AGENDA

- A Look at Avangrid and UI
- Storm Activity in CT For The Past 7 Years
- Vegetation Management Program
- Step Down Bank Removal Program
- Perimeter Feeder Ties Program
- Coastal Substation Flood Mitigation Program
- Substation Getaway Rebuild Program
- Woodbridge Fuel Cell and Microgrid Project
- Improved Substation Security Measures
- Woodmont Grid Connected Battery Storage Project
- New Damage Assessment Tools
- Question and Answers
Avangrid Networks combines the resources and expertise of eight electric and natural gas utilities with an $8.3 billion rate base serving 3.1 million customers in New York and New England.


UI

- United Illuminating - Located in Central Coastal Connecticut.
- ~328,000 customers across 17 Municipalities.
- ~335 square miles.
- ~20% of CT’s peak electric demand.
MAJOR STORM ACTIVITY IN CONNECTICUT FOR THE PAST 7 YEARS

*Total Meters Affected*

- **Tropical Storm Irene**
  - 8/29/2011
  - *201,743

- **Snowstorm**
  - 10/29/2011
  - *49,805

- **Hurricane Sandy**
  - 10/20/2012
  - *286,422

- **Strong Winds and Heavy Rain**
  - 1/31/2013
  - *20,604

- **Nor’easter Riley**
  - 3/2/2018
  - *17,053

- **Nor’easter Quinn**
  - 3/07/18
  - *43,465

- **Tornado & Thunderstorm**
  - 05/13/2018
  - *40,647

*Total Meters Affected*
VEGETATION MANAGEMENT PROGRAM ($160M OVER 10 YRS.)

- Establish the UPZ around UI’s infrastructure.
- UPZ will improve storm resiliency 25-50%.
- Balance customer demand for reliable service with environmental benefits of trees.
- Implement a comprehensive, detailed and flexible plan.

Laws & Regulations
CGS16-234 & Docket No. 12-01-10

- Mandatory Tree Warden and DOT Permits.
- Abutting and Private Property owners may consent, object, or request a modification.
- Appeals of the Tree Warden’s decision may be mediated before going to PURA.
- Tree work outside of the public right-of-way requires written consent.
- UPZ is the “starting point”.
- Non-hazardous trees may be retained.
- Resolve objections at the local level.
STEP DOWN BANK REMOVAL PROGRAM ($34.5M)

- Convert 13 multi-customer 13.8/4.16 kV step down banks and associated 4.16kV overhead infrastructure to 13.8kV class equipment over a three year period.
- This conversion allows for circuit ties, increase back-up feeder ability, and remove single points of failure.
- Remove remaining 70 Step Down Banks by 2024

### COMPLETED IN 2017 - $2.9M

<table>
<thead>
<tr>
<th>Location</th>
<th>Capital Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stuyvesant Ave. Step Down Bank</td>
<td>$246,502</td>
</tr>
<tr>
<td>Grannis Rd. Step Down Bank</td>
<td>$136,262</td>
</tr>
<tr>
<td>Arch Str. Step Down Bank</td>
<td>$655,987</td>
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<tr>
<td>Evers Pl. Step Down Bank</td>
<td>$388,285</td>
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<tr>
<td>Branford Rd. Step Down Bank</td>
<td>$741,065</td>
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</table>

### ENGINEERED FOR 2018 - $382,764

<table>
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<tr>
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<th>Capital Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dunbar Hill Rd. Step Down Bank</td>
<td>$246,502</td>
</tr>
<tr>
<td>Orange Ave. Step Down Bank</td>
<td>$136,262</td>
</tr>
</tbody>
</table>
Create nine additional feeder ties between substations to add backup capacity and increase resiliency.

There are locations in the distribution system that are located at outlying portions of the system that do not have 13kV ties to adjacent circuits.

Allow additional back-up ties to an average of 1,025 customers per location.

Company completed 4 perimeter feeder ties and 2017 with a total capital spend of $2,369,720.
FLOOD MITIGATION

- Raise impacted equipment (individual components).
- Install Perimeter Floodwall System (access gates, pumps, etc.).
- Raise and rebuild adjacent (to existing substation).

<table>
<thead>
<tr>
<th>Substation</th>
<th>Location</th>
<th>Station Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash Creek</td>
<td>Bridgeport, CT</td>
<td>115/13.8kV Substation</td>
</tr>
<tr>
<td>Congress St</td>
<td>Bridgeport, CT</td>
<td>115/13.8kV Substation</td>
</tr>
<tr>
<td>Pequonnock</td>
<td>Bridgeport, CT</td>
<td>115/13.8kV Substation</td>
</tr>
<tr>
<td>Singer</td>
<td>Bridgeport, CT</td>
<td>345/115kV Substation</td>
</tr>
<tr>
<td>East Shore</td>
<td>New Haven, CT</td>
<td>345/115/13.8kV Substation</td>
</tr>
<tr>
<td>Grand Ave</td>
<td>New Haven, CT</td>
<td>115kV Switching Station</td>
</tr>
<tr>
<td>Mill River</td>
<td>New Haven, CT</td>
<td>115/13.8kV Substation</td>
</tr>
</tbody>
</table>

Flood Wall System (10ft above grade, typical)
OBJECTIVE:

- Convert overhead aerial cable feeders exiting distribution substations to underground feeders.
- Reduce outage exposure to approximately 15,517 customers by eliminating single point of failure.
- Reduce Pole Loads/Sail Effect.
WOODBRIDGE FUEL CELL AND MICROGRID PROJECT

Project Benefits:
• “Keep the Lights on” during prolonged outages and storm resiliency.
• Installation/operation of fuel cell helps meet RCP Class I renewable goals.
• Brings visibility to UI and Woodbridge as one of the first municipal community microgrids that utilizes fuel cell technology in Connecticut.
• Potential for increased sustainability and a reduced carbon footprint for the Amity School District.
• Gaining essential knowledge in the operational and technical issues associated with islanding a microgrid with inverter based generation.
• UI owned microgrid and generation ensures a safe and reliable operation, eliminates O&M concerns, and ensures seamless billing for the Town of Woodbridge and the Amity School District when in microgrid island mode.

Microgrid Program Summary
• Microgrid must include more than one Critical Facility.
• Program funds to be divided between small, medium, and large municipalities.
• Program funds cannot be used for generation or energy storage.
• Program development is collaborative effort between UI, Eversource, and DEEP.
TECHNICAL CHALLENGES - INVERTER BASED MICROGRID GENERATION

• Transition to island mode:
  - Utilize an advanced microgrid controller & load leveler
  - Ability to energize transformers & pick up customer loads
  - Transitions must be made one customer at a time
  - Transition to and from island mode will be ‘open transition’.

• Load following:
  - Fuel cells do not have the ability to follow system load changes
  - A load resistive bank (load leveler) is being used to smooth load transition

• Fault locating while in island mode:
  - Fault current issues
  - Additional PQ system required to detect faults

• Operational issues:
  - Fault detection if outage occurs in microgrid mode
  - New equipment and procedures unique to the Woodbridge microgrid

• Introduction of non standard equipment (special order 15kV switches)

• Communications:
  - Fiber optic cables required to connect equipment within the microgrid
  - Wireless communication between microgrid, fuel cell, and UI operations
Progress to Date

- Round 1 (July, 2013) – Awarded $17.9M to 9 projects (UI 3, Eversource 5, Groton 1)
  - Woodbridge Town Center ($3M award)
  - Bridgeport City Hall ($2.97M award)
  - Fairfield – Public Safety ($1.2M award)
- Round 2 (Oct., 2014) – Awarded $5M to 2 Projects both in UI’s territory
  - Milford ($2.9M award)
  - University of Bridgeport ($2.18M award)
- Round 3 (Dec., 2015) – $30M of funding available.
  - This Round now includes funding for the generation portion of a microgrid
  - None awarded in UI’s territory.
  - CTE&T (located at Bella Vista, New Haven) Application submitted.
IMPROVED SUBSTATION SECURITY MEASURES ($32M)

Install 14-foot tall fences
- Increased height impedes quick penetration thereby prolonging available window for response.
- Privacy slats – Obscures substation equipment from ballistic assault.
- Outward –angled barbed wire at top.

PA System
- Immediate communication to potential intruders.

Add Cameras, Motion Detection & Analytics
- Cameras to cover fence line and control rooms.
  - Able to detect activities outside and inside the substation.
  - Infrared imaging provides nighttime coverage.
- Enhanced Motion Detection/Video Analytics.
  - Improved detection and assessment of activities in and around the substation(s).

Enhanced Signage
- Deterrence.
WOODMONT GRID CONNECTED BATTERY STORAGE PROJECT

- Implement a 1.25 MW, 2.5 MWh battery solution that demonstrates the benefits of utility grid side battery storage ownership and operation Pending Regulatory Approval

**Primary Demonstration Use Cases**

- **Peak Load Reduction**: Reduce summer peak load to defer distribution investment
- **Load Shaping**: Initiate daily load shaping/leveling
- **Secondary Use Cases**: Reliability, Hosting Capacity, Market Participation

**Goals of Pilot**

- Gain operational learning and develop operational protocols for future deployment of grid side battery storage
- Demonstrate the effectiveness of each Use Case

• Project resulted from Connecticut Public Act 15-5, Sec. 103
• Filed proposal with PURA in November 2017
• PURA Opened Docket #17-11-13;
• Moving forward with battery storage RFP in parallel with docket

**In Service Date**: TBD, ~18 Months after approval

**Location**: Woodmont Substation, Milford, CT

**Estimated Costs**

- CAPEX: $4.3M
- Annual O&M: $.2M
NEW DAMAGE ASSESSMENT TOOLS

Aggregated Outage Reporting:
- Digital Customer Experience
- Remote Device Outage Notification

Intuitive Damage Collection:
- On-Demand Training
- Mobile Capability
- Real-Time Updates

Efficient Planning and Communication:
- Safe and Achievable Restoration Plan
- Up To Date ETRs
Question & Answer