Combined Heat & Power & The Urban Energy Revolution

NYIT -- Sept 28, 2012
Agenda

• Distributed Generation Overview
• Interconnection - Technical
• Interconnection – Process and Rates
• Recent Developments and Future Opportunities
What is Con Edison?
Public Utility Energy Provider

<table>
<thead>
<tr>
<th></th>
<th>Customers</th>
<th>Infrastructure</th>
<th>Service Territory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric</td>
<td>3.3 million</td>
<td>One of the largest underground systems in the world</td>
<td>All 5 boroughs and Westchester County</td>
</tr>
<tr>
<td>Gas</td>
<td>1.1 million</td>
<td>4,333 miles of gas mains and services</td>
<td>3 out of the 5 boroughs and Westchester County</td>
</tr>
<tr>
<td>Steam</td>
<td>1,760</td>
<td>Largest district steam system in the world</td>
<td>Manhattan below 96th Street</td>
</tr>
</tbody>
</table>
Distributed Generation Overview

What is distributed generation (DG?)

- Traditional System: Power Plant, 45% Efficiency
- CHP System: CHP, 80% Efficiency
Distributed Generation Overview

Technology trends

Cumulative Number of DG applications

- Applications: 0, 250, 500, 750, 1000, 1250
Distributed Generation Overview

Technology trends

Total Customers by Technology

Total Installed Capacity
Recent Developments and Future Opportunities

Long-range plan projections

- High Case
- Base Case
- Existing ICE CHP
- Existing GT CHP
- Existing ST, Solar PV, MT CHP, and FC CHP


Power (MW): 0, 100, 200, 300, 400, 500, 600, 700, 800
### Distributed Generation Overview

#### Technology overview

<table>
<thead>
<tr>
<th></th>
<th>Reciprocating Engines (NG)</th>
<th>Gas Turbines</th>
<th>Microturbines</th>
<th>Fuel Cells</th>
<th>Solar PV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity</strong></td>
<td>10kW - 5+ MW</td>
<td>500kW – 20MW</td>
<td>30kW – 250kW</td>
<td>5kW – 2MW</td>
<td>&lt; kW-20 MW</td>
</tr>
<tr>
<td><strong>Electrical Efficiency</strong></td>
<td>69% – 78%</td>
<td>49% – 66%</td>
<td>47% – 59%</td>
<td>54% – 82%</td>
<td>20% – 45%</td>
</tr>
<tr>
<td><strong>Capital Cost [$1000/kW]</strong></td>
<td>1.2 – 2.3</td>
<td>1.5 – 5.5</td>
<td>2.6 – 3.15</td>
<td>5.6 – 10.0</td>
<td>6.0 – 7.5</td>
</tr>
<tr>
<td><strong>O&amp;M Cost [$/MWh]</strong></td>
<td>12 – 29</td>
<td>5 – 14</td>
<td>16 – 35</td>
<td>43 – 51</td>
<td>22 – 25</td>
</tr>
<tr>
<td><strong>Nox [lb/MWh]</strong></td>
<td>0.05-2.17</td>
<td>0.07-2.4</td>
<td>0.06-0.54</td>
<td>0.02-0.06</td>
<td>--</td>
</tr>
<tr>
<td><strong>CO2 [lb/MWh]</strong></td>
<td>1,145-1,359</td>
<td>1,024-1,877</td>
<td>1,377-1,736</td>
<td>773-1,440</td>
<td>--</td>
</tr>
</tbody>
</table>

*New York State: 0.48. East River 1 and 2: 0.04-0.08. NYS ‘Clean DG’ Standard 1.6. California: 0.07

**New York State: 705. East River 1 and 2: 626.
Distributed Generation Overview

Current and expected large-scale CHP

- Forecast CHP (2012 – 2018)
- Existing large scale CHP
## Factors affecting CHP adoption

### Economic
- Large upfront cash
- Fuel price risk
- Payback period
- Incentives

### Technical & Operational
- Retrofit difficulty
- Not core business
- O&M costs
- Commissioning
- Space constraints

### Environmental
- LEED Scoring & Green Branding
- Uncertain environmental regulation
Distributed Generation Overview

Potential impacts on our distribution system

- Increased fault duty on company circuit breakers
  - Customer side solutions available
- Impact on network protectors
  - Smart Grid Pilots
- Islanding
- Harmonic distortion contributions
- Voltage flicker

- Potential high gas main extension costs
- Customer-side high-pressure gas DoB/FDNY concerns
Distributed Generation Overview

Service considerations

Area Substation

A
B
C
D
E

120/208 Volt Grid

13 kV Feeder
Distributed Generation Overview

Purpose of network protectors

Area Substation

A
B
C
D
E

120/208 Volt Grid

13 kV Feeder
Distributed Generation Overview

Network protector considerations: reliability
Distributed Generation Overview
Network protector considerations: **islanding**

![Diagram showing network protector considerations for distributed generation.

- **Area Substation**
- **DG Customer**
- **120/208 Volt Grid**
- **13 kV Feeder**

ConEdison
Distributed Generation Overview

Interconnection process

• Interconnection application – electric, gas, or steam
• Design reviews
• Contract/agreements and engineering specifications
• Interconnection/installation
• Testing
• DG rates – Electric and Steam standby, Gas Delivery
  – Rider H Gas/Cross Commodity Support
• Incorporate into load forecasting and planning
Recent Developments and Future Opportunities

Rate Design Considerations

Standard non-DG Interconnection – costs recovered through kW and kWh charges
Recent Developments and Future Opportunities

Rate Design Considerations

Standard DG Interconnection – costs recovered through kW charges

- Contract Demand and Daily As-Used Demand
Recent Developments and Future Opportunities

Rate Design Considerations

Offset (or Campus) DG Interconnection - Costs recovered through kW charges

• Contract Demand and Allocated Daily As-Used Demand
Recent Developments and Future Opportunities

DG opportunities and challenges (utility perspective)

• Opportunities
  – Large potential load reductions
  – Target substation and distribution projects
  – Cross commodity impacts
  – Demand response and customer load control

• Challenges
  – Reliability, timing, and control of demand reductions
  – High penetration
  – Customer fit and economics
  – Environmental impacts
Recent Developments and Future Opportunities

From energy consumers to energy partners

• Systems
  – Interconnection, demand-side markets, monitoring, modeling

• Technology
  – Communications
  – Industry standards

• Future: Customers active part of energy equations
  – Energy resources, control room systems, building management systems, remote dispatch
Recent Developments and Future Opportunities
Utility response to increased adoption

coned.com/dg
coned.com/es
Thank you!

Margarett Jolly
212-460-3328
jollym@coned.com
www.coned.com/DG