Program Update: Middletown Microgrid Feasibility Study

5/17/2018
## Agenda

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<td>Tony Mercantante</td>
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LEIDOS Program Team

Businovation, LLC

Paul Heitmann

- Strong background in DER technologies and standards (IEEE)
- Leading national initiatives in Transactive Energy

BBD, LLC

Fred Brody

- Leading multiple Monmouth community outreach coordination engagements
- Strong advocacy for NJ clean energy and transportation programs

Leidos Engineering

Joe Blackwell

- Deep experience in Microgrid design and planning
- Extensive knowledge of technology application and regulatory models
BPU Background
Overview of NJBPU’s Town Center Microgrids Program

Presented to:
Middletown Township

Presented by:
Michael Hornsby,
NJBPU
michael.hornsby@bpu.nj.gov

May 17, 2018
Disclaimer

This presentation was prepared by The New Jersey Board of Public Utilities Staff and does not necessarily represent the views of the New Jersey Board of Public Utilities, its Commissioners, or the State of New Jersey. This presentation is provided for informational purposes only and does not provide a legal interpretation of any New Jersey Statutes related to microgrid operations.
NJBPU Sandy Resiliency Response

- Make utility infrastructure more resilient
  - Distribution automation
  - Raising substations/feeder
  - Hardening poles
  - Vegetation management
- Help local entities become more resilient
  - Promoting advanced microgrids
Town Center DER Microgrid or Advanced Microgrid
What is a Microgrid?

- A group of interconnected loads (e.g. Police & Fire Dept.) and Distributed Energy Resources (DER) (e.g. solar, generators, batteries) that can operate as a single controllable entity with respect to the grid.

- A microgrid can connect and disconnect from the grid to operate in both “grid-connected” or “island” modes.
NJBPU Microgrid Initiatives

• Helped develop 58 NJ Microgrids.
• Engaged NJIT to identify potential town center MG locations - 17 identified.
• Collaborating with NJ Transit for “Transit Grid” to provided resilience for NYC metro area trains.
• Staff Microgrid Report - November 1, 2016.
• Funding 13 Town Center MG Feasibility Studies.

http://nj.gov/bpu/commercial/
### Microgrid Feasibility Studies Underway

<table>
<thead>
<tr>
<th>Location</th>
<th>Average NJBPU Grant</th>
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<tbody>
<tr>
<td>Paterson</td>
<td>~$175,000</td>
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<tr>
<td>Montclair</td>
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<td>Hudson County (Secaucus)</td>
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<td>Hoboken</td>
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<td>Woodbridge</td>
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<td>Highland Park</td>
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<td>Middletown</td>
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<td>State of New Jersey (City of Trenton)</td>
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<td>Neptune</td>
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<td>Camden County (City of Camden)</td>
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<td>Galloway Township</td>
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<tr>
<td>Atlantic City</td>
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<td>Cape May County (Middle Township)</td>
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Average NJBPU grant: ~$175,000
Microgrid Project Locations

Legend:
- Orange: Atlantic City Electric
- Gray: Cooperative
- Blue: JCP&L
- Yellow: Rockland Electric
- Dark Gray: Municipal
- Orange: PSE&G
BPU’s Feasibility Study Report Requirements

• Details on the energy use
• MG boundaries and Rights of Way (ROW)
• Identification of emergency shelters
• Ownership/business model
• DER technologies/communication systems, interconnection & tariff issues
• Cost and financing options
• Optimization modeling with Rutgers University
• Community benefits

Next step: Competitive, limited funding for detailed design
Related New Jersey Initiatives
Town Center Microgrids
Improving towns' energy resilience to major outages

By Richard D. Missel, Commissioner and Former President, New Jersey Board of Public Utilities

The New Jersey Board of Public Utilities (Board) is advancing the New Jersey State Energy Master Plan’s (NJS EMP) priorities of improving energy resilience and increasing the use of Town Center DC (TCD) Distributed Energy Resource (DER) microgrid feasibility studies.

Microgrids are mini grids powered by small distributed generation that provide local, isolated, and resilient energy to critical facilities located in small geographic areas, such as hospitals, public safety buildings, schools, and other buildings that can serve as emergency shelters during a disaster. Their modular grids operating in micro mode, “islanded,” from the main power grid, can separately and protect themselves from any problems with the main grid and keep vital services in place.

Improving Resilience

In the aftermath of Hurricane Sandy, it became a priority to improve energy resilience and the emergency preparedness and response of critical facilities. In addition to the need to improve the resilience of critical infrastructures, which was evident in the wake of Sandy, there was a need to address a clear need for local government agencies to improve and enhance the energy resilience of local critical facilities. As Chairman of the New Jersey Energy Master Plan Committee, I was tasked with developing these concepts within the NJ power lines and then became a key section of the NJS EMP.

To implement the EMP Update policy supporting the development of microgrids to improve the grid’s reliability and resilience to critical facilities in the event of a major emergency, the Board developed a Tier 2 (T2) DC microgrid that can supply power to critical facilities in the grid when the grid goes down. The Board’s microgrid feasibility study was successful, and the Board decided to fund 11 applications in the study and more than doubled the program’s budget to $23 million.

These microgrids are developed, and communities will have the power to keep critical facilities operational and running, independent of the grid during emergencies.

We’re pleased to collaborate with local government leaders who have the vision to deliver these projects. We look forward to completing the Phase One Energy Study, exploring the next phase of design, construction, and they are moved for completion of these projects in the future. The NJS EMP has been concerned to supporting the use of these distributed generation resources to prove that microgrids can work in these areas, and that we can scale New Jersey’s model and ensure that we are anticipating how we can use the evolving energy grid.
NWS Earle Participation
MISSION: Provide ordnance for all Atlantic Fleet Carrier and Expeditionary Strike Groups, and support strategic Department of Defense ordnance requirements
Pier Complex

- 2.9 mile finger pier complex ($257M replacement value)
- 2 active piers, 4 berths, 45’ depth of water

- Direct access to the Atlantic Ocean - cross no bridges or tunnels to reach blue water (3 miles distance)
- Utilize railroad shipment to conduct large load outs in a short time
A Sizeable Asset

Size in Acres:

10,893  Mainside
705    Waterfront
253    Normandy Rd (17 miles)

11,851  Total Acres
$1.7B   Replacement Value

(Only 9 of the 53 towns in Monmouth County are larger)

• Covered by two Congressional districts: NJ 4th & NJ 6th.
• Bordered by five municipalities: Middletown, Colts Neck, Tinton Falls, Howell, Wall.
• FY 2016 Direct Economic Impact: $120.745 Million.
Sandy Damage

- Weapons Station electric power out 7-14 days
- $50M in total damages
- Ready for limited operations in one week, but full repair took until December 2015

- Warehouse R25 V-Zone Damage
- Replaced for $3.2M, but moved 1000’ inland and 8’ higher
Middletown Project Data & Technology Topics
Virtual Power Plants represent an 'Internet of Energy', said senior analyst Peter Asmus of Pike Research. "These systems tap existing grid networks to tailor electricity supply and demand services for a customer. **VPPs maximize value for both the end user and the distribution utility** using a sophisticated set of software-based systems. They are dynamic, deliver value in real time, and can react quickly to changing customer load conditions."
The New Energy Paradigm (Context)

Source: Goldman Sachs Global Investment Research.

Combining blockchain with the Internet of Things could enable the negotiation of distributed power transactions. By using distributed wireless or wireline data links in a
The New Energy Paradigm (Connection)

Function:
- Power Conversion
- Power Conditioning
- Power Quality
- Protection
- DER and Load Control
- Ancillary Services
- Communications
- Metering

Evolution:
- IoT enabled
- Wireless powered
- Energy stored
- SiC, GaN equipped
Electric Power Systems Landscape

Legend:
- Red: Data Flows
- Black: Variable Power Flows
- Gray: Controllable Power Flows
- Blue: Reduced Power Flows
Relevant Technology Domains and Impacts

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<thead>
<tr>
<th>TECHNICAL</th>
<th>FINANCIAL</th>
<th>REGULATORY</th>
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<tbody>
<tr>
<td>What energy system components are available? Emerging? Obsolete?</td>
<td>What are the current and projected underlying costs?</td>
<td>What barriers to adoption are present to the technology?</td>
</tr>
<tr>
<td>How inter operable and multi functional are the components?</td>
<td>What is range of operational lifetime and duty cycle?</td>
<td>What public safety issues may be created?</td>
</tr>
<tr>
<td>What standards and compliance tools exist? Developing?</td>
<td>How could the tech adoption impact the existing capital base?</td>
<td>What standards/compliance are adopted? What agency jurisdiction?</td>
</tr>
<tr>
<td>Where are these used within reference systems and what data have they produced?</td>
<td>What are the net system cost/benefits (+ or -) observed?</td>
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EARLE: Potential Local Generation (ie Solar, CHP, RNG, Storage, etc)

Example Only: One possible microgrid configuration concept
TC DER Middletown Participant Survey

### TCDER Survey: Site Profile

- Baseline information for existing facility DER investment or buildout plans
- Obtain the energy consumption profile for all buildings located at site
  - Energy monthly (kWhr-elec) (Therms-gas)
  - Peak monthly load (kW-elec)
- Identify any mission critical load
- Approximate facility building(s) size (sq ft.)
- Characterize the existing facility backup generation by type and capacity where available

<table>
<thead>
<tr>
<th>Building 1</th>
<th>Building 2</th>
<th>Building 3</th>
<th>Building 4</th>
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<tbody>
<tr>
<td>Apps SQFT</td>
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<td>Apps SQFT</td>
<td>Apps SQFT</td>
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<tr>
<td>High Energy</td>
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<tr>
<td>Low Energy</td>
<td>Low Energy</td>
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This next section identifies key utility services data/files/documents that will help us best characterize the nature of the facility's complex energy use, which we will then use to define potential microgrid application priorities. Please identify (using checkboxes) which of the following data is available - we will then work separately with your designated Point of Contact to have the appropriate data reviewed, transferred, and compiled.

- Electric Utility Use (Monthly kWh)
- Electric Power Demand (kW load/hr)
- Natural Gas Use (Monthly MCF)

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Utility Use</th>
<th>Electric Power Demand</th>
<th>Natural Gas Use</th>
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<tbody>
<tr>
<td>2017</td>
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<tr>
<td>2016</td>
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<tr>
<td>2015</td>
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TC DER Middletown Participant Survey

TCDER Survey: Application Priority

> Provide specific scenarios that could be enabled by the Microgrid as community resource. (Education)

> Collect prioritization ranking for alignment to current facility business purpose
  > Operational Efficiency
  > Emergency Recovery
  > Regional Evacuation
  > Environmental Impact Mitigation
  > Community Education

> Self identify all primary facility mission(s)
Middletown Feasibility Study Program Overview
Leidos: Commercial Energy Solutions

Our business is separated into 4 growth areas focused around 3 distinct markets and one cross-cutting market, which we call Advanced Solutions.

- **Utility Power Systems Engineering**
- **Microgrid Planning and Engineering**
- **Smart Grid Solutions**
- **Infrastructure Modernization**
- **Digital Asset Management**
- **Smart Cities Development**
- **Asset Transactions**
- **Energy Efficiency**
- **Program / Project Management**

**2017**
$10.2B REVENUE

**ADVANCED SOLUTIONS** 13% REVENUE

**DEFENSE & INTELLIGENCE** 36% REVENUE

**HEALTH** 18% REVENUE

**CIVIL** 33% REVENUE
Microgrid Project Examples

> US DOE
  > Renewables integration in WV Super Circuit Microgrid demonstration project

> Pacific NW National Laboratory
  > Microgrid engineering and design for Joint Base Lewis McChord

> City of Fresno, CA
  > Campus Microgrid Feasibility Study

> Hawaiian Electric Co.
  > Microgrid Study to defer electric system investment

One of the EMP Update’s new Plan for Action’s policy recommendations included: “Increase the use of microgrid technologies and applications for Distributed Energy Resources (DER) to improve the grid’s resiliency and reliability in the event of a major storm.” This new policy recommends that:

“The State should continue its work with the USDOE, the utilities, local and state governments and other strategic partners to identify, design and implement Town Center DER microgrids to power critical facilities and services across the State.”

The Town Center DER Microgrid – Feasibility Study Incentive Program is the first step in implementing this new policy goal.
Microgrid Technology Examples
Middletown Study: Critical Infrastructure

- NWS Earle Waterfront Administrative Area
- Township of Middletown Sewage Authority (TOMSA)
- NY Waterways Ferry Terminal
- Middletown Public Works and CNG Fueling Facilities
- Middletown Municipal Complex
- Public Schools
  - Bayshore Middle School
  - Leonardo Elementary School
  - Bayview Elementary School
- Monmouth County Highway Department
- Middletown Fire Stations 3, 4 and 7
- Monmouth County Bayshore Outfall Authority
- State Route 35, 36 and Leonardville Road Traffic Signals
Key Study Partners and Stakeholders

- Township of Middletown
- US Navy - Naval Weapons Station Earle
- Jersey Central Power and Light
- New Jersey Natural Gas
- Township of Middletown Sewerage Authority
- NY Waterways Ferry Terminal
- Middletown Board of Education
- County of Monmouth
- State of New Jersey Department of Transportation
- Leidos Engineering – Project Lead
- Brody Business Development – Stakeholder Engagement
- Businovation – Power System Engineering
Final Report Elements

1. Critical facilities data – energy and costs, FEMA, ROW, technology, etc.
2. Microgrid projected data – energy and costs
3. Technical and operational alternatives
4. Critical facility cost, construction, and implementation
5. Project ownership model alternatives
6. Project and critical facilities financial models
7. Utility regulatory analysis
8. Project benefits and risks description
9. Recommendations

> Final report to BPU will support follow up and implementation decisions
Project Activities Timeline


Data Gathering  →  Technology Research  →  Engineering and Analysis  →  Recommendations

Outreach 1  →  Outreach 2  →  Final Report
Community Dialog
How To Provide Input

> Question and Comments?

> It is important for us to hear input going forward:

> Email: microgrid@middletownnj.org
Thank you!
Backup
Priority: A clean energy future for New Jersey

NJ’s economic future, and the quality of life of its residents, depends on the ability of our state to transform its power system. To achieve the Governor’s goal of 100% clean energy by 2050, the committee believes that an essential step is for the Governor to jumpstart NJ’s most promising new clean energy industry – offshore wind. Specifically, he should commit to the nation’s largest offshore wind solicitation of 1,100 MW of electric power to bring new companies and jobs to NJ. Other urgent actions include stabilizing the state’s solar market and utilizing 100% of the Clean Energy Fund to advance energy efficiency, grow the clean-energy economy, and drive down carbon emissions. Innovative financing options such as a State Green Bank and Green Bonds, which have been successfully used in NY and CT, should also be considered. The Governor should also transform the utility business model and regulatory framework to a performance and outcome-based system that includes a price on carbon. Finally, the Governor should utilize the recent Volkswagen (VW) settlements and the signing of the multi-state Memorandum of Understanding (MOU) on Zero Emissions Vehicles to serve as a springboard for the electrification of the state’s transportation system.
Priority: Confronting climate change

To address the crisis of climate change, the committee recommends that the Governor rejoin the Regional Greenhouse Gas Initiative (RGGI) and support strengthening the program. NJ should commit to the goal of reducing greenhouse gas emissions consistent with the goals of the Paris Climate Agreement and become the 16th state to join the U.S. Climate Alliance. The Governor should launch a similar partnership effort with NJ local governments to reduce pollution. The committee also recommends the Governor launch a “Coastal Resiliency Initiative,” including identifying best practices and updating key environmental laws, such as CAFRA, to address the threats posed by climate change. He should reinstate the DEP Office of Climate Change, and end the State’s embargo on climate science. Additionally, he should direct the DEP and DOE to work with stakeholder groups to advance statewide climate literacy programs in schools and promote “Green STEM” initiatives.