Program Update: Middletown Microgrid Feasibility Study

5/17/2018

Agenda

Topic	Presenter	Time
Introductions	Tony Mercantante	10 min
BPU Background	Mike Hornsby	15 min
Related NJ Initiatives	Fred Brody	10 min
NWS Earle Participation	Dennis Blazak	10 min
Middletown Project Data & Technology Topics	Paul Heitmann	15 min
Middletown Feasibility Study Program Overview	Joe Blackwell	10 min
Community Dialog	Tony Mercantante	40 min

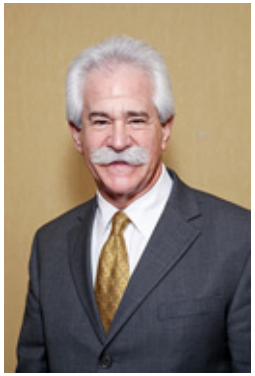
LEIDOS Program Team

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

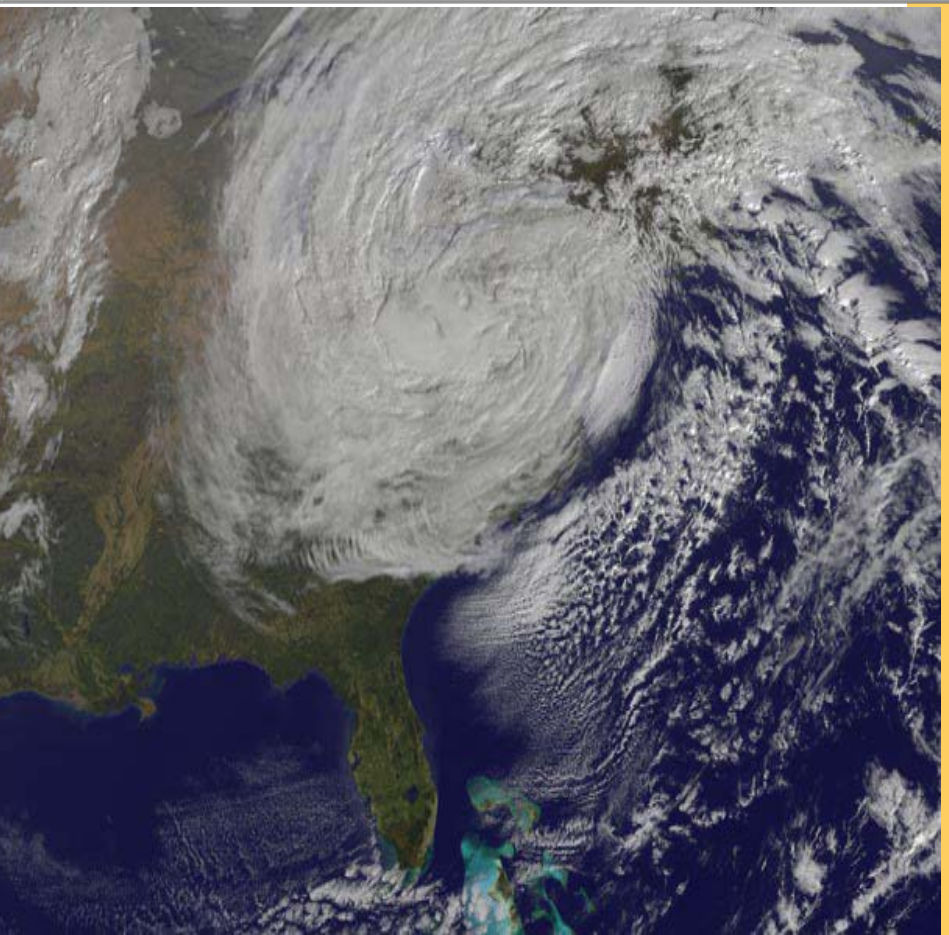
Leidos Engineering

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

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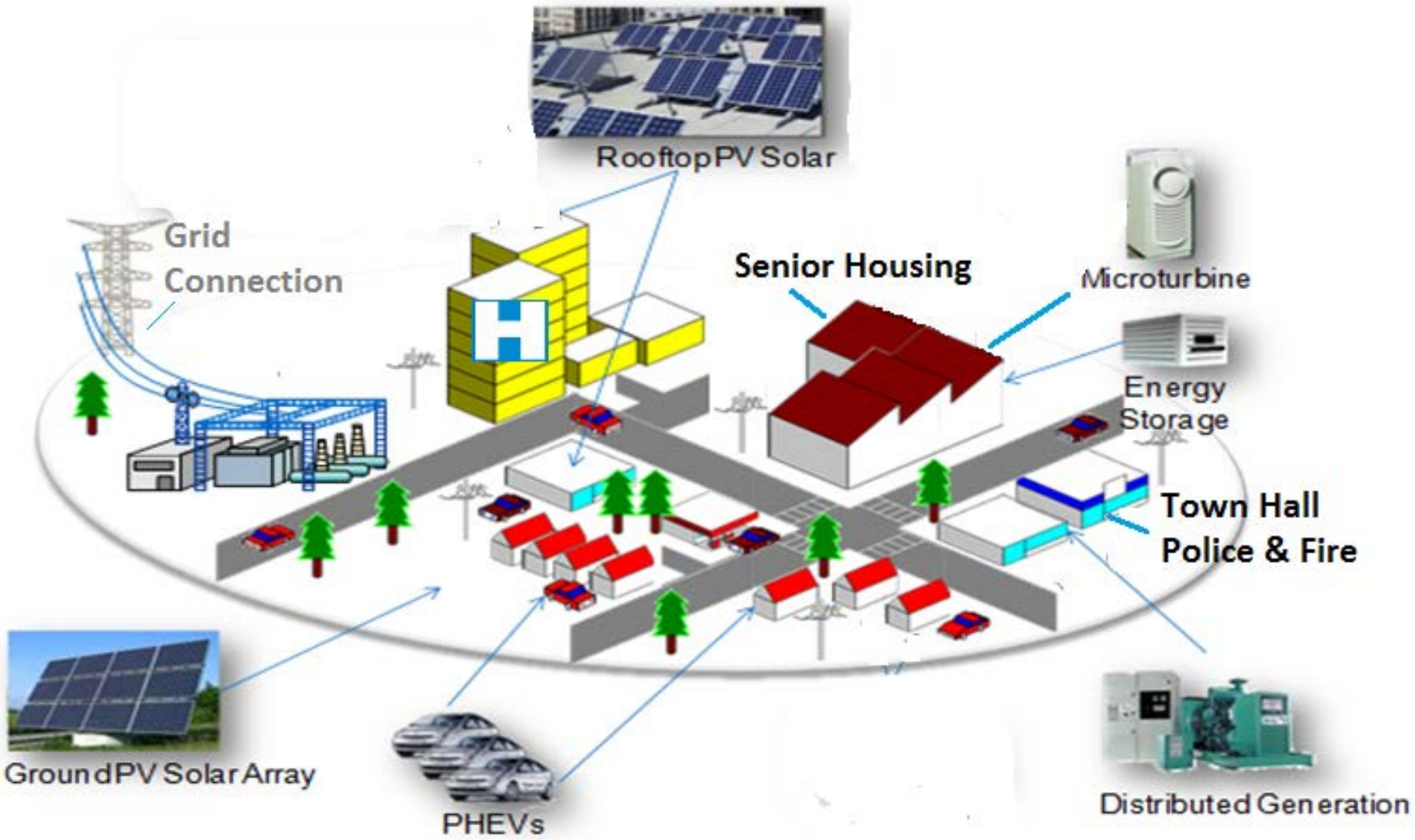
NJBPU Sandy Resiliency Response

- **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.

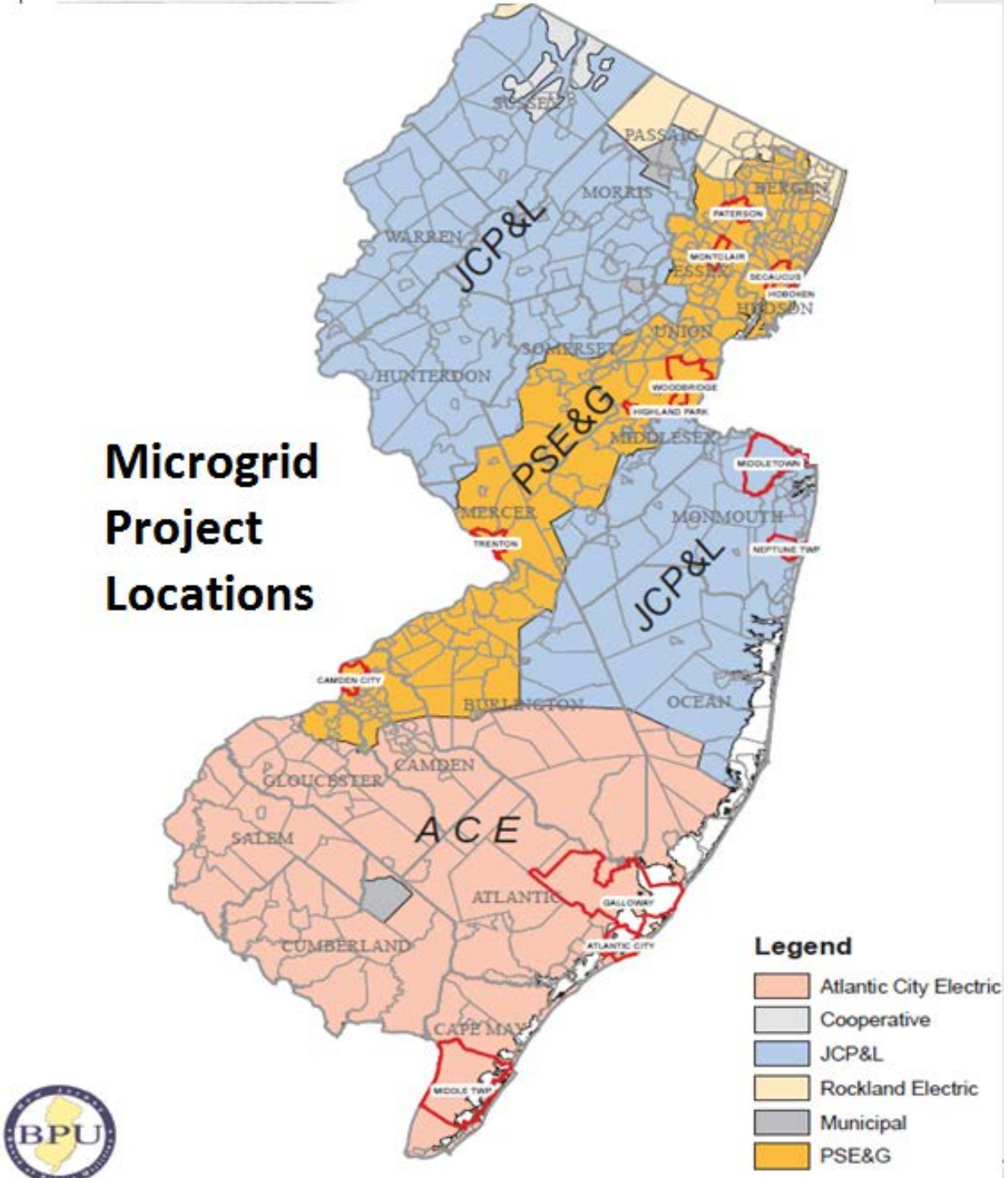
http://nj.gov/bpu/commercial/

13 Microgrid Feasibility Studies Underway

- Paterson
- Montclair
- Hudson County (Secaucus)
- Hoboken
- Woodbridge
- Highland Park
- Middletown
- State of New Jersey (City of Trenton)
- Neptune
- Camden County (City of Camden)
- Galloway Township
- Atlantic City
- Cape May County (Middle Township)

Average NJBPU grant: ~$175,000

Microgrid Project Locations



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

Public Information

nj Energy

Town Center Microgrids

Improving towns' energy resilience to major outages

By Richard S. Mroz, 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 (EMP) priorities of improving energy resilience and increasing the use of Town Center (TC) Distributed Energy Resource (DER) microgrid technologies by funding 13 Town Center DER Microgrid feasibility studies.

Microgrids are mini grids powered by onsite distributed generation that provide electric, heat, and cooling to critical facilities located in a small geographic area, such as hospitals, public safety headquarters, town halls, schools, and other buildings that can serve as emergency shelters during a crisis. These smaller grids operating on their own, "islanded" from the main power grid, can separate and protect themselves from any problems with the main grid and keep vital services in place.

Improving resilience

In the aftermath of Superstorm Sandy, it became a priority to improve energy resilience and the emergency preparedness and response of the regulated utilities. In addition to the need to improve the resilience of utility infrastructure, action was taken to address a clear need for local government agencies to improve and enhance the energy resilience of local critical facilities. As Chairperson of the State Energy Master Plan Committee, I was entrusted to incorporate these priorities within the New Jersey State Energy Master Plan and they became a new section in the 2015 Energy Master Update.

To implement the EMP Update policy supporting the development of microgrids to improve the grid's resiliency and reliability of critical facilities in the event of a major emergency, the Board is working to develop TC DER microgrids that are capable of providing on-site power, heat, and cooling to connected critical facilities within a local area or town center setting during electric grid outages. These town center microgrids could include, local and/or state government critical operations, police and fire facilities, hospitals, shelters, and multifamily buildings that are all centrally located. The critical facilities would be connected to a single or series of DER technologies that can operate while isolated and islanded from the main grid when power is down.

New Jersey currently has 57 running microgrids, many of which have received funding from NJ's Clean Energy Program. Princeton University has become a national example of how to keep critical power on for residents, emergency workers, and crucial facilities when the grid goes down. Princeton's microgrid, an efficient on-campus power generation and delivery network, is an example I have shared many times when discussing the benefits of a microgrid.

Report and recommendations

In 2016, with New Jersey Institute of Technology (NJIT) serving as the Board's consultant, the Board prepared and released the BPU Microgrid Report. The report provides detailed information on advanced microgrid systems and DER technologies and provides recommendations on policy considerations. In the report, we defined what a microgrid is and established three different levels of microgrids.

- **Level 1** microgrid is a single facility with a single owner.
- **Level 2** is single owner with multiple facilities, such as a college campus.
- **Level 3** is a microgrid connecting multiple facilities owned by multiple owners, such as town centers.

Upon the Board's acceptance of the Microgrid Report, staff established a stakeholder process to develop and implement town center microgrid pilot projects. Following the initial stakeholder process, the Board established a Town Center Distributed Energy Resource Microgrid Feasibility Study program with a budget of $1 million to provide incentives for local and state government agencies to study the feasibility of microgrids. Applicants were limited to local government entities or state agencies, which own or manage critical facilities. However, after receiving and evaluating 13 applications for feasibility studies for proposed microgrids and the potential benefits offered, the Board decided to fund all 13 applications and more than doubled the program's budget to $2,052,480.

Also approved was the State of New Jersey, Department of Treasury, with the partners Mercer County, and Mercer County Improvement Authority.

These projects are dispersed throughout the State and have several in the service territory of each electric company. They all have different attributes and capitalize on existing critical facilities and energy infrastructure. Some include biomass, water or wastewater facilities, hydroelectric, combined heat and power, and thermal generation.

These microgrid feasibility studies will provide great detail on options concerning designs, connections, financing options, and the types of buildings to be included in a town center microgrid. As these microgrids are developed, communities will have the power and freedom to keep critical facilities operational and running, independent of the grid during emergencies.

We are pleased to collaborate with local government leaders, who have the vision to deliver these projects. We look forward to completing the Phase One Feasibly Studies, exploring the next phase of design feasibility, and then are hopeful for completion of these projects in the future. The BPU has been committed to supporting the use of these distributed generation resources to prove that microgrids can work in these communities, so that we can make New Jersey more resilient and ensure that we are anticipating how we can use the evolving energy grid.

Power Priorities

Policy priorities in this new section of the New Jersey State Energy Master Plan are based on New Jersey's Plan for Action in the aftermath of Superstorm Sandy and include:

- Protecting critical energy infrastructure.
- Improving the electric companies' emergency preparedness and response.
- Increasing the use of microgrid technologies and applications for distributed energy resources (DER).
- Creation of long-term financing for resiliency measures.

Testing...

The Board approved funding for applications submitted by:

Atlantic City	Hoboken	Paterson
Camden County	Hudson County	Woodbridge Township
Cape May County MUA	Middletown Township	Trenton
Galloway Township	Montclair Township	
Highland Park	Neptune Township	

NWS Earle Participation

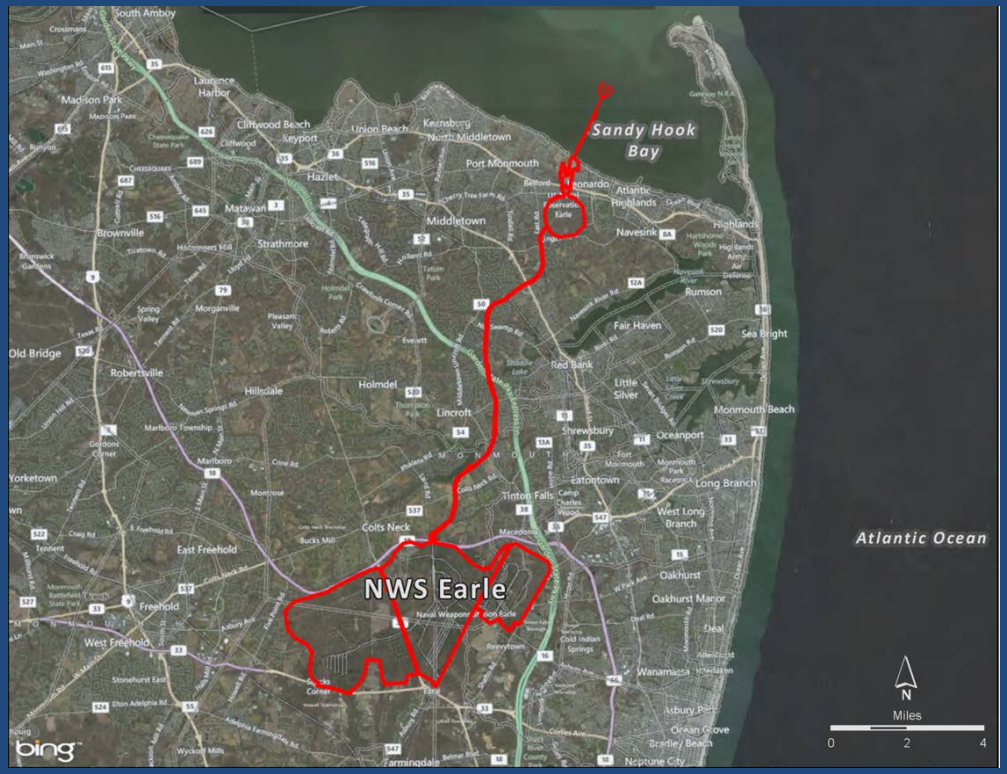
MISSION: Provide ordnance for all Atlantic Fleet Carrier and Expeditionary Strike Groups, and support strategic Department of Defense ordnance requirements

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

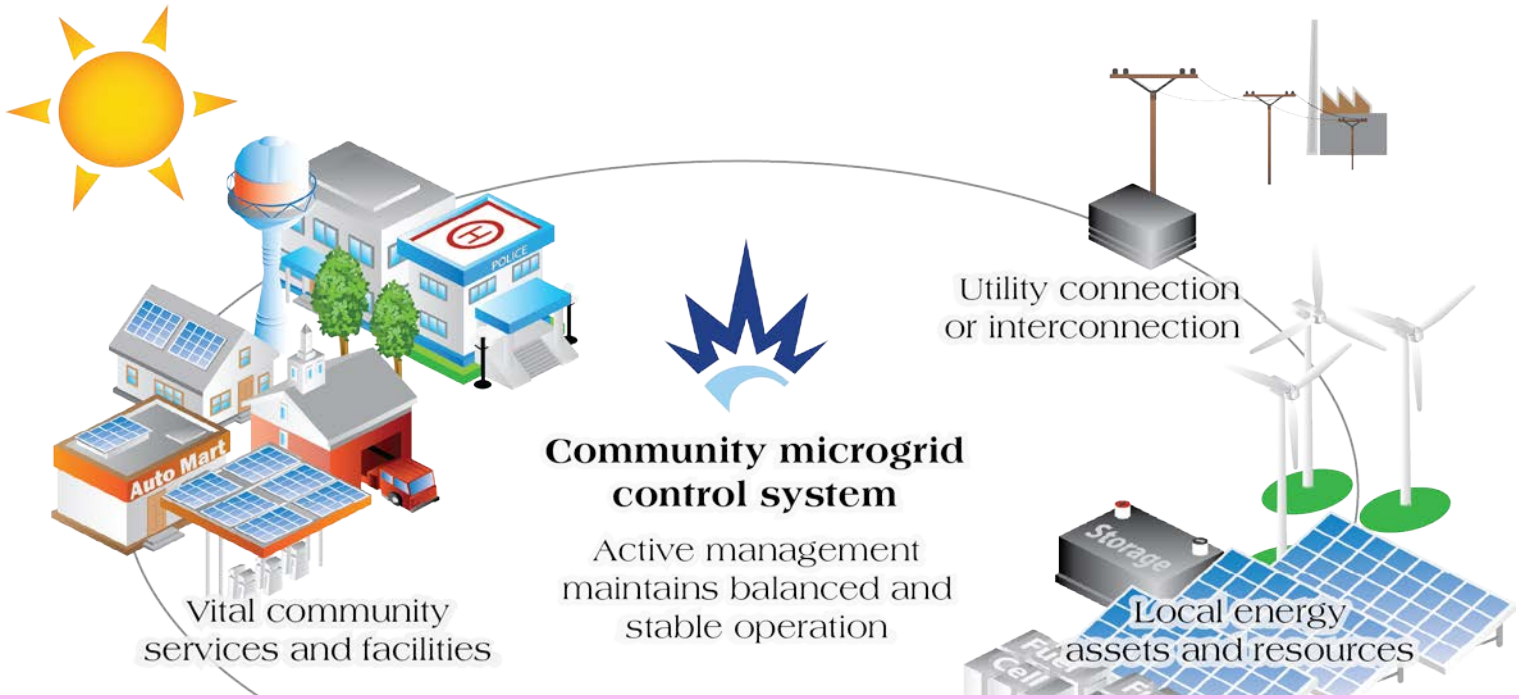
- Weapons Station electric power out 7-14 days
- $50M in total damages
- Ready for limited operations in one week, but full repair took until December 2015

- Warehouse R25 V-Zone Damage
- Replaced for $3.2M, but moved 1000’ inland and 8’ higher

Middletown Project Data & Technology Topics

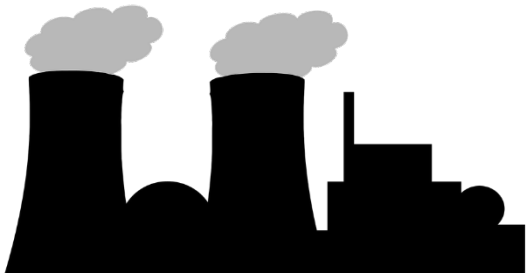
leidos

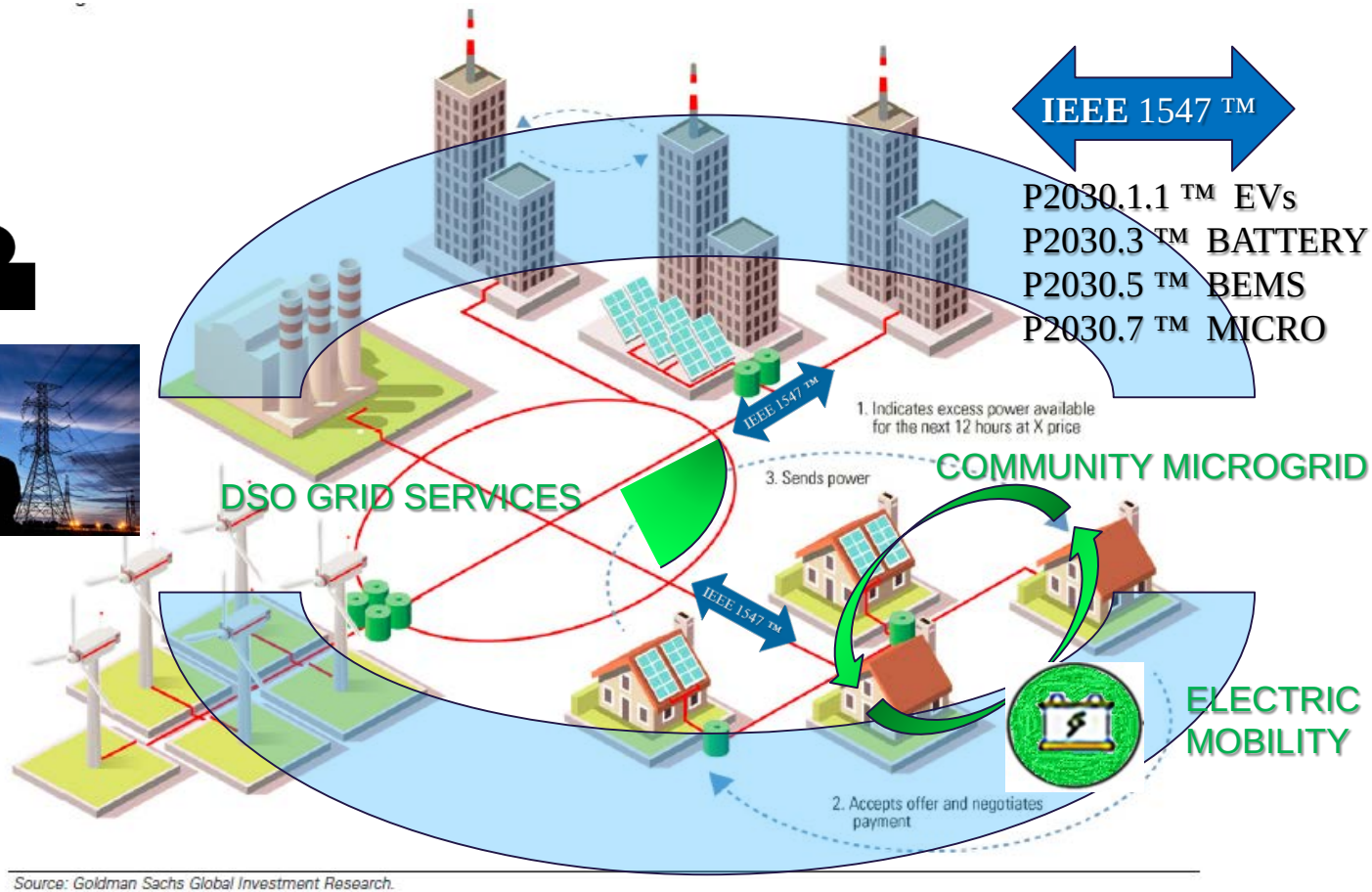
The New Energy Paradigm (Concept)



Virtual **P**ower **P**lants 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)

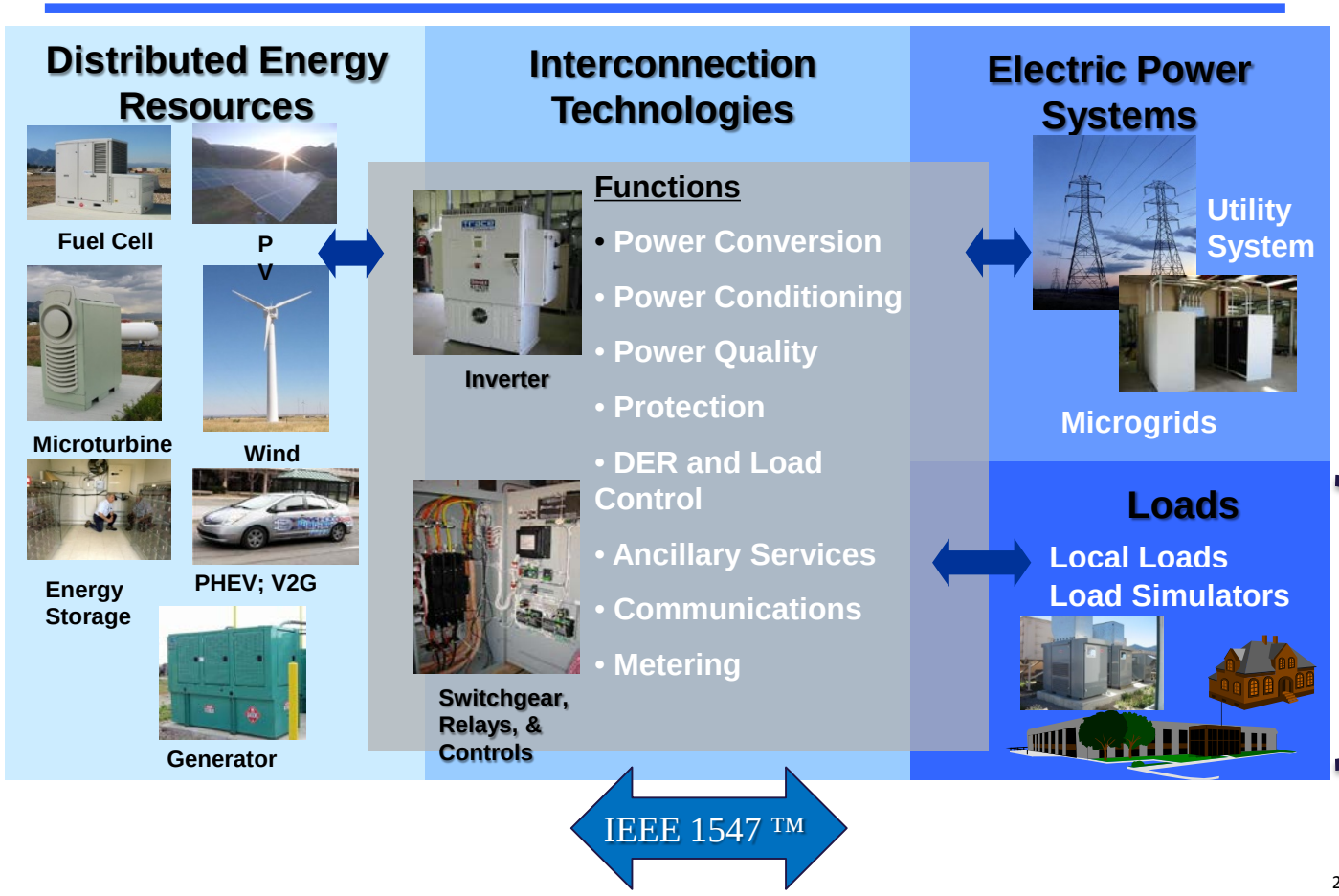




Source: Goldman Sachs Global Investment Research.

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)

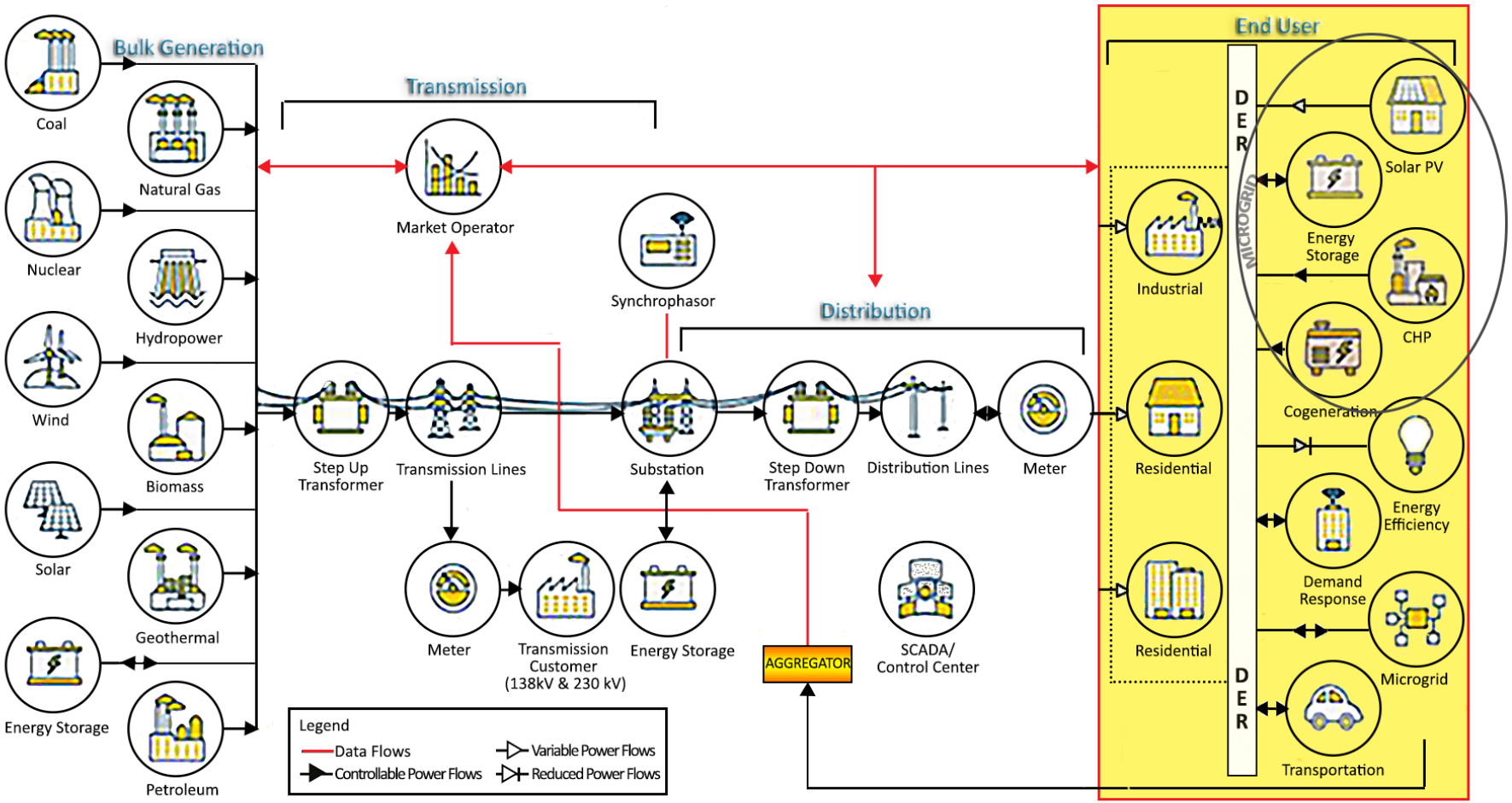


Evolution

- **IoT** .. enabled
- **Wireless**.. powered
- **Energy** .. stored
- **SiC, GaN..** equipped

25

Electric Power Systems Landscape

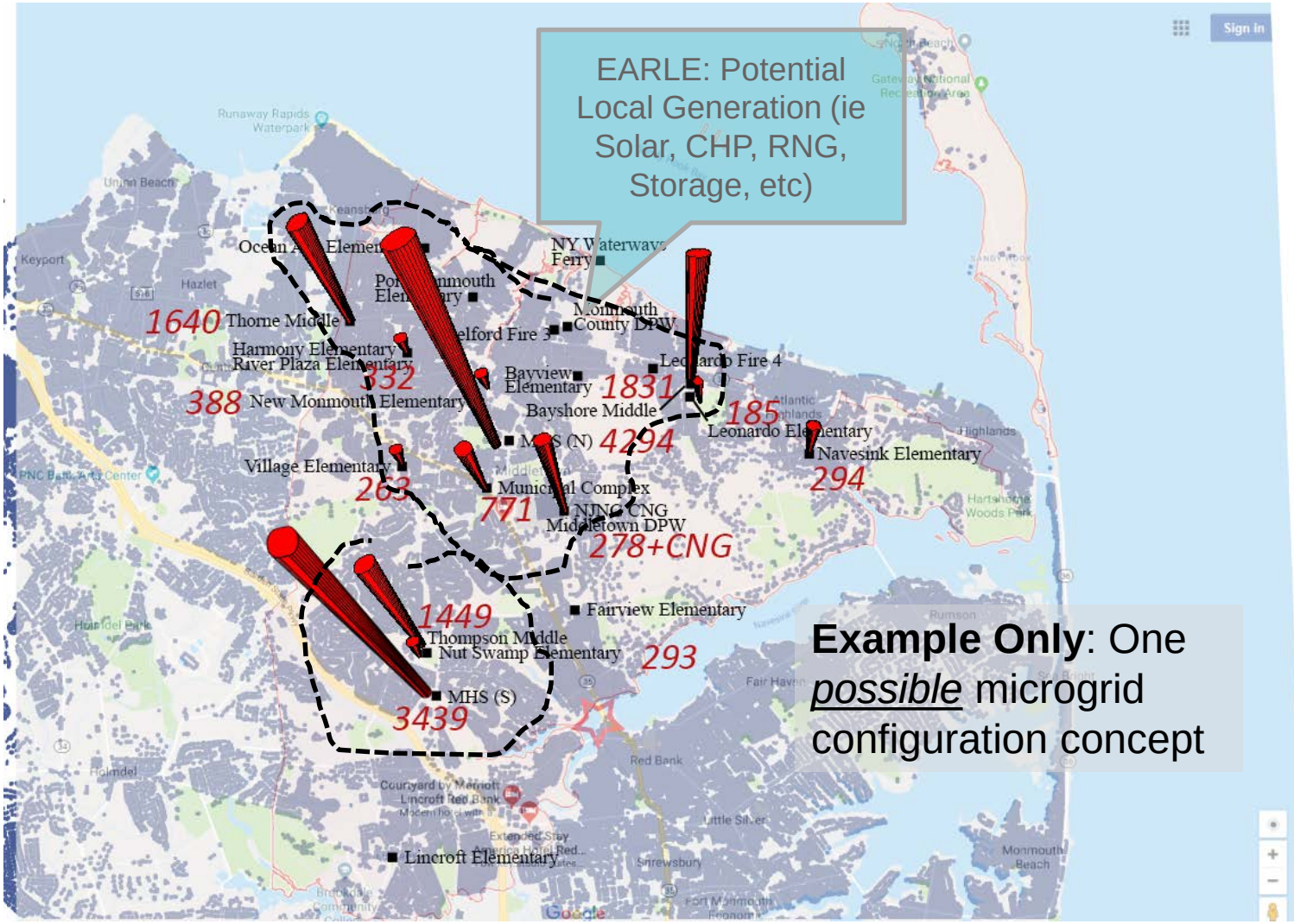


Relevant Technology Domains and Impacts

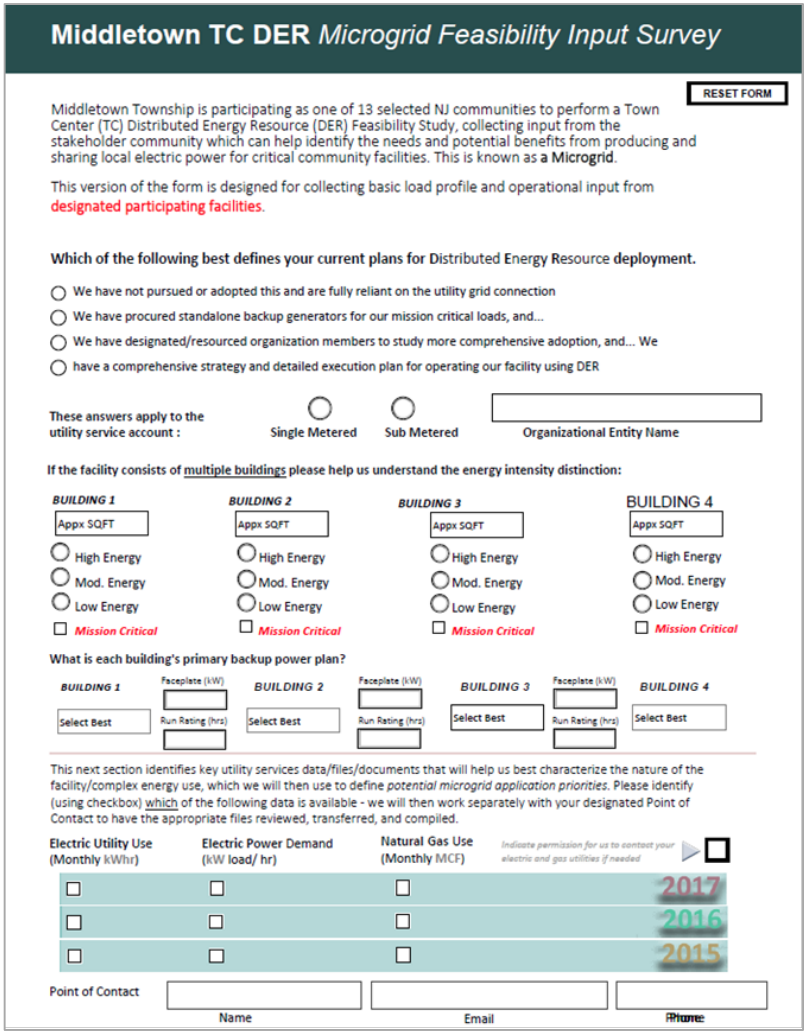
- IoT / Blockchain
- Energy Storage (incl. EV)
- Building Energy Mgmt
- Microcontroller/Microgrid
- SiC Power Electronics
- Smart Inverters
- Artificial Intelligence
- Multi Agent Platforms
- Security and Privacy
- Communications Systems / Protocols
- SCADA

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

Middletown Microgrid Energy Balance



TC DER Middletown Participant Survey



Middletown TC DER *Microgrid Feasibility Input Survey*

RESET FORM

Middletown Township is participating as one of 13 selected NJ communities to perform a Town Center (TC) Distributed Energy Resource (DER) Feasibility Study, collecting input from the stakeholder community which can help identify the needs and potential benefits from producing and sharing local electric power for critical community facilities. This is known as **a Microgrid**.

This version of the form is designed for collecting basic load profile and operational input from designated participating facilities.

Which of the following best defines your current plans for Distributed Energy Resource deployment.

- We have not pursued or adopted this and are fully reliant on the utility grid connection
- We have procured standalone backup generators for our mission critical loads, and...
- We have designated/resourced organization members to study more comprehensive adoption, and... We
- have a comprehensive strategy and detailed execution plan for operating our facility using DER

These answers apply to the utility service account : Single Metered | Sub Metered | Organizational Entity Name

If the facility consists of multiple buildings please help us understand the energy intensity distinction:

BUILDING 1	BUILDING 2	BUILDING 3	BUILDING 4
Appx SQFT	Appx SQFT	Appx SQFT	Appx SQFT
High Energy	High Energy	High Energy	High Energy
Mod. Energy	Mod. Energy	Mod. Energy	Mod. Energy
Low Energy	Low Energy	Low Energy	Low Energy
Mission Critical	Mission Critical	Mission Critical	Mission Critical

What is each building's primary backup power plan?

BUILDING 1	Faceplate (kW)	BUILDING 2	Faceplate (kW)	BUILDING 3	Faceplate (kW)	BUILDING 4
Select Best	Run Rating (hrs)	Select Best	Run Rating (hrs)	Select Best	Run Rating (hrs)	Select Best

This next section identifies key utility services data/files/documents that will help us best characterize the nature of the facility/complex energy use, which we will then use to define *potential microgrid application priorities*. Please identify (using checkbox) which of the following data is available - we will then work separately with your designated Point of Contact to have the appropriate files reviewed, transferred, and compiled.

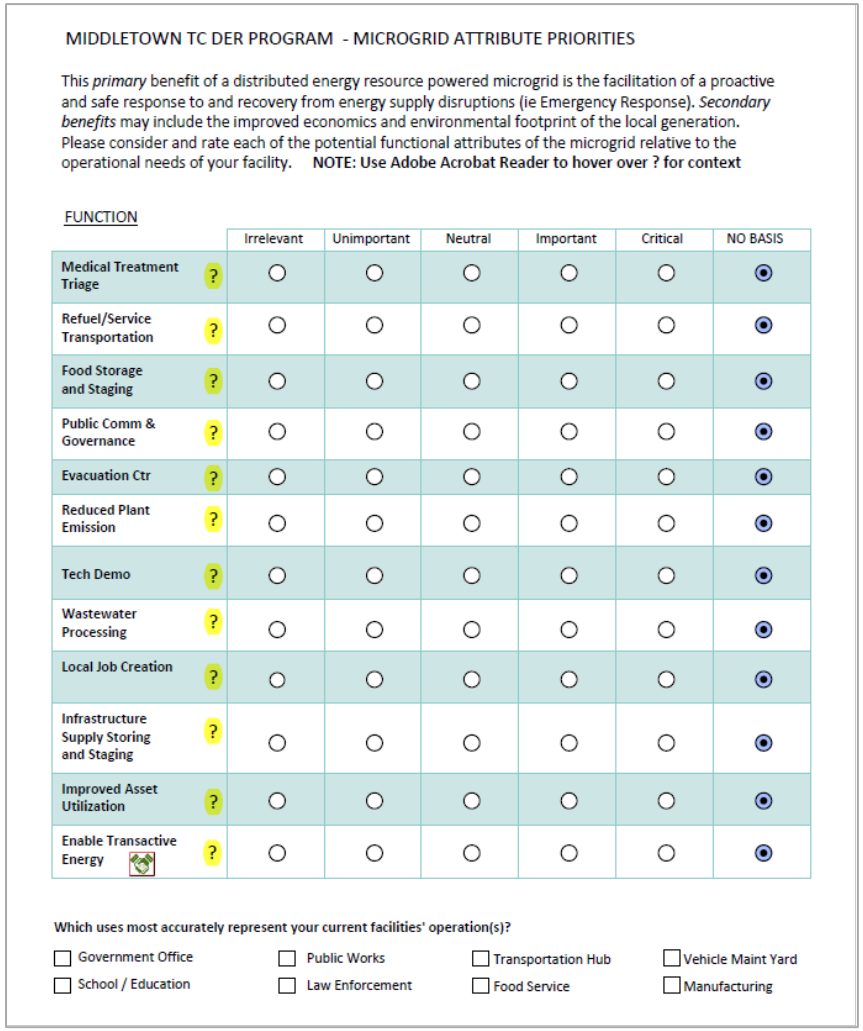
Electric Utility Use (Monthly kWhr)	Electric Power Demand (kW load/ hr)	Natural Gas Use (Monthly MCF)	*Indicate permission for us to contact your electric and gas utilities if needed*	
☐	☐	☐		2017
☐	☐	☐		2016
☐	☐	☐		2015

Point of Contact: Name | Email | Phone

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

TC DER Middletown Participant Survey



MIDDLETOWN TC DER PROGRAM - MICROGRID ATTRIBUTE PRIORITIES

This *primary* benefit of a distributed energy resource powered microgrid is the facilitation of a proactive and safe response to and recovery from energy supply disruptions (ie Emergency Response). *Secondary benefits* may include the improved economics and environmental footprint of the local generation. Please consider and rate each of the potential functional attributes of the microgrid relative to the operational needs of your facility. **NOTE: Use Adobe Acrobat Reader to hover over ? for context**

FUNCTION

	Irrelevant	Unimportant	Neutral	Important	Critical	NO BASIS
Medical Treatment Triage ?	○	○	○	○	○	◉
Refuel/Service Transportation ?	○	○	○	○	○	◉
Food Storage and Staging ?	○	○	○	○	○	◉
Public Comm & Governance ?	○	○	○	○	○	◉
Evacuation Ctr ?	○	○	○	○	○	◉
Reduced Plant Emission ?	○	○	○	○	○	◉
Tech Demo ?	○	○	○	○	○	◉
Wastewater Processing ?	○	○	○	○	○	◉
Local Job Creation ?	○	○	○	○	○	◉
Infrastructure Supply Storing and Staging ?	○	○	○	○	○	◉
Improved Asset Utilization ?	○	○	○	○	○	◉
Enable Transactive Energy ?	○	○	○	○	○	◉

Which uses most accurately represent your current facilities' operation(s)?

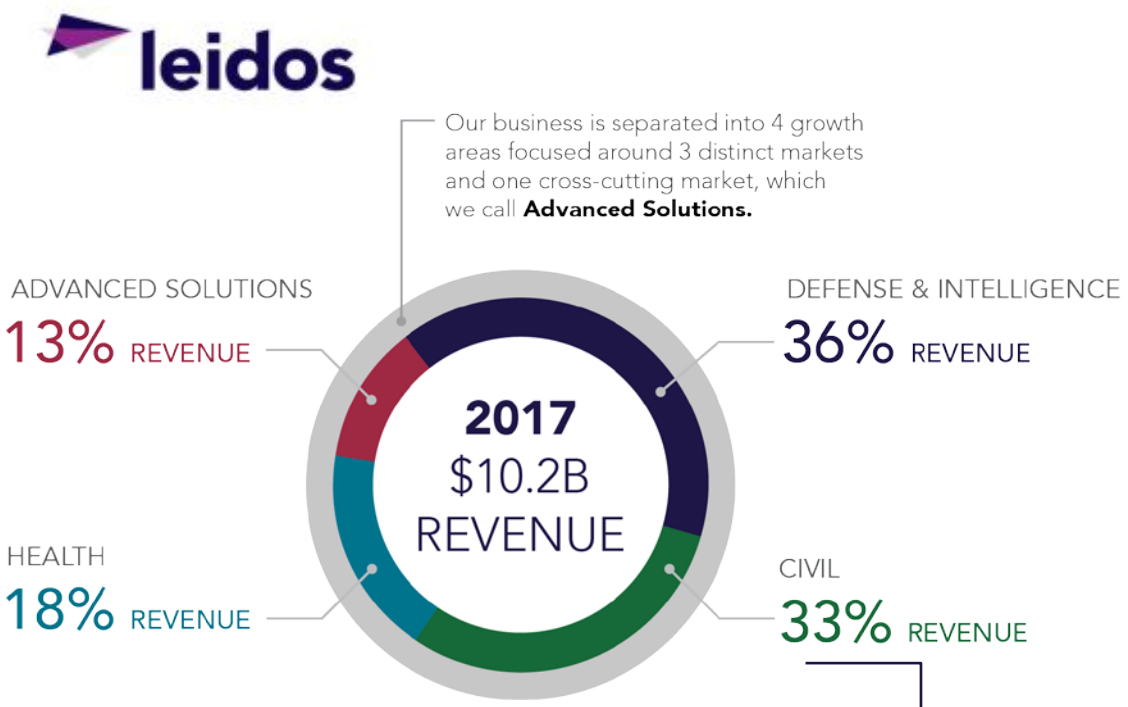
☐ Government Office ☐ Public Works ☐ Transportation Hub ☐ Vehicle Maint Yard
☐ School / Education ☐ Law Enforcement ☐ Food Service ☐ Manufacturing

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



Commercial Emergy 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

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

Project Purpose – Microgrid Study Grant

The 2015 New Jersey Energy Master Plan Update (EMP Update) established a new overarching goal: “Improve Energy Infrastructure Resiliency & Emergency Preparedness and Response.”

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:

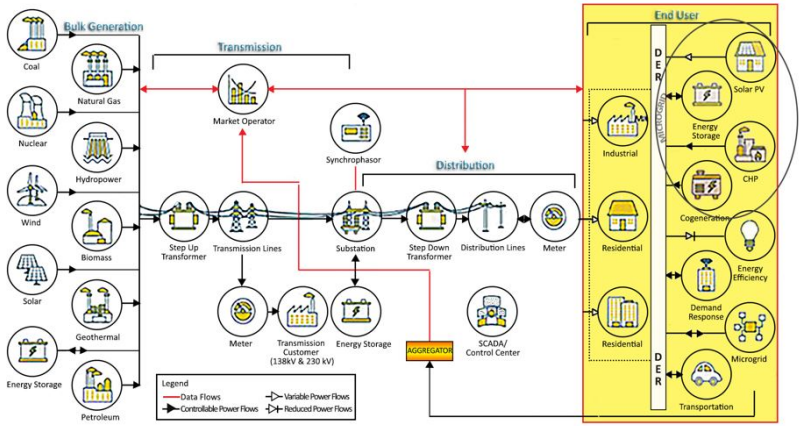
> *“The State should continue its work with the USDOE, the utilities, local and state governments and other strategic partners to identify, design and implement Town Center DER microgrids to power critical facilities and services across the State.”*

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

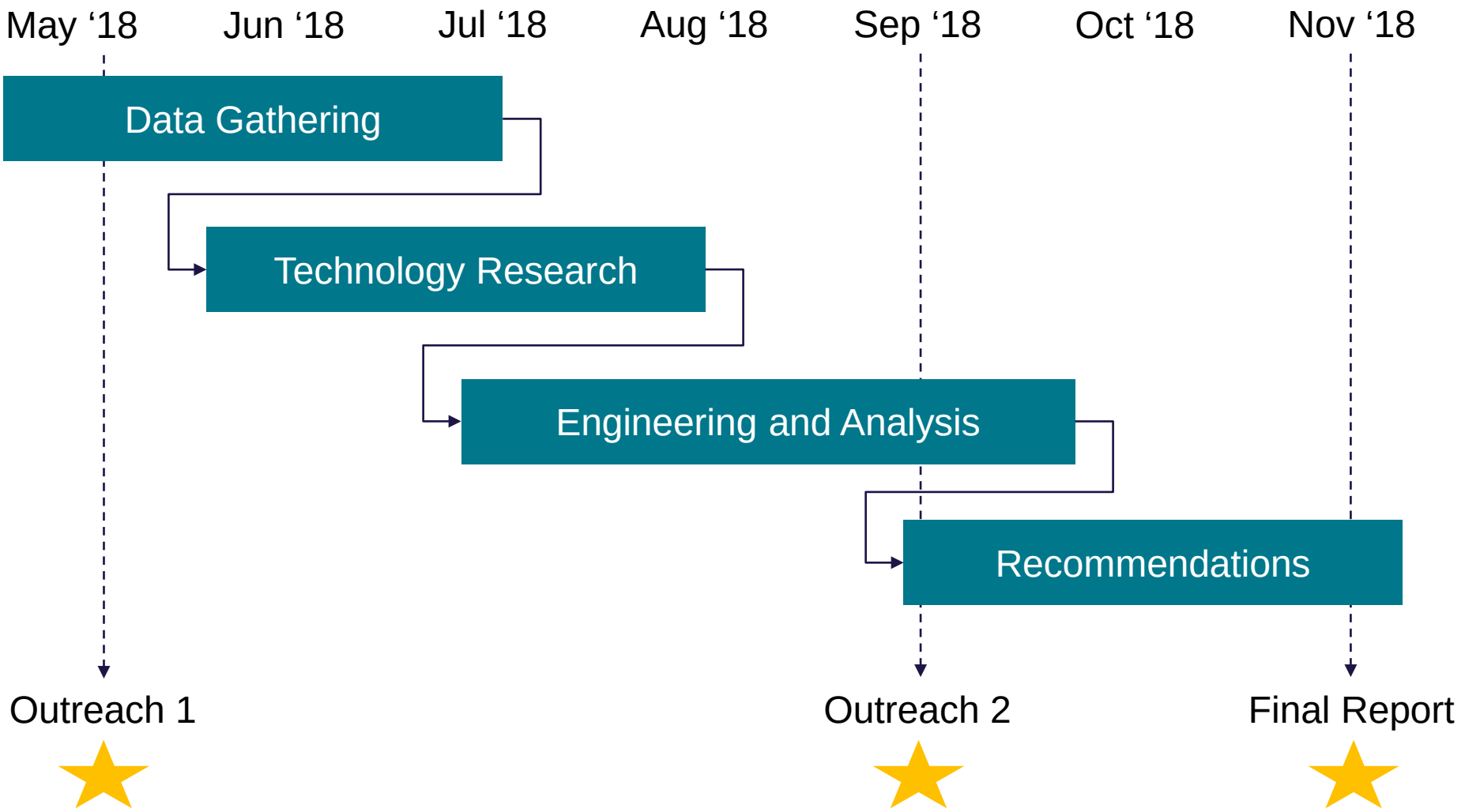
- Township of Middletown
- US Navy - Naval Weapons Station Earle
- Jersey Central Power and Light
- New Jersey Natural Gas
- Township of Middletown Sewerage Authority
- NY Waterways Ferry Terminal
- Middletown Board of Education
- County of Monmouth
- State of New Jersey Department of Transportation
- 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



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

Backup: Gov Murphy's Energy Plan (Priority#1)

- 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.

Backup: Gov Murphy's Energy Plan (Priority#2)

- 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.