Interim Report on the August 14, 2003 Blackout

January 8, 2004

NYISO Interim Report on the August 14, 2003 Blackout
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Executive Summary

The New York Independent System Operator ("NYISO") has prepared this Interim Report on the August 14, 2003 Blackout to describe the system disturbance that caused it and the restoration in New York State. We will also summarize the next steps being taken to study those events and activities further. While the data collection is nearly complete, developing models of the precursors to the system disturbance, the initiating events and the event itself, and analyzing those models will take additional time. Studies now being conducted by various reliability organizations and by the NYISO continue, and any final recommendations for the NYISO's operating and planning procedures depend on the results.

No matter what recommendations result from the ongoing studies, there is one conclusion the NYISO knew and advocated publicly before August 2003, and that was unequivocally confirmed by the blackout: Reliability standards must be mandatory and they must be stringently enforced. Efficient system design must rest on the assumption that neighboring systems comply with accepted design and operating standards. The North American Electric Reliability Council (NERC) standards are a good baseline, but that should not preclude even more stringent standards when needed. Reliability standards in New York are mandatory, and exceed the voluntary NERC standards.

The system disturbance swept through New York without warning and in a matter of seconds. The automatic relay and load-shedding protection in New York operated as intended, maintaining service in some areas and allowing restoration of the system to begin immediately.

The NYISO operators, all certified by NERC, had undergone extensive training to prepare them to respond quickly in an emergency. Operators of generating plants in New York State had also been trained by the NYISO under a program known as the Generator Operating Training Seminar. Effective restoration plans, prior training, and constant communication within New York allowed the NYISO, the Transmission Owners (TOs), and the Municipal Systems to restore power to the NYCA completely in less than 30 hours.

The Event

On August 14, 2003, until shortly after 4 p.m., the power system was secure and operating normally in New York on an unremarkable summer day. All bulk power system transmission was in service except for the outage of the Linden Goethals 230 kV transmission line, which resulted from a previous fault. There was a generation capability surplus of approximately 3,000 MW. Normal levels of operating reserves had been maintained throughout the day. Power flow transfers on both internal and external transmission interfaces were within prescribed limits, and the bulk power system cross-state voltage profile was within normal operating limits.

The NYISO had received no notifications or advisories from other control areas and thus, had no awareness of the precursors to the blackout. At 4:06 p.m., there were small (approximately 100 MW) but increasing power shifts out to Ontario. At 4:09 p.m., the NYISO noted a power swing of approximately 700 MW out to Ontario, and a coincident swing of similar proportion

from PJM into the NYISO. At 4:10:39 p.m., a sudden power surge, estimated to be in excess of 3,500 MW, entered the NYISO system from PJM, through New York and westward into the Ontario system. Within six seconds, the ties between PJM and NY tripped, and in the next two seconds the upstate ties with ISO New England ("ISO-NE") opened, followed immediately by the severing of the NY Total East interface. The result was a separation of the NYISO system into two electrical islands, and the separation of western New York from the Ontario system just west of Niagara Falls, Ontario.

The severe frequency oscillations in the western island caused the large nuclear and combined cycle units in the Oswego area to trip. Some of the fossil generation tripped by relay protection, and in other cases operators took the units off-line because they were becoming thermally unstable. This operator action insured the quick restart of these units during the restoration process. The Western New York island survived with an approximate balance of load and generation of 5,700 MW.

The southeastern island, including the Hudson Valley, New York City, and Long Island, was unstable because of the extreme mismatch of load and generation. Contributing to the deficiency were the northeastern portion of the PSE&G and Rockland Electric (New Jersey) areas, initially representing over 2,000 MW of unsupported load, and southwestern Connecticut, including over 500 MW of unsupported load that attached to the southeastern island of New York. The southeastern island could not survive with a generation deficiency in excess of 6,000 MW, despite the fact that the under-frequency load shedding protection operated properly, and by approximately 4:20 p.m., it was effectively blacked out.

In total, 22,984 MW of New York load was lost.

In New York, assessment and restoration of the system began immediately. The NYISO Restoration Plan is designed to:

- Stabilize the remaining New York Control Area ("NYCA") transmission system,
- Extend the stabilized system to blacked-out areas to provide start-up power and customer load restoration,
- Extend the stabilized system to energized islanded areas to restore frequency control, and
- Restore normal transmission operation.

The NYISO's control room dispatchers coordinated these efforts with Generators and Transmission Owners in the New York Control Area (NYCA) and with control room dispatchers in neighboring control areas. Dispatchers and Generators focused on extraordinary efforts to bring units back into service. Dispatchers received outstanding cooperation from Demand Response Providers and neighboring control areas.

The Markets

Prior to 4:00 p.m. on August 14, 2003, the New York wholesale electricity markets, including the Day-Ahead and Real-Time Balancing Markets, were operating normally. Day-Ahead Market operation for Thursday the 14th and Friday the 15th had been completed normally before the time of the system disturbance. Day-Ahead Market operation for Saturday the 16th and Sunday the 17th continued to operate normally during the restoration period. The Real-Time Market was suspended immediately following the Blackout. Normal Real-Time Market operations recommenced on Monday the 18th.

The NYISO implemented existing tariff provisions for the settlement of the markets in emergency situations, and carried out these settlements in cooperation with Market Participants. The necessary adjustments were successfully incorporated in the August bills.

Next Steps

National, international and regional organizations and regulatory bodies are now examining the system events and analyzing various contributing factors. The NYISO is participating in many of these studies. As the detailed sequence of events becomes clearer, the NYISO expects that these efforts will address the many additional questions remaining about the system disturbance. We expect that these analytical investigations will produce recommendations for national, regional, and local consideration.

In the short term, the NYISO has certified to NERC that it is in full compliance with the near-term measures recommended to all Control Areas in NERC's letter of October 15, 2003. We have also evaluated the desirability of modifying operating limits or procedures immediately, and concluded that any changes should be made only after a full analysis of the system disturbance becomes available and the prospective changes can be effectively modeled.

As analysis of the system disturbance continues, the NYISO will continue to work with others to evaluate the following:

1. Did New York's bulk power system perform appropriately following separation from the Eastern Interconnection? All of the data thus far indicate that it did.
2. An evaluation of whether stronger New York ties with PJM and ISO-NE are needed.
3. The impact on the stability of the southeastern New York island of the additional unsupported load of northern New Jersey and southwestern Connecticut.
4. The impact of the isolation of Ontario generation onto the New York bulk power system during the disturbance.
5. An evaluation of whether New York's bulk power system separation from the Eastern Interconnection could be avoided if a wider area relay coordination scheme were in place.
6. A consideration of other options that could potentially avoid New York's bulk power system separating from the Eastern Interconnection following a similar system disturbance.

Because the restoration of power to and the restart of nuclear units remains crucial to public safety and system restoration, the NYISO will continue to work through the ISO/RTO Council (IRC), NERC, NYDPS, and DOE to evaluate the appropriate level of communications with the Nuclear Regulatory Commission (NRC) in system emergencies.

The NYISO will issue a final report on the system disturbance and restoration, including New York-specific recommendations, following the issuance of the International Task Force's Final Report.

NYISO Interim Report on the August 14, 2003 System Disturbance

The New York Independent System Operator ("NYISO") has compiled this interim report on the August 14, 2003 blackout. Part I of the report outlines the conditions of the system in the New York Control Area ("NYCA") before the event. Part II describes the progression of the system disturbance that caused the blackout. The disturbance moved slowly in the Midwest and rapidly -- in a matter of seconds -- through the NYCA. Part III details the successful restoration of the bulk power system in New York State. Part IV summarizes the settlement of the energy market administered by the NYISO following the system disturbance. Part V reports on the further evaluations underway by the NYISO and others to complete the study of the system disturbance and its aftermath.

I. *Conditions Before the Event*

A. Forecasted Conditions

On August 13, 2003, the NYISO planned for a typical August day for the 14th. The NYISO prepared its day-ahead plan, which is part of the Day-Ahead Market operation. In the day-ahead plan, resources are committed to meet expected load and reserve requirements for the next day. Developing this plan involves consideration of forecasted system conditions, including load forecast, generation and transmission outages, and neighboring system conditions.

The NYISO uses its Security Constrained Unit Commitment (SCUC) software for operation of the Day-Ahead Market. The SCUC process conducts the next day security analysis and ensures the bulk power system can be operated within security limits for the anticipated system conditions. SCUC ensures that bulk power system operating limits, including those for transmission lines and voltage/stability interface transfer limits, will not be violated under the expected conditions.

B. Capacity Report

On August 13, 2003, the NYISO executed the SCUC process for the Day-Ahead Market. Forecasted load for August 14th was representative of a normal summer day at 28,500 MW, which is about 90% of the forecasted summer peak load. There was an expected capability surplus of approximately 3,000 MW above required load and reserve requirements. The components of this calculation for August 13, 2003 are listed in the following table:

Peak Hour	HB16
Total Generation Available (+)	31,662 MW
Estimated Peak Load (-)	28,500 MW
Derates (-)	554 MW
Required Reserve (-)	1,800 MW
NYISO DNI (+)	1,907 MW
ICAP Exports (+)	277 MW
Excess	2,992 MW

The required operating reserve is 1,800 MW, one and one-half times the NYCA largest single contingency.

C. Scheduled Outages

There was one 230 kV transmission outage scheduled for that day, the Linden-Goethals A2253, a 230 kV tie with New Jersey, which was due to a previous fault. In addition, there were other non-bulk power transmission outages (facilities below 230kV).

D. In-day Conditions on August 14, 2003

As August 14, 2003 progressed, normal system operations were maintained in the real-time market by the use of Security Constrained Dispatch ("SCD"). The SCD process, like the SCUC process for the day-ahead plan, ensures that the bulk power system is operated within security limits for real-time conditions. SCD ensures that bulk power system operating limits, including those for transmission lines, and voltage/stability interface transfer limits, are not violated in real-time operation.

Prior to the events of the blackout, the NYISO experienced no forced transmission facility or generation outages, including NERC reportable events. All scheduled transmission outages scheduled to be returned to service that day (including outages of non-bulk power systems facilities below 230kV) were returned to service by 15:07.

NYISO Internal Interfaces

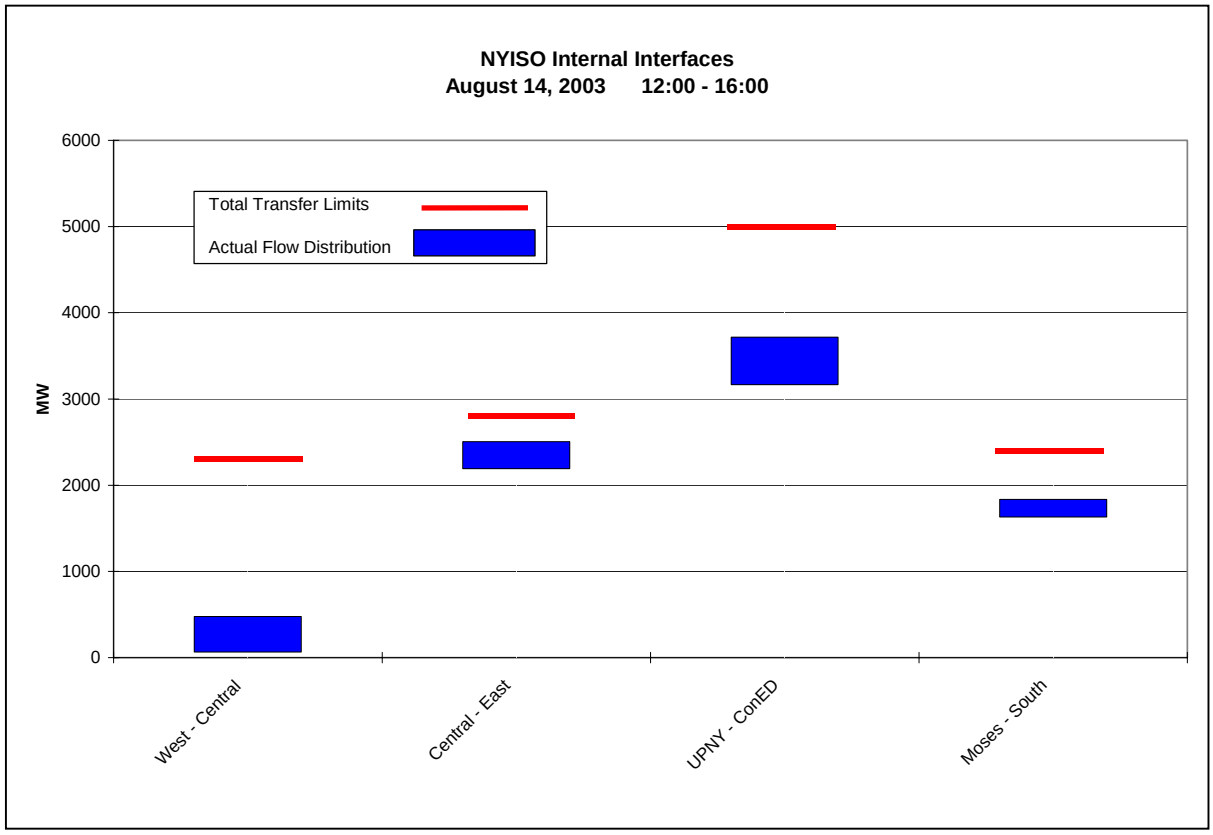


Figure 1.1

Interface flows in the state were typical for a summer day and within secure limits.

New York was importing close to the maximum from New England and Hydro Quebec, there was no Available Transmission Capacity (ATC) remaining on imports from either for most of the day. However, the scheduling on the ISO-NE interface maintains a transfer reliability margin (TRM) of a few hundred megawatts for contingency purposes.

NYISO External Interfaces

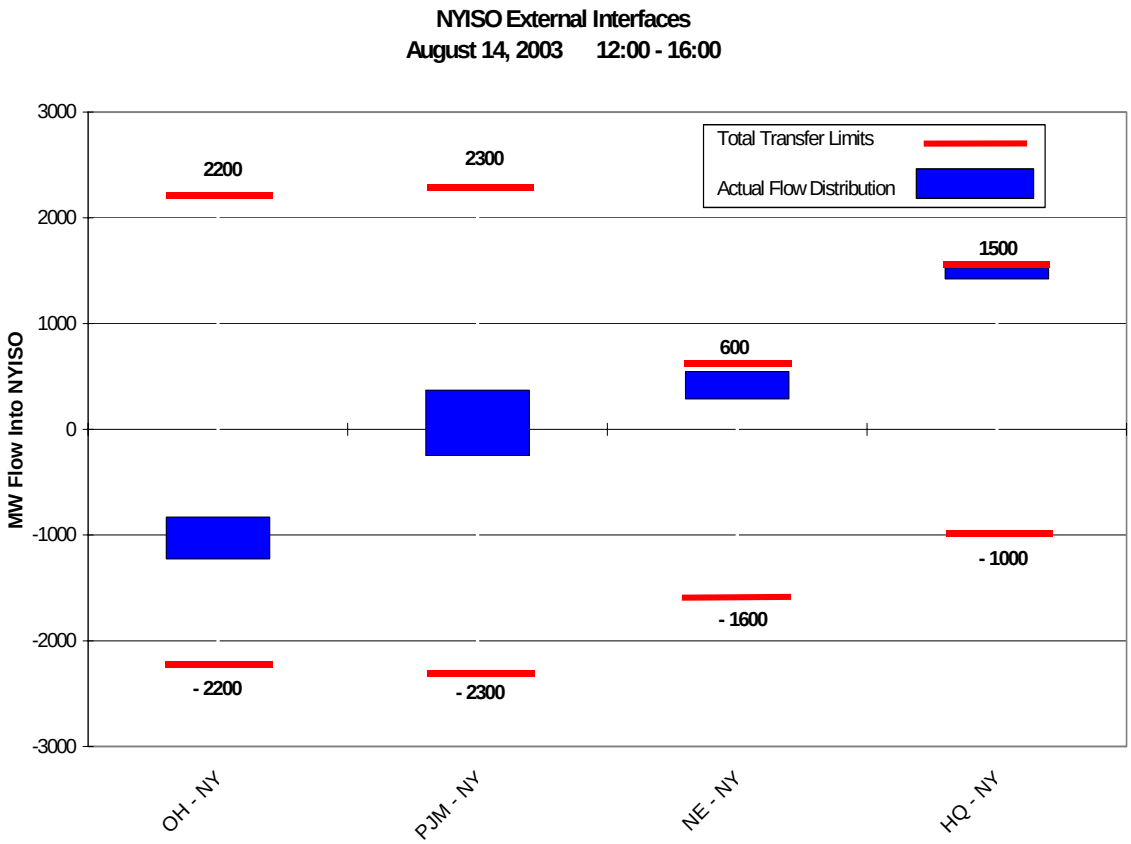


Figure 1.2

Throughout the day, bulk power system voltages were normal.

Bulk Power System Cross-State Voltage Profile

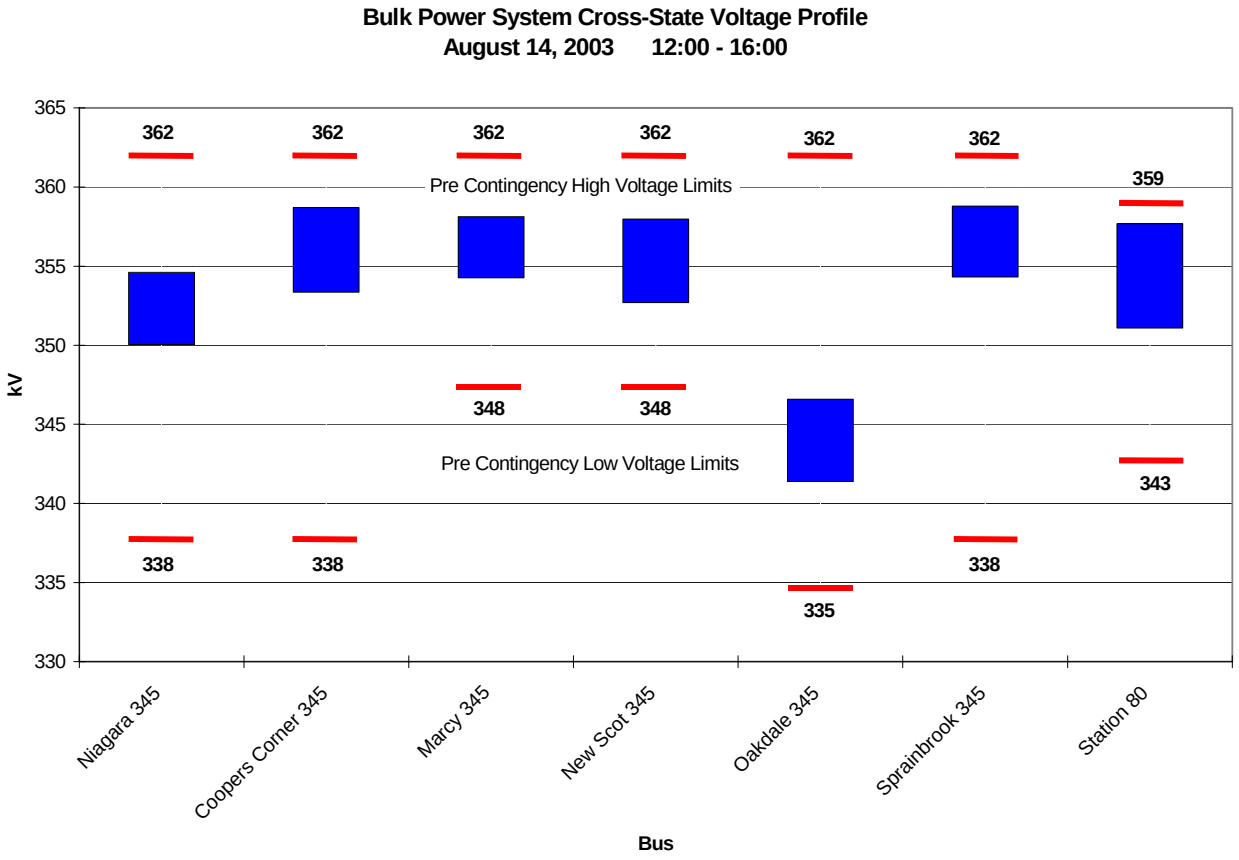


Figure 1.3

All monitored station voltages on the 230 kV, 345 kV and 765 kV stations of the bulk power system were within normal operating limits. Voltage limits are established to insure that the worst criteria contingency does not cause the voltages to go below established post contingency voltage limits, typically 95 % of nominal.

There were no operator declared Alert States or Major Emergencies until the system disturbance occurred. Operating reserves were maintained through the day, with no reserve activations or reserve pickups called.

Up to the time of the blackout, NYISO system operations were normal and typical of a summer day.

Transmission system loadings were within normal transfer limits for thermal, voltage and transient stability, and transmission system voltages were within normal operating limits. All generation was operating within rated capabilities for both real and reactive power; all automatic voltage regulators were in service. Transmission and generation operating margins were within NPCC, New York State Reliability Council (NYSRC), and NYISO Criteria, Rules and Procedures.

At about 16:09, the NYISO control center noted a power swing of approximately 700 MW out to Ontario. At that same time, the operators also observed a coincident swing of similar proportion from PJM into the NYISO. This event appeared to be consistent with the expected system response to the loss of a large generator on the Ontario system. The NYISO Shift Supervisor, therefore, prepared to initiate the NPCC shared activation of reserve procedure, expecting a call from the IMO reporting the generation loss and the amount of shared reserve that IMO would request from the NYISO.

The power flow of 700 MW entering the NYISO system from PJM and moving westward on the NYISO 345 kV system caused the 345 kV system voltages to rise, with the New Scotland and Edic station voltages approaching their respective normal high voltage limits. Also responding to the increasing voltage, the Marcy Automatic Shunt Switching scheme switched in the 200 MVAR shunt reactor in the 765 kV station. Responding to this voltage rise, the NYISO System Operator contacted the Niagara Mohawk System Operator to prepare to switch out a shunt capacitor, a normal response for this condition.

II. *The System Disturbance*

As a result of the investigations conducted by the Joint U.S./Canada Task Force ("Task Force"), it is now evident that a series of events in northern Ohio that began earlier in the day resulted in a rapid succession of severe power swings, and voltage and frequency oscillations that caused the near collapse of the system in New York and Ontario, and most of eastern Michigan and northern Ohio. The disturbance also affected parts of northwestern Pennsylvania, northeastern New Jersey, and southwestern Connecticut. This Interim Report relies on the description of events in the report of the Task Force. Since that report has been widely distributed, this Interim Report will not repeat the details of the Task Force report except to the extent necessary to understand what occurred in New York.

This section of the interim report describes the system disturbance in six major components; a detailed sequence of events is available in Appendix B:

- NYISO Pre-Disturbance System - Progression of Disturbance outside of the NYISO
  - Prior to 16:10:38
- Loss of PJM-NYISO Ties
  - New York – PJM separate 16:10:45
- Loss of ISO-NE – NYISO Ties
  - New York – New England separate 16:10:47
- Separation of New York Total East Interface
  - New York separates along Total East interface 16:10:49
- Separation of Southwest Ontario from New York
  - Ontario separates west of Niagara Falls 16:10:50
- Collapse of Southeastern-New York Island
  - Southwest Connecticut separates from New York 16:11:22

At approximately 16:10:38 a sudden power swing, estimated to be in excess of 3,500 MW, entered the NYISO system from PJM, through New York and westward into the Ontario system at Niagara.

With the final separations in Michigan and the loss of the Erie West – Ashtabula line, the FirstEnergy and Detroit Edison systems were then only connected to the Eastern Interconnection through the Michigan – Ontario ties and the Ontario system to the NYISO. This instantaneously caused the loading of the PJM-NY and NY-IMO interfaces to rise toward 3,500+ MW.

Within six seconds, the ties between PJM and NY tripped, and in the following two seconds the ties with ISO-NE opened, followed in rapid succession by the severing of the NY Total East interface. This resulted in the separation of the NYISO system into two electrical islands, and the separation of the Ontario system from western New York just west of Niagara Falls, Ontario.

A. NYISO Pre-Disturbance System - Progression of Disturbance outside of the NYISO

1. The Slow Progression of Transmission Trips in Northeastern Ohio

Through the mid-day hours, loads in the midwestern systems were running above anticipated levels and, as a result, voltages on the 345 kV systems in Indiana and Ohio were at or below desired levels, particularly in the Akron and Cleveland areas of the FirstEnergy system. By mid-afternoon, as conditions continued to worsen, operators in the FirstEnergy system control center did not detect and react to the changing system conditions and configuration due to the failure of the alarms processor of their energy management system, and failure to determine system conditions by alternate means.

Following the loss of the Eastlake unit #5 (13:31) and the failure of the FE EMS alarms functionality (14:14), the tripping of three 345 kV lines supplying the Cleveland area from the south were not detected by the FE system operators:

15:05:41 Harding – Chamberlin 345 kV trips

15:32:03 Hanna – Juniper 345 kV trips

15:41:33 Star – South Canton 345 kV trips

Each of these lines tripped indicating single phase to ground faults, and in each case the probable cause was contact with a tree in the right-of-way.

The loss of these lines caused heavy loading on the parallel 138 kV transmission system in the Akron and Cleveland areas. Between 15:39 and 16:08 there was a rapid cascading failure of sixteen 138 kV lines and loss of about 600 MW of local load. This also resulted in the loss of the Tidd – Canton Central 345 kV circuit.

This sequence caused increased loading on the Sammis – Star 345 kV circuit, causing it to load to over 120% of its normal rating. At 16:05:57 this line tripped (due to an apparent impedance). This marks the turning point in the event culminating in a high-speed cascade of transmission line and generator trips.

Following the loss of Sammis – Star, there were no remaining 345 kV lines connecting the Cleveland load center from the south. At that point, the Cleveland load was being supplied by one line from Erie, PA in the east and by one 345 kV and some 138 kV circuits from the Toledo area to the west. Power that was flowing from the south now sought these two alternate paths.

2. Cascade in NW Ohio and SE Michigan

The 16:05:57 trip of Sammis – Star is the first event that could be identified in the review of the NYISO telemetered data. It caused approximately 100 MW increase in flow on the PJM to NY ties and 100 MW increase in flow toward Ontario; at the same point the data showed an abrupt increase of 0.02 Hz in the frequency – indicating a loss of at least 700 MW load.

The power flowing into the Toledo area from southern Ohio caused the remaining two ties between FirstEnergy and AEP to trip:

16:08:59	Galion – Ohio Central – Muskingum 345 kV trips
16:09:06	East Lima – Fostoria Central 345 kV trips

Initial External Interface Flows

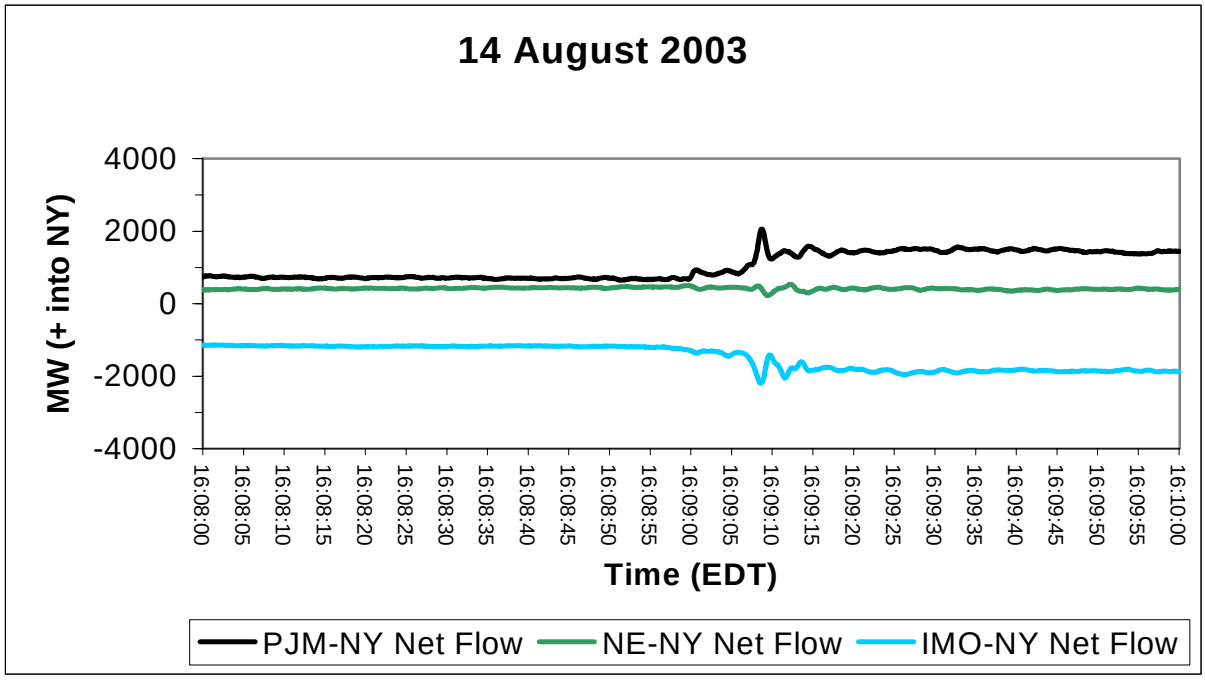


Figure 2.1

When these lines tripped, a large power swing occurred through central Michigan (2,000 MW) and through Pennsylvania, New York (700 MW) and Ontario to supply the FE system. Also during the next 30 seconds, over 900 MW of generation tripped in the Midwest systems (Michigan and Ohio).

The 700 MW swing and the additional increase in flow as the generation tripped is clearly documented in the IMO-NY interface flow. The FirstEnergy system was then connected to the Eastern Interconnection only through its ties to Detroit Edison (north from Toledo) and the Ashtabula – Erie West 345 kV circuit to Pennsylvania.

Heavy power flows on the 345 kV transmission system in central Michigan resulted in the tripping of generation and, ultimately, the tripping of the transmission lines.

16:10:36 Argenta – Battle Creek 345 kV
Battle Creek – Oneida 345 kV
Argenta – Tompkins 345 kV

16:10:37 Hampton – Pontiac 345 kV
Thetford – Jewell 345 kV

These transmission lines connect the Consumers Power and Detroit Edison systems. Loss of these lines effectively disconnected the Detroit Edison system from the rest of Michigan. At this point, the Detroit Edison and FirstEnergy systems were connected to the rest of the eastern interconnection through Detroit's ties to Ontario and the one line to Pennsylvania.

When the separation occurred in central Michigan, a very large power swing moved east and north into Pennsylvania and New York and across Ontario in an attempt to serve the loads in southeastern Michigan and northern Ohio.

16:10:38.5 Erie West – Ashtabula 345 kV trips

External Interface Flows During Event

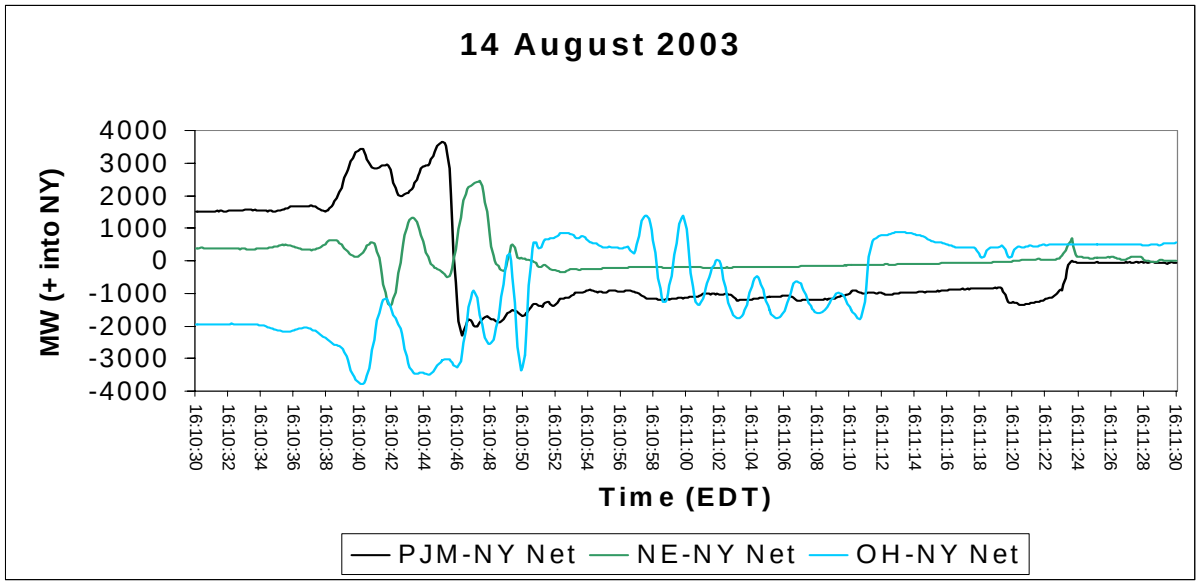


Figure 2.2

NYISO Pre-Disturbance System

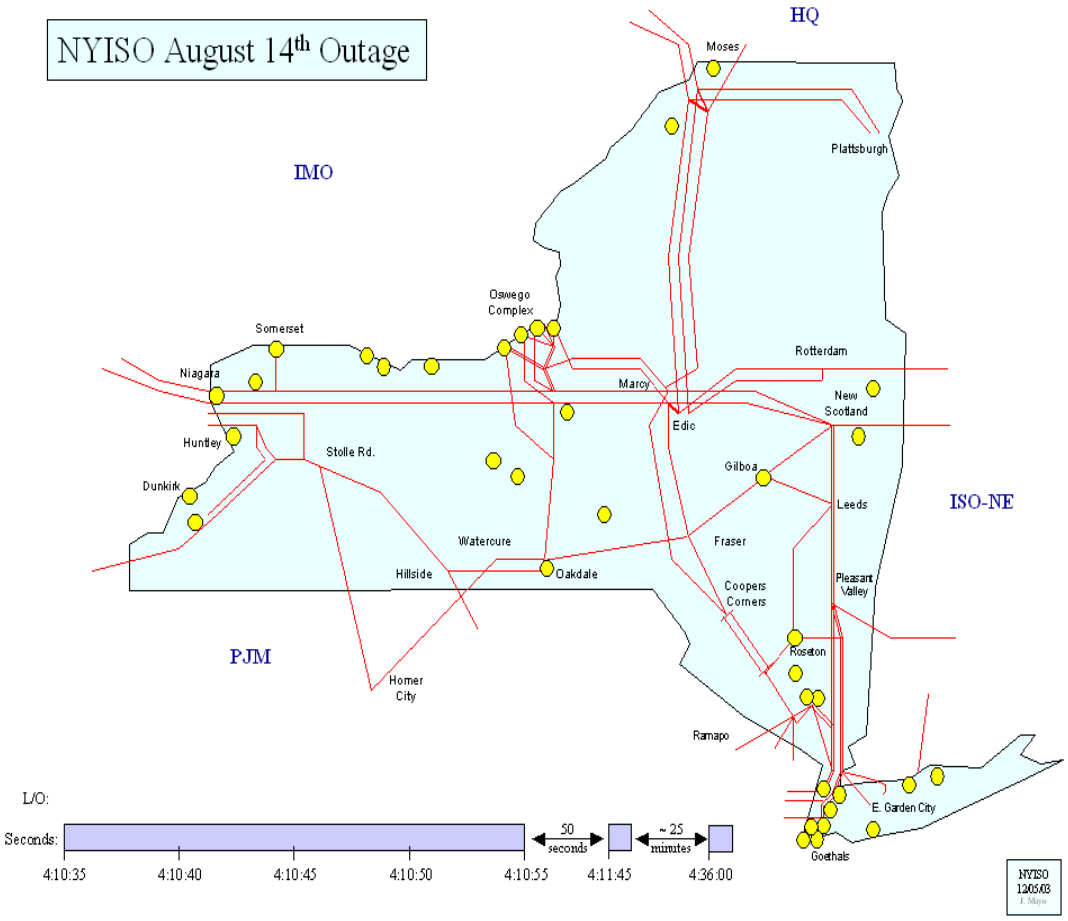


Figure 2.3

B. Loss of PJM-NYISO Ties

Within the next six seconds the PJM-NY ties opened. This sudden power swing, estimated to be in excess of 3,500 MW, entered the NYISO system from PJM, through New York and westward into the Ontario system at Niagara. In the next few seconds, the following lines tripped:

16:10:39.5	Homer City – Watercure Road 345 kV
16:10:39.8	Homer City – Stolle Road 345 kV
16:10:43.5	South Ripley – Dunkirk 230 kV
16:10:44.0	East Towanda – Hillside 230 kV

The Homer City 345 kV lines to New York, and South Ripley 230 kV tripped due to apparent impedance in zone 1. East Towanda 230 kV indicated apparent impedance in zone 3.

16:10:45.2	Branchburg – Ramapo 500 kV Linden – Bayway 230 kV Athenia – Cedar Grove 230 kV (2 circuits)

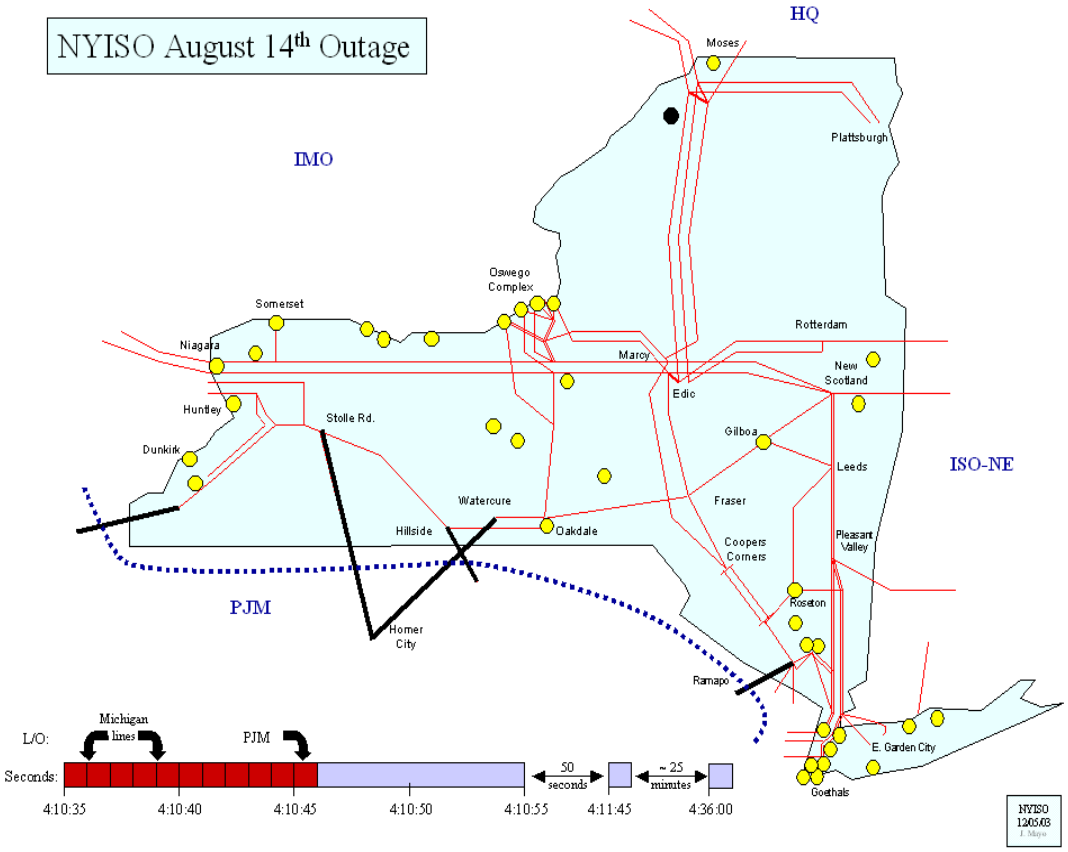


Figure 2.4

PJM Ties During Event

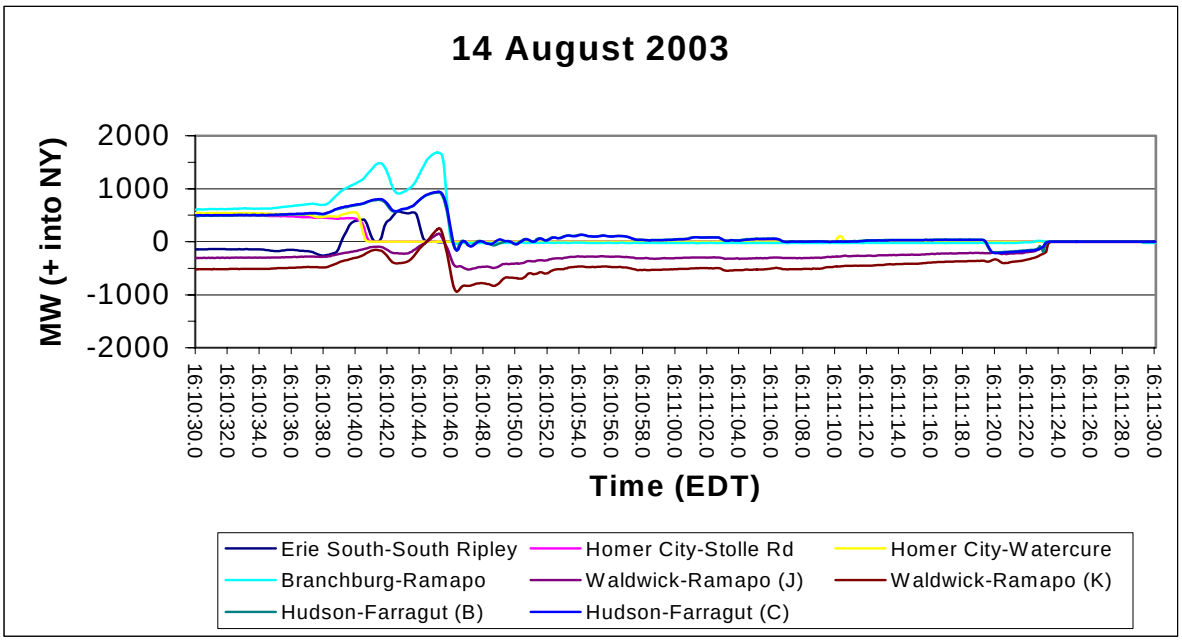


Figure 2.5

The separation of parallel 230 kV and numerous 138 kV lines in northern New Jersey completed the separation of PJM and the NYISO and also separated the Rockland Electric and PSE&G northern division from the main PJM system as well. This northeastern part of New Jersey remained connected to the NYISO through the Ramapo – Waldwick 345 kV, and Hudson – Farragut 345 kV circuits. On the initial separation, there appeared to be 2,200 MW of flow into New Jersey on the above ties. In 8 seconds, it quickly drops to 1,100 MW and over the next minute to approximately 450 MW. (Please see figure 2.2)

16:10:45.265 Marathon – Wawa 230 kV (2 circuits)

Nearly simultaneously with the PJM-NY separation, the Ontario main system separated from Manitoba and Minnesota north of Lake Superior. This is a long (and, therefore, weak) path.

With the opening of the PJM – NY interconnections, the NPCC systems and Detroit Edison and FirstEnergy systems, and northeastern New Jersey were completely separated from the Eastern Interconnection, forming a large NPCC island. Within this large island several smaller islands formed:

- New York – New England upstate ties separate: 16:10:47
- New York separates along Total East interface: 16:10:49
- Ontario separates west of Niagara Falls: 16:10:50
- Southwest Connecticut separates from New York: 16:11:22
- Ontario – Michigan separate: 16:11:57

C. Separation from ISO-New England

At 16:10:46 – 16:10:47 the ties between ISO-NE and New York tripped, and an island was formed including most of the ISO-NE Area and the Canadian Maritime provinces of New Brunswick and Nova Scotia.

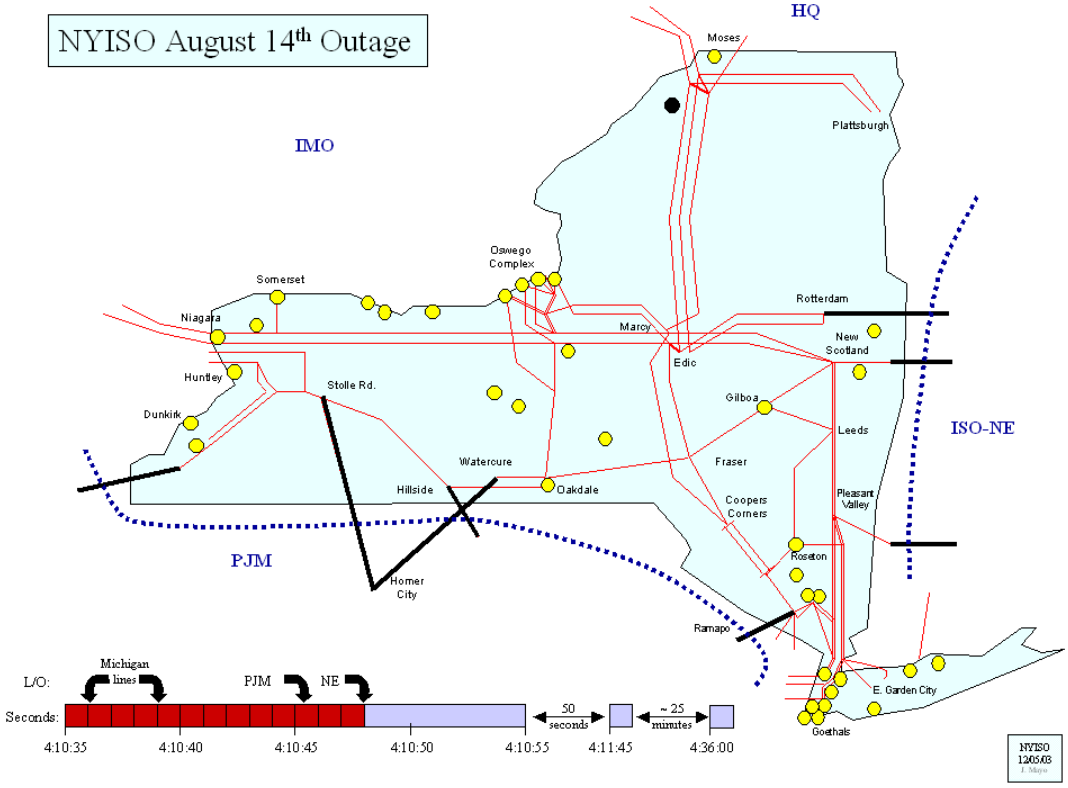


Figure 2.6

Upon separation, the frequency in the large island, consisting of New York, IMO and FirstEnergy, declined rapidly to 59.3 Hz due to the severe generation deficiency in the island (particularly in the Detroit and FirstEnergy areas), and frequency in the New England island recovers toward 60.0 Hz.

System Frequency

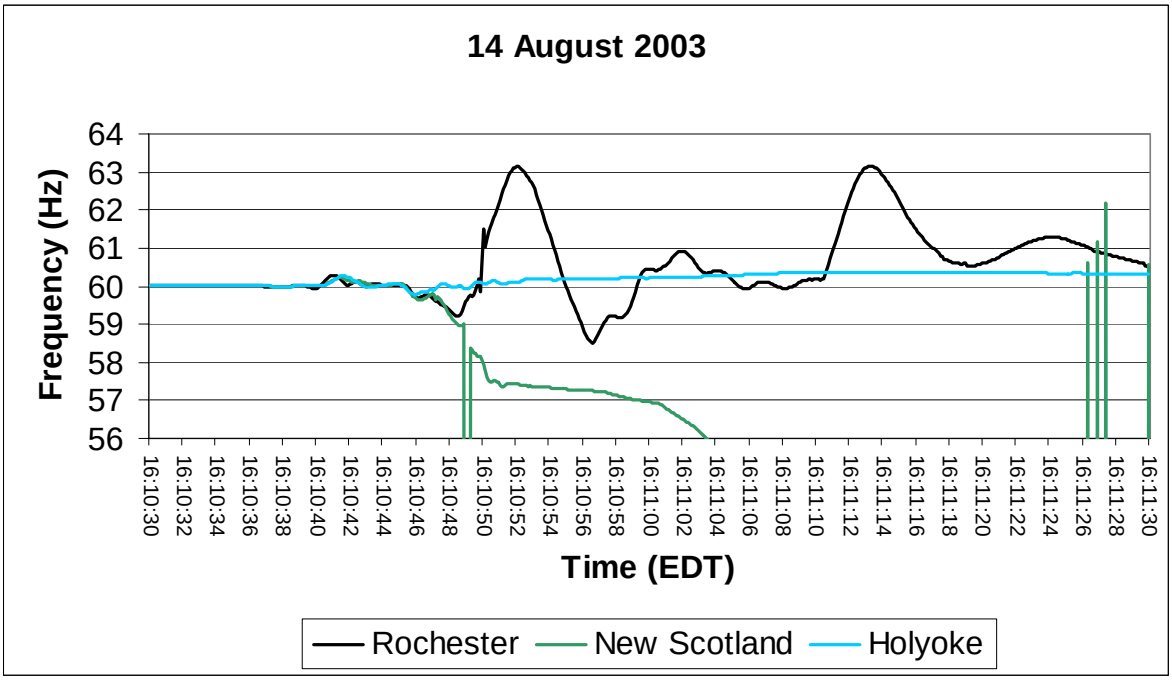


Figure 2.7

Immediately prior to the separation, the power swing out of New England was due to the inertial response of the generation caused by the declining frequency. Essentially, the New England Generators began to produce more output to "feed" the power flow into Ontario.

Within two seconds of the separation from PJM, the major ties between ISO-NE and the NYISO opened:

16:10:46	Rotterdam – Bear Swamp 230 kV
16:10:47	Alps – Berkshire – Northfield 345 kV
16:10:47	Long Mountain – Frost Bridge 345 kV

Prior to the disturbance, ISO-NE was exporting to the NYISO. This, combined with the power flows toward southwestern Connecticut, caused the Pleasant Valley path to open east of Long Mountain rather than the actual NY-NE tie.

ISO-NE Ties During Event

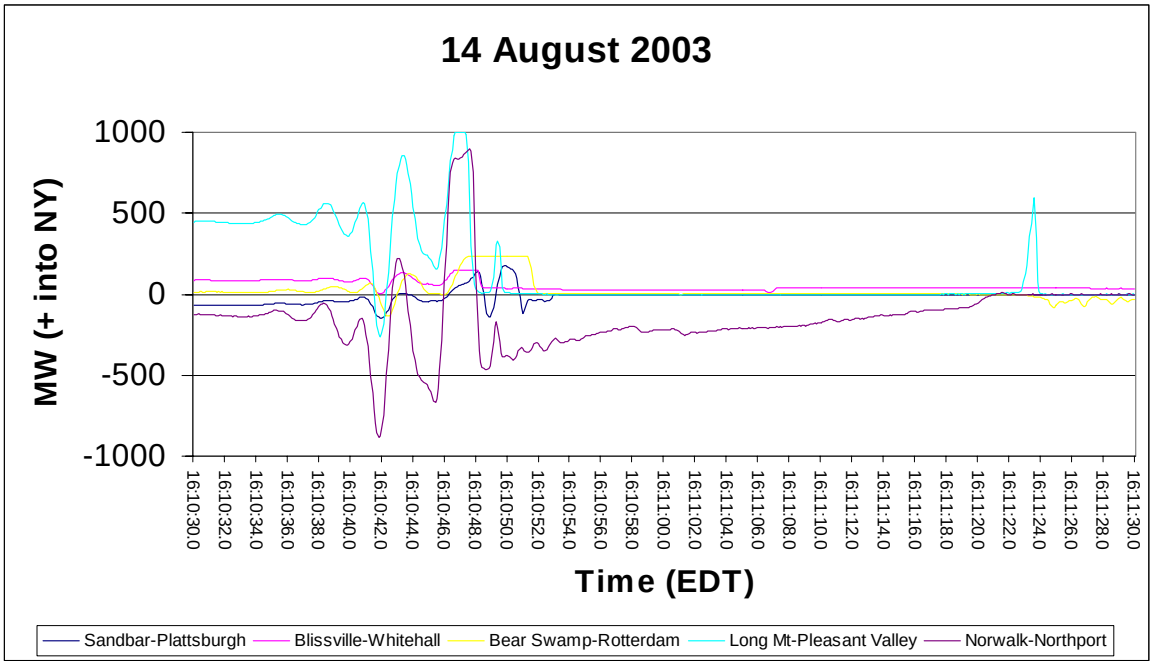


Figure 2.8

Additional 115 kV transmission and 345/115 transformers tripped to separate southwestern Connecticut from the main New England system and left it connected only to New York through the Pleasant Valley – Long Mountain 345 kV line and the Northport – Norwalk Harbor 138 kV line. On this initial NY/NE separation, the flow from New York toward Connecticut was approximately 950 MW and dropped to about 500 MW within about 10 seconds. This was further reduced to approximately 300 MW when the Long Mountain path opened (16:11:22) and the southwestern Connecticut area was isolated on the one remaining tie to Long Island.

D. Separation of New York Total East Interface

The major transmission paths between central and eastern New York opened nearly simultaneously:

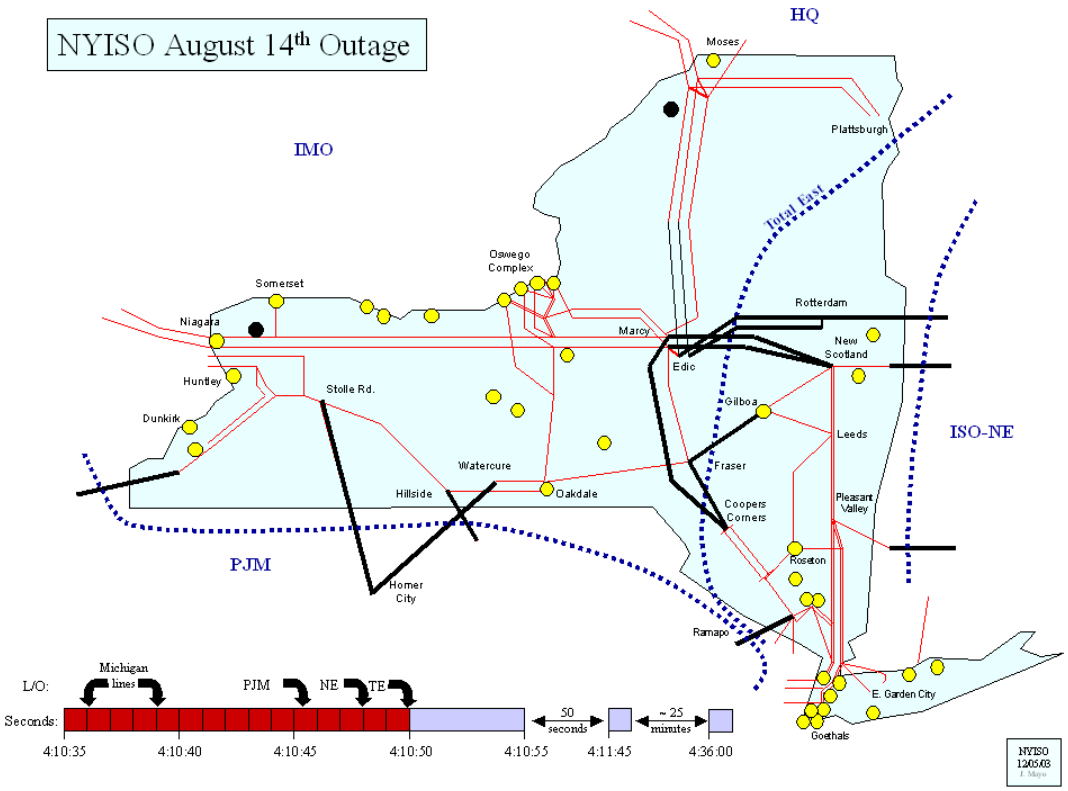


Figure 2.9

16:10:48	Marcy – New Scotland 345 kV Marcy – Coopers Corners 345 kV Fraser – Gilboa 345 kV
16:10:49	Fraser – Coopers Corners 345 kV
16:10:49.7	Edic – New Scotland 345 kV
16:10:50	Porter – Rotterdam 230 kV (2 circuits)

The result was the effective separation of southeastern New York from the systems to the west. The southeastern New York island, including southwest Connecticut and northeast New Jersey, was severely generation deficient. The frequency declined rapidly through 59.0 Hz and all stages of automatic under frequency load shedding operated in the southeastern island to disconnect 7,115 MW load by 16:10:54.

Central East Ties During Event

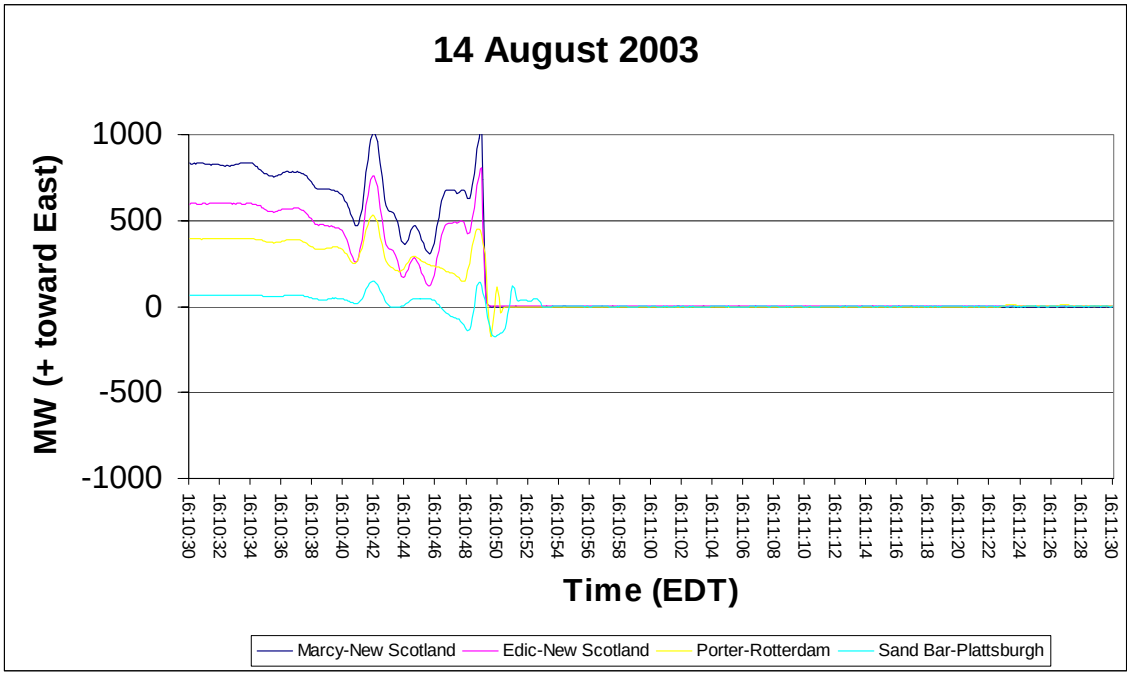


Figure 2.10

E. Separation of Southwest Ontario from New York

The Ontario system separated west of the Niagara Falls area nearly simultaneously with the Total East separation of southeastern New York from the large island to the west.

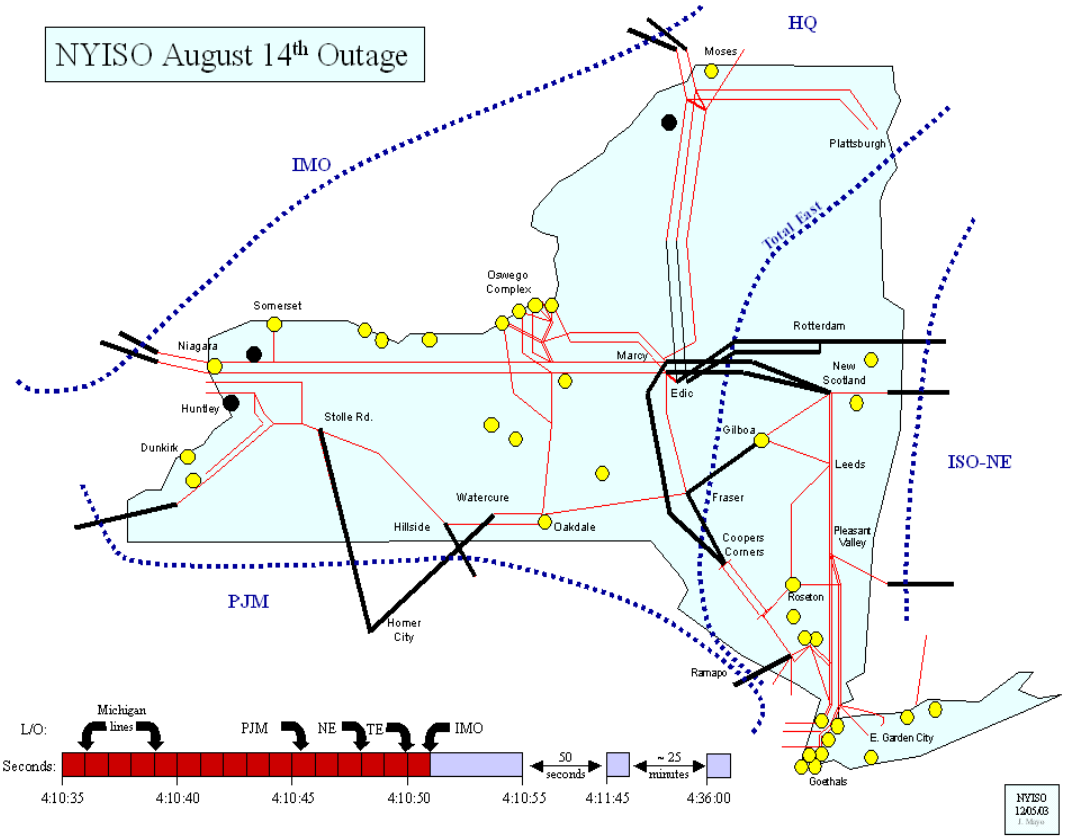


Figure 2.11

16:10:49.4 St. Lawrence – Hinchinbrooke 230 kV (2 circuits)
St. Lawrence – Albion 230 kV

16:10:49.8 Middleport – Hamilton – Beck 230 kV (5 circuits)

When the separation occurred, a new island formed including New York (west of Total East), the Ontario Beck and Saunders generation and the Niagara Falls (Ontario) load. This island was generation rich, and the frequency rose to 63.2 Hz.

IMO Ties During Event

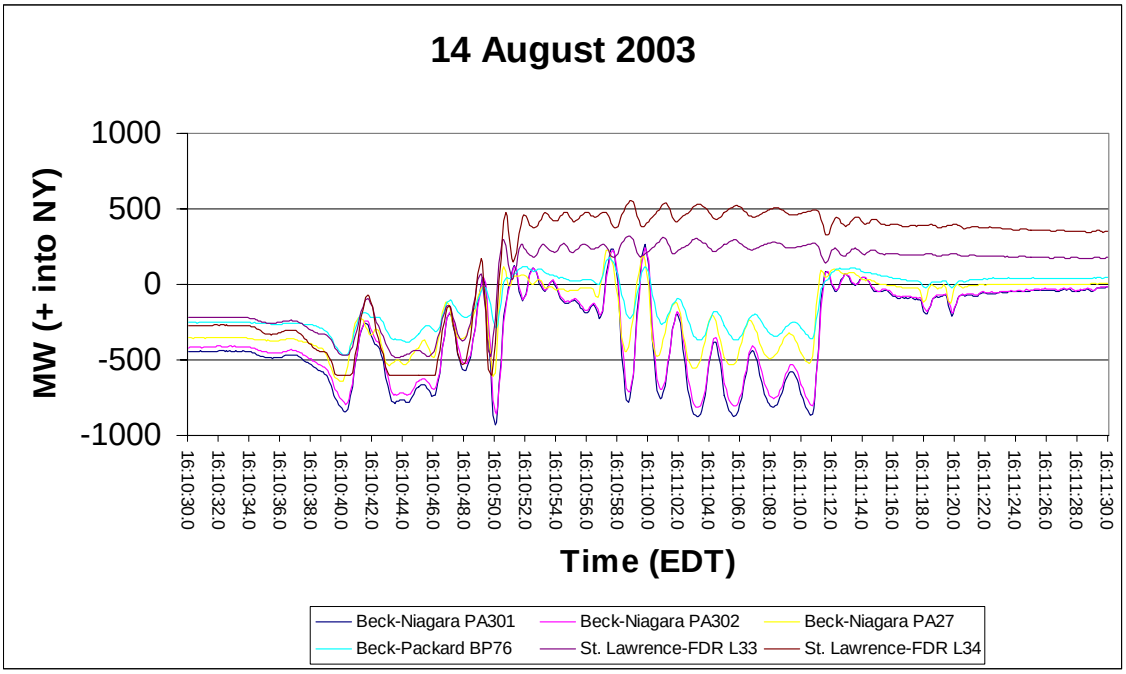


Figure 2.12

Transmission lines (3 circuits) between Middleport and Beck reclosed at 16:10:55, reconnecting the western New York island with the severely generation deficient southwest Ontario island (including Detroit Edison and what was left of FirstEnergy). The frequency declined rapidly to 58.5 Hz and the power oscillations (on the IMO-NY ties) returned. The rapid frequency decline initiated both stages of under-frequency load shedding in the western New York island, and 3,389 MW of load was disconnected by 16:11:15. The 3 Middleport – Beck circuits' tripped and locked out at 16:11:10, and the western NY island frequency again rose toward 63.0 Hz.

In the southwest Ontario island (including Detroit and what was left of the FirstEnergy system) frequency declined to 57 Hz and less than a minute later, at 16:11:57, the Ontario – Michigan ties opened, too late to save the Ontario system.

F. Collapse of Southeastern-New York Island

In the southeastern New York island, after separating from the west, the frequency declined toward 57 Hz. Due to the low frequency and low voltages, the nuclear units at Indian Point both tripped on low reactor coolant flow. The reactor trips were initiated at 16:10:51 and 16:10:54, respectively. Frequency in the southeastern New York was effectively in free fall. Over the next minute, many in-city generators tripped.

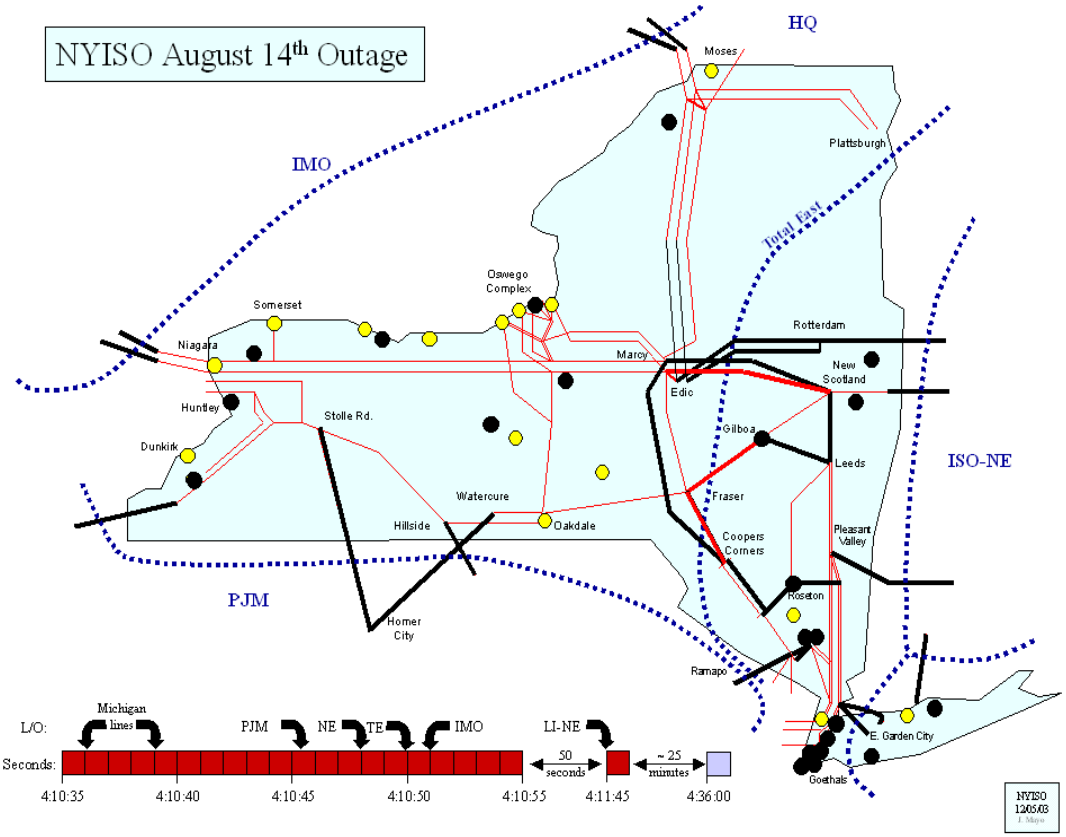


Figure 2.13

Another series of line trips occurs just after 16:11:20:

16:11:22 Long Mountain – Plumtree 345 kV

16:11:22.7 Sprain Brook – East Garden City 345 kV

16:11:23.5 Dunwoodie – Shore Road 345 kV

Opening of the Long Mountain – Plumtree circuit caused the remaining load in southwest Connecticut to be supplied only through the Northport – Norwalk Harbor 138 kV cable. Tripping of both the Y49 and Y50 circuits was due to distance impedance relays at the Con Edison end of each line, and was likely the result of the severely depressed voltage in the Sprain Brook area. With the opening of the Long Mountain – Plumtree 345kV circuit (in southwest Connecticut) and the Y49 and Y50 circuits between Con Edison and LIPA the southwest Connecticut and LIPA systems are effectively separated from the rest of southeastern New York and formed another island.

16:11:45 Northport – Norwalk Harbor 138 kV

For roughly the last 25 seconds before it tripped, this line supplied about 300 MW toward Connecticut. When it tripped, southwest Connecticut was isolated, and collapsed.

G. Reclosing and Reconfiguration of the Western New York Island

Within the NYISO, reclosings, automatic and operator initiated, occurred following the initial tripping and separations. These operations moved the boundary of the island, re-energized portions of the 345 kV system, but did not immediately restore any load that was interrupted. At the same time some of the reclosings were occurring, there were additional line trips within the southeastern area. The most significant of these breaker operations were:

16:11:10 Fraser – Gilboa 345 kV reclosed

16:11:23 Fraser – Coopers Corners 345 kV reclosed
Coopers Corners – Rock Tavern (CCRT-34) tripped
Rock Tavern – Roseton 345 kV tripped

16:11:26 Ladentown – Buchanan South 345 kV tripped

When Fraser – Coopers Corners reclosed, the Coopers Corners – Middletown – Rock Tavern and Rock Tavern – Roseton 345 kV circuits tripped. However, a complete path was reestablished between Utica, in central NY, and Ramapo (and thereby, from Niagara to Waldwick, NJ).

16:11:29.8 New Scotland – Leeds 345 kV (2 circuits) tripped

16:11:30 Edic – New Scotland 345 kV reclosed

When Edic – New Scotland reclosed, the New Scotland – Leeds (2 circuits) tripped. (The reclose time is based on EMS (approximate) time stamp, whereas the trips are based on the New Scotland DFR.) This restored the 345 kV path from Utica to Albany.

In the western island, the severe frequency oscillations resulted in the tripping of the large nuclear and combined cycle units in the Oswego area. Some of the fossil fueled generation in western New York tripped by relay protection, and some units were tripped by operator action because the units were becoming thermally unstable (boiler or fuel issues). This operator action, in several cases, insured the quick restart of these units during the restoration.

H. End State of the August 14th Event

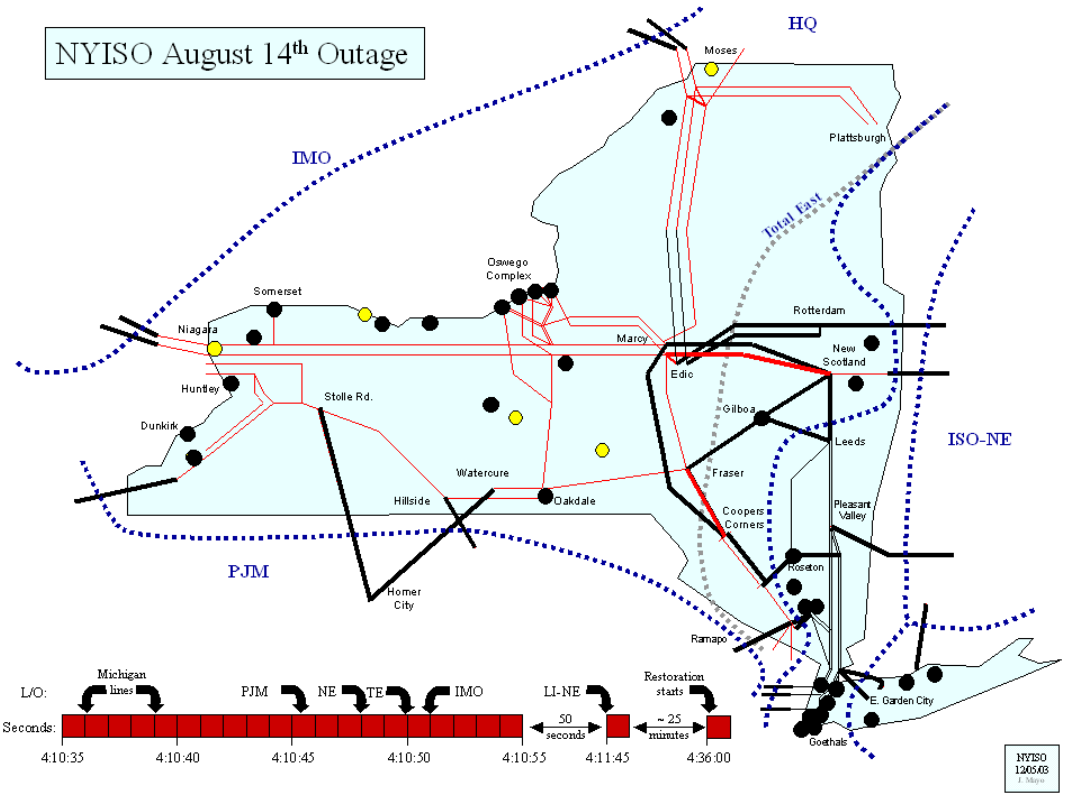


Figure 2.14

A major portion of the northern section of the Eastern Interconnection was blacked out. Some isolated areas of generation and load remained online for several minutes. Some of those areas in which a close generation-demand balance could be maintained remained operational; other generators ultimately tripped offline and the areas they served were blacked out.

At 16:08, just prior to the event, the NYISO was serving approximately 28,700 MW of load. Ten minutes later, the load was 5,716 MW, representing a loss of 22,984 MW. Automatic under-frequency load shedding disconnected a total of 10,648 MW statewide.

III. *Bulk Power System Restoration*

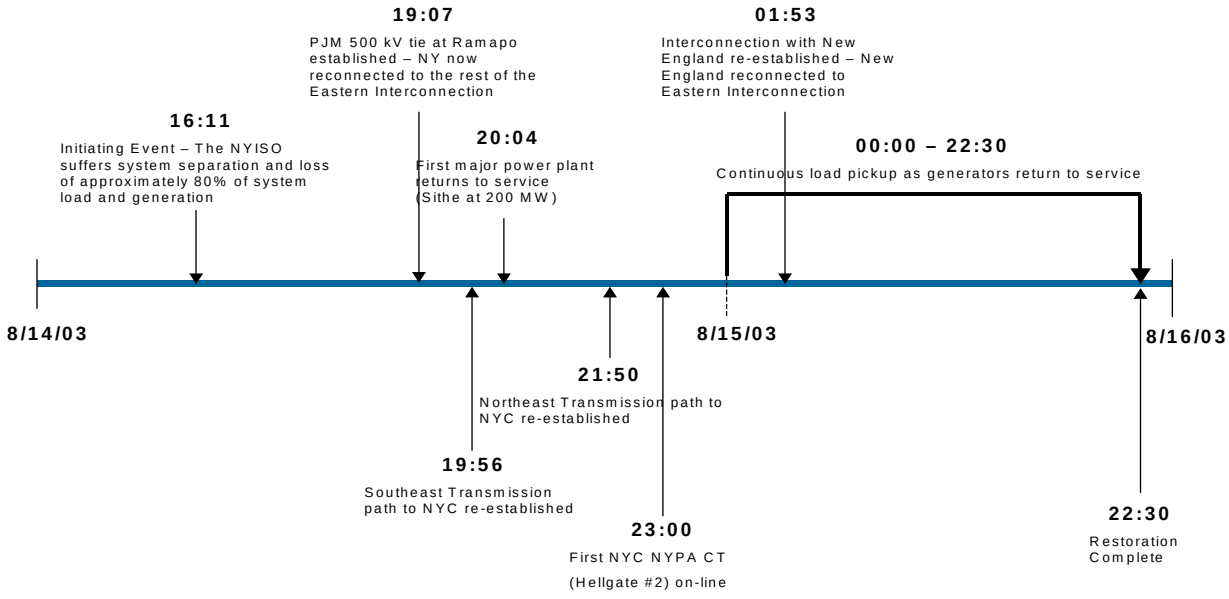
The NYISO entered a "Restoration State" at approximately 16:11. The NYISO Emergency Operating Manual defines a Restoration State as occurring when an area within the NYISO Control Area becomes islanded, or when customer load becomes interrupted. The Manual also details the procedures the NYISO employs for the restoration of service to the New York State bulk power system. Additionally, the NYISO's Control Room operators conduct training on the restoration process, and the NYISO conducts annual drills with Transmission Owners on restoration procedures.

Following the guidelines of the NYISO's Restoration Plan, the NYISO's restoration actions focused on the following goals:

- Stabilize the remaining NYCA transmission system;
- Extend the stabilized system to blacked-out areas to provide start-up power and customer load restoration;
- Extend the stabilized system to energized islanded areas to restore frequency control; and
- Restore normal transmission system operations.

The NYISO's restoration followed the priorities set in the Plan and did not encounter any significant impediments. Power restoration to the upstate area began Thursday evening, and Long Island was able to start bringing customers back in that same timeframe using local generation. The restoration to the rest of the downstate did not begin until the backbone transmission system was re-energized, allowing major generating plants to be resynchronized to the grid.

Timeline for Restoration Event



Throughout the event, the NYISO was in constant communications with the TOs through the control center system operators (dispatchers). In addition, the NYISO established secondary lines of communications with the TOs to identify and agree upon the actions to be carried out by the system operators. Initial conversations included the sharing of information on the status of each TO's area and the expected restoration procedures. The TOs and the NYISO also conferred to set up the actions needed in anticipation for re-synchronization. All restoration activities, including those required for synchronization, were carried out through coordinated steps controlled by the control center system operators. Likewise, the NYISO was in constant communications with the neighboring Control Areas principally through the control center system operators.

During the initial minutes following the disturbance, the NYISO operators' primary focus was to get an accurate assessment of the system necessary to carry out the restoration.

A. Initial Assessment At 16:18

The NYCA transmission system was islanded and with radial interconnections at Niagara, St. Lawrence, and Waldwick stations. The bulk power transmission system was energized from Niagara station in the West, Massena station to the North, New Scotland station in the Capital area, Ramapo station in the Hudson Valley, and Oakdale station in the Central LBMP zone. The western island remained relatively stable and was able to serve about 5,700 MW of load in western New York and in the Albany and Schenectady area following the event. Generation at the Beck and Niagara, Saunders and St. Lawrence, some thermal generation in western New York, and the HVdc intertie with Quebec formed the basis for restoration of both the New York and Ontario systems.

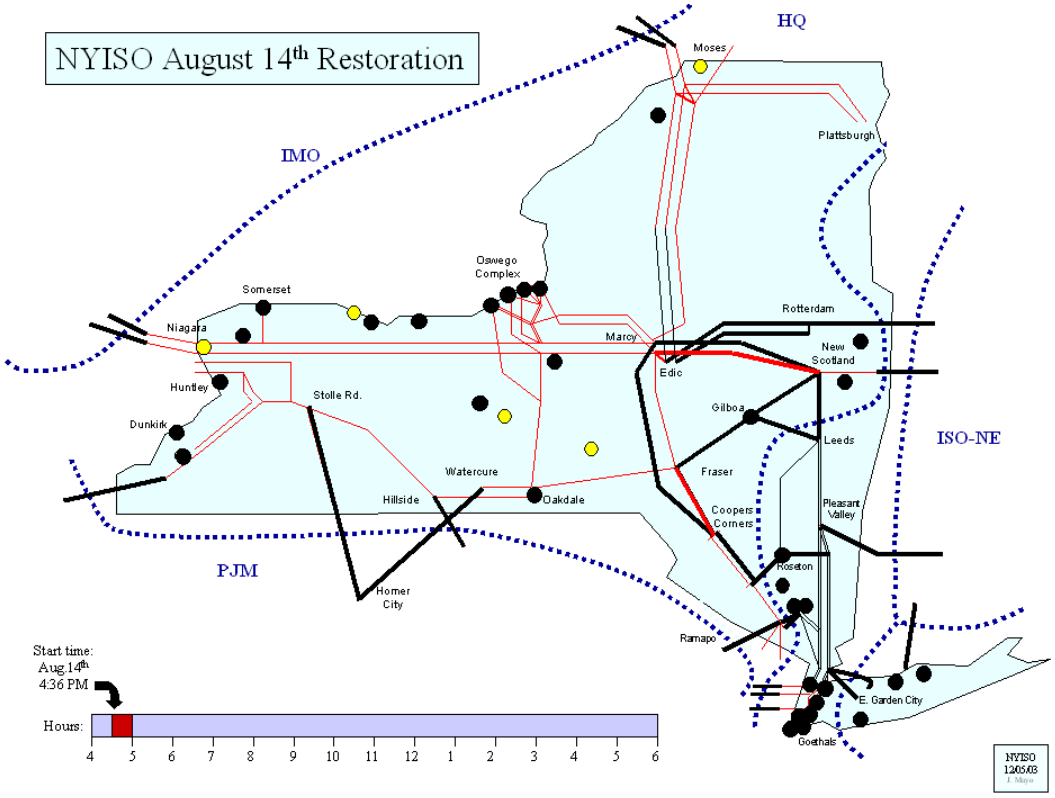


Figure 3.1

There were large frequency and voltage deviations during the initial islanded period as generation and load imbalances were encountered.

B. Interconnection with the Eastern Interconnection (16:30 –19:30)

At 16:27, the NYISO ordered Gilboa to start its Black Start procedures. The NYISO coordinated with the IMO about the Saunders and Beck generation, which were radially connected to the NYISO system. The NYISO confirmed with PJM that the Waldwick interconnections were still in service, supplying radial load in North New Jersey. At 17:15 over the Hotline, the NYISO reported to the TOs about the status of the bulk power system, and directed them to follow through with their local restoration plans and to coordinate anything affecting the bulk power system with the NYISO.

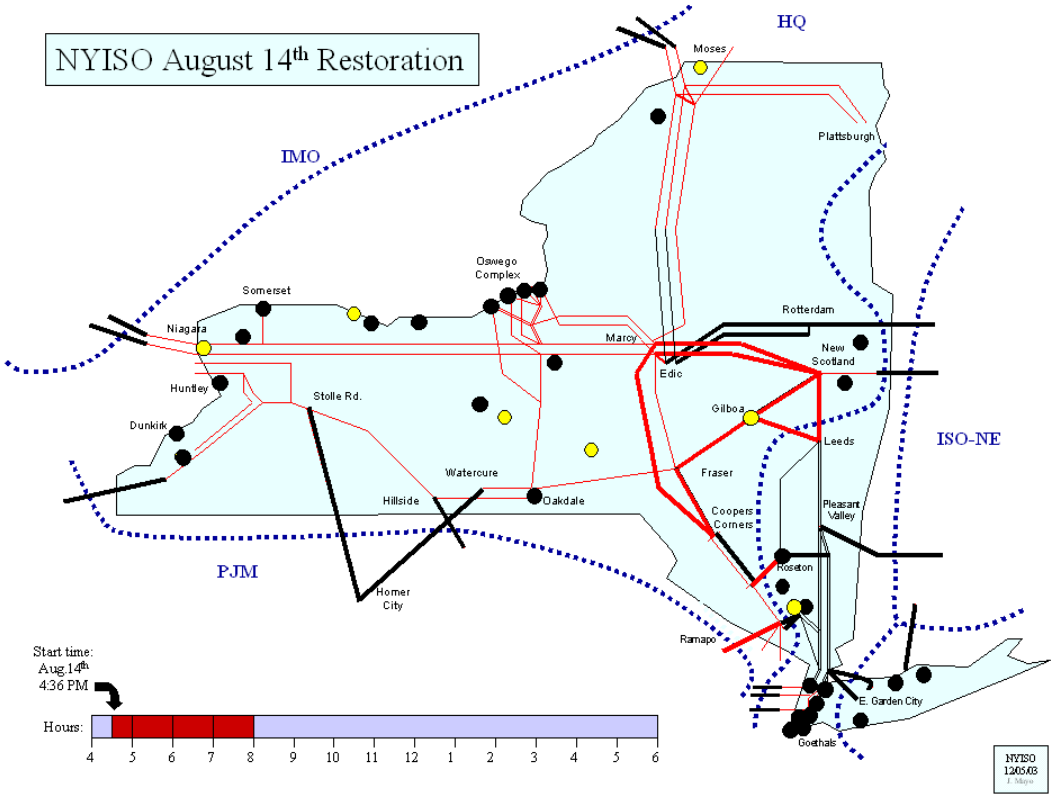


Figure 3.2

One of the NYISO's first objectives was to resynchronize the NYCA transmission system with the PJM 500 kV interconnection at Ramapo, to restore normal frequency control to the Western NY island. The effort to achieve synchronization was complicated by the islanded NYISO operation. While the NYISO was islanded, there were two primary areas of concern.

The first was the frequency control that requires the balance of the island load and generation resources. Restoration of large amounts of load without sufficient generation would cause the frequency to decay and result in the available generation tripping offline. For the NY island, this was compounded by the fact that additional generation from the IMO (Beck and Saunders) was connected and additional load in Northern New Jersey was being served by the island. The second area of concern was voltage control on the bulk power system. High voltages can result from interconnecting transmission lines without loads at the end of these lines. Thus, when a transmission line is energized, there needs to be some load at the end of the line to control the voltage. But for the large amounts of load to be picked up to control the voltage and quickly restore the grid, there must be generation or an interconnection to address the frequency control concern. To allow the NYISO restoration to proceed most efficiently, the need to synchronize the NY island to the Eastern Interconnection via the PJM 500 kV interconnection was given the highest priority, to stabilize the frequency.

Synchronization of two systems -- the Western NY island and the Eastern Interconnection (PJM's grid) -- required that the two systems be operating at nearly the same frequency. Synchronization to the PJM grid was initially discussed at 17:18 and an attempt to synchronize was unsuccessful at 18:02 due to large frequency imbalance between the NYISO and the PJM systems. However, the NYISO, Con Edison, and Orange & Rockland adjusted the New York system load configuration, and a second attempt at 19:07 was successful; the NYISO was able to coordinate the balance of generation and load levels at the required frequency. The NYISO directed Con Edison personnel to manually close into the PJM 500 kV grid via synchroscope operation at Ramapo station. After synchronizing at Ramapo, the frequency control for the Western NY island returned to near normal operation.

At 17:28, Con Ed reported that the Ramapo to Buchanan transmission path was energized, and configured the system to bring off-site station power to Indian Point nuclear power stations. The first Gilboa generator came online at 17:51 via the Gilboa –Fraser 345 kV line for voltage control.

C. Extending the system to blacked-out areas to provide station power and customer load restoration (19:30 – 24:00)

By 19:07, with New York resynchronized with PJM at Ramapo, the process to extend the now stabilized system into the blacked-out southern island was well underway. At 19:56, a Southeast transmission corridor from Buchanan to Eastview (W93) and from Eastview to Sprain Brook (W79) was energized to Sprain Brook station and cranking power was available to Astoria East station, as well as load restoration at 179ST station.

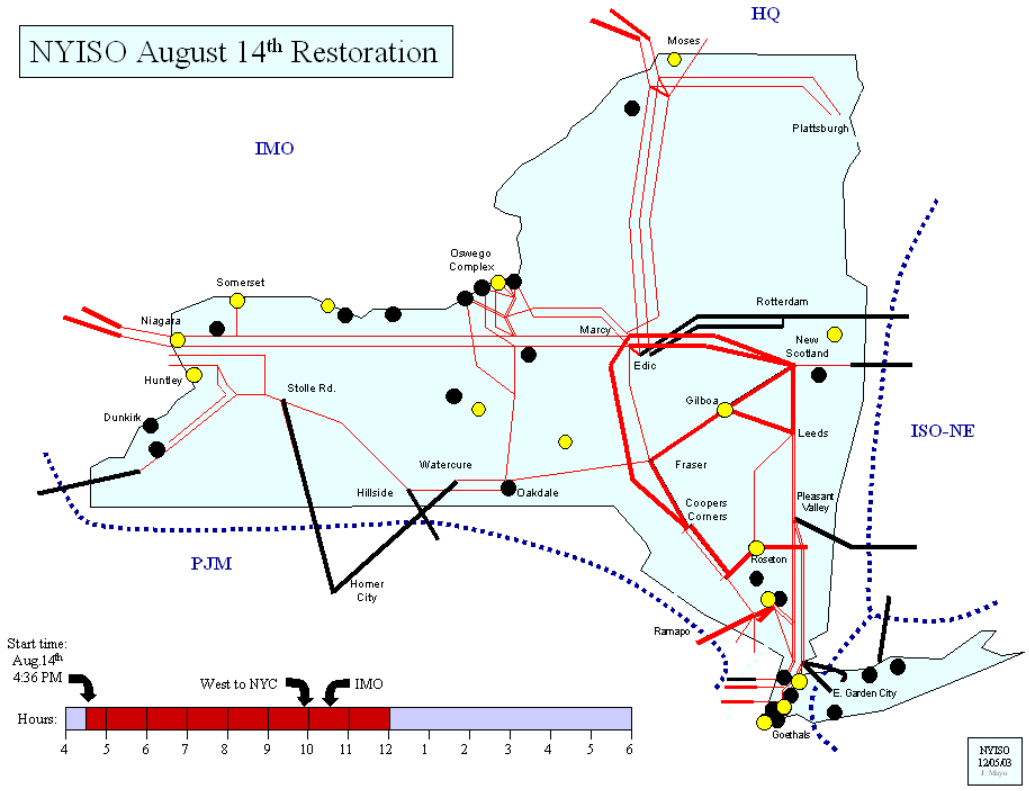


Figure 3.3

The NYISO and the TOs continued to energize the bulk power system and pick up load throughout Thursday evening. By 21:50, the energized transmission grid was extended along the Northeast corridor from New Scotland 345 kV into Westchester by express feeders through Leeds, Pleasant Valley, Wood Street, Millwood, and Eastview 345 kV substations. Express feeders are groups of transmission facilities that are typically energized in sequence with the primary intent to facilitate restoration activities. The express feeders were energized as defined by the ISO Restoration Plan. The Northeast corridor feeders and the Southeast corridor feeders

into Sprain Brook were then paralleled at 00:11 at Con Edison's Sprain Brook substation, thereby providing two upstate New York transmission paths to the NYC area.

At 23:00, the energized PJM grid was extended from PJM (Hudson 230 kV) into the Con Edison system by express feeders through Farragut, Gowanus, and Gothals to the Linden generating station for cranking power. Following Linden unit start-up, these feeders were paralleled with the Con Edison system. By 23:00 EDT, PJM was also connected to New York through the Hudson- Farragut 345kV interconnections.

The NYISO Customer Relations Department in conjunction with the Market Monitoring Unit established a process for collecting generator status information. Beginning the evening of August 14th and continuing periodically throughout the restoration period, the NYISO staff called generators to determine their physical condition and estimated time the unit would return to service. The focus was on large capacity units and downstate units. The NYISO Operations Department used this information directly and provided it to the New York Transmission Owners for use in planning system restoration.

D. Restoration continues (00:00 to 04:00 August 15th)

At midnight on August 15th, approximately 40% of the load had been restored to the NYISO system. The NYISO and PJM continued to restore the remainder of the interconnections between the two control areas.

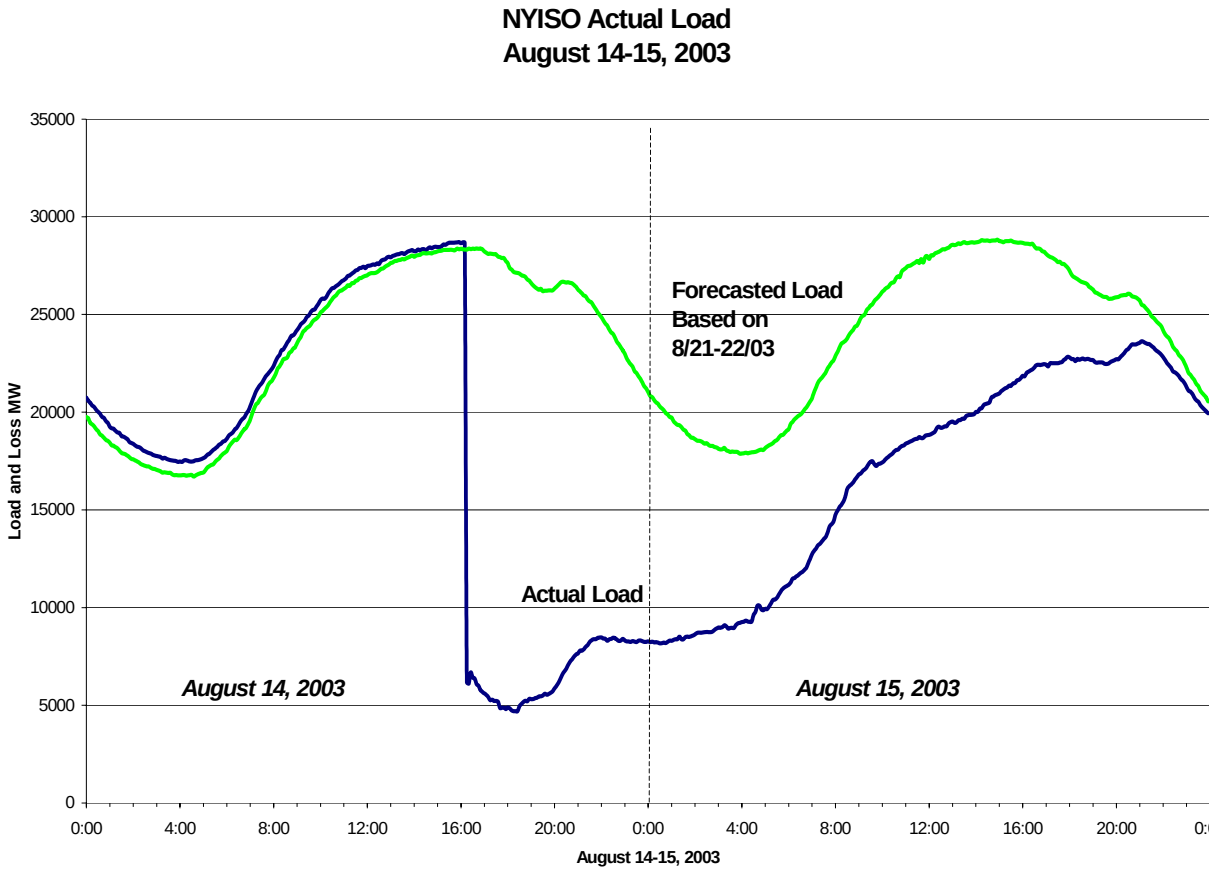


Figure 3.4

The New England control area was reconnected to New York and thus, to the Eastern Interconnection at 01:53 EDT on Friday, August 15th.

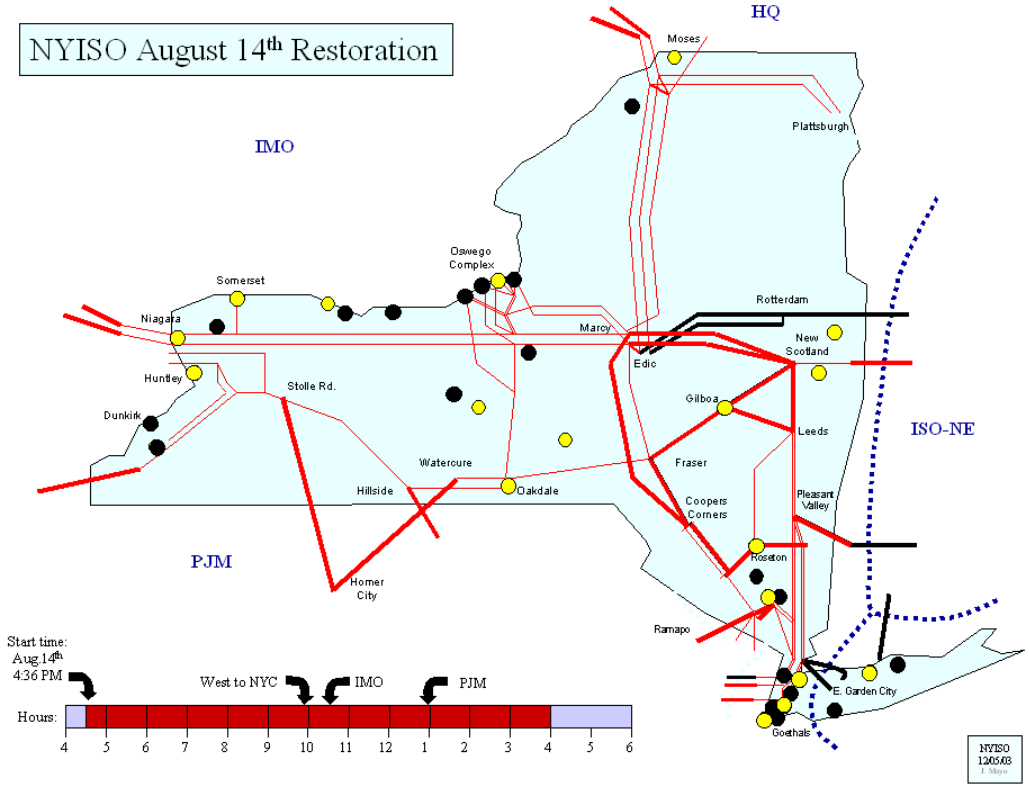


Figure 3.5

The transmission grid was extended from Northeast (New Scotland 345 kV) into ISO-NE by an express feeder through Alps and Berkshire into ISO-NE's Northfield substation. The NYISO and ISO-NE coordinated the synchronization of the New England transmission system to the NYCA transmission system, via synchroscope operation at Northfield, to restore normal frequency control for ISO-NE.

Synchronization of the New England transmission system to the NYISO's transmission system was required to be sequenced after the Southeast and Northeast corridor feeders were paralleled at Con Edison's Sprain Brook substation. This sequencing was required due to the high voltage conditions observed at the New Scotland 345 substation with the Northeast express feeder into NYC energized but not paralleled at Sprain Brook until 00:11. The remainder of the interconnections with ISO-NE were restored during this period.

E. Paralleling with LIPA (04:00-05:00)

At 04:00 on August 15th, approximately 60% of the NYCA load had been restored. At 04:05 Con Ed energized the Sprain Brook-West 49th Street (M51) and the West 49th Street to 13th Street (M55) and began adding load to control the voltage conditions. At 05:20 the energized transmission grid was extended from the Con Edison system (Sprain Brook 345 kV) into Long Island (East Garden City 345 kV). Synchronization of the Long Island transmission system to the NYISO's transmission system restored normal frequency control for Long Island. At 07:34, the NYISO issued an order implementing the EDRP/SCR program, which would reduce load beginning at 10:00 and continue until 24:00. The NYSDEC Air Emissions waiver was in effect and would allow generators to go to maximum capability if required. This remained in effect until the end of the Major Emergency at 00:00 on August 18th.

F. Load Shedding During Restoration (08:00 – 23:00 August 15th)

At 08:00 approximately 64% of the NYCA load had been restored, however, the morning load pickup occurred faster than the generation was coming online. At 08:59, the NYISO made a hotline call to request immediate relief from the EDRP/SCR customers. At 09:25, the NYISO informed the TOs of the potential for rolling blackouts due to the load and generation imbalance. At 09:33, the NYISO ordered the TOs to shed 300 MW of load due to the Area Control Error (ACE) dragging 630 MW. The TOs complied with the load shedding order, and by 10:02, the NYISO informed the TOs to restore half the load that was shed in response to the NYISO's direction. At 10:24, the NYISO instructed the TOs to restore the remainder of the load.

At 12:26, the Cross Sound Cable went in service, allowing an additional 100 MW of emergency energy to flow from ISO-NE to Long Island.

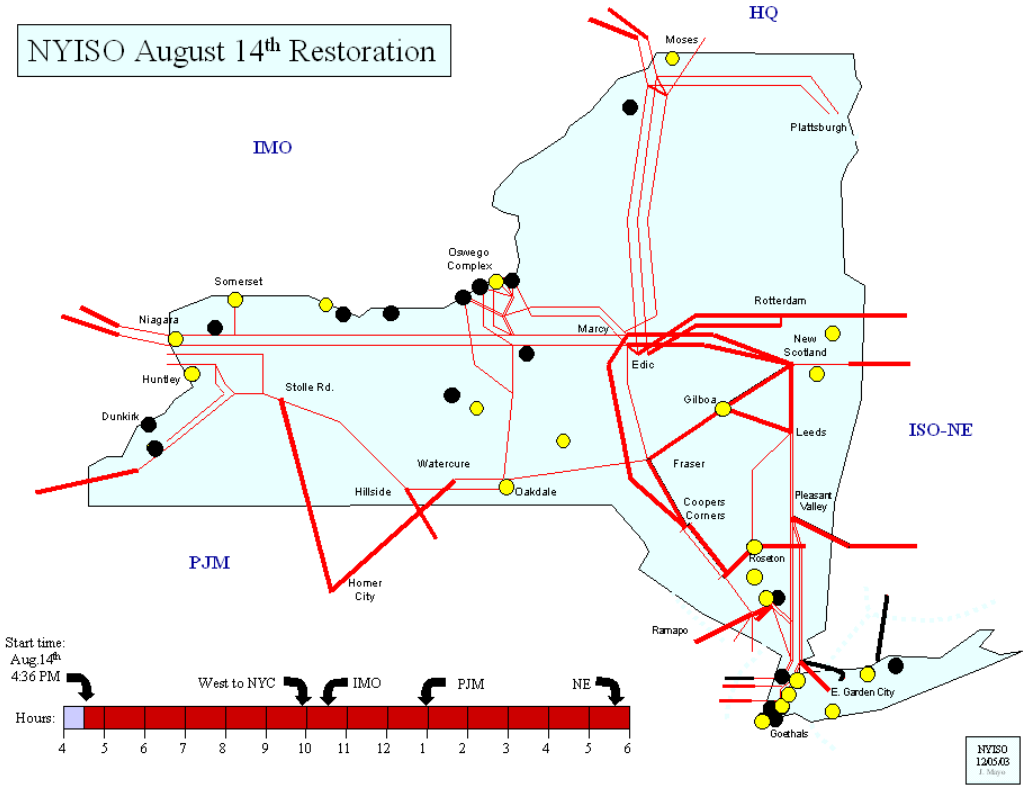


Figure 3.6

The NYISO and the New York TOs worked to extend the energized NYCA grid by restoring available transmission facilities as voltage and reactive conditions permitted. At 22:30 on August 15th, Con Ed and LIPA notified the NYISO that they had 100% of their customers online. At that point, service across the NYCA was completely restored. The NYISO remained in a Major Emergency State for the remainder of the weekend to ensure that the bulk power system was stable and the NYISO was capable of supplying load without the need for emergency energy purchases from the neighboring Control Areas, and to ensure an orderly reopening of the market.

IV. *Market Performance*

Prior to 16:00 on Thursday, August 14th, the New York wholesale electricity markets, which include the operation of the Day-Ahead and Real Time Markets, were operating normally. The Day Ahead Market (DAM) for Thursday the 14th and Friday the 15th had been completed as normal at the time of the blackout. DAM operation for Saturday the 16th and Sunday the 17th continued as normal during the restoration period. The Real-Time Market was suspended immediately following the blackout event. Normal Real-Time Market operations recommenced as of hour beginning 0 on Monday the 18th. The NYISO implemented tariff provisions for the settlement of the markets in emergency situations, carried out these settlements in cooperation with Market Participants, and successfully incorporated the necessary adjustments in the August bills.

Under these circumstances, even though the NYISO did not suffer any loss of its IT infrastructure, there was no means to operate a competitive real-time market until the bulk power system was restored, and the NYISO and transmission owners had evaluated the damage (if any) to the quality of the telemetry and communications required to support real-time operation. By Friday morning, substantial portions of the network had been restored and the NYISO was reconnected to the Eastern Interconnection. The NYISO notified the market that the real-time market operation was suspended beginning at 16:00 on Thursday the 14th and would not be restored until hour beginning 0 on Monday, August 18th.

The NYISO asked Market Participants to continue to bid and offer into both the Day-Ahead and Real-Time Markets, as they normally would have. Attached are the SCUC summary reports for August 14th through August 18th in Appendix C.

DAM bids and offers were needed to carry out normal DAM solutions and unit commitments for Saturday the 16th, Sunday the 17th, and Monday the 18th. Market Participants responded as requested and bidding for those three days was generally normal. A small number of generators failed to submit offers for August 16th and August 17th while load bidding was normal. There was some drop off in the amount of virtual bidding observed for the weekend but not a dramatic amount. The NYISO, therefore, carried out the Day-Ahead Market solution processes normally and valid results were produced and posted. Specifically, the normal market assumptions were as follows:

- Scheduled outages only were included (post disturbance network conditions were ignored)
- Any generator that provided offers was assumed to be able and willing to meet his scheduled obligation (post disturbance generation outages were ignored)
- Forecast load was assumed to be as forecasted by the normal load forecast program (ignoring post disturbance outage conditions)

As prescribed by the NYISO tariffs, the DAM solution was therefore consistent with what the NYISO's market software would have produced if the disturbance and outage had not occurred as prescribed by the NYISO tariffs.

While the Real-Time Market had been suspended, the NYISO also wanted normal bids and offers available to begin testing the real-time market software (even though the results would not be binding on participants) as soon as system conditions stabilized in order to verify that all parts of real-time market operation were operating normally before restarting the market, planned for midnight Sunday night. System restoration conditions were such that the NYISO Operations Department began a systematic process of turning control of the system generation over to the dispatch software on Saturday evening. Testing of the real-time scheduling, dispatch, and market software proceeded through Sunday. The Real-Time Market was successfully restarted at midnight for hour beginning 0 Monday the 18th of August, as planned.

A. Summary of Settlement Rules

The NYISO staff met Thursday evening, August 14th, and Friday, August 15th, to determine how best to settle the markets during the emergency period. The tariff provides guidance on specifically this outage circumstance in Attachment E – "Temporary Extraordinary Procedures for Correcting Prices Resulting From Market Design Implementation Errors and Emergency System Conditions" of the Market Services Tariff which addresses how to set prices in circumstances where either a substantial network outage or failure of IT infrastructure prevent the NYISO from calculating prices normally. Specifically, it directs the NYISO to establish prices "as closely as reasonably practicable" to what they would have been "but for" the emergency. The NYISO concluded that the best estimate of what prices would have been but for the emergency are the DAM prices that took into account bids/offers as provided by market participants and the system conditions used for the day-ahead solution process which assumed normal scheduled outages.

This approach was more fully developed to address all aspects of real-time settlements and reviewed with market participants, the staff of the New York Public Service Commission, and the FERC. The approach was universally accepted as fair and superior to other more subjective alternatives. In addition, it has the advantage of keeping whole market participants with day-ahead obligations that were unable to meet them due to network outages by settling day-ahead and real-time imbalances at the day-ahead prices. The approach avoided unnecessary financial harm to some market participants and likewise eliminated the potential for unearned windfalls for others. The details of the settlement approach were distributed to Market Participants in early September. The NYISO was able to make the temporary software modifications to the settlement software in time to incorporate the settlement for the emergency period as part of the normal settlement invoices for the month of August.

B. Anomalies

A final component of settling the emergency period is consideration for extraordinary expenses (not bid or recovered by the settlement process) incurred by market participants while responding to NYISO direction during the emergency period. The NYISO has provided guidelines to market participants as to the nature of expenses that may qualify for compensation and the process to follow in making claims. The NYISO is in the process of reviewing the claims it has received to determine and validate eligibility for compensation.

V. Interim ISO Operational Considerations and Further Evaluations

In response to the August 14th events, the North American Electric Reliability Council (NERC) identified six near-term recommendations for maintaining system reliability and asked the Reliability Coordinators for the NERC regions to review their operating standards and practices in light of those recommendations. The NYISO, as Reliability Coordinator for the NYCA, certified to NERC that it is in full compliance with all the near-term measures NERC identified. A copy of NERC's October 15th letter outlining its near-term recommendations and a copy of the NYISO response are attached in Appendix A.

In particular, with regard to the establishment of a daily voltage/reactive power management plan, the NYISO's procedures include conducting both Day-Ahead and Real-Time studies to ensure that minimum pre- and post contingency voltage decline does not exceed NPCC criteria and that reactive resources are dispatched to meet the reactive power demand.

With respect to communications, the internal NYISO operating procedures follow and complement NPCC C-03 and C-20 which establish protocols among the NYISO, transmission owners, market participants, and neighboring control areas for normal and emergency conditions. Finally with regard to training of the system operators, the NYISO has a program of annual exercises to simulate restoration from a widespread blackout. This program involves Transmission Owners and to the extent possible, factors in the response from neighboring control areas. Additionally, all system operators are NERC certified. They participate in mandatory training on voltage control, communications, System Restoration Plan, and other topics. Normal training exceeds 20 days per system operator annually.

The NYISO's existing procedures comply with all applicable NERC, NPCC, and NYSRC criteria and with the near-term reliability recommendations identified by NERC following the system disturbance.

A. Nationally

The International Task Force's final report and New York's own internal investigation will yield numerous detailed recommendations.

However, based on the Task Force's and New York's Interim Report, it is abundantly clear that:

- The reliability standards set by NERC, which are now voluntary, must be made mandatory, as are the NPCC and NYSRC rules.

- The communications among ISOs, RTOs, and control areas need to be significantly improved.

- Better communications among the control area operators need to be accompanied by pre-arranged and effective operating procedures.

- Participation in an ISO, RTO or tight power pool for reliability purposes should be mandatory.

- Finally, the energy bill before Congress contains several provisions intended to encourage investment in transmission and to improve generation siting processes thus strengthening and modernizing the grid.

B. Restoration

Effective Restoration Plans and extensive prior training allowed the NYISO to restore power to the NYCA completely in less than 30 hours. Following separation from the Eastern Interconnection, New York's bulk power system performed as anticipated, and the NYISO, therefore, was able to follow the Restoration Plan without significant deviation. In accordance with the Restoration Plan, assessment and restoration of the bulk power system began immediately following the system disturbance. The NYISO focused its preliminary efforts on stabilizing frequency in the NYCA to synchronize the New York island to the Eastern interconnection, and extending the remaining transmission system to start up generation and restore customer load.

The NYISO's control room dispatchers coordinated these efforts with Generators and Transmission Owners in the NYCA and with control room dispatchers in neighboring control areas. Dispatchers and Generators made extraordinary efforts to bring units back into service. In several cases, dispatchers intervened to insure the quick restart of generation by making the decision to trip certain units. Dispatchers remarked on the outstanding cooperation by and among the Demand Response Providers and the various control areas and noted that this cooperation was vital to efficient system restoration.

In response to the Blackout and restoration efforts, the NYISO Operating Committee formed a Restoration Working Group to report to the System Operation Advisory Subcommittee (SOAS). In addition, the NYISO's Operating Committee is currently reviewing the NYISO restoration procedures. They will be evaluating whether any revisions are warranted. The Working Group is evaluating a number of concepts, including the following:

- Whether the distribution of responsibility for restoring the bulk power system between the NYISO and individual transmission owners should be adjusted to reflect the restoration experience;
- What amount of capacity should be reserved to energize the system and major generation sites in the New York Control Area in the event of a major system disturbance;
- Whether NYISO load shedding protocols during periods of system restoration should be modified;
- Whether the NYISO should investigate development of a formal process for disseminating system information to the transmission owners during a system disturbance supplementing the current process and procedure in place.
- Whether transmission owners' restoration plans are optimally coordinated with the NYISO's restoration plan.

C. Next steps

The NYISO is currently working on the following committees and investigations:

- DOE International Investigation team
- NPCC Blackout Investigation team - regional
- NYISO Operating Committee Restoration team
- NPCC Inter-Regional Restoration WG
- Mid-Atlantic Area Council (MAAC), East Central Area Reliability Coordination Agreement (ECAR) and NPCC (MEN) Group – Load Flow base case development of event
- NPCC Task Force System Studies (TFSS) – Dynamic Base Case development of event
- NYSRC Council Request for Investigation

The NPCC Blackout Investigation team is developing the power flow and dynamic base cases associated with the event and the NYISO will use those cases to:

- Explain why the events happened as they did;
- Determine whether various automatically operated equipment and controls operated as expected or as designed during the event;
- Identify any equipment failures or mis-operations that may have occurred;
- Evaluate various possible mitigation measures to improve the reliability of the NYISO system for a similar event;
- Evaluate potential protection system coordination over a wider area (e.g. NPCC/PJM/MAAC).
- Evaluate whether predetermined "islanding" protection schemes are appropriate for the NYCA (such schemes are utilized in the Western US, Japan and other areas)

D. Final Reports

The International Task Force's Final Report is expected to be completed by early 2004. New York's own Final Report will follow the release of the International Task Force's Report. The New York Report will contain the deliberation and further evaluation of the restoration in the NYCA following the August 14th System Disturbance.

Follow-up and implementation of the recommendations from these reports will be factored into the NYISO's project schedule and prioritized appropriately.

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL

Princeton Forrestal Village, 116-390 Village Boulevard, Princeton, New Jersey 08540-5731

October 15, 2003

To: **NERC Control Areas and Reliability Coordinators**

Subject: **Near-Term Actions to Assure Reliable Operations**

The NERC Board of Trustees, with the endorsement of its Stakeholders Committee, directed on October 10, 2003 that the following letter be sent to the CEOs of all NERC Control Areas and Reliability Coordinators.

NERC is assisting the United States-Canada Power Outage Task Force's joint-international investigation of the August 14 blackout that affected parts of the Midwest and Northeast United States, and Ontario, Canada. Although considerable progress has been made in the investigation to determine what happened, an understanding of the causes of the outage is still being developed through analysis by teams of experts.

The reliability of the North American bulk electric systems, including the avoidance of future cascading outages, is of paramount importance to NERC and its stakeholders. Pending the outcome of the final report on the outage, NERC emphasizes to all entities responsible for the reliable operation of bulk electric systems the importance of assuring those systems are operated within their design criteria and within conditions known to be reliable through analytic study. If the power system enters an unanalyzed state, system operators must have the authority and the capability to take emergency actions to return the power system to a safe condition.

NERC requests that each entity in North America that operates a Control Area and each NERC Reliability Coordinator review the following list of reliability practices to ensure their organizations are within NERC and regional reliability council standards and established good utility practices. NERC further requests that within 60 days, each entity report in writing to their respective regional reliability council, with a copy to NERC, that such a review has been completed and the status of any necessary corrective actions. This brief list of near-term actions is not in any way intended to diminish the need to comply with all NERC and regional reliability council standards and good utility practices.

1. **Voltage and Reactive Management:** Ensure sufficient voltage support for reliable operations.
   - Establish a daily voltage/reactive management plan, assuring an adequate static and dynamic reactive supply under a credible range of system dispatch patterns.
   - During anticipated heavy load days, or conditions of system stress such as caused by heavy wide-area transfers, ensure all possible VAR supplies are verified and available, and VAR supplies are applied early in the day ahead of load pickup.
   - Reserve sufficient dynamic reactive supply (e.g. online generation and other dynamic VAR resources) to meet regional operating criteria and system needs.
   - In accordance with NERC and regional practices maintain voltage schedules of all bulk electric transmission facilities above 95% nominal values and in conformance with regional criteria.

- Report any low voltage limit violations at critical high voltage transmission facilities to the reliability coordinator.
- Ensure all interconnected generators that have, or are required to have, automatic voltage regulation (AVR) are operating under AVR.
- Coordinate potential differences of voltage criteria and schedules between systems and ensure these differences are factored into daily operations.

2. **Reliability Communications:** Review, and as necessary strengthen, communication protocols between Control Area operators, Reliability Coordinators, and ISOs.
   - Share the status of key facilities with other appropriate Control Area operators, Reliability Coordinators, and ISOs.
   - Control Area operators, Reliability Coordinators, and ISOs should conduct periodic conference calls to discuss expected system conditions and notify all neighboring systems of any unusual conditions. Conduct additional calls as needed for system critical days.

3. **Failures of System Monitoring and Control Functions:** Review and as necessary, establish a formal means to immediately notify control room personnel when SCADA or EMS functions, that are critical to reliability, have failed and when they are restored.
   - Establish an automated method to alert power system operators and technical support personnel when power system status indications are not current, or that alarms are not being received or annunciated.
   - Determine what backup capabilities can be utilized when primary alarm systems are unavailable. If a backup to failed alarms is not immediately available, then monitoring and control should be transferred in accordance with approved backup plans.
   - Identify and implement procedures to move to 'conservative system operations' when operators are unsure about next contingency outcomes (i.e., unstudied conditions, loss of SCADA or EMS visibility, unexplained or unknown power system conditions).
   - Ensure all critical computer and communication systems have a backup power supply, and the backup supply is periodically tested.
   - Ensure that system operators have a clear understanding of the impact to their energy management system control functions whenever their transaction tagging and scheduling systems fail. Identify and implement appropriate contingency procedures for loss of real-time ACE and AGC control.

4. **Emergency Action Plans:** Ensure that emergency action plans and procedures are in place to safeguard the system under emergency conditions by defining actions operators may take to arrest disturbances and prevent cascading.
   - Actions might include but should not be limited to acting immediately to reduce transmission loading, ordering redispatch, requiring maximum reactive output from interconnected resources, and shedding load without first implementing normal operating procedures.
   - Ensure operators know, not only that they have the authority to shed load under emergencies, but that, in addition, they are expected to exercise that authority to prevent cascading.

5. **Training for Emergencies:** Ensure that all operating staff are trained and certified, if required, and practice emergency drills that include criteria for declaring an emergency, prioritized action plans, staffing and responsibilities, and communications.

6. **Vegetation Management:** Ensure high voltage transmission line rights of way are free of vegetation and other obstructions that could contact an energized conductor within the normal and emergency ratings of each line.

Michehl R. Gent
President and CEO

NPCC SELF CERTIFICATION FORM ON NERC NEAR-TERM ACTIONS TO ASSURE RELIABLE OPERATION APPENDIX A

RELIABILITY PRACTICES FOR CONTROL AREAS AND RELIABILITY COORDINATORS

The reliability of the North American bulk electric systems, including the avoidance of future cascading outages, is of paramount importance to NERC and its stakeholders. Pending the outcome of the final report on the August 14, 2003 blackout, NERC emphasizes to all entities responsible for the reliable operation of bulk electric systems the importance of assuring those systems are operated within their design criteria and within conditions known to be reliable through analytic study. If the power system enters an unanalyzed state, system operators must have the authority and the capability to take emergency actions to return the power system to a safe condition.
NERC requested that each entity in North America that operates a Control Area and each NERC Reliability Coordinator review the following list of reliability practices to ensure their organizations are within NERC and regional reliability council standards and established good utility practices.
Each entity is requested to report before December 15, 2003 to NPCC, with a copy to NERC, that such a review has been completed and the status of any necessary corrective actions.

Responsible Reporting Entity:	New York Independent System Operator
Contact Name:	Michael Calimano
Title:	Vice-President – Operations and Reliability
Phone: 518-356-6129	E-mail: mcalimano@nyiso.com

Assessment Date: November 2003 Applicable function(s): ☒ Control Area ☒ Reliability Coordinator

The reporting entity certifies to have reviewed and be in compliance with the following reliability practices:

		NERC/NPCC/ AREA RELIABILITY PRACTICES
1. ☐	**Voltage and Reactive Management:** Ensure sufficient voltage support for reliable operations.	
1.1 ☐	Establish a daily voltage/reactive management plan, assuring an adequate static and dynamic reactive supply under a credible range of system dispatch patterns.	The NYISO Transmission and Dispatching Operations Manual specifies the procedures for coordinating and controlling the voltage of the ISO Secured Transmission System and the respective actions to be taken by the NYISO and the Transmission Operators. The procedures include conducting Day-ahead and real-time studies to ensure that minimum pre and post contingency voltages can be maintained and that post contingency voltage decline does not exceed NPCC criteria. The voltage collapse studies are documented in internal procedures.
1.2 ☐	During anticipated heavy load days, or conditions of system stress such as caused by heavy wide-area transfers, ensure all possible VAR supplies are verified and available, and VAR supplies are applied early in the day ahead of load pickup.	The NYISO operates within operating security limits that are based on maintaining pre-contingency voltages levels. Generators are required to test and verify reactive capability twice a year in order to qualify for Voltage Support Services. The NYISO's Tariff includes penalties for generators that fail to produce reactive power when called upon to supply it. The NYISO's operating procedures require the NYISO to ensure that sufficient reactive resources are dispatched to meet the reactive power demand and that these resources are applied in a timely fashion, as required by the system conditions at the time.
1.3 ☐	Reserve sufficient dynamic reactive supply (e.g.	The NYISO ensures, through its voltage collapse studies,

	online generation and other dynamic VAR resources) to meet regional operating criteria and system needs.	that sufficient reactive resources are available and dispatched to meet all applicable reliability standards.
1.4 ☐	In accordance with NERC and regional practices maintain voltage schedules of all bulk electric transmission facilities above 95% nominal values and in conformance with regional criteria.	In general, the NYISO's operational procedures and reliability standards are established to meet or exceed the NERC and NPCC requirements. These procedures already require the system operators, transmitters and generators to maintain the voltage schedules of their facilities above 95% of the nominal values. In practice NYISO operates the NYISO transmission facilities under its control well above nominal levels. For example the NYISO 345 kV system is generally operated above 350 kV at its critical stations.
1.5 ☐	Report any low voltage limit violations at critical high voltage transmission facilities to the reliability coordinator.	Voltage control of the NYISO Secured Transmission System is coordinated by the NYISO Shift Supervisor to provide adequate voltage at all times so as to maintain power transfer capability. When there is a Major Emergency due to voltage problems, the NYISO Shift Supervisor notifies all Transmission Owners of the condition and directs the necessary corrective action.
1.6 ☐	Ensure all interconnected generators that have, or are required to have, automatic voltage regulation (AVR) are operating under AVR.	The NYISO already requires that generators equipped with AVRs operate their units with the AVRs in automatic mode. Generators coordinate the outage of AVRs on generating units with 40 MW capability or larger with the NYISO.
1.7 ☐	Coordinate potential differences of voltage criteria and schedules between systems and ensure these differences are factored into daily operations.	The NYISO coordinates voltage control with the neighbouring control areas in conformity with NPCC B-03, NPCC C-04, and the applicable interconnection agreements.
2. ☐	**Reliability Communications:** Review, and as necessary strengthen, communication protocols between Control Area operators, Reliability Coordinators, and ISOs.	The NYISO's internal operating procedures follow and complement NPCC documents C-03 and C-20 establishing the communication protocols among the NYISO, transmission owners, market participants and the neighbouring control areas in normal and emergency conditions. System operators are trained to ensure that they understand the importance of timely and effective communication for maintaining the reliability of the NYISO grid and the integrity of interconnections.
2.1 ☐	Share the status of key facilities with other appropriate Control Area operators, Reliability Coordinators, and ISOs.	The NYISO conforms to the NERC and NPCC requirements with respect to information sharing among reliability coordinators. Internal operating procedures describe the use of RCIS and SDX facilities to communicate specific reliability information with the neighboring control area operators, reliability coordinators and ISOs. This information generally includes but is not limited to: - system emergencies; - weather advisories; - EEA alerts; - Critical infrastructure protection; and - Critical transmission/generation outages. Outage information is also shared during weekly NPCC conference calls as per NPCC guide C-13.
2.2 ☐	Control Area operators, Reliability Coordinators,	The NYISO conforms to the NPCC's communication

	and ISOs should conduct periodic conference calls to discuss expected system conditions and notify all neighboring systems of any unusual conditions. Conduct additional calls as needed for system critical days.	guidelines with respect weekly and emergency conference calls as described in document C-13. With PJM, the NYISO exchanges information about the power system conditions through daily and ad hoc conference calls, as required.
3. ☐	**Failures of System Monitoring and Control Functions:** Review and as necessary, establish a formal means to immediately notify control room personnel when SCADA or EMS functions, that are critical to reliability, have failed and when they are restored.	The NYISO systems provide alarms to system operators and the on-shift supporting staff when data acquisition components or functions (communication lines, RTG etc) have failed. Where available, measured quantities impacted by such failures switch to the secondary source or appear as failed on the operators displays. Failures to other EMS functions are also flagged on the operators' displays. Procedures are in place to address workarounds and establish the communication protocol used on loss of critical telemetry or EMS functions.
3.1 ☐	Establish an automated method to alert power system operators and technical support personnel when power system status indications are not current, or that alarms are not being received or annunciated.	The NYISO has built into the EMS many different alarms functions when statuses of the power system data or computer system are not functioning. The computer system is always checking for a “heart beat;” if that has failed the system operator and computer operator both receive audible alarms that require acknowledgement. When data being transmitted to the NYISO fails the values are inverted to alarm the operator that the data is stale.
3.2 ☐	Determine what backup capabilities can be utilized when primary alarm systems are unavailable. If a backup to failed alarms is not immediately available, then monitoring and control should be transferred in accordance with approved backup plans.	The Backup Dispatch System (BDS) is a comprehensive set of procedures that address the possible loss of functionality of the NYISO Control Center, Transmission Owners' Control centers, and communication facilities. These include several sets of components and procedures to address major events affecting normal NYISO functionality. These procedures specify transfer of control when "backup to failed alarms is not immediately available?"
3.3 ☐	Identify and implement procedures to move to ‘conservative system operations’ when operators are unsure about next contingency outcomes (i.e., unstudied conditions, loss of SCADA or EMS visibility, unexplained or unknown power system conditions).	The NYISO market rules and procedures instruct system operators to respond to operating conditions at hand by taking whatever actions necessary to maintain the power system within prescribed limits This includes moving to more conservative operating limits when uncertain about the evolution of system conditions. System operators are authorized and trained to develop ad hoc limits for out of scope system conditions.
3.4 ☐	Ensure all critical computer and communication systems have a backup power supply, and the backup supply is periodically tested.	All critical computer and communication systems have a backup power supply. . The backup power supply is tested periodically, as provided for in the NYISO's existing procedures. This year, the NYISO participated in the pilot program established by NPCC to conduct a trial test of compliance with section 4.10 of NPCC A-03. This involved monitoring the testing of critical components associated with the key facilities in each control area’s restoration plan. The NYISO is prepared to ensure that compliance with section 4.10 of NPCC A-03 is enforced, once the program is declared mandatory by the NPCC.
3.5 ☐	Ensure that system operators have a clear understanding of the impact to their energy management	The NYISO’s system operators are trained to respond to the loss of electronic tagging service as described in

	system control functions whenever their transaction tagging and scheduling systems fail. Identify and implement appropriate contingency procedures for loss of real-time ACE and AGC control.	NERC Appendix 3A3. The purpose of the Manual Dispatch Systems is to provide the facilities and functions that enable the NYISO dispatchers to reliably maintain the balance of the energy, transactions and ancillary service schedules in the New York State Transmission System after the loss of significant components of the primary EMS and Market Participant System (MIS).
4. ☐	**Emergency Action Plans:**	-
4.1 ☐	Ensure that emergency action plans and procedures are in place to safeguard the system under emergency conditions by defining actions operators may take to arrest disturbances and prevent cascading. Actions might include but should not be limited to acting immediately to reduce transmission loading, ordering redispatch, requiring maximum reactive output from interconnected resources, and shedding load without first implementing normal operating procedures.	The NYISO has in place an Emergency Operating Manual that describes the actions that the system operators may implement during emergency conditions to maintain the security of the power system. These actions include: - Reducing transactions to relieve the loading on selected flowgates; - Redispatching and reconfiguring resources; - Requesting emergency assistance such as voltage support from interconnected resources; and If required, shedding load pre-contingency to respect limits. The NYISO has authority to direct the operation of the New York State Power System under the terms of its tariffs and agreements.
4.2 ☐	Ensure operators know, not only that they have the authority to shed load under emergencies, but that, in addition, they are expected to exercise that authority to prevent cascading	The NYISO's authority to take appropriate actions to keep the power system in balance and within studied limits, including shedding firm load, is stipulated in the above listed agreements. The NYISO's existing operating procedures detail the specific instructions to be implemented by system operators to maintain the system within applicable limits. The job descriptions of the operating staff specifically indicate as one of their key responsibilities, the obligation to approve the use and, when required, to implement the Emergency Operating Procedures, which includes shedding load to maintain system security and prevent cascading outages. System operators are trained to ensure that they understand the control actions required to maintain the security of the power system and prevent cascading outages.
5. ☐	**Training for Emergencies:** Ensure that all operating staff are trained and certified, if required, and practice emergency drills that include criteria for declaring an emergency, prioritized action plans, staffing and responsibilities, and communications.	This answer relates to restoration training but the question is about training in emergency procedures. The NYISO has a program of annual exercises to simulate restoration from widespread blackout. This program involves Transmission Owners and, to the extent possible, factors in the response from neighboring control areas. Market rules require that all restoration participants exercise their restoration plan annually. All system operators are NERC certified. Furthermore, they participate in mandatory training on voltage control, communications, System Restoration Plan etc. Normal training exceeds 20 days per system operator annually.

6. ☐	**Vegetation Management:** Ensure high voltage transmission line rights of way are free of vegetation and other obstructions that could contact an energized conductor within the normal and emergency ratings of each line.	The NYISO has requested information from Transmission Owners regarding their vegetation management procedures and, if necessary, implement corrective actions to ensure that high voltage transmission line rights of way are free of vegetation and other obstructions that could contact an energized conductor within the normal and emergency ratings of each line. Transmission Owners' responses are attached.
7. ☐	**Corrective Actions** (if applicable)	

Additional Comments:

Certified by: _____

Signature of Authority: I understand that this information is being provided as per NERC requirements "Near-Term Actions to Assure Reliable Operations."

Title: Vice-President – Operations & Reliability

Date of Certification: 9 December 2003

NYISO/NERC DATA REQUEST FOR INFORMATION ABOUT VEGETATION MANAGEMENT

Vegetation Management: Ensure high voltage transmission line rights of way are free of vegetation and other obstructions that could contact an energized conductor within the normal and emergency ratings of each line.

NYPA Response

The New York power Authority's 1400 circuit miles of transmission lines are inspected by aerial helicopter surveillance twice annually and by ground patrols once annually. During these patrols any aberrant tall growing trees that are capable of breeching the wire security zone are either immediately cut (ground patrol) or noted for near future removal(aerial patrol). This type of individual tree removal effort is done as part of a "hotspotting" effort that is used to complement our ongoing integrated vegetation management (IVM) program. Also, "danger trees" located just outside the legally cleared ROW easement, are likewise noted and rated for their need of removal by a separate danger tree survey performed semiannually. Danger tree work and unusual vegetation situations that require special procedures are completed by in-house crews.

All routine IVM work performed on the ROW is done by contractor work forces. The NYPA is currently on a four-year treatment cycle in regards to the implementation of our IVM program. This means that each transmission line right-of-way (ROW) is completely treated (i.e., all tall growing tree species are either physically removed or treated with an herbicide or both) once every four years. As an additional guarantee, the Authority has a 10% retainer in our vegetation management contracts that requires the Tree Company to achieve a 100% tree kill/removal in the wire zone and 95% in the ROW border zones. Thus the contractor must return the following year to insure that this standard is provided by removing all skips and misses from the preceding year in order to be paid the full amount for their services. In addition, a detailed ROW vegetation inventory is completed for each transmission facility once every four years to facilitate the cost effective vegetation management activities performed the following year as all this competitively bid IVM work is done to demanding per unit price specifications based on tree height, density and species.

NYPA has implemented a sophisticated GIS program for its ROW vegetation management that allows us to track all scheduled vegetation management activities and archive all treatment and inventory data as well as map pertinent landscape features, land use conditions and environmentally sensitive areas. NYPA is also a member of the US Environmental Protection Agency's Pesticide Environmental Stewardship Program (PESP) and a member of "Project Habitat" sponsored by BASF Corporation.

National Grid Response

National Grid transmission vegetation management maintenance programs are carried out within the framework of our NY Department of Public Service approved Transmission Right-of-Way Maintenance Program. The Program specifies clearances from trees within and adjacent to the right-of-way to be achieved at the time of maintenance in order to keep high voltage transmission line rights-of-way free of vegetation and obstructions that could potentially impact energized conductors. The Program also requires all high voltage transmission line rights-of-way to be helicopter patrolled annually by Forestry staff in June and early July.

National Grid is operating in compliance with the Program. All high voltage transmission lines were patrolled in June and early July 2003. Any tree problems identified were addressed. Following the August 14 event, all high voltage transmission lines were helicopter patrolled by Forestry personnel. No evidence of any tree contacts was found.

LIPA Response

All LIPA overhead transmissions lines are inspected twice annually from the ground (once in early spring and once late fall) to identify any tree/wire conflicts and tree vegetation intrusion into energized conductor operating space. A programmatic combination of "hot spot" tree trim and whole circuit trim are used to ensure that LIPA's transmission lines remain clear of vegetation. Additionally 100% of the overhead transmission system is scanned using thermo-vision camera from helicopters during each summer to identify hot spots. During this inspection, the transmission lines are again visually inspected for any wire/conflicts. Hot spot tree trim is used to correct any deficiencies identified.

We also have a formal Right of Way Management Program designed to meet the requirements of LIPA and the NYS PSC. This document was most recently issued to LIPA for their review and comment in June of 2003. We follow this program guide in performing all right of way maintenance necessary to keep high voltage transmission line right of ways free of vegetation and obstructions that could potentially impact an energized conductor.

NYSEG Response

NYSEG carries out an annual inspection program and a cyclic vegetation management program to protect the overhead transmission system from tree/wire conflicts.

Annual Patrols: The divisions and corporate forestry perform separate patrols annually.

Over a two-year period, 34.5 kV through 115 kV transmission lines are patrolled three times by helicopter and once from the ground by the divisions. One patrol is done in the spring after foliage has matured, and the other is done in the fall after hunting season. 230 kV and 345 kV transmission line are patrolled once by helicopter and once from the ground each year by the divisions. The purpose of the division patrols is to look for right-of-way encroachments, structural and hardware problems and to identify vegetation conditions that could threaten operation of the line before the next scheduled vegetation management treatment. The division forester is one of the observers during the spring patrol.

Corporate forestry performs an additional patrol in June of each year on 230 kV and 345 kV transmission lines to look for emergency vegetation conditions exclusively. Any questionable conditions observed during this patrol are inspected from the ground by the division forester and any necessary remedial work is scheduled and completed in accordance with the severity of the problem.

Vegetation Management Program: The entire transmission system is maintained in accordance with a comprehensive management plan that has been reviewed and approved by the PSC. The purpose of the plan is to manage the vegetation of the rights of way to prevent it from impacting an energized conductor. Most of the system is on a seven to eight year cycle. Exceptions to this cycle length are the lower Hudson valley, which is on a six-year cycle due to the longer growing season, and select lines that are on narrow or restricted right of way that require maintenance every four years.

Rochester Gas & Electric Response

Vegetation Management:

To "ensure high voltage transmission line rights-of-ways are free of vegetation and other obstructions that could contact an energized conductor within the normal and emergency ratings of each line", RG&E instituted a comprehensive right-of-way management program.

The right-of-way management program is implemented at various levels employing several major components.

They are:

Four-year vegetation management cycle, utilizing herbicides as the major component
Yearly aerial inspections

June helicopter patrol for vegetation and hardware conditions
June helicopter thermovision patrol for heating conditions
Detailed summer inspection of 20% of system utilizing Agrotors, Inc.
Priority schedule for remedial actions for tree conditions
Helicopter and or walking inspections following major storms or temporary outages

System Forester, responsible for program management
Minimum conductors clearances for vegetation
Three year trimming cycle for roadside sections
Regular side trimming of off-road sections, as required
Acquiring additional easement rights, for tree cutting, where necessary

ConEd Response

Vegetation is managed in accordance with the Land and Vegetation Management Plan for Overhead Transmission Rights-Of-Way. The plan is currently being updated to reflect program enhancements based on industry expert review of our rights-of-way, our own experience, benchmarking with other utilities, and input from the NYS Public Service Commission. Generally, vegetation is treated on a three year cycle using herbicides and various mechanical techniques, including tree removal, clearance trimming, and mowing. Sensitive locations and areas where narrow rights-of-way exist are monitored closely and trimmed more frequently. Side trees on private property are periodically evaluated. Private trees identified as presenting a significant fall over risk are addressed directly with adjacent property owners.

Clearances between vegetation and conductors are monitored twice per year during spring and fall ground patrols of the entire system. Monthly helicopter patrols of the entire system are also conducted. More detailed helicopter inspections, known as comprehensive inspections are conducted on parts of the system during most years. In addition to vegetation clearances, other items or obstructions that could jeopardize line reliability are monitored during the patrols. Also, personnel performing line work on towers or rights-of-way are instructed to look for and report any situation that could affect reliability.

Central Hudson Gas & Electric Corporation Response

All CHG&E overhead transmission lines are aerially inspected quarterly and thermo-vision inspected annually. Additionally, 20% of CHG&E overhead transmission lines are inspected from the ground annually. Full vegetation maintenance is performed on 20% of CHG&E overhead transmission lines each year. Annually, commencing in the spring, CHG&E assembles 'danger tree crews' to address hot spots and danger trees, which were reported during our aerial and ground inspections, reported by CHG&E work forces or obtained from customer alerts. Finally, CHG&E Line Clearance Foremen randomly inspect overhead transmission line right-of-ways throughout the year, performing an inventory of future danger trees and hot spots. CHG&E believes that this "Transmission Right of Way Long Range Vegetation Management Plan" ensures that our high voltage transmission lines remain free of vegetation and obstructions that could potentially impact an energized conductor.

The Staff of the NYS DPS is presently reviewing our 5-year plan "Transmission Right of Way Long Range Vegetation Management Plan", which was recently submitted for comment.

TIME	TIME ms	TIME SOURCE	OWNER	EVENT	NOTES/COMMENTS
15:05:41		DFR	MISO	Chamberlain-Harding 345KV line tripped	high impedence phase C to ground
15:32:03		DFR	MISO	Hanna-Juniper 345KV line sagged and tripped	tree contact-visual confirmation
15:38:47	770	DFR	MISO	Star-S. Canton 345KV line trips/recloses	phase 3 to ground fault. Prior to trip there was 1278 MVA on the line, the phase 2 to ground voltage was at 98% and the phase 3 to ground voltage was at 94%
15:41:33	430	DFR	AEP	Star-S. Canton 345KV line trips/recloses	phase 3 to ground fault close to the Star terminal
15:41:35		DFR	AEP	Star-S. Canton 345KV line trips/recloses/trips	phase 3 to ground fault. Locks open at Star.
15:42:07		DFR	AEP	Star-S. Canton 345KV line recloses/trips	recloses at S. Canton and trips again. Line already open at Star
15:45:39	710		MISO	Canton Central-Tidd 345KV line trips/recloses	
16:05:57	504	DFR	MISO	Sammis-Star 345KV line tripped	1310 emergency rating. 1495 MW loading
16:08:58	535	DFR	AEP	Galion-Muskingum River-Ohio Central 345KV tripped	multiphase fault. high loading 1320 MVA with emergency rating of 1234 MVA
16:09:06	311	DFR	AEP	East Lima-Fostoria Central 345KV tripped	high loading 2000 MVA with emergency rating of 1383 MVA. Auto reclose is delayed by Synch. Check Relay. FirstEnergy and AEP 104 degrees out of synch. Line closed successfully in 1min 44 secs.
16:09:19		DFR	NYPA	Marcy 765kV Shunt Reactor Switched I/S	by UASS (relay action)
16:10:19		EMS	Indeck	Indeck-Silver Springs Generator tripped	
16:10:19		DFR	NYPA	Marcy 345kV Capacitor #2 Switched O/S	by operator action
16:10:36	384	EMS	Sithe Energies Inc.	Sithe-Massena Generator tripped	
16:10:36	800	DFR	MISO	Battle Creek - Oneida 345 kV line recloses and trips again	
16:10:37			MISO	East to West transmission system (southern circuits) opens in central Michigan	
16:10:38	162	DFR	MISO	Hampton - Pontiac 345 kV line trips	
16:10:39	500	SDAC	NYSEG	Homer City-Watercure 345KV 30 line tripped	Tripped at Homer City only 21 zone 1 and 21 G
16:10:39	800	SDAC	NYSEG	Homer City-Stolle Road 345KV 37 line tripped	
16:10:41	746	EMS	MISO	Perry Unit 1 Generator tripped	
16:10:41	831	DFR	AEP	Fostoria Central-Galion 345KV tripped	
16:10:41		SDAC	NYISO	Dunkirk-S. Ripley 230KV 68 line tripped	
16:10:43	328	DFR	IMO	IMO-Michigan J5D tripped	
16:10:43	400	SDAC	NYSEG	Hillside-East Towanda 230KV 70 line tripped	
16:10:43	700	SDAC	NYISO	S. Ripley-Erie South 230KV 69 line tripped	
16:10:43			Niagara Mohawk	American Refuel Generator tripped	
16:10:44			Niagara Mohawk	Indeck Olean Generator tripped	
16:10:44		EMS	PJM	Athenia 220-2 230/138 KV transformer tripped	
16:10:45	200	EMS	ConEd	Branchburg-Ramapo 500KV 5018 line tripped	Other Terminal at P S E & G.
16:10:45	200	DFR	PJM	Branchburg-Ramapo 500KV 5018 line tripped	
16:10:45	500	EMS	PJM	Athenia-Roseland 230KV line tripped	tripped at Athenia
16:10:45	800	DFR	PJM	Bayway 220-1 230/138 KV transformer tripped	

16:10:45	**800**	DFR	PJM	Linden-Bayway 230KV H-2234 line tripped	
16:10:45		EMS	PJM	Athenia-Cedar Grove 230KV line tripped	tripped at Athenia
16:10:45		EMS	PJM	Belleville-Athenia 230KV line tripped	tripped at Belleville
16:10:45		EMS	PJM	Roseland-Cedar Grove 230KV line tripped	
16:10:46		EMS	ISO-NE	Rotterdam-Bear Swamp 230KV E205 line tripped	***Conflicting time with NM 16:10:51***
16:10:47	**500**	DDR	ISO-NE	Long Mt.-Frost Bridge 345KV 352 line tripped	
16:10:47		DFR	ISO-NE	Alps-Berkshire-Northfield 345KV 393/312 line tripped	same time as NM
16:10:47		EMS	Niagara Mohawk	S. Ripley-Erie South 230KV 69 line tripped	***Not in NM rev 4 update, now 16:12:04. Conflicting time with SDAC 16:10:44***
16:10:47		BEN	NYISO	Apparent separation between Niagara/Rochester and New Scotland/Sprain Brook	
16:10:47		EMS	Sithe Energies Inc.	Sithe-Ogdensburg Generator tripped	
16:10:48	**890**	DFR	Niagara Mohawk	Marcy-N. Scotland 345KV UNS-18 line tripped	
16:10:48	**910**	EMS	ConEd	Underfrequency Load Shed	1111 MW
16:10:48	**939**	DFR	Niagara Mohawk	Edic-New Scotland 345KV 14 line tripped	Line trip at New Scotland
16:10:48	**940**	DFR	Niagara Mohawk	Edic-New Scotland 345KV 14 line tripped	Line trip at Edic
16:10:48		EMS	ISO-NE	Hoosick-Bennington 115KV 6 line tripped	
16:10:48		EMS	ISO-NE	Whitehall - Blissville 115KV K37 line tripped	somewhere west of Whitehall
16:10:48		EMS	LIPA	Underfrequency Load Shed	25.6 MW
16:10:48		BEN	NYISO	Niagara/Rochester Frequency at 59.20Hz	
16:10:48		SER	NYPA	Marcy-N. Scotland 345KV UNS-18 line tripped	Opened at Marcy via 21-1S distance relay operation
16:10:48		SER	NYPA	Marcy-Coopers Corners 345KV UCC2-41 line tripped	Opened at Marcy via 21-1S distance relay operation
16:10:48		DFR	NYPA	Fraser-Gilboa 345KV GF5-35 line tripped	Opened at Gilboa via 21-1P Zone 1 dist. relay. ***Conflicting time with NYSEG 16:10:49***
16:10:48		EMS	NYPA	Underfrequency Load Shed	59 MW
16:10:48			NYSEG	LEA Lockport units #1-#3 Generation tripped	
16:10:49	**420**		IMO	St. Lawrence-Hinchinbrooke 230KV L20H, L21H, L22H lines tripped	St. Lawrence Generation radial to NY thru L33 and L34 PAR
16:10:49	**420**		IMO	St. Lawrence-Albion 230KV L24A line tripped	St. Lawrence Generation radial to NY thru L33 and L34 PAR
16:10:49	**650**	EMS	ConEd	Underfrequency Load Shed	1319 MW
16:10:49	**727**	DFR	Niagara Mohawk	Edic-New Scotland 345KV 14 line closed	Line reclosed at New Scotland only (I.e. line end open)
16:10:49	**797**		IMO	Beck QFW 230KV circuits tripped	Beck generation radial to NY
16:10:49		EMS	Central Hudson	Underfrequency Load Shed	237.32 MW
16:10:49		EMS	ConEd	Hellgate GT #2 Generator tripped	NYPA unit
16:10:49		EMS	ConEd	Harlem River GT #1 Generator tripped	NYPA unit
16:10:49		EMS	ConEd	Underfrequency Load Shed	11.3 MW
16:10:49		EMS	LIPA	Underfrequency Load Shed	64.3 MW
16:10:49		EMS	Niagara Mohawk	Dunkirk-S. Ripley 230KV 68 line tripped	***Line trip at Dunkirk and S. Ripley. Conflicting time with SDAC 16:10:44***
16:10:49		EMS	Niagara Mohawk	Alps-Berkshire 345KV 393 line tripped	same time as ISO-NE
16:10:49			Niagara Mohawk	Fort Orange Generator tripped	
16:10:49			Niagara Mohawk	Fueura/JMC Generator tripped	

16:10:49		EMS	NRG	Huntley 65 Generator tripped	
16:10:49		SER	NYPA	Brentwood GT Generator tripped	
16:10:49			NYSEG	Fraser-Coopers Corners 345KV 33 line tripped	
16:10:49			NYSEG	Fraser-Gilboa 345KV GF5-35 line tripped	***Conflicting time with NYPA 16:10:48***
16:10:49		EMS	O&R	Underfrequency Load Shed	345 MW
16:10:50	**90**	DFR	IMO	St. Lawrence-Albion 230KV L24A line unsuccessful reclose	
16:10:50	**510**	EMS	ConEd	Underfrequency Load Shed	752 MW
16:10:50	**890**	EMS	ConEd	Underfrequency Load Shed	1446 MW
16:10:50		EMS	Central Hudson	Underfrequency Load Shed	26.05 MW
16:10:50		EMS	ConEd	Astoria GT Generator tripped	NRG unit
16:10:50		EMS	ConEd	Underfrequency Load Shed	1206 MW
16:10:50		EMS	KeySpan Generation	Greenport Generator tripped	
16:10:50		EMS	LIPA	Underfrequency Load Shed	443.4 MW
16:10:50			Niagara Mohawk	Sithe-Sterling Generator tripped	
16:10:50		SER	NYPA	Harlem River GT #1 Generator tripped	
16:10:51		EMS	ConEd	Underfrequency Load Shed	199.9 MW
16:10:51		EMS	Entergy	Indian Point 2 Reactor trip	
16:10:51		EMS	LIPA	Underfrequency Load Shed	162.4 MW
16:10:51		EMS	Niagara Mohawk	Porter-Rotterdam 230KV 31 line tripped	***Line trip at Rotterdam. NM conflicting EMS time 16:10:52***
16:10:51		EMS	Niagara Mohawk	Rotterdam-Bear Swamp 230KV E205 line tripped	***Line trip at Rotterdam. Conflicting time with ISO-NE 16:10:46***
16:10:51		EMS	Niagara Mohawk	Porter-Rotterdam 230KV 30 line tripped	***Line trip at Rotterdam. NM conflicting EMS time 16:10:52***
16:10:51			Niagara Mohawk	Indeck Corthinth GT and ST Generators tripped	
16:10:51			Niagara Mohawk	LGE Rensselaer GT and ST Generators tripped	
16:10:51			Niagara Mohawk	School Street #5 Generator tripped	
16:10:51			Niagara Mohawk	Spier Falls #8 Generator tripped	
16:10:51			Niagara Mohawk	Green Island #2 Generator tripped	
16:10:51		EMS	NRG	Huntley 66 Generator tripped	
16:10:51			NYSEG	Saranac units #1, #2, #3 Generation tripped	aka Falc. Sea.
16:10:51		EMS	NYSEG	Underfrequency Load Shed	414.6 MW
16:10:51		EMS	RGE	Underfrequency Load Shed	7.2 MW
16:10:52		EMS	ConEd	Underfrequency Load Shed	84.6 MW
16:10:52		EMS	LIPA	Underfrequency Load Shed	94.5 MW
16:10:52		EMS	Niagara Mohawk	Porter-Rotterdam 230KV 30 line tripped	***Line trip at Porter. NM conflicting EMS time 16:10:51***
16:10:52			Niagara Mohawk	Kamine Carthage ST Generator tripped	
16:10:52			Niagara Mohawk	Gas Ornage 1 and 2 Generators tripped	
16:10:52			Niagara Mohawk	Indeck Oswego Generator tripped	
16:10:52			Niagara Mohawk	Fenner Wind Farm Generation tripped	
16:10:52			Niagara Mohawk	Fort Drum Generator tripped	
16:10:52		EMS	Niagara Mohawk	Porter-Rotterdam 230KV 31 line tripped	***Line trip at Porter. NM conflicting EMS time 16:10:51***

16:10:52		BEN	NYISO	Niagara/Rochester Frequency at 63.27Hz	
16:10:52			NYPA	Moses-Adirondack 230KV MA-2 line tripped	Opened at Moses via Pri Relaying - ABC
16:10:52			NYSEG	Oakdale 345 kV capacitor bank C1 tripped	
16:10:52		EMS	Reliant Energy	Central misc. hydros Generators tripped	
16:10:52		EMS	Reliant Energy	Mohawk Valley misc. hydros Generators tripped	
16:10:53		EMS	Central Hudson	Underfrequency Load Shed	11 MW
16:10:53		EMS	ConEd	Underfrequency Load Shed	7 MW
16:10:53		EMS	LIPA	Underfrequency Load Shed	5.6 MW
16:10:53			Niagara Mohawk	Fulton Generators tripped	
16:10:53			Niagara Mohawk	Vestas Wind Generation tripped	
16:10:53			Niagara Mohawk	Burrows Paper Lyonsdale Generator tripped	
16:10:53			Niagara Mohawk	Sewalls Hydro Generator tripped	
16:10:53			Niagara Mohawk	Johnsonville Hydro 1 and 2 Generators tripped	
16:10:53			Niagara Mohawk	School Street 3 and Generators tripped	
16:10:53			Niagara Mohawk	Kamine Beaver ST Generator tripped	
16:10:53			Niagara Mohawk	Soft Maple Hydro Generator tripped	
16:10:53			Niagara Mohawk	Franklin Falls Generator tripped	
16:10:53		EMS	NYSEG	Mill C Units #2 & 3 (NYSEG)	
16:10:53		EMS	Reliant Energy	Capital misc. hydros Generators tripped	
16:10:53		EMS	RGE	Russell Unit #4 (RG&E)	
16:10:54		EMS	Entergy	Indian Point 3 Reactor trip	
16:10:54		EMS	HQTE	Cedars -Dennison 115kV lines CD11, CD12 tripped	
16:10:54		EMS	ISO-NE	Plattsburgh-Grand Isle 115KV PV20 line tripped	***Conflicting Time with NYPA 16:11:04***
16:10:54		EMS	LIPA	Underfrequency Load Shed	34.7 MW
16:10:54		EMS	Mirant	Swinging Bridge 2 Generator tripped	
16:10:54			Niagara Mohawk	Sithe Lakeside GT 3 and 4 Generators tripped	
16:10:54			Niagara Mohawk	Jarvis Hydro Generator tripped	
16:10:54			Niagara Mohawk	East Syrase ST Generator tripped	
16:10:54			Niagara Mohawk	OEF Ogensburg GT 1 Generator tripped	
16:10:54			Niagara Mohawk	High Dam Hydro Generator tripped	
16:10:54		SER	NYPA	Hellgate GT #2 Generator tripped	
16:10:54		EMS	NYSEG	Cadyville Units #2 & 3 (NYSEG)	
16:10:54		EMS	NYSEG	High Falls Units #1 & 2 (NYSEG)	
16:10:54		EMS	NYSEG	Mechanicville Hydro Units #1 & 2 (NYSEG)	
16:10:54		EMS	Reliant Energy	North misc. hydros Generators tripped	
16:10:54		EMS	RGE	Underfrequency Load Shed	12.4 MW
16:10:55		EMS	ISO-NE	Smithfield-Falls Village 69KV 690 line tripped	
16:10:55			Niagara Mohawk	Adir Hydro South Glens Falls Generators tripped	
16:10:55			Niagara Mohawk	Lighthouse Hll 2 Generator tripped	
16:10:55			Niagara Mohawk	School Street 2 Generator tripped	
16:10:55			Niagara Mohawk	Green Island #3 Generator tripped	
16:10:55			Niagara Mohawk	Onon. Resource Generator tripped	
16:10:55			NYSEG	Coopers Corners 345 kV capacitor bank C1A tripped	
16:10:55		EMS	NYSEG	Underfrequency Load Shed	316.6 MW
16:10:56	**184**	DFR	IMO	Beck-Burlington-Middleport 230KV Q25BM reclose	
16:10:56	**379**	DFR	IMO	Beck-Burlington-Middleport 230KV Q23BM reclose	

16:10:56			Calpine Energy Service	Nissequogue Cogen tripped	aka stoney brook
16:10:56			Niagara Mohawk	Indeck Yerkes Generator tripped	
16:10:56		BEN	NYISO	Niagara/Rochester Frequency at 58.49Hz	
16:10:56		EMS	NYPA	Underfrequency Load Shed	150 MW
16:10:56		EMS	Reliant Energy	Mohawk Valley misc. hydros Generators tripped	
16:10:57	**835**	DFR	IMO	Beach-Middleport 230KV Q29HM reclose	
16:10:57	**835**	DFR	IMO	Beck 230KV Q24HM and Q30M unsuccessful reclose	
16:10:57		EMS	ConEd	Underfrequency Load Shed	8.3 MW
16:10:57			Niagara Mohawk	Moshier Hydro 2 Generator tripped	
16:10:57			Niagara Mohawk	Norwood Hydro Generators tripped	
16:10:57			NYSEG	Coopers Corners 345 kV capacitor bank C1B tripped	
16:10:57		EMS	RGE	Station 80 Breakers 3502, 3402, 3T8082 trip, 345kv bus 1 dead	Transformer #1 Differential Relay 87T - Misoperation
16:10:57		EMS	RGE	Underfrequency Load Shed	89.9 MW
16:10:58		EMS	ConEd	Underfrequency Load Shed	106.2 MW
16:10:58		SER	NYPA	Flynn Generator tripped	
16:10:58			NYSEG	Fraser-Coopers Corners 345KV 33 line reclosed	
16:10:58			NYSEG	Fraser-Coopers Corners 345KV 33 line autoreclosed	***NYSEG conflicting time 16:11:23***
16:10:58			NYSEG	Indeck-Morton Salt units #1-#2 Generation tripped	
16:10:59		EMS	ConEd	Underfrequency Load Shed	1210 MW
16:10:59		EMS	NYSEG	Kents Falls Unit #1 (NYSEG)	
16:10:59		EMS	RGE	Underfrequency Load Shed	20.1 MW
16:11:00	**948**	DFR	Niagara Mohawk	Marcy-N. Scotland 345KV UNS-18 line closed	
16:11:00		EMS	ConEd	Underfrequency Load Shed	18.6 MW
16:11:00		EMS	KeySpan Generation	Port Jefferson GTs 2 and 3 Generators tripped	
16:11:00		EMS	Mirant	Grahamsville Generator tripped	
16:11:00		EMS	MISO	Midway-Lemoyne-Foster 138 (?) Kv line tripped	?
16:11:00			Niagara Mohawk	Sithe Lakeside GT 1 and 2 Generators tripped	
16:11:00		EMS	NRG	Ilion Generator tripped	
16:11:00		EMS	NRG	Arthur Kill 2 Generator tripped	
16:11:00		EMS	NRG	Arthur Kill 3 Generator tripped	
16:11:00			NYSEG	Fraser-Gilboa 345KV GF5-35 line reclosed	
16:11:00			NYSEG	Fraser-Gilboa 345KV 35 line autoreclosed	
16:11:00		EMS	Onondaga	Onondaga Cogen Unit #3 Generator tripped	
16:11:00		EMS	Onondaga	Onondaga Cogen Unit #2 Generator tripped	
16:11:00		EMS	Onondaga	Onondaga Cogen Unit #1 Generator tripped	
16:11:00			Reliant Energy	Gowanus 1-4 GT Generators tripped	
16:11:00			Reliant Energy	Narrows GT Generators tripped	
16:11:00		EMS	Reliant Energy	Capital misc. hydros Generators tripped	
16:11:00		EMS	RGE	Underfrequency Load Shed	411.5 MW

16:11:01		EMS	KeySpan Generation	East Hampton Diesels 2 3 4 Generators tripped	
16:11:01		EMS	NRG	Astoria GT #10-13 Generators tripped	
16:11:01		EMS	RGE	Underfrequency Load Shed	64.6 MW
16:11:02		EMS	ConEd	Waterside 6 Generator tripped	"The relay targets & overall unit protection indicate that a voltage unbalance may have cause the SVT to operate tripping the generator breakers, boiler, turbine, etc…"
16:11:03		EMS	Niagara Mohawk	Porter-Rotterdam 230KV 30 line closed	***Line close at Porter. NM conflicting EMS close time 16:22:58***
16:11:03		EMS	Niagara Mohawk	Porter-Rotterdam 230KV 31 line closed	***Line close at Rotterdam. NM conflicting EMS close time 16:11:52***
16:11:03		EMS	Niagara Mohawk	Rotterdam-Bear Swamp 230KV E205 line closed	Line close at Rotterdam.
16:11:03		EMS	Niagara Mohawk	Dunkirk-S. Ripley 230KV 68 line closed	Line reclosed at S. Ripley
16:11:04		EMS	ConEd	KIAC Cogen tripped	Calpine units
16:11:04		EMS	Entergy	Fitzpatrick Reactor trip	
16:11:04		EMS	KeySpan Generation	Shoreham 1 Generator tripped	
16:11:04		SER	NYPA	Plattsburgh-Grand Isle 115KV PV20 line tripped	Opened at Sandbar. ***Conflicting Time with ISO-NE 16:10:54***
16:11:04		EMS	NYPA	JAF MOD 10031 Generator tripped	Fitzpatrick Entergy Unit
16:11:04		SER	NYPA	Gowanus #5 GT tripped	
16:11:04		SER	NYPA	Gowanus #6 GT tripped	
16:11:04		SER	NYPA	Hellgate GT #1 Generator tripped	
16:11:04		SER	NYPA	Kent Ave. GT tripped	
16:11:04		SER	NYPA	Pouch GT tripped	
16:11:04		SER	NYPA	Vernon GT #2 and #3 Generators tripped	
16:11:05	**695**	EMS	Sithe Energies Inc.	Sithe-Sterling Generator tripped	
16:11:06		EMS	KeySpan Generation	Ravenswood 1 Generator tripped	***Conflicting time with ConEd-using KS time/confirmed approx by NYISO EMS***
16:11:06		EMS	KeySpan Generation	South Hampton GT Generator tripped	
16:11:07		EMS	RGE	Hydro Sta. #2 (RG&E)	
16:11:07		EMS	RGE	Hydro Sta. #4 (RG&E)	
16:11:07		EMS	RGE	Underfrequency Load Shed	10.4 MW
16:11:08	**958**	EMS	HQ	Beauharnois A6 Generator tripped	
16:11:09	**286**	DFR	Entergy	Indian Point 2 Generator tripped	Time matched with ConEd. Target info from ConEd.
16:11:09			Niagara Mohawk	NYSE Saranac Energy Generators tripped	
16:11:09		DFR	NYPA	Gilboa 3 Generator tripped	

16:11:09			RGE	Ginna Reactor tripped	
16:11:10	**94**	EMS	HQ	Beauharnois A5 Generator tripped	
16:11:10	**300**	DFR	IMO	Beck 230KV Q23BM trip	opens at Beck
16:11:10	**444**	DFR	IMO	Beck 230KV Q29HM trip	opens at Beck Middleport and Beach
16:11:10	**515**	DFR	IMO	Beck 230KV Q25BM trip	opens at Beck Middleport and Burlington
16:11:10		EMS	KeySpan Generation	Barrett 1 Generator tripped	
16:11:10		EMS	NYSEG	Homer City -- Watercure 345kV #30 autoreclosed at Homer City	
16:11:10		EMS	NYSEG	Homer City -- Watercure 345kV #30 tripped at Watercure	
16:11:10		EMS	NYSEG	Fraser breaker B1/3562 autoreclosed Fraser -- Gilboa #35 line Fraser bus restored	
16:11:12		EMS	ConEd	Pouch GT tripped	NYPA unit
16:11:12		EMS	KeySpan Generation	Glenwood GT 3 Generator tripped	NYISO EMS time
16:11:12		EMS	LIPA	Newbridge-Freeport 138KV 461 line tripped	
16:11:12		DFR	NYPA	Gilboa 1 Generator tripped	
16:11:13	**75**	EMS	HQ	Beauharnois A13 Generator tripped	
16:11:13		EMS	ConEd	Vernon GT #2 and #3 Generators tripped	NYPA unit
16:11:13		EMS	MISO	Avon Unit 9 Generator tripped	
16:11:13		EMS	MISO	Beaver-Davis Besse 345kV tripped	
16:11:13		BEN	NYISO	Niagara/Rochester Frequency at 63.10Hz	
16:11:13		EMS	O&R	Lederle Generation tripped	
16:11:14	**89**	EMS	HQ	Beauharnois A13 Generator tripped	
16:11:14	**202**	DFR	Central Hudson	East Fishkill 345/115KV xfmr tripped	
16:11:14	**620**	DFR	Dynegy	Roseton #2 Generator tripped	relay operation
16:11:14			El Paso Merchant Energy	Linden Cogen ST 100, 200, 300 tripped	
16:11:14			El Paso Merchant Energy	Linden Cogen GT 100, 200 tripped	
16:11:14			El Paso Merchant Energy	Linden Cogen GT 300, 400, 500 tripped	
16:11:14		EMS	PJM	Homer City - Wayne 345kV line HCW tripped	
16:11:15			El Paso Merchant Energy	Rensselaer Cogen tripped	
16:11:15		EMS	RGE	Underfrequency Load Shed	17.6 MW
16:11:16		EMS	O&R	Hillburn-Ramapo 138KV 52 line tripped	RAMAPO – OPEN, CLOSE
16:11:17	**510**	DFR	Dynegy	Roseton #1 Generator tripped	relay operation
16:11:17	**627**	DFR	IMO	Beck 230KV Q25BM unsuccessful reclose	
16:11:17	**740**	EMS	Sithe Energies Inc.	Sithe-Batavia Generator tripped	
16:11:18		EMS	AES Corp.	Greenidge unit #4 tripped	

16:11:19	**244**	DFR	IMO	Beck 230KV Q29HM unsuccessful reclose	
16:11:19	**410**	DFR	Dynegy	Roseton #1 Generator tripped	breakers opened
16:11:19		EMS	ConEd	Waterside 8 Generator tripped	Increased steam flow with resultant drop in drum pressure with a subsequent rising drum level to trip point.
16:11:19		EMS	LIPA	Underfrequency Load Shed	49.2 MW
16:11:21		EMS	O&R	Lovett-W. Haverstraw 138KV L53 line tripped	
16:11:21		EMS	O&R	Lovett-W. Haverstraw 138KV L54 line tripped	WEST HAVERSTRAW – OPEN, CLOSE, OPEN
16:11:22	**669**		ConEd	East Garden City-Sprainbrook 345KV Y49 line tripped	***Resolved time with LIPA***
16:11:22	**669**	LIPA IRIG	LIPA	East Garden City-Sprainbrook 345KV Y49 line tripped	***Resolved time with ConEd.***
16:11:22		EMS	ISO-NE	Long Mt.-Plumtree 345KV 321 line tripped	
16:11:22		EMS	RGE	Allegany Steam Generator tripped	
16:11:23	**503**	EMS	ConEd	Dunwoodie-Shore Road 345KV Y50 line tripped	Other Terminal at LIPA86-1A/Y50 Zone 1 trips locally at Dunwoodie, and sends direct trip to Shore Rd. via 86-4/Y50. ***RESOLVED TIME WITH LIPA***
16:11:23	**503**	LIPA IRIG	LIPA	Dunwoodie-Shore Road 345KV Y50 line tripped	***Resolved time with ConEd***
16:11:23	**566**	DFR	Central Hudson	Roseton-Rock Tavern 345KV 311 line tripped	
16:11:23		EMS	Entergy	Indian Point 3 Generator tripped	Time matched with ConEd. Target info from ConEd.
16:11:23		EMS	LIPA	Locust Grove-Syosset 138KV 559 line tripped	
16:11:23			NYSEG	Fraser-Coopers Corners 345KV 33 line autoreclosed	***Conflicting NYSEG time 16:10:58***
16:11:23			NYSEG	Coopers Corners-Rock Tavern 345KV 34 line tripped	
16:11:24	**308**	DFR	Central Hudson	Rock Tavern Capacitor Bank #2 tripped	
16:11:24		EMS	KeySpan Generation	Glenwood GT 2 Generator tripped	NYISO EMS time
16:11:24		EMS	LIPA	Newbridge-East Garden City 138KV 462 line tripped	
16:11:24		EMS	O&R	Burns-W. Haverstraw 138KV 531 line tripped	
16:11:24		EMS	O&R	W. Nyack-Lovett 138KV 562 line tripped	

16:11:24		EMS	O&R	Sugarloaf-Ramapo 138KV 26 line tripped	
16:11:25		EMS	Mirant	Rio 2 Generator tripped	
16:11:26		EMS	LIPA	Northport-Pilgrim 138KV 677 line tripped	
16:11:26		EMS	O&R	Ladentown-Buchanan S. 345KV Y88 line tripped	REMOTE END – CECONY ***Conflicting time with ConEd 16:12:10***
16:11:27		EMS	KeySpan Generation	Ravenswood 2 Generator tripped	***Conflicting time with ConEd-using approx. time from NYISO EMS***
16:11:27		EMS	Niagara Mohawk	N. Scotland-Alps 345KV 2 line tripped	
16:11:28		EMS	KeySpan Generation	Port Jefferson ST 3 Generator tripped	
16:11:28		EMS	KeySpan Generation	Port Jefferson ST 4 Generator tripped	
16:11:28		EMS	LIPA	Northport-Pilgrim 138KV 679 line tripped	
16:11:29	**418**	DFR	ConEd	Spranbrook-East View-Buchanan 345KV W79/W93 tripped	Audiotone Transfer Trip Receive from Sprain BrookCEY-Phase distance relay, part of Directional Comparison Blocking
16:11:29	**791**	DFR	Niagara Mohawk	N. Scotland-Leeds 345KV 94 line tripped	***Line trip at New Scotland. NM conflicting close and trip times. Is not in order.***
16:11:29	**806**	DFR	Niagara Mohawk	N. Scotland-Leeds 345KV 93 line tripped	
16:11:29		EMS	Mirant	Rio 1 Generator tripped	
16:11:29		EMS	O&R	Lovett #3 Generator tripped	Mirant unit
16:11:30	**190**	DFR	Dynegy	Roseton #2 Generator tripped	breakers opened
16:11:30		EMS	Niagara Mohawk	Edic-New Scotland 345KV 14 line closed	Line reclosed at Edic (I.e. line closed)
16:11:30		EMS	O&R	Lovett #5 Generator tripped	Mirant unit
16:11:33			NYPA	Fraser SVC	Returned to service/then re-tripped
16:11:36	**512**	DFR	Reliant Energy	Astoria 4 Generator tripped	
16:11:36		EMS	Reliant Energy	Astoria 2 Generator tripped	
16:11:36		EMS	Reliant Energy	Astoria 3 Generator tripped	
16:11:36		EMS	Reliant Energy	Astoria 5 Generator tripped	
16:11:38		EMS	KeySpan Generation	Barrett 2 Generator tripped	
16:11:38		DFR	NYPA	Gilboa-Leeds 345KV GL-3 line tripped	Opened at Leeds
16:11:39		EMS	ConEd	Ravenswood 3 Generator tripped	Keyspan unit
16:11:39		EMS	Entergy	Fitzpatrick Generator trip	

16:11:42		EMS	Mirant	Mongaup 1-4 Generators tripped	
16:11:45		EMS	ISO-NE	Northport-Norwalk 138KV 1385 line tripped	Transfer trip from Northport. ***Conflicting time with LIPA 16:11:46***
16:11:46		EMS	LIPA	Northport-Norwalk 138KV 1385 line tripped	***Conflicting time with ISO-NE 16:11:45***
16:11:46		EMS	Niagara Mohawk	N. Scotland-Alps 345KV 2 line closed then tripped	
16:11:47		EMS	ConEd	Bowline 1 Generator tripped	Mirant unit
16:11:47		EMS	Niagara Mohawk	Leeds-Gilboa 345KV 3 line tripped	
16:11:47		EMS	Niagara Mohawk	N. Scotland-Leeds 345KV 94 line tripped	***Line trip at Leeds. NM conflicting close and trip times. Is not in order.***
16:11:47			NYPA	Fraser-Gilboa 345KV GF5-35 line reclosed	?
16:11:50		EMS	Dynegy	Danskammer #2 Generator tripped	Dynegy Trip
16:11:50		EMS	O&R	Lovett #4 Generator tripped	Mirant unit
16:11:51	**12**	DFR	Niagara Mohawk	N. Scotland-Leeds 345KV 94 line closed	***Line close at New Scotland. NM conflicting close and trip times. Is not in order.***
16:11:51	**943**	DFR	Niagara Mohawk	Scriba-Nine Mile Point 2 345KV 23 line tripped	
16:11:52		EMS	KeySpan Generation	Montauk Diesel 2 and 4 Generators tripped	
16:11:52		EMS	Niagara Mohawk	Porter-Rotterdam 230KV 31 line closed	***Line close at Porter. NM conflicting EMS close time 16:11:52***
16:11:53			Central Hudson	Roseton-East Fishkill 345KV 305 line tripped	***Conflicting time with ConEd 16:12:23. Not in last update from CH 9/10/03***
16:11:53		EMS	ConEd	Harlem River GT #2 Generator tripped	NYPA unit
16:11:54		EMS	Constellation Power Source	Nine Mile Point 1 Generator tripped	
16:11:57	**312**		IMO	IMO-Michigan L4D trip	
16:11:57	**362**		IMO	IMO-Michigan L51D trip	
16:12:00		EMS	AES Corp.	Westover unit #7 tripped	aka goudey
16:12:00		EMS	AES Corp.	Westover unit #8 tripped	aka goudey
16:12:00		EMS	Mirant	Bowline 1 Generator tripped	
16:12:00		EMS	Mirant	Bowline 2 Generator tripped	
16:12:00			Trigen Syracuse Energy Corp	Syracuse Trigen tripped	
16:12:01		EMS	Niagara Mohawk	N. Scotland-Leeds 345KV 94 line closed	***Line close at Leeds. NM conflicting close and trip times. Is not in order.***
16:12:02	**246**	EMS	Sithe Energies Inc.	Sithe GT #1 Generator tripped	
16:12:02	**445**	EMS	Sithe Energies Inc.	Sithe GT #2 Generator tripped	
16:12:02	**460**	EMS	Sithe Energies Inc.	Sithe GT #4 Generator tripped	
16:12:02	**929**	EMS	Sithe Energies Inc.	Sithe GT #3 Generator tripped	
16:12:02		EMS	Constellation Power Source	Nine Mile Point 2 Generator tripped	

16:12:02		EMS	KeySpan Generation	Ravenswood 3 Generator tripped	***Conflicting time with ConEd***
16:12:02		DFR	NYPA	Harlem River GT #2 Generator tripped	
16:12:04	**486**	EMS	Sithe Energies Inc.	Sithe ST #5 Generator tripped	
16:12:04		EMS	Niagara Mohawk	Dunkirk-S. Ripley 230KV 68 line tripped	Line trip at S. Ripley
16:12:04		EMS	Niagara Mohawk	S. Ripley-Erie South 230KV 69 line tripped	***Line trip at S. Ripley. Conflicting time with NYSO SDAC 16:10:44***
16:12:04		EMS	Niagara Mohawk	Dunkirk-S. Ripley 230KV 68 line close/trip	***Line close/trip at Dunkirik. NM conflicting EMS close time 16:13:00***
16:12:07		SER	NYPA	Poletti Generator tripped	
16:12:09		EMS	ConEd	Hellgate GT #1 Generator tripped	NYPA unit
16:12:09		DDR	RGE	Ginna Generator tripped	
16:12:10		EMS	ConEd	Ladentown-Buchanan S. 345KV Y88 line tripped	***Conflicting time with O&R 16:11:26***
16:12:11		EMS	NRG	Huntley 67 Generator tripped	
16:12:12	**676**	EMS	Sithe Energies Inc.	Sithe ST #6 Generator tripped	
16:12:12			NYPA	Fraser SVC tripped	
16:12:15		EMS	ConEd	Poletti Generator tripped	NYPA unit
16:12:19		EMS	KeySpan Generation	East Hampton GT Generator tripped	
16:12:19		EMS	NRG	Dunkirk #2 Generators tripped	
16:12:20		EMS	AES Corp.	Greenidge unit #3 tripped	
16:12:23		EMS	ConEd	Roseton-East Fishkill 345KV 305 line tripped	Other terminal at Roseton (CHG&E). ***Conflicting time with CH 16:11:53***
16:12:25		EMS	ConEd	Waterside 9 Generator tripped	According to station SOE and alarm the unit tripped at 4:10:44
16:12:27		EMS	ConEd	Arthur Kill 3 Generator tripped	NRG unit
16:12:28		EMS	Cayuga Energy	South Glens Falls Generator tripped	
16:12:28		EMS	ConEd	East River 6 Generator tripped	
16:12:29		EMS	Niagara Mohawk	S. Ripley-Erie South 230KV 69 line closed	Line reclosed at S. Ripley
16:12:30		EMS	ConEd	East River 7 Generator tripped	
16:12:30		EMS	O&R	Bowline 1 Generator tripped	Mirant unit
16:12:44		EMS	Niagara Mohawk	Dunkirk-S. Ripley 230KV 68 line closed	Line reclosed at S. Ripley
16:12:48		EMS	Niagara Mohawk	N. Scotland-Alps 345KV 2 line closed	
16:12:50		EMS	Niagara Mohawk	S. Ripley-Erie South 230KV 69 line tripped	Line trip at S. Ripley.
16:12:50		EMS	Niagara Mohawk	Dunkirk-S. Ripley 230KV 68 line closed	Line reclosed at Dunkirk
16:12:50		EMS	Niagara Mohawk	Dunkirk-S. Ripley 230KV 68 line tripped	Line trip at S. Ripley

16:13:00		EMS	Niagara Mohawk	Dunkirk-S. Ripley 230KV 68 line closed	***Line reclosed at S. Ripley. NM conflicting EMS close time 16:12:50***
16:13:08		EMS	NRG	Dunkirk #1 Generator tripped	
16:13:21		EMS	Mirant	Lovett 5 Generator tripped	
16:13:24		EMS	KeySpan Generation	Far Rockaway 4 Generator tripped	
16:13:24		EMS	LIPA	Northport-Pilgrim 138KV 672 line tripped	
16:13:29		EMS	Mirant	Lovett 4 Generator tripped	
16:13:42		EMS	KeySpan Generation	Glenwood ST 4 Generator tripped	NYISO EMS time
16:13:42		EMS	KeySpan Generation	Glenwood ST 5 Generator tripped	NYISO EMS time
16:13:45		EMS	ConEd	Astoria 2 Generator tripped	Reliant units
16:13:55		EMS	KeySpan Generation	Northport 1 Generator tripped	Went to 0 MW at 16:13:55
16:13:56	**968**	EMS	HQ	Beauharnois A1 Generator tripped	
16:14:02		EMS	KeySpan Generation	Northport 4 Generator tripped	
16:14:22		EMS	KeySpan Generation	Northport 3 Generator tripped	
16:14:38		SEL	Niagara Mohawk	N. Scotland-Alps 345KV 2 line tripped	***NM conflicting EMS time16:11:27***
16:14:47			NYSEG	Homer City-Watercure 345KV 30 line autoreclosed	
16:15:00			MISO	Sammis-Star 345KV line tripped and reclosed	
16:15:06			NYSEG	Homer City-Watercure 345KV 30 line tripped	
16:15:07		EMS	Niagara Mohawk	Rotterdam-Bear Swamp 230KV E205 line tripped	Line trip at Rotterdam.
16:15:57	**418**	EMS	Dynegy	Danskammer #3 Generator tripped	Dynegy Trip
16:16:07	**579**	EMS	Dynegy	Danskammer #4 Generator tripped	Dynegy Trip
16:16:39		EMS	KeySpan Generation	Northport 2 Generator tripped	
16:17:00			MISO	Fermi Nuclear tripped	
16:17:04	**138**	EMS	HQ	Beauharnois A23 Generator tripped	
16:17:08		EMS	ConEd	Ravenswood 2 Generator tripped	Keyspan unit
16:17:11	**970**	EMS	HQ	Beauharnois A24 Generator tripped	
16:17:20		EMS	ConEd	Ravenswood 1 Generator tripped	Keyspan unit
16:17:35			Calpine Energy Service	Kiac Steam Generator tripped	

16:17:37			Calpine Energy Service	Kiac GT #2 and #1 Generators tripped	
16:17:51	**390**	EMS	HQ	Beauharnois A25 Generator tripped	
16:17:58			Cayuga Energy	Carthage Generator tripped	
16:18:43		EMS	AES Corp.	Cayuga unit #1 Generator tripped	aka milliken
16:18:54		EMS	LIPA	L. Success-Jamaica 138KV 903 line tripped	opened by District Operator
16:19:00		EMS	Indeck	Indeck-Oswego Generator tripped	
16:19:11		EMS	LIPA	Valley Stream-Jamaica 138KV 901 line tripped	opened by District Operator
16:20:00		EMS	ConEd	Underfrequency Load Shed	95.3 MW
16:20:25		EMS	ConEd	Astoria 4 Generator tripped	Reliant units
16:20:59		EMS	ConEd	Astoria 3 Generator tripped	Reliant units
16:21:37		EMS	ConEd	Ravenswood GT6 Generator tripped	Keyspan unit
16:22:15		EMS	ConEd	Ravenswood GT7 Generator tripped	Keyspan unit
16:22:43		EMS	LIPA	Northport-Elwood 138KV 681 line tripped	
16:22:45	**98**	DFR	Niagara Mohawk	N. Scotland-Leeds 345KV 94 line tripped	Line trip at New Scotland.
16:22:52			NYPA	SL Sync Cond #1tripped	
16:22:53		SER	NYPA	Plattsburgh-Saranac 115KV 1 line tripped	
16:22:55		EMS	ConEd	Arthur Kill 2 Generator tripped	NRG unit
16:22:58		EMS	Niagara Mohawk	Porter-Rotterdam 230KV 30 line closed	***Line close at Rotterdam. NM conflicting EMS close time 16:11:03***
16:23:00		EMS	Niagara Mohawk	Rotterdam-Bear Swamp 230KV E205 line closed	Line close at Rotterdam.
16:23:05		SER	NYPA	Plattsburgh-Saranac 115KV 1 line reclose	closed at Plattsburgh
16:23:14		EMS	PSEG	Albany 2 Generator tripped	NYISO EMS time
16:23:20		EMS	LIPA	Northport-Elwood 138KV 678 line tripped	
16:23:44		EMS	NRG	Dunkirk #4 Generator tripped	
16:27:42		SER	NYPA	Alcoa Potline #6 restored	
16:28:38		SER	NYPA	Alcoa Potline #6 tripped	by operator action
16:30:00		EMS	Niagara Mohawk	S. Ripley-Erie South 230KV 69 line closed	Line reclosed at S. Ripley
16:34:38		EMS	RGE	Allegany Gas Generator tripped	
16:35:02	**521**	EMS	AES Corp.	Somerset Generator tripped	1 tripped offline as a result of an operator-initiated trip, subsequent to an automatic trip of the unit boiler. No protective relaying was involved. The boiler tripped due to the inability of the controls to respond to the excessive system load fluctuations. Our SER indicates the generator breaker opened at 16:32:46.527
16:35:25		SER	NYPA	Moses-Adirondack 230KV MA-1 line tripped	Opened at Moses
16:35:59		DFR	NYPA	Fraser-Gilboa 345KV GF5-35 line tripped	Opened at BG(operator action). Buses were stripped to initiate blackstart procedures
16:35:59		DFR	NYPA	Gilboa-Leeds 345KV GL-3 line tripped	Opened at BG(operator action). Buses were stripped to initiate blackstart procedures
16:35:59		DFT	NYPA	Gilboa-N. Scotland 345KV GNS-1 line tripped	Opened at BG(operator action). Buses were stripped to initiate blackstart procedures

16:36:13		SER	NYPA	Moses-Plattsburgh 230KV MWP-1 line tripped	All 3 terminals opened – Moses, Willis & Platts.; Pl-Pri Relaying-ABC, M-86TTB, W-86TTB
16:37:42		SER	NYPA	Alcoa Potline #6 restored	
16:38:38		EMS	Central Hudson	Rock Tavern 345/115KV xfmr 1 tripped	supervisory control
16:38:51		EMS	Central Hudson	Rock Tavern 345/115KV xfmr 3 tripped	supervisory control
16:43:18		EMS	NRG	Dunkirk #3 Generator tripped	
16:46:57		EMS	Central Hudson	Hurley Ave 345/115KV xfmr 1 low side opened	supervisory control
16:47:45		EMS	Central Hudson	Pleasant Valley 345/115 xfmr 1 low side opened	supervisory control
16:54:26		EMS	AES Corp.	Cayuga unit #2 Generator tripped	aka milliken
17:02:09		EMS	O&R	W. Haverstraw 345/138KV Bank 194 tripped	
17:03:13		EMS	RGE	Station 80 345kV Bus #1 restored	
17:05:32		EMS	O&R	Ladentown-Ramapo 345KV W72 line tripped	
17:05:32		EMS	O&R	Ladentown-W. Haverstraw 345KV L67 line tripped	
17:20:28		EMS	O&R	S. Mahwah 345/138KV Bank 258 tripped	
18:02:23		EMS	NYSEG	Fraser 345/115/34.5 KV Bank #2 tripped	
18:02:28		EMS	NYSEG	Coopers Corners 345/115/34.5 KV Bank #3 tripped	
18:04:36		EMS	NYSEG	Coopers Corners 345/115/34.5 KV Bank #2 tripped	
18:22:32		EMS	NYSEG	Oakdale 345/115/34.5 KV Bank 2 tripped	

Appendix C

Market Operations Report
Wednesday, August 13, 2003 @ 11:00 AM

DAM Performance – (SCUC for 8/14/03)
SCUC Engineer: A. Brodie, x-8790

- Posted @ 10:00 AM
- No AMP Mitigation – Not Triggered
- ISO Forecast Loads: 17, 273 MW (HB4) 28, 351 MW (HB16)

- System Lambda ranges from: $34 - $76

- Zonal LBMP prices ranges from:

$33 - $75	in Central
$35 - $81	in Capital
$63 - $121	in NYC
$54 - $111	in Long Island

- Proxy Bus LBMP prices ranges from:

$29 - $74	for PJM
$36 - $82	for NPX
$31 - $69	for OH
$34 - $74	for HQ

- Regulation Cost: $10.00 - $25.00
- 10 min Spinning reserves: $0.67 - $10.00
- 10 min Non-spinning reserves: $0.84 - $3.89
- 30 min operating reserves: $0.35 - $4.02

Market Operations Report
Thursday, August 14, 2003 @ 11:00 AM

DAM Performance – (SCUC for 8/15/03)
SCUC Engineer: A. Brodie, x-8790

- Posted @ 9:50 AM
- No AMP Mitigation – Triggered, No Reference Bids for Evaluation
- ISO Forecast Loads: 17, 767 MW (HB4) 28, 277 MW (HB15)

- System Lambda ranges from: $40 - $79

- Zonal LBMP prices ranges from:

$39 - $79	in Central
$42 - $83	in Capital
$63 - $159	in NYC
$53 - $112	in Long Island

- Proxy Bus LBMP prices ranges from:

$36 - $78	for PJM
$42 - $87	for NPX
$38 - $75	for OH
$40 - $76	for HQ

- Regulation Cost: $10.00 - $25.00
- 10 min Spinning reserves: $0.67 - $10.00
- 10 min Non-spinning reserves: $0.84 - $3.89
- 30 min operating reserves: $0.30 - $4.02

Market Operations Report
Friday, August 15, 2003 @ 11:00 AM

DAM Performance – (SCUC for 8/16/03)
SCUC Engineer: A. Brodie, x-8790

- Posted @ 10:05 AM
- No AMP Mitigation – Not Triggered
- ISO Forecast Loads: 11,698 MW (HB4) 16,000 MW (HB13)

- System Lambda ranges from: $49 - $93

- Zonal LBMP prices ranges from:

$47 - $91	in Central
$50 - $96	in Capital
$60 - $111	in NYC
$54 - $103	in Long Island

- Proxy Bus LBMP prices ranges from:

$42 - $88	for PJM
$50 - $98	for NPX
$44 - $85	for OH
$47 - $91	for HQ

- Regulation Cost: $10.00 - $25.00
- 10 min Spinning reserves: $0.67 - $3.25
- 10 min Non-spinning reserves: $0.84 - $3.49
- 30 min operating reserves: $0.30 - $3.85

Market Operations Report
Saturday, August 16, 2003 @ 11:00 AM

DAM Performance – (SCUC for 8/17/03)
SCUC Engineer: P. Tran Ha, x-6162

- Posted @ 10:00 AM
- No AMP Mitigation – Not Triggered
- ISO Forecast Loads: 15,060 MW (HB6) 20,001 MW (HB13)

- System Lambda ranges from: $52 - $88

- Zonal LBMP prices ranges from:

$51 - $88	in Central
$53 - $90	in Capital
$56 - $94	in NYC
$55 - $96	in Long Island

- Proxy Bus LBMP prices ranges from:

$50 - $88	for PJM
$54 - $91	for NPX
$49 - $86	for OH
$50 - $85	for HQ

- Regulation Cost: $10.00 - $25.00
- 10 min Spinning reserves: $1.40 - $10.00
- 10 min Non-spinning reserves: $0.84 - $3.49
- 30 min operating reserves: $0.50 - $3.56

Market Operations Report
Sunday, August 17, 2003 @ 11:00 AM

DAM Performance – (SCUC for 8/18/03)
SCUC Engineer: P. Tran Ha, x-6162

- Posted @ 9:50 AM
- No AMP Mitigation – Not Triggered
- ISO Forecast Loads: 15,495 MW (HB3) 24,999 MW (HB16)

- System Lambda ranges from: $54 - $130

- Zonal LBMP prices ranges from:

$53 - $130	in Central
$55 - $135	in Capital
$58 - $142	in NYC
$57 - $138	in Long Island

- Proxy Bus LBMP prices ranges from:

$51 - $131	for PJM
$56 - $89	for NPX
$51 - $119	for OH
$52 - $123	for HQ

- Regulation Cost: $10.00 - $25.00
- 10 min Spinning reserves: $0.67 - $10.00
- 10 min Non-spinning reserves: $3.09 - $4.59
- 30 min operating reserves: $0.35 - $4.02