Workshop on Microgrid Technology & Applications

October 10-11, 2013
Rensselaer Polytechnic Institute, Troy, NY

Microgrids -- A New Paradigm??

Michael Worden
New York State Department of Public Service
Hurricane Sandy

Rockaway Beach, Queens 10/31/12
Consolidated Edison trucks are submerged on 14th Street near the ConEd power plant in New York. 10/29/12

http://bigstory.ap.org/article/coned-prepped-big-storm-got-even-bigger-1
Brooklyn Battery Tunnel, NYC, published 11/2/12

Red Hook, 10/29/12
# Peak Outage Levels and Duration of Restoration, by Company

<table>
<thead>
<tr>
<th>Company</th>
<th>Peak Outage Level</th>
<th>Start of Event</th>
<th>Time of Peak</th>
<th>Time of Majority Restoration (&lt; 1,000 customers remaining)</th>
<th>Duration of Majority Restoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGrid</td>
<td>37,588</td>
<td>10/29 @ 1330</td>
<td>10/29 @ 2130</td>
<td>10/31 @ 1530</td>
<td>2 days, 2 hours</td>
</tr>
<tr>
<td>RGE</td>
<td>26,580</td>
<td>10/29 @ 1430</td>
<td>10/30 @ 0730</td>
<td>11/02 @ 1930</td>
<td>4 days, 5 hours</td>
</tr>
<tr>
<td>CHGE</td>
<td>83,551</td>
<td>10/29 @ 1030</td>
<td>10/30 @ 0300</td>
<td>11/04 @ 0330</td>
<td>5 days, 17 hours</td>
</tr>
<tr>
<td>NYSEG</td>
<td>116,069</td>
<td>10/29 @ 1030</td>
<td>10/30 @ 1530</td>
<td>11/08 @ 1330</td>
<td>10 days, 3 hours</td>
</tr>
<tr>
<td>ORU</td>
<td>145,716</td>
<td>10/29 @ 1300</td>
<td>10/30 @ 2100</td>
<td>11/09 @ 1900</td>
<td>11 days, 6 hours</td>
</tr>
<tr>
<td>ConEd</td>
<td>824,991</td>
<td>10/29 @ 0700</td>
<td>10/30 @ 1730</td>
<td>11/12 @ 1200</td>
<td>14 days, ~5 hours</td>
</tr>
<tr>
<td>LIPA</td>
<td>950,943</td>
<td>10/29 @ 0630</td>
<td>10/30 @ 1600</td>
<td>11/15 @ 1200</td>
<td>17 days, ~6 hours</td>
</tr>
<tr>
<td><strong>Statewide</strong></td>
<td><strong>2,109,877</strong></td>
<td><strong>10/29 @ 0630</strong></td>
<td><strong>10/30 @ 1700</strong></td>
<td><strong>2,185,438 Sum of peaks</strong></td>
<td></td>
</tr>
</tbody>
</table>

Note: Flood affected customers are not included in this analysis.
FLOODED AREAS WITH CUSTOMERS THAT CANNOT BE RESTORED
AS OF 11/29/2012  09:00 AM

CONED FLOODED AREAS
Total Customers Affected: 1,370
Brooklyn: 343
Queens: 295
Staten Island: 732

LIPA FLOODED AREAS
Total Customers Affected: 10,456
Nassau (excl. Long Beach): 490
Long Beach: 405
Suffolk: 515
Rockaways: 9,046
CUSTOMERS WITHOUT POWER BY COUNTY
Peak Customer Outages: 997,000

HURRICANE IRENE
Report Date: 8-28-2011
Report Time: 19:00

Legend:
County
- No Outages
- 1 - 500
- 501 - 5,000
- 5,001 - 15,000
- 15,001 - 25,000
- 25,001 - 50,000
- 50,001 - 100,000
- 100,001 - 150,000
- 150,001 - 210,000

Key Map:

New York State
Department of Public Service
Electric Outage Reporting System
CUSTOMERS WITHOUT POWER BY COUNTY

Peak Customer Outages: 68,000

TROPICAL STORM LEE
Report Date: 9-10-2011
Report Time: 01:00

Legend:
- County
- No Outages
- 1 - 500
- 501 - 1,000
- 1,001 - 2,000
- 2,001 - 6,000
- 6,001 - 10,000
- 10,001 - 15,000
- 15,001 - 20,000
- 20,001 - 25,000
- 25,001 - 40,000
- 40,001 or More
- Non-Event Area

Key Map:

New York State
Department of Public Service

Electric Outage Reporting System
CUSTOMERS WITHOUT POWER BY COUNTY

Peak Customer Outages: 400,000

OCTOBER 2011 SNOWSTORM
Report Date: 10-30-2011
Report Time: 08:00

Legend:

- No Outages
- 1 - 500
- 500 - 5,000
- 5,001 - 25,000
- 25,001 - 50,000
- 50,001 - 75,000
- 75,001 - 100,000

Key Map:
What’s a Microgrid

• Certainly not the 1888’s version
• Is it the Campus Model
• Virtual net metering; Con Edison Campus model
• Ultimately needs to be fully integrated with the utility system
  – Benefits of the Grid
  – Operate independently
• And part of a bigger, more fully integrated, utility and customer system
Technical Issues

• How to fully integrate
  – Ideally the best of both worlds
    • Island
    • Grid support
    • Ancillary Services??
  – Need to protect the integrity of the utility system and the customer’s equipment
  – NY Standardized interconnection requirements
  – How to strengthen the grid through microgrids
Policy Issues

• So who runs the microgrid
• Is it “utility” regulated by the PSC
• Who sets the rates
• How do we make this cost effective
  – Do we need incentives
  – How do we measure performance
  – How do we deal with stand by rates
• Are certain costs socialized – e.g., protecting critical services
So what’s the new paradigm?

• It’s not the late 1800’s version of power systems
• Likely is now only a vision
  – An evolution
  – Technology is a key