Hurricane Sandy Preparations, Response & Recovery

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*Vice President – Operations*

Management Committee Meeting

*November 2, 2012*
Topics

- Storm Preparation
- Sequence of Events
  - Infrastructure Status
  - Operations Recovery
- Storm Impacts to NYCA Loads
ISO Preparedness Plans

- Preparedness Plans began Thursday, October 25

- Cancellation of all scheduled transmission line maintenance
  - NY TOs cancelled internal transmission line maintenance
  - NYISO cancelled relevant, adjacent external transmission line maintenance

- Scheduled and participated in several coordination conference calls with NPCC and TOs

- Monitored storm forecasts
ISO Preparations

- Solicited generation impacts at different storm surge levels
- TOs & ISO scheduled reliability commitments
- NYISO Operations Support
  - Scheduled additional control room operators at the Primary Control Center and scheduled operator staffing at the Alternate Control Center
- Facilities and Computer Systems
  - Cancelled all software deployments & facility work
  - Scheduled around-the-clock facility staffing
Sequence of Events – Monday 10/29/12

8 AM  Declared Thunder Storm Alert in anticipation of extreme weather conditions

12 PM  NYISO SRE of two Athens units for voltage control for off-peak hours

4 PM  LI customer outages begin
A few Long Island transmission lines outages
Loss of Cross Sound Cable
LI generation capacity outages (290 MW)

5 PM  LI and the start of NYC customer outages begin
Continued LI transmission line outages and the start of NY City transmission outages
LI & NYC generation capacity outages (335 MW)

6 PM  Reports of customer outages for all Transmission Owners
Additional transmission line outages across all Transmission Owners
Additional LI & NYC generation capacity outages (386 MW)
Loss of Neptune & Northport Norwalk Cable
Sequence of Events – Monday 10/29/12

7 PM  Additional customer outages including pre-emptive NYC network shutdown
       Additional Transmission line outages
       Additional LI & NYC generation capacity outages (1,518 MW)
       Loss of Linden-Goethals A2253 (Line A)
       First notifications of substation and generation personnel evacuations

8 PM  Additional customer outages
       Additional Transmission line outages
       Additional LI & NYC generation capacity outages (1,775 MW)
       Loss of Linden VFT (300 MW)
       Loss of Hudson-Farragut B3402 (Line B)
       Loss of Hudson-Farragut C3403 (Line C)
Sequence of Events – Monday 10/29/12

9 PM  Additional customer outages
       Additional Transmission line outages
       Additional LI & NYC generation capacity outages (342 MW)
       Loss of Nine Mile 1 (622 MW), caused by loss of transmission
       Loss of Indian Point 3 (1056 MW), caused by loss of transmission
       High transmission voltage conditions, opened Marcy-Coopers Corners

10 PM Additional customer outages
       Additional LI & NYC generation capacity outages (100 MW)

11 PM Additional LI & NYC generation capacity outages (328 MW)
       Continued high transmission voltages, opened Coopers-Rock Tavern
NYC & LI External Interconnection Status

- Cross Sound Cable
- Y49 & Y50
- NNC
- Neptune
- B & C PARs
- VFT
- A PAR

Monday Night Water Levels
The Battery & Kings Pt, NY
Infrastructure Customer Outages Tuesday

- Over 2 million electric customers were out of service on Tuesday (10/30/12) morning – based on data from utility websites

<table>
<thead>
<tr>
<th>Transmission Owner</th>
<th>Customer Outages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Hudson</td>
<td>78,906</td>
</tr>
<tr>
<td>Consolidated Edison</td>
<td>752,153</td>
</tr>
<tr>
<td>LIPA</td>
<td>905,267</td>
</tr>
<tr>
<td>National Grid</td>
<td>20,754</td>
</tr>
<tr>
<td>NYSEG</td>
<td>115,040</td>
</tr>
<tr>
<td>Orange &amp; Rockland</td>
<td>188,892</td>
</tr>
<tr>
<td>RGE</td>
<td>23,339</td>
</tr>
<tr>
<td>Total</td>
<td>2,084,351</td>
</tr>
</tbody>
</table>
Infrastructure Generator Outages

Tuesday

- Some generation outages were caused by loss-of-transmission and other generation outages were caused by severe weather conditions; high winds and flooding

<table>
<thead>
<tr>
<th>Area</th>
<th>Generation Outage (Capacity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Island</td>
<td>2037 MW</td>
</tr>
<tr>
<td>NY City</td>
<td>3037 MW</td>
</tr>
<tr>
<td>Upstate</td>
<td>1678 MW</td>
</tr>
</tbody>
</table>
Infrastructure Transmission Outages

Tuesday

- At one point over 90 transmission outages
  - (27) 345 kV Transmission Lines
  - (3) 230 kV Transmission Lines
  - (11) 345/138 kV Transformers
  - (35) 138 kV Transmission Lines
  - (4) Phase Angle Regulators
  - (11) 115 kV Transmission Lines

- In addition, there were many transmission “trip & recloses”

- Some transmission substations were pre-emptively isolated to minimize damage

- External interconnection outages include: NNC, Cross Sound, Neptune, A Line, B Line, C Line, and VFT
Operations Recovery - Tuesday

- Continued high off peak transmission voltages
  - NYCA off peak load as low as 9680 MW
  - Declared Major Emergency from 0109 to 0612
  - Marcy-Coopers Corners and Coopers Corners – Rock Tavern remain out

- NYISO SRE of two Athens units and Roseton 1 for voltage control for off-peak hours

- Remained in Thunder Storm Alert until 1915

- Only three transmission lines connecting Long Island to NY City (Jamaica - Valley Stream 901 forced out)

- 1206 MWs of generation restored

- 29 transmission lines restored
Infrastructure Status Wednesday

- Customer Outages
  - 1.9 million

- Generation Capacity Outages
  - Long Island 1,621 MW
  - NY City 2,253 MW
  - Upstate 1,672 MW

- Transmission Line Outages
  - (25) 345 kV Transmission Lines
  - (1) 230 kV Transmission Lines
  - (29) 138kV Transmission Lines
  - (7) 115 kV Transmission Lines

- External interconnection outages include: NNC, Cross Sound, Neptune, A Line, B Line, C Line, and VFT
Operations Recovery - Wednesday

- Continued high off peak transmission voltages
  - *Marcy-Coopers Corners and Coopers Corners – Rock Tavern remain out*
  - *SVCs in manual modes, including on peak hours, to mitigate high transmission voltages*
  - *NYISO SRE of two Athens units and Roseton 1 for off peak voltage control*

- Cross Sound Cable energized

- Some NY City networks successfully restored

- 924 MW Generation Capability restored

- 11 transmission lines restored
Infrastructure Status - Thursday

- **Customer Outages**
  - 1.6 million

- **Generation Capacity Outages**
  - *Long Island* 763 MW
  - *NY City* 2,187 MW
  - *Upstate* 1,672 MW

- **Transmission line outages**
  - (23) 345 kV Transmission Lines
  - (1) 230 kV Transmission Lines
  - (24) 138kV Transmission Lines
  - (5) 115 kV Transmission Lines

- **External interconnections outages** include: NNC, Neptune, A Line, B Line, C Line, and VFT
Operations Recovery - Thursday

- Continued high off peak transmission voltages
  - Marcy-Coopers Corners and Coopers Corners – Rock Tavern remain out to mitigate high transmission voltages
  - SVCs operated in manual mode in off peak hours to mitigate high transmission voltages
  - NYISO SRE of two Athens units and Roseton 1 for off peak voltage control

- Northport – Norwalk Cable (NNC) returned to service
- 321 MW Generation Capability restored
- 3 transmission lines restored
Adjacent Regions

- NYISO participated in many NPCC conference calls

- ISO-NE
  - 3,100 MW of reliability commitments
  - Lost several coastal generating stations
  - Approximately 1.4 million customer outages

- PJM
  - 4,000 MW of reliability commitments
  - Lost several coastal generating stations
  - Approximately 4.2 million customer outages
Summary

- Despite the horrific nature of the storm and resulting devastation to the electric infrastructure, Long Island and New York City remained synchronized to the Eastern Interconnection.

- Communications and cooperation across all Market Participants and with neighboring Reliability Coordinators was excellent.

- Prior, during, and after Hurricane Sandy, the generation and utility asset owners contributed to the sole, primary objective of maintaining electric system reliability.

- The auxiliary support infrastructure performance was excellent:
  - *ISO and TO Energy Management Systems worked properly*
  - *Real-Time data systems between Generators, Substations, Transmission Owners and the ISO worked properly*
  - *Phone communications worked properly*
NYCA Load --
Impact of Hurricane Sandy

- The following charts display hourly electric load for Monday (10/29/12) and Tuesday (10/30/12) when Hurricane Sandy struck New York -- compared to the hourly electric load on the same days of the previous week.
New York City Hourly Electric Load

Monday

Tuesday

MW

Hour of Day

2,400 MW

10/22

10/23

10/29

10/30
Upstate Hourly Electric Load

MW

Hour of Day

Monday

Tuesday

10/22

10/23

10/29

10/30

1,100 MW