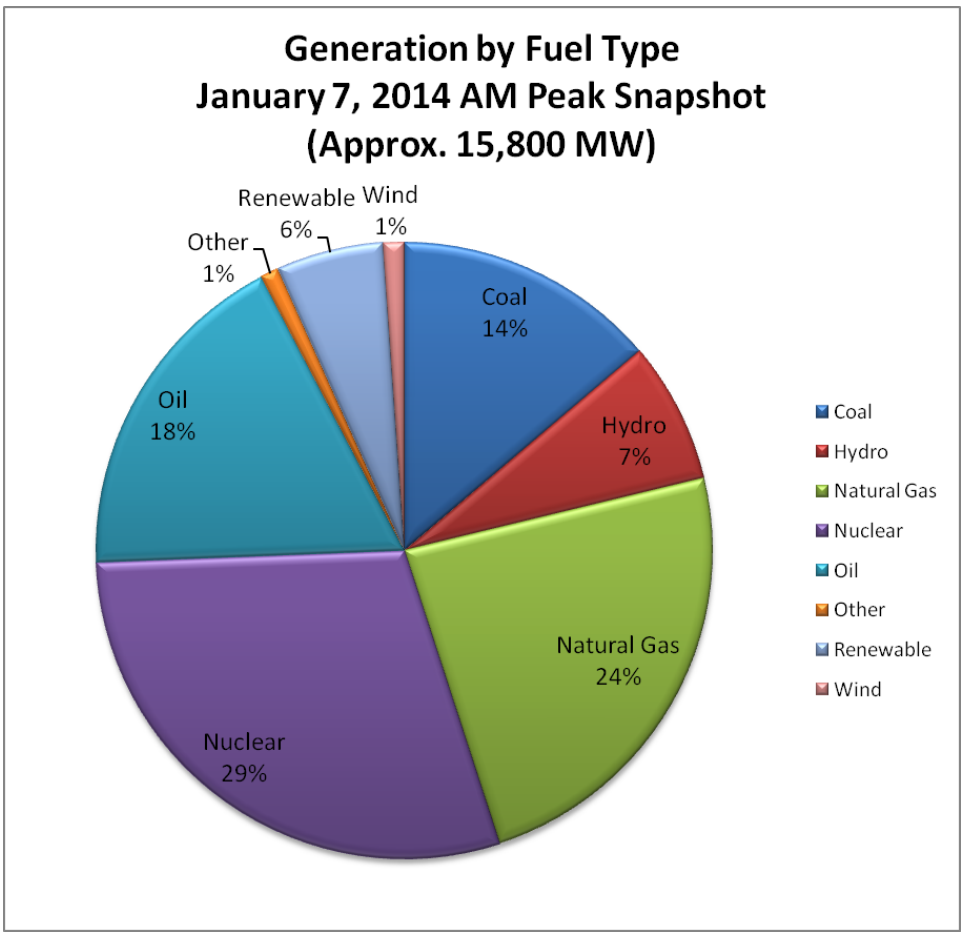

Figure 2 - January 7th Morning Generation by Fuel Type

Figure 3 compares the total MW generated during the January 7th morning peak to total Capacity Supply Obligation (CSO) for each fuel type. It is apparent from this graph that levels of natural gas generation were quite low during this time in comparison to the capacity. Natural gas includes generation fueled by LNG.

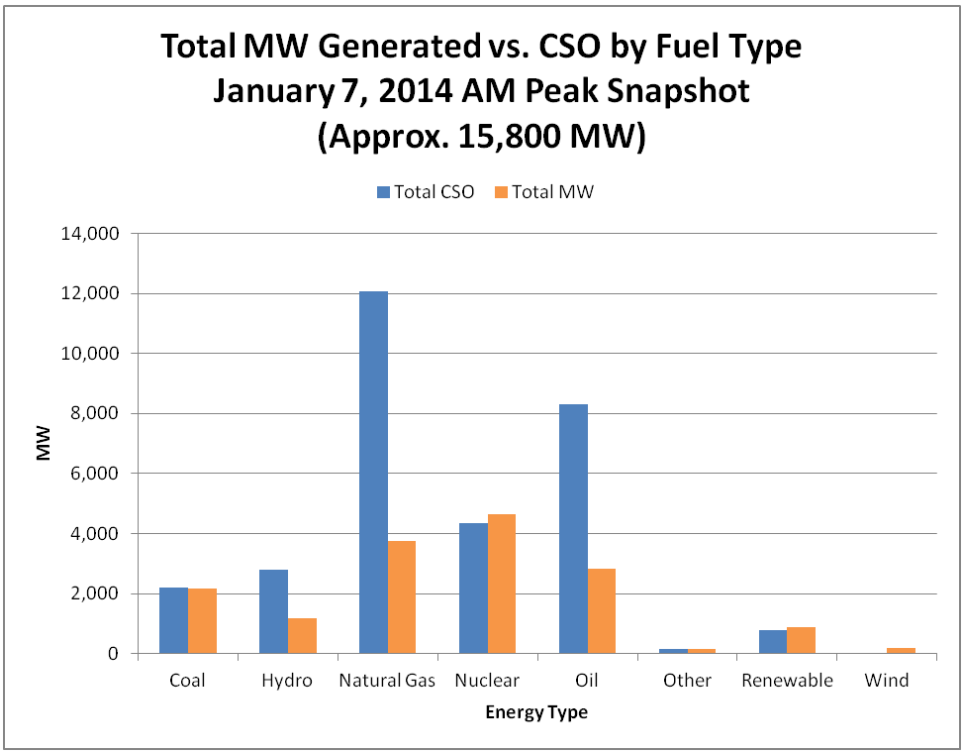

Figure 3 - Generation vs. CSO by Fuel Type (Morning)

The level of natural gas generation broken down by natural gas supply source for a snapshot time during the January 7th, morning peak hour is shown in Figure 4. It is interesting to note that not a single generator was online fueled from the Tennessee Gas Pipeline.

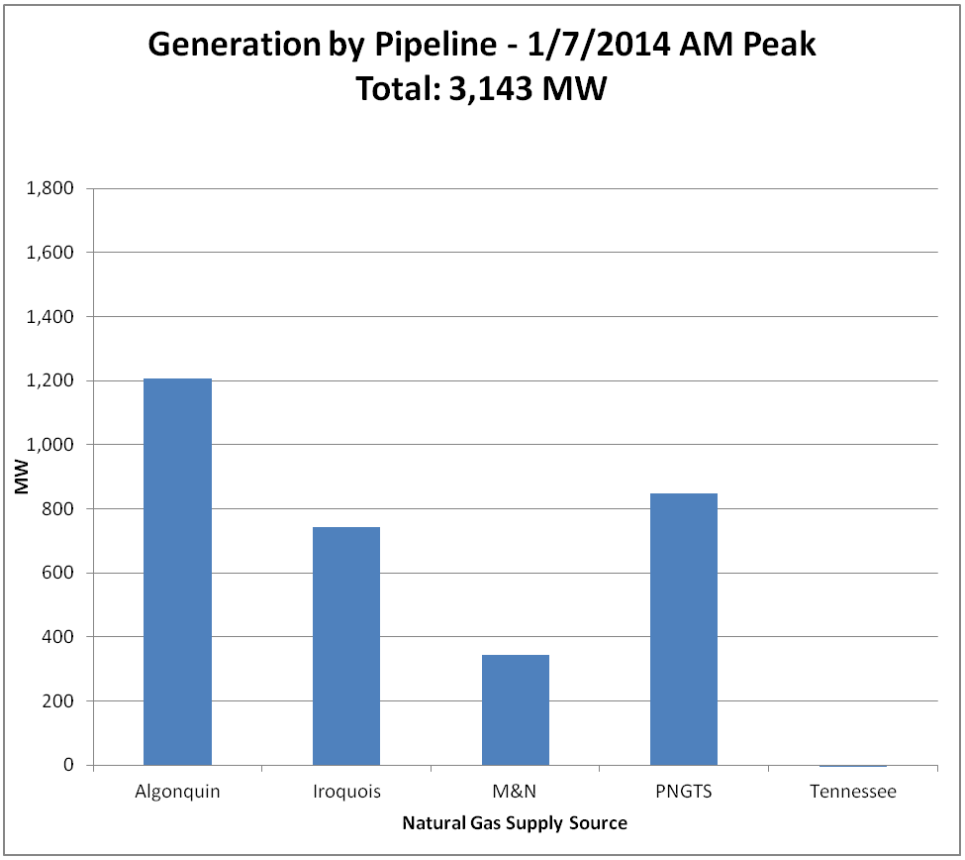

Figure 4 - Gas Generation by Pipeline 1/7 (Morning Peak)

Figure 5 shows the mix of generation by fuel type in New England during the Evening peak load hour (hour ending 19) of January 7, 2014 arranged by percent of total generation. Natural gas includes generation fueled by LNG.

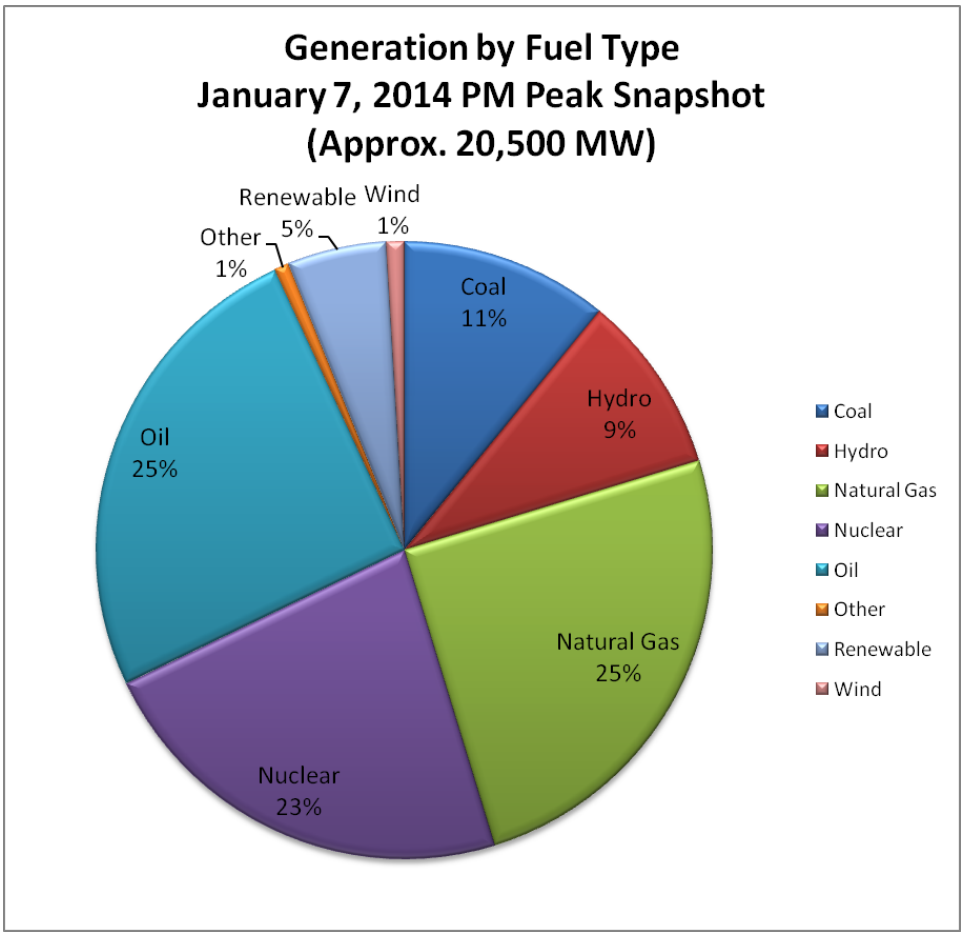

Figure 5 - January 7th Evening Generation by Fuel Type

Figure 6 compares the total MW generated during the January 7th evening peak to total CSO for each fuel type. It is apparent from this graph that levels of natural gas generation were quite low during this time, and only slightly higher than during the morning of that day. Natural gas includes generation fueled by LNG.

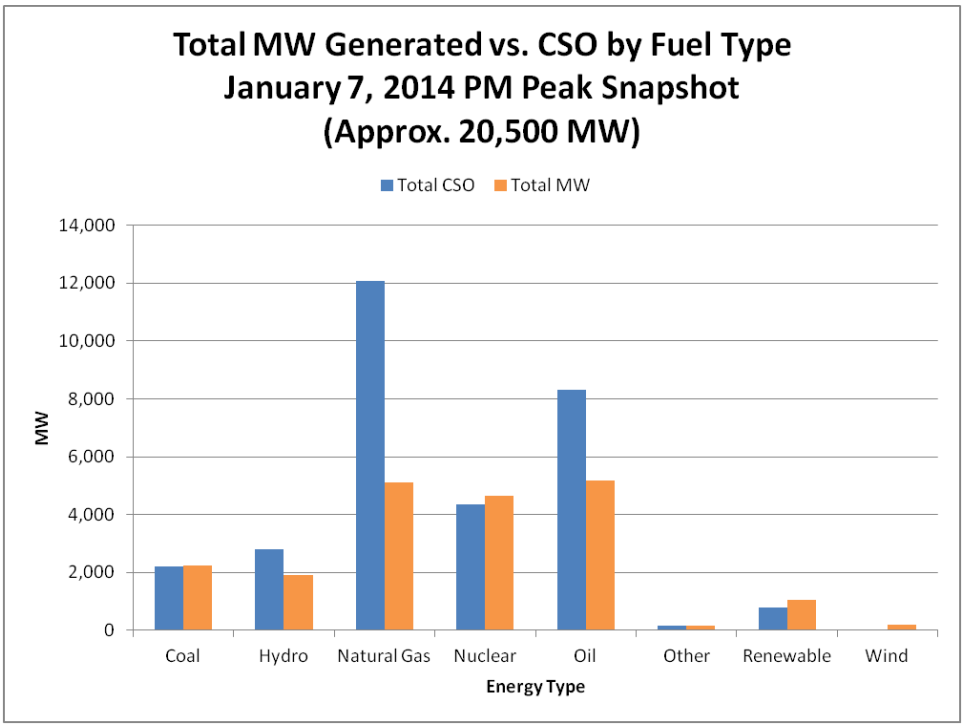

Figure 6 - Generation vs. CSO by Fuel Type (Evening)

The level of natural gas generation broken down by natural gas supply source for a snapshot time during the January 7th, evening peak hour is shown in Figure 7. As with the morning peak in Figure 4, it is interesting to note that not a single generator was online fueled from the Tennessee Gas Pipeline.

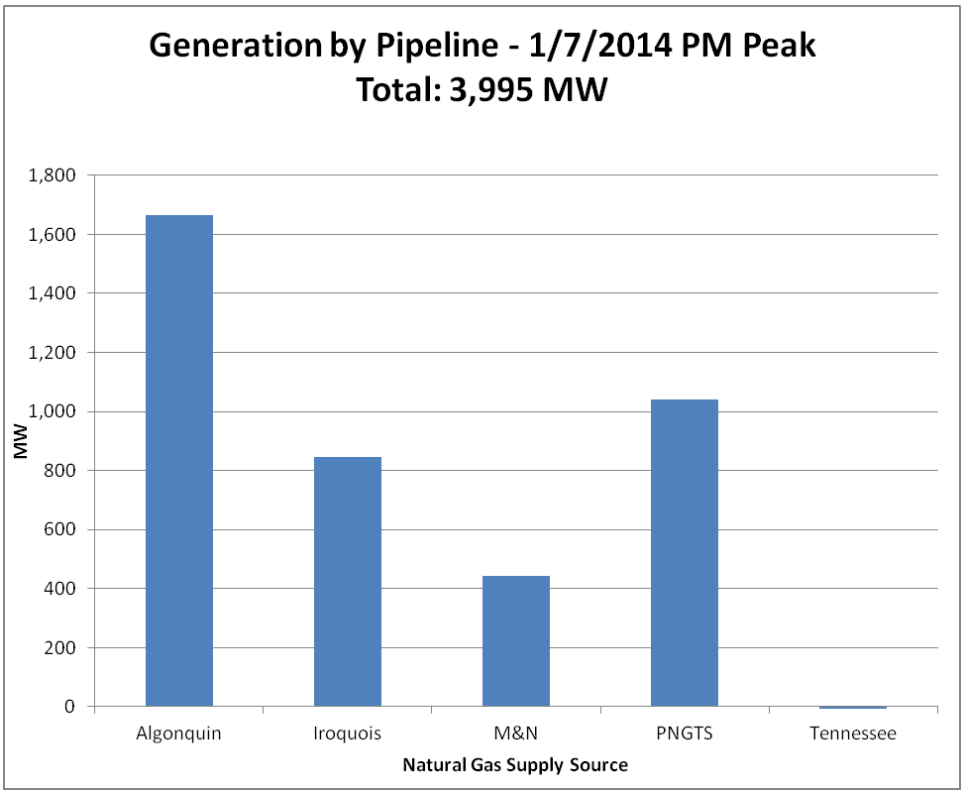

Figure 7 - Gas Generation by Pipeline 1/7 (Evening Peak)

2.3 Reserve Capacity

Table 2 below shows a capacity analysis taken from January 7, 2014 at 18:21, during the peak load hour of that day. The 44 MW capacity margin shows that the ISO was meeting its load and operating reserve requirements with a 44 MW surplus.

Category		MW Value
Capacity Supply Obligation (CSO)	+	30,703
Capacity Additions > CSO	+	2,980
Available Dispatchable Loads	+	0
Outages and Reductions	–	4,677
Generation Unavailable Due to Start Time	–	5,921
NYISO Purchases	–	1,480
NBSO Purchases	+	638
HQ Purchases	+	1,594
Total Available Capacity	=	**23,836**

ISO-NE Load		**21,432**
Operating Reserve Requirement		2,360
Net Capability Required		**23,792**
Capacity Margin		**44**

Table 2 – Peak Hour Capacity Analysis for January 7, 2014

2.4 Generator Known Outages and Reductions

During the peak hour on January 7, 2014 there were approximately 1,700 MW of generator known outages (meaning outages which did not begin on the 7th) and approximately 1,000 MW of generator known reductions. Generator known outages and reductions are in reference to Seasonal Claimed Capability (SCC) values.

3. Transmission Performance

3.1 Major Transmission Constraints

There were two major (binding) transmission constraints on the ISO-NE system on the day of January 7, 2014. These were the 326 Line constraint (New England North-South Interface, essentially New Hampshire-Massachusetts) from hours ending 8 through 22, and the Orrington-South Interface (northern Maine) constraint from hours ending 6 through 17. These transmission constraints occurred due to high imports from New Brunswick even though all area lines were in service.

3.2 Major Transmission Outages

On January 7, 2014 there was one 345 kV line out of service in Southeastern Massachusetts (planned) and the outage had no impact on generation output or interface transfer capabilities in or out of New England.

3.3 Interchange Issues

On January 6 at 13:30 an NPCC Conference Call was held, participants on the call were ISO-NE, NYISO, IESO, NBPSO, HQ, NPCC and PJM. ISO-NE and all other areas verified the interchange schedules between them. The following New England schedules were confirmed for January 7th:

- 1,100 MW import from NYISO across the northern AC tie lines
- 100 MW export to NYISO across the NNC to Long Island
- 1,300 MW import from HQ across Phase 2 HVDC Interconnect into Massachusetts
- 218 MW import from HQ across the Highgate HVDC Interconnect into Vermont
- 626 MW import from New Brunswick Power into Maine

During the evening of the January 6th, both NYISO and PJM experienced generation losses that had the potential to alter the imports into New England for the next day. ISO-NE staff was in communications with NYISO as a result of those losses and ISO-NE adjusted its forecasted imports into New England from NYISO and determined the imports would most likely be limited to zero and as a result ordered additional generation capability to replace the expected loss.

All of the ISOs then reconvened on a coordinated conference call to review expectations on the morning of January 7, where expected transfers between areas were reviewed. The following schedules for New England were confirmed:

- 0 MW import from NYISO across the northern AC tie lines
- 100 MW export to NYISO across the NNC to Long Island
- 1,300 MW import from HQ across Phase 2 HVDC Interconnect into Massachusetts
- 218 MW import from HQ across the Highgate HVDC Interconnect into Vermont
- 626 MW import from New Brunswick Power into Maine

During the conference call ISO-NE stated they expected to meet reserve requirements. ISO-NE also stated that if emergency transactions were needed external to New England the expectation was that New England could start additional resources and transfer additional capability out of the region with approximately four to five hours notice.

Later that morning PJM requested 500 MW of emergency energy from ISO-NE, from 15:00 until 23:00. ISO-NE, NYISO and PJM then coordinated the transaction to get the emergency energy delivered to New York and from New York to PJM. Finally, to support the 500 MW emergency energy sale to PJM, ISO-NE ordered additional generation to meet the request.
At 12:00 ISO-NE entered Master/Local Control Center Procedure No. 2, Abnormal Conditions Alert, due to weather in the region and to ensure that all resources remained in a "hands off mode" on equipment and in preparation to provide the extra capability requested earlier in the day.

At 15:00, ISO-NE scheduled 500 MW of emergency energy to NYISO and NYISO delivered the emergency energy to PJM with an emergency energy transaction. That transaction ended at 23:00 as expected.

4. System Load

The following graphs show the New England system load forecast and actual load for the days of January 6 – 8, 2014. For reference, the peak load for the winter of 2013 – 2014 is 21,514 MW on Tuesday, December 17, 2013. The all time ISO-NE winter peak load is 22,818 MW on Thursday, January 15, 2004.

The weather forecast for January 6th proved accurate for this day. The peak hour load forecast deviation between forecast and actual load was 0.5%.

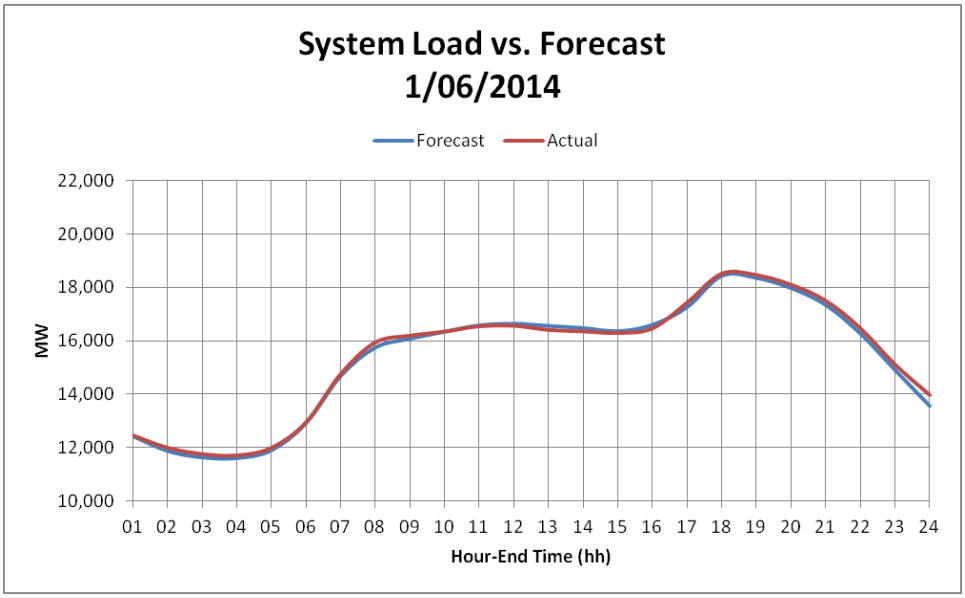

Figure 8 - January 6 System Load

The observed weather for Hartford and Boston for January 7th was colder than forecasted and loads ran higher than expected. The peak hour deviation between the forecasted and actual load was 3.05%.

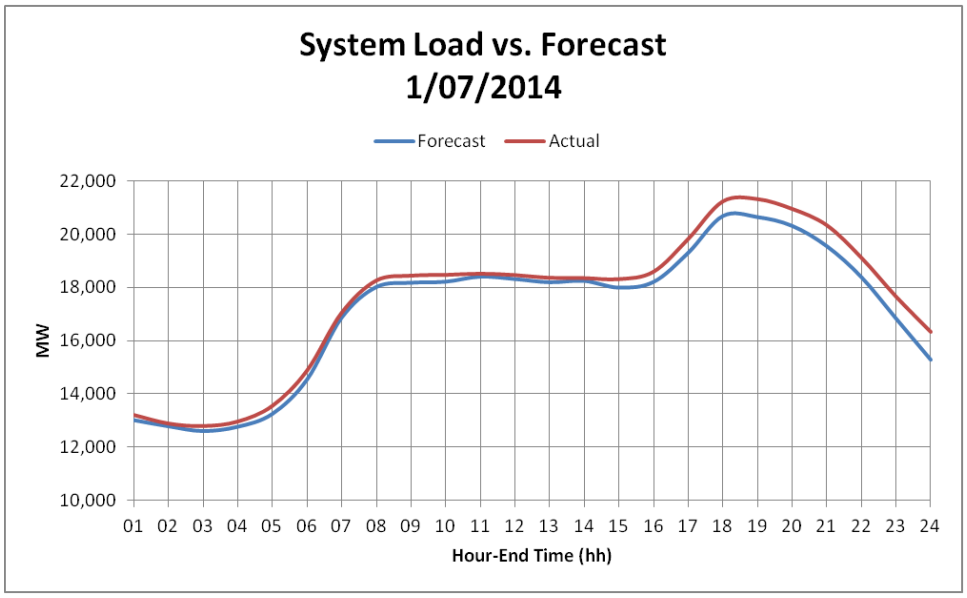

Figure 9 - January 7 System Load

The weather forecast proved accurate for January 8th. The peak hour deviation between forecast and actual load was – 1.68% .

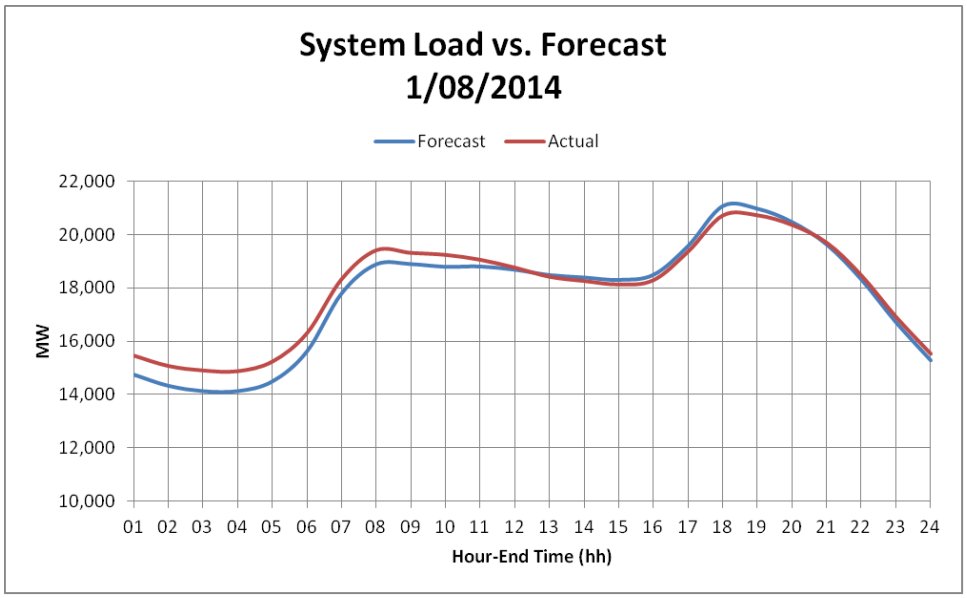

Figure 10 - January 8 System Load

Tables 3 and 4 show the forecasted and observed high and low temperatures for the cities of Hartford, CT and Boston, MA along with the time of day associated with each of those temperatures.

Hartford Forecasted vs. Actual High and Low Temperatures (and Times)				
Date	**Forecasted High (°F)**	**Forecasted Low (°F)**	**Observed High (°F)**	**Observed Low (°F)**
Monday 1/6/2014	49° - 13:00	25° - 23:00	54° - 14:00	27° - 23:00
Tuesday 1/7/2014	16° - 14:00	10° - 23:00	11° - 14:00	5° - 23:00
Wednesday 1/8/2014	22° - 14:00	5° - 07:00	22° - 14:00	4° - 08:00

Table 3 – Hartford, CT Temperatures

Boston Forecasted vs. Actual High and Low Temperatures (and Times)				
Date	**Forecasted High (°F)**	**Forecasted Low (°F)**	**Observed High (°F)**	**Observed Low (°F)**
Monday 1/6/2014	50° - 15:00	29° - 23:00	56° - 15:00	31° - 23:00
Tuesday 1/7/2014	18° - 14:00	12° - 23:00	16° - 14:00	10° - 23:00
Wednesday 1/8/2014	24° -14:00	8° -06:00	22° - 14:00	8° - 06:00

Table 4 – Boston, MA Temperatures

There was no need to call on demand response/interruptible load during this time period, however the following capacities (CSO) were available:

- Winter Program Demand Response: 21 MW available prior to implementing OP #4
- Demand Response: 261 MW available within 30 minutes under OP #4 Action 2
- Emergency Generation: 133 MW available within 30 minutes under OP #4 Action 6

5. Preparations in Advance of the Cold Snap

Beginning on December 31st and continuing through the latest cold snap that ended on January 8th, ISO New England System Operations Staff has held regular conference calls with the NPCC Reliability Coordinators including: ISO New England, New Brunswick Power, New York ISO, Hydro Quebec, Independent Electric Operator of Ontario and PJM. In addition, the ISO conducted conference calls and held its normal regular day-to-day communications with the Transmission Operators at the six Local Control Centers within New England. In addition, a conference call was held with the gas industry at the request of ISO New England with the Northeast Gas Association on January 2nd to discuss the upcoming cold weather in the region and the importance of maintain close coordination particularly regarding any irregularities or outages that might occur. During all of these calls and over the course of the normal scheduling and operations processes, generation and transmission outages were continuously evaluated and lines and or generators were returned to service in order to prepare the grid for operation during the expected cold weather conditions. Finally, one of the most important aspects of the calls with the external Reliability Coordinators is to confirm expected interchange schedules to ensure enough resources are being made available to meet the load and operating reserve requirements in a coordinated fashion. It should be noted however that normal and routine coordination within New England and the external areas and gas pipelines are a continuous and normal practice.

6. Preliminary lessons learned or plans for post-event analysis

ISO-NE has submitted its Information Policy changes to FERC to improve gas-electric coordination per FERC Order 787. In addition, ISO-NE continues to move forward with its Strategic Planning Initiative to improve resource availability and performance. Cold weather related equipment issues did not cause any operational issues. In terms of further post-event analysis, ISO-NE intends to review operations during the days in question with asset owners to determine whether there are any lessons learned.