Neptune Township Advanced Microgrid
Draft & Application
April 2020

Prepared for:

Township of Neptune

25 Neptune Boulevard

Neptune, New Jersey 07753

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1.1 Applicant Name and Address

Applicant Name: Township of Neptune

Applicant Address: 25 Neptune Boulevard, Neptune, NJ 07753

1.2 Applicant Contact Information

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1.3 Project Name

Neptune Township Advanced Microgrid

2.0 Project Description

2.1 A General Description of the Proposed TCDER Microgrid Project

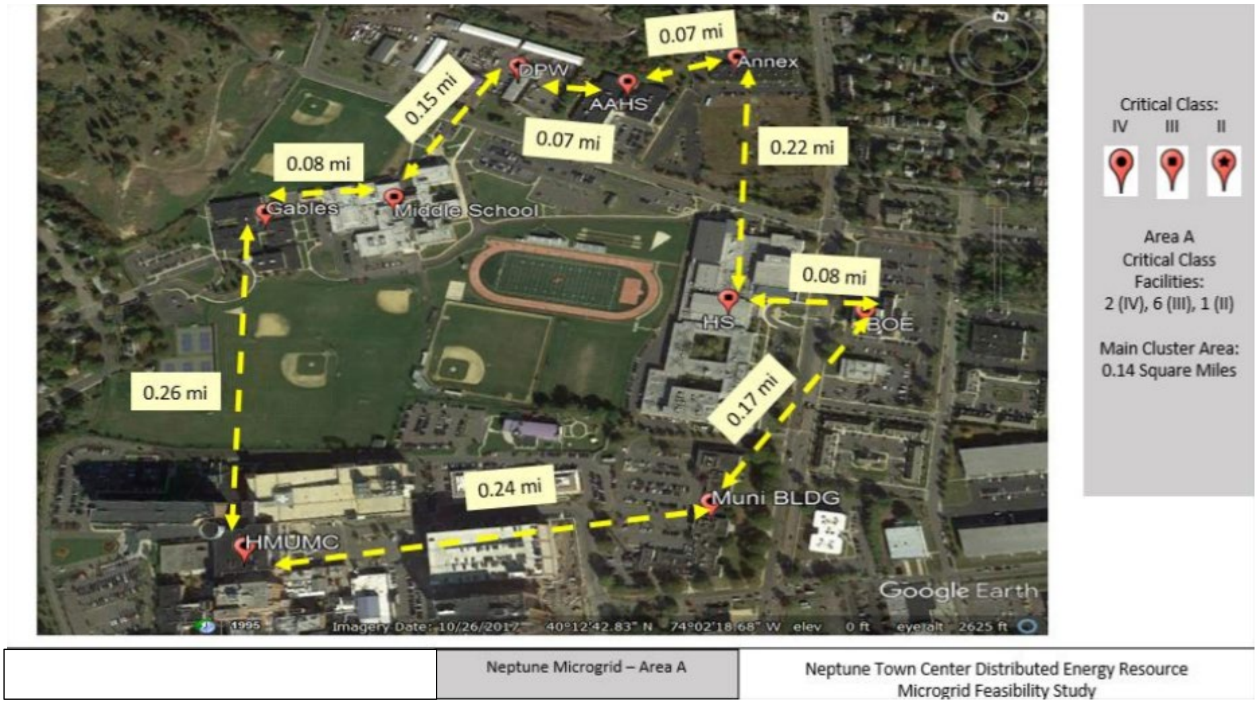


Figure 1 Project Location Map

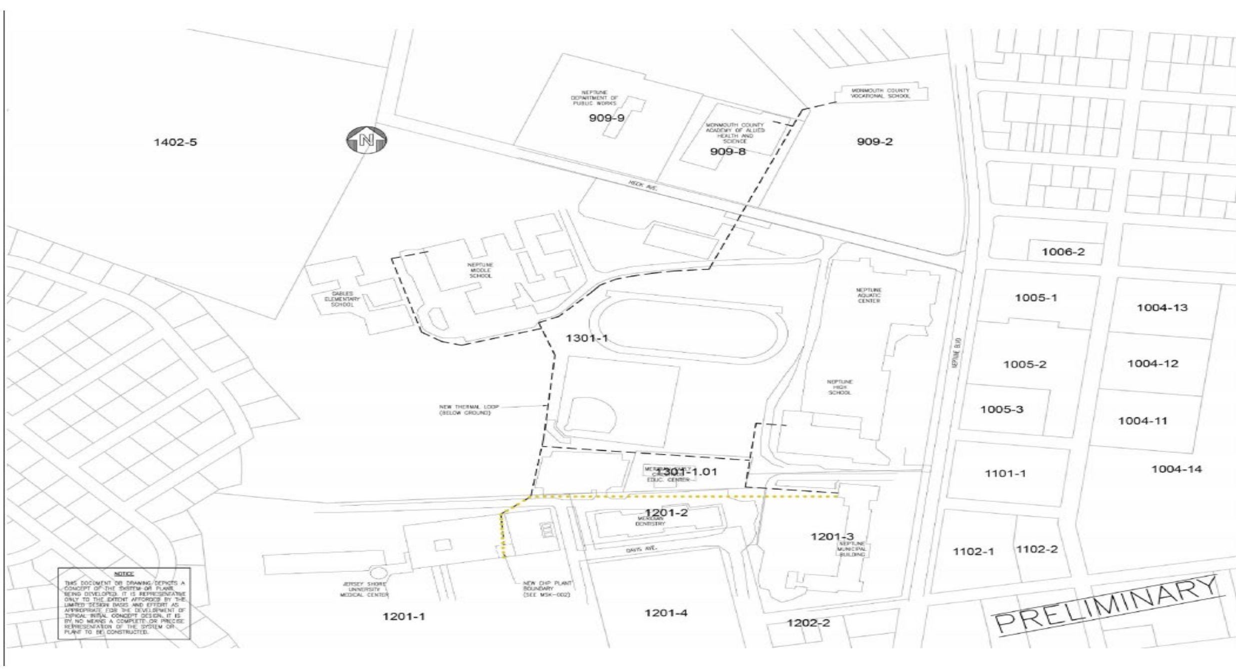


Figure 2 Project Technical Conceptual Architecture

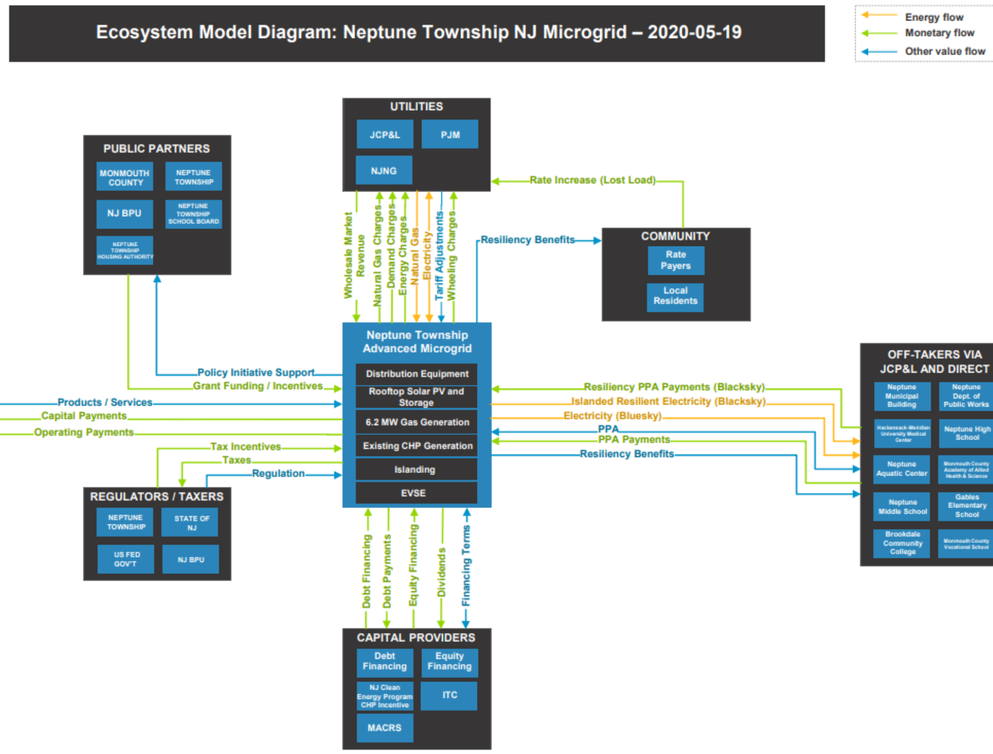


Figure 3 Project Commercial Conceptual Architecture

Executive Summary

The NTAM feasibility study identified the following facilities critical to the primary functions of the NTAM, including the Municipal Complex, the Hackensack-Meridian University Medical Center (HMUMC), and the Department of Public Works (DPW). The Microgrid will support the electric baseload of these critical facilities, allowing them to operate during black-sky conditions. These facilities are considered critical because of their location in proximity to the nerve-center of town, their electric and thermal loads, primary use and potential uses, occupancy, size, and FEMA classifications. Overall, electric demand tends to peak in the summer for these facilities, due to high occupancy from seasonal tourism and weather-based cooling requirements. To prepare for NTAM implementation, each facility has undergone technical inspections to determine energy demand requirements and management opportunities, energy conservation measures, and equipment requirements for a dynamic network of distributed generation.

Our recommended approach includes a new pair of reciprocating engines with approximately 6.2 MW output to be installed at the HMUMC, to be operated and managed in baseload mode and to complement the existing pair of reciprocating engines at the Medical Center. In addition, we are recommending Photovoltaics (PV) be added to all Township and County-owned facilities in Area A, with the except of the Neptune Board of Education (BOE), pending further technical information.

The needs of the potential sheltering candidates and evacuees can be complimented and NTAM black-sky services can be supplemented with the inclusion of additional facilities and infrastructure. To maintain focus on the intent of the study, we completed the evaluation and analyses for Area A and performed additional work investigating a secondary cluster of facilities identified as Area B. However, for the purpose of this Phase 2 30% design effort, we are proceeding only with Area A. The Feasibility Study findings regarding Area B have been shared with the various Area B stakeholders for their information and potential future use.

As a further justification for the criticality of this microgrid, given the current situation with COVID-19, many of our municipal and county partners find themselves in need of black start capable facilities. Having broadband capacity has become more crucial than ever, especially with our many schools having to go remote. One could only imagine the added complication that a power loss would bring to already stressed local, county and school services. Additionally, working together with our partners at the Hackensack Medical Center network, we will examine ways that the microgrid benefits can help make the entire region more prepared for future events such as this by creating more places that have hardened systems to help serve the needs of the community from healthcare to food processing and emergency shelter.

Area A Project Description

Area A's energy consumption characteristics are typical for facilities located in New Jersey and depend primarily on occupancy and the outside air temperature. While occupancy and dynamic heat loads are scheduled, repetitive and predictable, the weather is variable. Accordingly, Area A uses more electric in the warmer summer months to accommodate space cooling. It is expected that during these periods, the demand costs will be higher. Conversely as electric consumption reduces, natural gas consumption increases to provide heating during the colder months.

2.2 Project Differences from the Feasibility Study Project

There are no differences from the Phase I Feasibility Study.

2.3 A Listing of Each Facility that will be Part of the TCDER Microgrid.

This listing includes:

	Facility Name	FEMA Category	Public Shelter Capacity	Essential Emergency Services	Why Included?	Who Benefits?
1	Neptune Municipal Building (incl. PD and Library)	IV	-	Police Department, Library	The facility is critical for serving public safety, coordinating any disaster response, and maintaining public services.	The facility and related community service.
2	Neptune Department of Public Works	II	2,750 Sq. Ft.	Waste Management, Infrastructure Repair	A functioning DPW is critical to supporting infrastructure and logistics and can mitigate the impacts of disasters and directly serve citizens during Black Sky events.	The facility and related community service.
3	Hackensack-Meridian University Medical Center	IV	-	Hospital, Central Utilities Plant	Hospital critical to offering medical services during Black Sky events. Central Utilities Plant houses the CHP equipment necessary for providing utilities to the microgrid.	The facility, and community medical service.

4	Neptune High School & Aquatic Center	III	151,686 Sq. Ft.	Education, Shelter	Shelter capacity.	The facility and community
5	Monmouth County Academy of Allied Health & Science	III	22,150 Sq. Ft.	Education, Shelter	Shelter capacity, possible PV addition.	The facility and community
6	Neptune Middle School	III	83,595 Sq. Ft.	Education, Shelter	Shelter capacity, possible PV addition.	The facility and community
7	Gables Elementary School	III	26,666 Sq. Ft.	Education, Shelter	Shelter capacity, possible PV addition.	The facility and community
8	Neptune Board of Education / Brookdale Community College	III	22,075 Sq. Ft.	Education, Shelter, Triage	A microgrid would enable Brookdale Community College to leverage its facilities for shelter and triage should that become necessary.	The facility and community
9	Monmouth County Vocational School – Neptune Annex	III	10,019 Sq. Ft.	Education, Shelter	Shelter capacity, possible PV addition.	The facility and community

Neptune Municipal Building (incl. PD & Library)

25 Neptune Boulevard, Neptune City, NJ 07753
Risk Category IV
Area:83,000 Sq. Ft.
Annual Electric Consumption: 1,229,064 kWh
Annual Gas Consumption: 46,177 Therms

Neptune Township has a land area of eight (8) square miles and is situated in the central easternmost part of Monmouth County. Neptune is a community with several diverse neighborhoods including Ocean Grove, Shark River Hills, Mid-Town, Bradley Park, the Gables, Seaview Island and West Neptune. This facility serves as a Municipal Complex to the Township and includes the Police Department and Library. The facility is critical for serving public safety, coordinating any disaster response, and maintaining public services.

The Municipal Building contains two (2) electric and two (2) gas meters which serve the whole complex.

Highlights included in our design and modeling assumptions include metering information and current facilities description.

Neptune Department of Public Works

2201 Heck Ave, Neptune City, NJ 07753
Risk Category II
Area: 11,000 Sq. Ft.
Annual Electric Consumption: 248,880 kWh
Annual Gas Consumption: 12,041 Therms

Neptune Department of Public Works (DPW) serves the community in several critical ways, including waste management, infrastructure repair, and other public services. A functioning DPW is critical to supporting infrastructure and logistics and can mitigate the impacts of disasters and directly serve citizens in during Black Sky events.

The DPW's energy consumption characteristics are typical for a public facility of similar size and shape and depend primarily on occupancy and the outside air temperature. While occupancy and dynamic heat loads are scheduled, repetitive and predictable, the weather is variable. Accordingly, the DPW uses more electric in the warmer summer months to accommodate space cooling. Conversely as electric consumption reduces, natural gas consumption increases to provide heating during the colder months. The DPW has one (1) electric and one (1) gas meter which serves the whole facility.

The Neptune Department of Public Works was visited in our site tour on December 19th. Highlights included in our design and modeling assumptions include metering information and current facilities description.

Hackensack-Meridian University Medical Center

1945 NJ-33, Neptune City, NJ 07753
Risk Category IV
Area: 815,995 Sq. Ft.
Annual Electric Consumption: 51,640,666 kWh
Annual Gas Consumption: 1,808,400 Therms

Hackensack-Meridian University Medical Center (HMUMC) is a key stakeholder with unmatched crisis assistance resources within miles of the evacuation routes which pass through Neptune Township. Founded in 1904, HMUMC has grown from a fifty (50) bed home for women and children to an approximately 1.5 million square foot multi-building facility, providing a long list of services, including cancer care, diagnostic imaging, interventional radiology, neuroscience institute, and rehabilitation services. HMUMC is broken up into seven (7) pavilions, which include the Brennan Pavilion, the Booker Pavilion, the Mehandru Pavilion, the Ackerman Pavilion, the Rosa Pavilion, the Rosa Diagnostic and Treatment Pavilion, and the Northwest Pavilion. In addition, the trauma center provides expertise and specialty capabilities unavailable at any other Medical Center in Monmouth or Ocean County. Designated by the State as a Level II Trauma Center in 1990, HMUMC treats more than 1,600 trauma patients per year.

A Level II Trauma Center means patients are cared for by a team of experts who specialize in traumatic injury. HMUMC is staffed 24-hours-a-day, seven days a week, 365 days a year. HMUMC provides vital elements not available at other medical centers, including full time board-certified trauma surgeons, 24hour CT scans, operating rooms staffed around-the-clock, a dedicated Surgical Intensive Care unit and a Pediatric Intensive Care Unit. The trauma admitting area is staffed by specialized nurses and technicians whose sole responsibility is to care for trauma patients. All elements ensure that trauma patients will receive the specialized care they need to increase the chance of survival from serious injury. NTAM will center on providing adequate support to the necessary services and infrastructure required to protect and maintain the essential needs of the facility, staff, and suppliers of this medical center.

HMUMC was visited in our site tour on December 19th and July 24th. The following information was realized on-site, from both field observations and from HMUMC staff.

HMUMC has a Central Utilities Plant, which contains equipment for electricity distribution to the various Medical Center spaces, generators, and the major mechanical equipment. It is served by JCP&L's J-88 subtransmission 34kV feeder, entering at Corlies Avenue and Davis Avenue, where it is transformed to 12kV for distribution to most facilities, with the exception of the Booker Child Care Center and the Medical Office Facility at 81 Davis Avenue, which is distributed at 480V. In addition to this feeder, the Central Utilities Plant has two (2) black-start capable 2000 kV oil emergency generators, as well as two (2) 1500 kV natural gas generators. The natural gas reciprocating engines have an approximately 3.6 MW output, with heat-recovery equipment to utilize the heat generated from running the engines, functioning as Combined Heat and Power (CHP) units. There are four other emergency diesel generators, located at the Brennan Pavilion, Ackerman Pavilion, Amdur Ambulatory Care Center, and Mehandru Pavilion.

Regarding thermal consumption, HMUMC utilizes their CHP units, as well as three (3) boilers, rated 20,000 pounds/hour. Steam is used for sterilization, humidification in the Hope Towers, and space heating in the winter, as some facilities have steam converters. The only direct steam load is for their ten (10) sterilizers, which include three (3) vacuum sterilizers, five (5) cart sterilizers, and two (2) standup sterilizers located throughout the campus. Approximately 120,000 square feet of the Medical Center utilizes steam converters, including the Rose Pavilion, Booker Pavilion, Ackerman Pavilion, and Amdur Ambulatory Care Center. Hot water is used for space heating during the winter in most facilities, as well as domestic hot water and the VAV reheat system year-round.

Regarding chilling, HMUMC has four vapor compression chillers and one absorption chiller, with a combined capacity of 5,900 tons. The Medical Center supplies chilled water year-round, to provide cooling to certain types of medical equipment (such as MRI machines) and to their interval server room, with a much larger load on hot summer days. The chilling baseload is approximately 1,200 tons, while the peak is around 5,000 tons of chilling, with one of the chillers functioning in reserve.

The Medical Center's energy consumption characteristics are typical for an acute-care Medical Center and trauma center of similar size and shape and depends primarily on the outside air temperature. Occupancy is high, repetitive, and predictable, the weather is variable. Accordingly, the Medical Center uses more electric in the warmer summer months to accommodate space cooling. Conversely as electric consumption reduces, natural gas consumption increases to provide heating during the colder months. The consumption is balanced using the on-site CHP system. HMUMC includes one electric meter and several gas meters that serve the entirety of the Medical Center.

Neptune High School & Aquatic Center

55 Neptune Boulevard, Neptune City, NJ 07753
Risk Category III
Area: 303,371 Sq. Ft.
Annual Electric Consumption: 5,515,089 kWh
Annual Gas Consumption: 31,351 Therms

The Neptune Township Schools are a comprehensive community public school district that serves students in pre-kindergarten through twelfth grade from Neptune Township, Monmouth County, New Jersey. The Neptune High School (NHS) encompasses the Neptune Aquatic Center, which holds a 32,000 square-foot, 335,000-gallon pool that is used for instructional, educational, recreational, and therapeutic activities. The community relies on the center, which itself relies on consistent energy for temperature control and comfort.

NHS's energy consumption characteristics are typical for a public facility of similar size and shape and depend primarily on occupancy and the outside air temperature. While occupancy and dynamic heat loads are scheduled, repetitive and predictable, the weather is variable. Accordingly, NHS uses more electric in the warmer summer months to accommodate space cooling. Conversely as electric consumption reduces, natural gas consumption increases to provide heating during the colder months. NHS contains two (2) electric and two (2) gas meters which serve the whole facility.

NHS and Aquatic Center was visited in our site tour on December 19th. Highlights included in our design and modeling assumptions include metering information and current facilities description.

Monmouth County Academy of Allied Health and Science

2325 Heck Ave, Neptune City, NJ 07753
Risk Category III
Area: 44,299 Sq. Ft.
Annual Electric Consumption: 725,520 kWh
Annual Gas Consumption: 35,751 Therms

The Academy of Allied Health and Science (AAHS) was established in 1996, as a small magnet public high school located in Neptune Township, in Monmouth County, New Jersey. The school is one of five career academies offered by the Monmouth County Vocational School District. This high school is based upon the expansion of medical knowledge for teenagers who want to pursue medical careers. It serves grades nine through twelve and maintains about 300 students.

The AAHS's energy consumption characteristics are typical for facilities of similar size and shape and depend primarily on occupancy and the outside air temperature. While occupancy and dynamic heat loads are scheduled, repetitive and predictable, the weather is variable. Accordingly, the AAHS use more electric in the warmer summer months to accommodate space cooling. Conversely as electric consumption reduces, natural gas consumption increases to provide heating during the colder months. The AAHS contains one (1) electric and one (1) gas meter which serve the whole facility.

The facility was not included in our site visit schedule due to its smaller size and the team's larger focus on the anchor site nearby of the HMUMC.

Neptune Middle School

2300 Heck Ave, Neptune City, NJ 07753
Risk Category III
Area: 167, 190 Sq. Ft.
Annual Electric Consumption: 2,059,561 kWh
Annual Gas Consumption:91,576 Therms

Neptune Middle School (NMS) is located adjacent to Neptune High School and Gables Elementary School. NMS provides utility services to Gables Elementary School, so its thermal consumption is inclusive of both facilities.

NMS's energy consumption characteristics are typical for a public facility of similar size and shape and depend primarily on occupancy and the outside air temperature. While occupancy and dynamic heat loads are scheduled, repetitive and predictable, the weather is variable. Accordingly, NMS uses more electric in the warmer summer months to accommodate space cooling. Conversely as electric consumption reduces, natural gas consumption increases to provide heating during the colder months. The NMS/Gables Elementary contain one (1) electric and one (1) gas meter which serve both facilities.

NMS was visited in our site tour on December 19th. Highlights included in our design and modeling assumptions include metering information and current facilities description.

Gables Elementary School

1 Gables Court, Neptune City, NJ 07753
Risk Category III
Area: 53,332 Sq. Ft.
Annual Electric Consumption: 734,560 kWh
Annual Gas Consumption: 0 Therms

Gables Elementary School (GES) teaches approximately 300 students from pre-kindergarten through fifth grade and is adjacent to and shares utility services with NMS.

GES's energy consumption characteristics are typical for a public facility of similar size and shape and depend primarily on occupancy and the outside air temperature. While occupancy and dynamic heat loads are scheduled, repetitive and predictable, the weather is variable. Accordingly, the GES uses more electric in the warmer summer months to accommodate space cooling. The NMS/Gables Elementary contain one (1) electric and one (1) gas meter which serve both facilities.

GES was not included in our site visit schedule due to the facilities smaller size, main mechanical equipment located at NMS, and the team's larger focus on NHS.

Neptune Board of Education / Brookdale Community College

60 Neptune Boulevard, Neptune City, NJ 07753
Risk Category III
Area: 44,149 Sq. Ft
Annual Electric Consumption: 502,640 kWh
Annual Gas Consumption: 18,164 Therms

The Neptune Board of Education (BoE) is responsible for the administrative, security, and financial wellbeing of the Township's school district. It also houses Brookdale Community College, which serves over 12,000 students across Monmouth County. In addition to protecting their security, a Microgrid would enable Brookdale Community College (BCC) to leverage its facilities for shelter and triage should that become necessary.

The Community College Facility's energy consumption characteristics are typical for a public facility of similar size and shape and depend primarily on occupancy and the outside air temperature. While occupancy and dynamic heat loads are scheduled, repetitive and predictable, the weather is variable. Accordingly, the Community College Facility uses more electric in the warmer summer months to accommodate space cooling. Conversely as electric consumption reduces, natural gas consumption increases to provide heating during the colder months. The Neptune BoE/BCC contain one (1) electric and one (1) gas meter, which serve both facilities.

Neptune BoE/BCC was visited in our site tour on December 19th. Highlights included in our design and modeling assumptions include metering information and current facilities description.

Monmouth County Vocational School: Neptune Annex

105 Neptune Boulevard, Neptune City, NJ 07753
Risk Category III
Area: 20,038 Sq. Ft.
Annual Electric Consumption: 198,880 kWh
Annual Gas Consumption: 7,663 Therms

The Neptune Annex of Monmouth County Vocational School supports the Monmouth County Allied Health and Science Facility.

The Annex energy consumption characteristics are typical for facilities of similar size and shape and depend primarily on occupancy and the outside air temperature. While occupancy and dynamic heat loads are scheduled, repetitive and predictable, the weather is variable. Accordingly, the Vocational School and Annex use more electric in the warmer summer months to accommodate space cooling. Conversely as electric consumption reduces, natural gas consumption increases to provide heating during the colder months. The Annex includes nine (9) electric meters and one (1) natural gas meter that support the complex. The site was not included in our site visit rotation due to the team's larger focus on the anchor site nearby of the HMUMC.

3.0 Technical Summary

3.1 Legal Permissibility

New Jersey's Local Redevelopment and Housing Law (N.J.S.A.40A:12A-14) grants local governments powers that can be useful in developing the microgrid. The ability to designate a preferred developer to complete the project, the ability to assemble blocks of property (or in this instance access to blocks of property), to obtain financing for the project and to provide relief from building and zoning codes to accommodate development of the required infrastructure are all measures that will have value in completing this complex undertaking. Use of these provisions would be based upon the following factors:

- The microgrid project area contains critical government & public health facilities
- Standards for these critical facilities were established following Hurricane Irene & Superstorm Sandy
- Standards call for these facilities to have continuing operational capacity
- The existing infrastructure does not meet these standards
- The failure to meet these standards in the project area is an impediment to the economic viability of the area
- The substandard infrastructure in the project area is a threat to public health & safety
- The implementation of the microgrid project will alleviate the substandard conditions
- The project will require coordinated planning and investment over a period of years to construct the necessary facilities
- The project will cover multiple properties and require assembling legal access to these properties for both construction of infrastructure and creation of utility rights of way
- The project will require considerable financing
- Continuity from planning to construction and implementation would be best served by identifying a single project team to implement the creation of the microgrid from planning to commissioning

New Jersey's redevelopment law provides local governments with the tools necessary to effectively address the factors cited above.

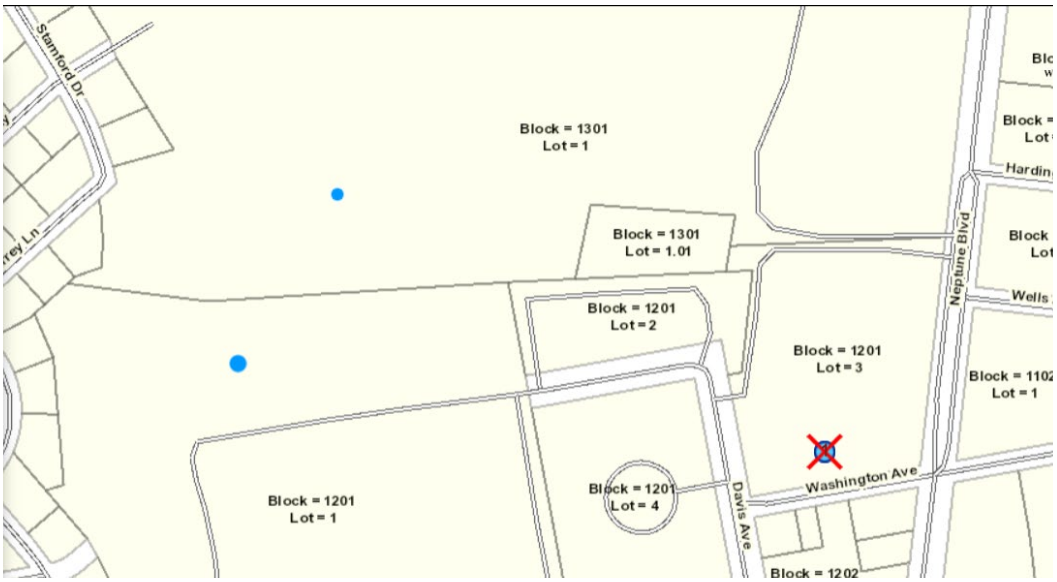
The New Jersey Local Redevelopment Law is applicable in this instance based upon the current status of infrastructure in the microgrid area. The project area will serve hospitals, police, fire, sewer, and water facilities that are vulnerable to disruption during extreme weather and other events. The facilities located within the study area have been determined to be "critical" by both FEMA and the NJBPU. The necessity for creating a resilient power grid that can enable these facilities to operate in time of disaster was revealed during and after flooding from Hurricane Irene and Superstorm Sandy.

Standards for infrastructure supporting these critical facilities have been established by the State of New Jersey and the study area does not meet these standards. The existing electrical infrastructure is obsolete and insufficient to ensure continued operations under emergency conditions. This is both an impediment to the economic vitality of the study area and a threat to public health and safety. The substandard infrastructure serves to meet the statutorily established criteria for a finding that the study area meets the definition as "in need of redevelopment".

The State of New Jersey has recognized the ability to invoke the provisions of the LRHL in similar circumstances prior to this undertaking. Designating the microgrid study area as either an "area in need of redevelopment" or an "area in need of rehabilitation" will allow for the creation of a comprehensive plan to gain access to the subject properties, design the microgrid infrastructure in an appropriate manner, finance the project and implement construction and operation of the microgrid in a rational and efficient manner. This will allow for the installation of the infrastructure necessary to accommodate resiliency, black start capability, critical facility support and overall economic growth and development.

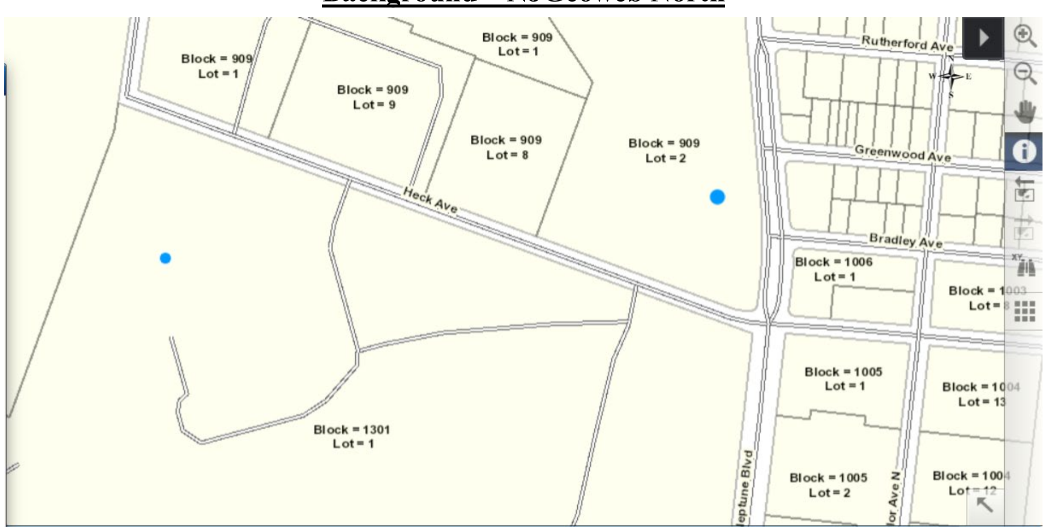
The initial feasibility study will serve, in part, as the required redevelopment study necessary to support the preferred designation. Going forward, pursuant to the local redevelopment law, the local governing body can name a redevelopment team and that team will be authorized to move forward to final design and implementation of the microgrid. The redevelopment envisions a linear easement for all of the activities, which will allow this microgrid to be consistent with all of the laws and statutes in the state of New Jersey, that will run conterminously with the final design of the project. The clear inherent public benefits of the community microgrid relative to economic development and enabling continued critical government and public health functions make this project fully consistent with the laws, regulations and goals of the State of New Jersey.

Background – NJGeoweb South



- Block 1201, Lot 1: Owner Meridian Hospitals Corp
- Block 1201, Lot 2: Owner Modern Health Realty Corp
- Block 1201, Lot 3: Township of Neptune
- Block 1201, Lot 4: Owner Meridian Hospitals Corp
- Block 1301, Lot 1: Neptune BOE

Background – NJGeoweb North



- Block 909, Lot 2: Owner Monmouth County Vocational School BOE
- Block 909, Lot 8: Owner Monmouth County Vocational BOE

3.2 Description of Distributed Energy Resources (DER)

To meet the required loads under various conditions, a CHP installation centered on a new pair of reciprocating engines with approximately 6.2 MW output is recommended, along with photovoltaics, a hot water supply and return loop, and appropriate Microgrid sectionalization and controls. This CHP system would be designed to run in baseload mode and equipment selection should emphasize reliability, maintainability, and availability. The existing CHP generation at the medical center should be retained and be run in peaking mode. In addition to the new CHP engines, new PV systems should be added to every suitable roof of the Township- and County-owned facilities, with the potential to add Roof-mounted PV systems and parking lot canopies to HMUMC. At least 920 kW to 1.6 MW of PV system could be added to Area A.

	DER Asset	Technology	Size (MW)	Microgrid Integration
1	Reciprocating Engines	Gas Engine Generator (CHP)	6.2	Two (2) new reciprocating engines to be integrated into the HMUMC Central Utilities Plant alongside existing reciprocating engines.
2	Roof-mounted PV System	Photovoltaic	1.6	Roof-mounted PV systems to be added to every suitable roof of the Township- and County-owned facilities, with the potential to add Roof-mounted PV systems and parking lot canopies to HMUMC.

Baseload Microgrid generation resources, which include both dispatchable and continuous assets, should be able to meet non-HMUMC Critical Loads and HMUMC's Essential Loads during an extended outage. Total Microgrid generation resources, which include the baseload generation, as well as the PV system, batteries, existing Area A natural gas back-up generators, and HMUMC diesel generators, should be able to meet even the peak summer loads for the non-HMUMC facilities and peak HMUMC loads. In addition, the sizing, selection, and configuration of the new equipment is intended to optimize the Blue-sky economics to minimize the capital expenditure needed to achieve the required Black-sky capacity.

The dispatchable and continuous generation assets at HMUMC will be electrically connected from the HMUMC's 12kV mini substation to the underground portion of feeder 57498, which feeds the non-HMUMC facilities. Thermally, a direct buried hot water supply and return loop will be created from HMUMC to supply the adjacent facilities via shallow underground trenching across the athletic fields.

Natural gas engines for power generation offer low first cost, fast start-up, proven reliability when properly maintained, excellent load-following characteristics, and significant heat recovery potential. As a combustion by-product, gas engine generators produce "waste-heat" in the forms of hot water (used to cool the engine) and hot exhaust gas. This waste heat can be transferred to usable thermal energy in the form of hot water, steam, or chilled water. Thermal loads most amenable to engine-driven CHP systems in commercial/institutional buildings are generally matched with space heating and hot water requirements for the host facility or connected facilities via a thermal heating loop; aka – District Energy Heating System. The primary applications for this technology in the commercial/institutional and residential sectors are those building types with relatively high and coincident electric and hot water demand such as institutional facilities, multifamily residential buildings, and lodging.

Photovoltaic (PV) devices convert light energy to electricity. When semiconducting materials are exposed to light, they absorb some of the sun's energy in the form of photons and emit electrons in the form of electricity. PV systems are made up of multiple components that collect the sun's radiated energy, convert it to electricity and transmit the electricity in a usable form. The performance of the PV array is affected on-site by geographic, meteorological, and seasonal conditions, as electricity production is dependent on the amount of solar irradiance the array is able to receive any one location, cloud cover, and other environmental factors such as smog and dust. Electricity produced by individual panels is direct current which is brought together in a combiner box and fed as a single DC flow to an inverter which converts the electricity to alternating current, a form that can distributed, transmitted or exported by the electrical grid.

District energy is a long-term investment to improve the physical infrastructure of the community it serves. It consists of a network of underground pipes carrying hot water, steam, or chilled water from a central plant to the buildings using the service. District energy networks offer a complementary infrastructure to gas and electricity networks. When coupled with appropriate DERs they can exploit a variety of fuel sources, both fossil and renewable, such as natural gas, geothermal, and solar/photovoltaic. The proposed district energy network will be able to capture and distribute surplus heat generated by the RICE CHP system within the microgrid and satisfy the aggregate the thermal demand of multiple buildings to a scale that enables the use of technologies with higher efficiencies, or ones that may otherwise not prove to be economical to deploy at the individual building level.

3.3 Level of Design

We propose to deliver a 30% - 35% level "Concept Design" package as guided by the 2009 US Army Corps of Engineers New York District Design Submission Requirements Manual. This design package will also include a commercial design sufficient to assess and demonstrate project financeability to a private third-party sponsor equity investor. We have organized the concepts design package into the following engineering workplans (EWP).

EWP #1 - 15% Basis of Design Document Approval

The engineering consultant in this phase would perform the following services:

- Alignment of stakeholder's business case with the project design basis
- Ratification of project schedule & critical milestone dates
- Development of fundamental inputs for the microgrid model driving detail design development
    - Review of updated utility information for all potential members of the microgrid
    - Heat & mass balance model development
    - Refine equipment sizing and selection
    - Define the general arrangement of equipment
    - Solar PV system definition, building structural analysis for roof mounted arrays
    - Battery storage system definition
    - Layout of thermal distribution network and schematic design of facility interface
    - Quantification of side reduction opportunities
    - Medium and low voltage electrical system model development
    - Interconnection design and agreement applications
    - CHP system integration with process and condition assessment of integrated BOP components

Deliverables under this task would serve to allow the project team to have a clear understanding of the project background, goals, directives, and criteria. The engineering consultant may recommend additional project basis to be established if deemed necessary, such that all parties involved in the project would have a common and clear understanding of the project requirements as the project design proceeds.

EWP #2 – 25% Schematic Design Review

The engineering consultant in this Phase would provide the following deliverables:

- PFD, P&ID (Natural Gas, Hot Water, Chilled Water, Combustion Air and Emission Systems and electrical distribution), Major and all BOP Equipment Layouts, Electrical SLDs, Thermal and Process Interconnections, Network Architecture and Permits Definition.
- Major Equipment Procurement Specifications and Qualification, Evaluation and Selection Criteria
- Integration of Underwriter's Design Compliance Review/Stipulations

Deliverables in this gate will lead to confirmation that the proposed DERs sizing and configuration as well as any other DG assets would be optimized based on consideration of the service areas electrical and thermal demands, the established performance and economics targets, the project requirements of all stakeholders, environmental permitting, and all applicable codes and standards. The engineering consultant would report challenges discovered, suggest appropriate improvement, and identify technical hurdles for discussion and resolution with the project stakeholder team.

EWP #3 - 35% Concept Design
The engineering consultant in this phase would provide the following progress review:

- 3D model presentation of the expanded CHP system at Hackensack-Meridian University Medical Center (HMUMC)
- Solar PV layout and electrical design/interconnection
- Electrical distribution layout and details
- Thermal distribution layout
- The engineers' estimate of probable cost itemizing the implementation costs of each Measure including:
    - Major Equipment - budgetary quotations for all major equipment and systems will be included in the estimate for the prime mover and all CHP auxiliary systems. The study will include a detailed technical offering from a North American OEM/CCHP Packager.
    - Mechanical Systems – all balance of plant equipment (additions or modifications thereto) inside the battery limit of the project will be itemized in the cost estimate. This equipment will be depicted in the engineering consultant's general arrangement drawings, schematics, and P&IDs. Piping systems will be priced based on installed unit metric cost data provided by in-house data from recent projects. The cost estimate will describe each hydronic/process piping system in detail and denote the systems' pipe size, equivalent length, diameter, and include for all trim and specialty items where denoted in the engineering consultant's system schematics and diagrams.
    - Building Automation Systems – modifications to the host facilities BAS will be described within the detailed cost estimate. Integration with the facility's current BAS will be during the discovery phase of the design.
    - Electrical Systems - all new electrical equipment or modification to the facility/service area's existing electrical distribution system(s) will be itemized in the cost estimate. This equipment will be depicted in the engineering consultant's general arrangement drawings and SLDs. The cost estimate will describe each component; denoting voltage, conductor size, type, and equivalent lengths inclusive of all specialty items where denoted on the engineering consultant's SLDs
    - Civil, Structural and Architectural Components – unit quantity metrics will be used to derive costs for excavation, disposal, back-fill, aggregate, and concrete. A preliminary foundation design for the CHP foundation(s) will be provided in the engineering consultant's Equipment General Arrangement Drawings.
    - Demolition/Remediation – any site remediation/restoration that may be required will be quoted as a lump-sum allowance. Applicable State Standards shall be the basis for the estimate of work/service.

- Project Soft Costs – The engineering consultant will detail the development and engineering costs for implementation of the project. Allowances will be cited in the cost estimate for all required permits, approvals, and inspection fees for jurisdictional and municipal governing authorities.
- The study will provide an assessment of operational and maintenance costs of the microgrid system.

3.4 Renewable Energy and Energy Storage Integration

Roof-mounted PV systems were included in the microgrid model at the following facilities:

Location	Estimated kW
Neptune Municipal Building	63
Neptune Department of Public Works	45
Hackensack-Meridian University Medical Center	493
Neptune High School	485
Neptune Aquatic Center	121
Monmouth County Academy of Allied Health & Science	186
Neptune Middle School	324
Gables Elementary School	167
Brookdale Community College	17
Monmouth County Vocational School	87
Total PV Estimated Capacity (kW DC)	**1,986**
Total PV Output (kW AC)	**1,629**

Electric energy storage was included in the microgrid model at the following facilities:

- Hackensack-Meridian University Medical Center

3.5 EV Charging Incorporation

Electric Vehicle (EV) charging stations were included in the microgrid model and will be considered in the design, at the following facilities:

- Neptune Municipal Building
- Neptune Department of Public Works
- Hackensack-Meridian University Medical Center
- Neptune High School and Aquatic Center
- Monmouth County Academy of Allied Health and Science
- Monmouth County Vocational School: Neptune Annex

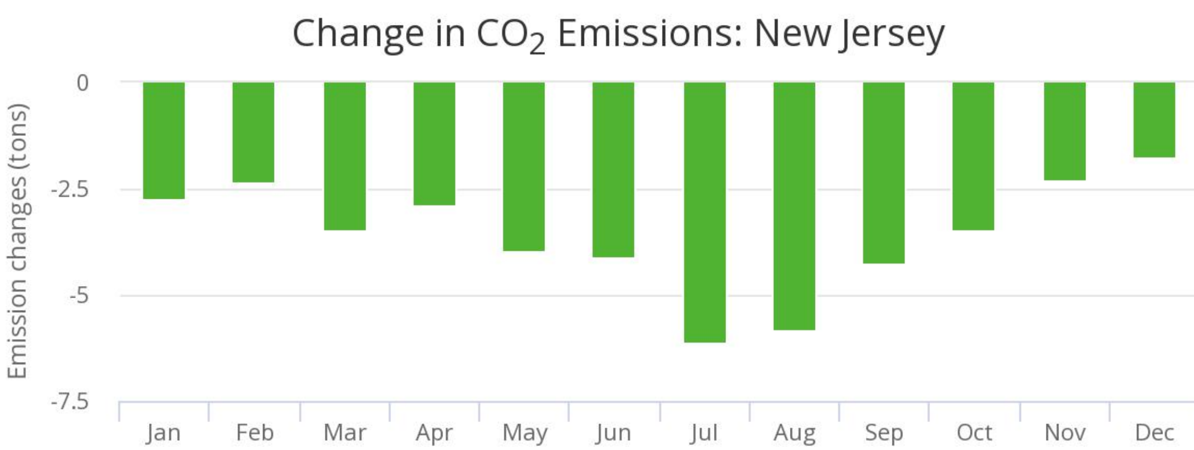
3.6 Peak Grid Demand & GHG Emission Reduction

The Neptune Township Advanced Microgrid (NTAM) anticipates new solar photo-voltaic (PV) roof-top generation capacity of 918-1,120 kW (AC). The U.S. EPA Avoided Emissions and Generation Tool (AVERT) is used to estimate the annual net volume of greenhouse gas (GhG) emissions that may be displaced in the regional fossil generation fleet through NTAM operation.[1] Based on the AVERT model, operation of NTAM will result in the annual displacement of 950 tons of carbon dioxide (CO2) emissions in the Mid-Atlantic Region (a 12-state area roughly corresponding to the PJM service area) with up to 43

[1] Avoided Emissions and Generation Tool (AVERT). "A tool that estimates the emissions benefits of energy efficiency and renewable energy policies and programs." https://www.epa.gov/statelocalenergy/avoided-emissions-and-generation-tool-avert

tons of CO2 emissions displacement for generating plants located specifically in the State of New Jersey - this is the equivalent to a reduction of 96,796 miles driven by an average passenger vehicle for a period of one year.[2] As may be seen in the figure below, emission reductions in New Jersey as a result of NTAM operation would be greatest in the summer months. Additional marginal GhG offsets will be gained through the cogeneration and thermal dispatch of the proposed new 6.2 MW CHP system at the Medical Center.

3.7 Energy Conservation Measure Implementation



This section shall include both a description of energy conservation measures already implemented, as well as expected to be implemented, in the Microgrid facilities.

The Township, as well as the Neptune Township School District, are motivated to enhance the performance, increase the efficiency, and decrease the environmental impacts of their facilities. The Township has recently upgraded their boiler plant to increase efficiency and decrease their overall energy consumption, while the Neptune Township School District has been actively pursuing energy projects, including working with the New Jersey Clean Energy Program to conduct Local Government Energy Audits to implementing Energy Conservation Measures (ECMs) such as lighting upgrades. On a similar note, Hackensack Meridian Health received 15 Practice Greenhealth Environmental Excellence Awards in 2018, including the Circle of Excellence for Energy at Hackensack University Medical Center. The NTAM would further these organizations' energy and environmental goals and objectives.

The preferred approach for the NTAM includes the identification, evaluation, and implementation of ECMs throughout the facilities in order to reduce the load to ensure that the DERs are properly sized. The ECMs considered shall include lighting systems and controls, HVAC equipment, building envelope improvements, food service equipment, and more specialized healthcare-specific equipment, and will back-in to the requirements of the applicable NJCEP energy efficiency and conservation incentives and rebates to minimize upfront costs and increase financeability. From previous audits conducted, LED upgrades, occupancy sensors, and thermal envelope improvements were identified as potential ECMs for most of the NTAM facilities. Additional noteworthy ECMs at Neptune Middle School include decommissioning the hot water heater #2 and analyzing the energy savings that could be realized from Variable Frequency Drive (VFD) implementation, while additional ECMs at HMUMC centered around improving the CHP and central plant operations through retrocommissioning and increasing heat usage.

[2] U.S. EPA Online Greenhouse Gas Equivalencies Calculator: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

The selected NTAM implementation team shall conduct an investment-grade energy audit and include ECM implementation in their design. This Energy Management Best Practice would not only result in the most technically, economically, and environmentally-sound design for the facilities, but would support the New Jersey Energy Master Plan.

3.8 Expected Permit Requirements

<u>Type: Cogeneration full time:</u>
NJ DEP Air Compliance Permit

Air Preconstruction permit	N.J.A.C. 7.27-8.2©1
Air Operating permits	N.J.A.C. 7:27--22.1
Air Permits Upgrade	7:27-18

Time Line: 120 Days Depending on Answers above
Note: This assumes permitting for full operation and run time of 8760
Cost $1,500
Requirement: Air Model
Building Permit
Electric Construction Permit
Utility interconnection inspection and “cut-in card”

Water: If the systems will require an additional flow rate of 2000 gallons a day, the following definitions should be used to assist in identifying discharge activities: Industrial wastewater is any wastewater or discharge which is not sanitary or domestic in nature, including non-contact or contact cooling water, process wastewater, discharges from floor drains, air conditioner condensate, etc.

IP for general water withdraw	100 Days under 2k
	240 Days over 2k
Permit Cost	$1,500

<u>Permit Outline for Solar Generation:</u>
NJ BPU GATTS Register
Local Planning Board Approval and Fire Safety
PJM Interconnection and Utility Metering Approvals
Time Line: 90 to 120 Days
Cost: $1500
CAFRA Note: If area is in CAFRA zone for ground-based systems, then impervious cover calculations will be necessary

<u>Permit Outline for Storage</u>
NJ BPU Approval
Utility: Interconnection
Local Inspection and Fire Safety
Cost: $3,500 Note: Assuming some interconnection studies to determine battery discharge impact

Note: Although wind and fuel cells were not considered for the study, changes in public policy or incentives may make them economically feasible in the future. The permitting for them is as follows:

<u>Permits Necessary for Wind:</u>

NJ DEP Land Use, Habitat and T/E impact study
NJ BPU Registration and go forward potential WREC registration via GATTS
Interconnection for Utility and PJM
Local Approvals including planning, zoning and council.
One Year local anemometer readings
Time Line: 18 to 24 Months
Cost: $35,000

Permits for Fuel Cell
NJ BPU Registration
Local Approval and Fire Safety
Utility Interconnection
Time Line: 8 Months
Cost: $2,500

3.9 Control and Communication Protocols

During black-sky events, shelter, life safety and human services will be provided in the Emergency Sheltering Facilities (ESFs). The extent of services, staffing and capacity will be prescribed in advance to maintain adequate resources and manage critical supply logistics throughout the Microgrid Area. The Township OEM leadership, Microgrid operator and relevant Stakeholder Representatives will continuously monitor the status of each ESF and provide reporting of operating status and availability of services in real time using a standard communication protocol. The reporting will be readily dispatchable to media outlets and emergency broadcast systems.

Communication between the TC DER MG (embedded generators) and the utility will occur through remote terminal units utilizing intertie network protection for the generation assets for all blue-sky modes of operation. When power from the utility is lost all embedded generators will be tripped off. If power from the utility is not restored within a prescribed period of time (~10s) the direct transfer trip looking out on the utility will command breaker no. 52-M1 to open isolating the underground circuit Neptune/Heck Ave Bus 1. Thereafter, all embedded (micro grid) generators will need to be black-started and reloaded in a priority sequence such as not to over/underload the any given DER.

3.10 Cyber Security Measures

The NTAM will utilize the Sandia-developed Energy Surety Microgrid^{TM} (ESM) methodology, or approved equal, to plan for and design a secure microgrid that is designed to detect threats and prevent cyber-attacks. The ESM methodology incorporates cyber security standards, such as firewalls and encryption, that will be included in microgrid design. The NTAM will utilize the appropriate level of security for the application and will work with tested and proven firms to ensure that designs hold up.

https://energy.sandia.gov/programs/electric-grid/integrated-research-and-development/esdm/

https://www.slideshare.net/sandiaecis/33cyber-security-rd-for-microgridsstampeprisnl-microgrid

4.0 Financing and Business Model

4.1 Estimated Cost of Proposed Design

The estimated cost of the 30% design effort is $526,100.

4.2 Amount of Total Design Cost Requested from NJBPU

The portion of the above amount requested from the BPU is $526,100.

4.3 Percentage of Total Design Cost Requested from NJBPU

The amount requested from the BPU is 100% of the estimated cost to complete the detailed design phase of development as described.

4.4 Source(s) of Funding for the Remaining Design Cost

The township anticipates that it will retain the services of a third-party developer to provide the additional funding to complete the next detailed design stage not otherwise provided by the BPU.

4.5 Expected Business Model

The purpose of the business model for the microgrid is to provide to the TCDER Microgrid program a prototype for *profitability* based on financial viability and positive social benefits. As discussed in the Phase I Feasibility Study, economic analysis suggests that the Neptune Township Advanced Microgrid is only marginally financeable as the profitability for a system operator will depend heavily on uncertain government subsidies, locking in energy revenues at today's rates, and having much of the cost of new and existing distribution infrastructure to be used by the microgrid borne by the EDC.

However, the value proposition of the TCDER Microgrid program is not just about private profit but is primarily driven by the dual goals of energy cost savings and increased levels of grid *reliability* and *resiliency* for municipalities and their critical facilities. The business model to be developed and tested in Phase 2 for the Neptune Township Advanced Microgrid therefore aims to reconcile the need for profitability and financeability of the TCDER Microgrid program and realization of its core value proposition by monetizing the social benefits offered by the microgrid to the larger distribution grid. This project offers a unique opportunity to measure and analyze the actual value of these social benefits offered by the microgrid and to establish it as a key component of the TCDER Microgrid model. This will lead directly to a model of profitability based on financial viability and positive social benefits.

Financeability & the TCDER Microgrid Value Proposition

Closely related to the importance of reliability and resiliency to the value proposition of the TCDER Microgrid business case, are the additional benefits of increased reliability and resiliency for the larger distribution grid. In other words, the microgrid becomes a valuable *risk management* tool for the EDC. These risk management benefits accumulate directly to the EDC, and indirectly to all EDC customers in the State of New Jersey. These benefits include deferred or avoided costs for grid capacity expansions by the EDC, and maintenance to aging power systems to perpetually sustain power quality and service standards. In this manner, a significant portion of the value proposition of the TCDER Microgrid will be seen to reside *outside* of the microgrid through the microgrid's support of the core mission of the larger distribution grid to provide reliable electric power service to all New Jersey residents. The business model to be developed for the Neptune Township Advanced Microgrid will make explicit the potential reliability-based services offered by the advanced microgrid *to the grid* and will provide options for quantifying and monetizing those benefits.

Further, the construction of the Neptune Township Advanced Microgrid provides unique opportunities for new investment in communication infrastructure (e.g., 5G cellular technology) as an overlay to the undergrounding of wires associated with the microgrid's distribution system. This provides new sources for financing of the project by other entities wishing to capitalize on the commercial opportunities provided by the enhanced communication infrastructure associated with the microgrid.

Description of the "Hybrid" Unbundled Utility Business Model

The Feasibility Study provided the framework for a "hybrid" business model for the Neptune Township Advanced Microgrid that combines aspects of ownership and operation of the microgrid assets by a private entity and the EDC. The hybrid model, also commonly known as the "unbundled utility" microgrid model, envisions ownership and operation of the generation and storage resources by a non-utility third-party developer-owner under a Design-Build-Own-Operate-Maintain (DBOOM) agreement with Neptune Township, while the distribution services between the substation and the meter (and beyond) are owned and operated by the local EDC. Layered in with the hybrid model is monetization by the third-party owner/operator of the value of the microgrid for providing increased reliability and resiliency to the larger grid to overcome potential revenue shortfalls.

Under the unbundled utility business model, portions of the feeders and attached distribution equipment of the EDC distribution grid will be repurposed for use of microgrid power distribution between host facilities and with the larger grid. The repurposing of existing EDC infrastructure and possible expansions of service with new wires and equipment may take many forms and result in various economic and financial terms for payment of use of the infrastructure for delivery of energy. In some cases, host sites can continue to pay the EDC via the delivery charge on the monthly bill while amending their existing bi-lateral supply agreements to account for the fact that a portion of their supply would now come from the microgrid. In other cases, where the value of the distribution in the energy flows becomes an increasingly smaller percentage of the value of the energy delivery, payments to EDC should be decreased accordingly to preserve the economic feasibility of the project.

The microgrid is expected to operate in blue-sky conditions nearly all the time. During blue-sky conditions, the microgrid can earn regular revenues through energy sales to pay the microgrid owner for the initial capital investment. Minimum annual earnings are required to show a viable project and attract investment. In addition, the microgrid customers are likely unwilling to pay significantly more for energy than they pay today.

Energy generated by the microgrid during blue-sky conditions can be grouped into two categories, including the distributed roof-top PV systems and the proposed Medical Center CHP system. Most facilities besides the Medical Center will adopt PV system panels installed on their rooftops. This analysis assumes reasonable estimates for PV system that would be deployed for each roof. By estimating the solar irradiation for the area (1,281 kWh/kW), the annual PV system electric production can be estimated for each facility. This conservative analysis, which assumed slightly less PV system capacity than the PV layouts provided, indicates that the PV system production would easily be consumed within the host facility during blue-sky conditions throughout the year. The business model that best fits this configuration would be a Power Purchase Agreement (PPA) because each of the PV systems would offset roughly 12% of the host facility's electricity use and be consumed on-site. The microgrid owner would issue a bill for electricity produced and consumed. The PPA price would be fixed at the current electricity rate (roughly $0.12/kWh for non-HMUMC Area A accounts). Typical PPA terms are set for 20 to 25 years. During black-sky events, the PV systems would still generate electricity and would be connected to support the microgrid. Yet, the black-sky operations would have little to no effect on the blue-Sky business model for deploying the 920 kW of PV system proposed for Area A.

The proposed 6.2 MW CHP system will become the essential generation asset and the cornerstone of the microgrid. The CHP system will be sited at the Medical Center and will produce both electric and thermal energy. Most of this energy will be used on-site within the Medical Center, especially during the heating and cooling seasons. The CHP system will operate nearly continuously (excluding scheduled maintenance downtimes). Electricity produced by the CHP system will offset electricity normally procured from the grid. The constant and relatively coincident electric and thermal loads make CHP extremely efficient in a Medical Center application. This type of on-site energy system is familiar to the Medical Center and their operations staff as they have been operating a CHP system within their Central Utilities Plant for many years.

The proposed CHP configuration would offer the flexibility to generate thermal energy in the form of steam, hot water, and/or chilled water, all of which are currently used by the Medical Center. Thermal energy from the engines' exhaust would be converted to steam and used within the existing Medical Center's steam distribution system. Hot water from the engines' other heat recovery circuits, such as the engine jacket water, can be used as either hot water in the HMUMC, or as the energy to drive an absorption chiller to make chilled water. The chilled water would also be used to offset chilled water normally generated by the electric chillers or existing absorption chiller. Most of the electricity and thermal energy generated by the CHP plant would be sold to the HMUMC during blue-sky conditions at a rate comparable to what they pay today for electricity, steam, hot water, or chilled water, with the remainder distributed to the non-HMUMC loads within Area A at prices similarly comparable to today's rates.

The Path Forward

As indicated above, the analysis provided in the Feasibility Study report suggests that the microgrid hybrid unbundled utility business model is only marginally financeable while keeping energy costs at today's rates, assuming no additional financial support from the state or Neptune Township, and that much of the cost of new and existing distribution infrastructure to be used by the microgrid will be borne by the EDC. However, it should be noted that the returns are also sensitive to the availability and certainty of securing all available governmental incentives. These incentives include the New Jersey Clean Energy Program CHP incentive, the federal Investment Tax Credit (ITC) and Modified Accelerated Cost Recovery System (MACRS) with bonus depreciation for the solar PV system, 100% accelerated depreciation for the CHP and thermal infrastructure, and New Jersey SREC sales, which at the time of the publication of the Phase 1 report was $210/MWh. Furthermore, the model also assumes that all the available tax incentives can be readily monetized; in practice, this may require a partnership with a tax equity investor if the project owner does not have sufficient tax liability. Private investors and microgrid owners may seek higher rates of return for projects of this type with long time horizons, multiple off-takers, and potential risk from changes to future loads.

To overcome these risks and make the promise of the TCDER Microgrid program a reality, the project will explore successful monetization of its risk management value to the larger grid. What is unknown at this juncture however is the value of the risk management component of the project since the value is largely location-specific in that it depends on viable restoration paths from the microgrid to critical loads and the status of the connected EDC infrastructure. This project offers a unique opportunity to measure and analyze the actual value of the risk management opportunity offered by the microgrid to establish it as a key component of the TCDER Microgrid model. This will lead directly to a model of profitability based on financial viability and positive social surplus.

4.6 Expected Cost of Development and Construction and Financing

The estimated cost of implementing the proposed design as provided in the Feasibility Study is approximately $28.84 Million and is summarized in ***Table 1***.

The estimated costs provide in the Feasibility Study report is a high-level (i.e., conceptual) order-of-magnitude estimate. The design effort will include a comprehensive revaluation of costs in light of location-specific factors to be included in the next level of design as well as information provided by development partners.

As indicated in the response to ***Question 3.4.5,*** it is anticipated that the financing of the purchase and construction of the microgrid generating and storage equipment, with some fixed costs for distribution equipment as presented in ***Table 1*** is to be financed by a non-utility third-party developer-owner under a Design-Build-Own-Operate-Maintain (DBOOM) agreement with Neptune Township. The success of determining and monetizing the value of the risk management services offered by the microgrid to the larger grid and EDC, as well as the installation of a 5G communications overlay on undergrounded wires may also free up financing from the utility, Neptune Township, or other public agencies.

Table 1: Estimated Cost of Implementing the Proposed Design

Microgrid Asset	Est. Capital Cost
PV System	$2,300,000
CHP& Thermal Loop	$26,542,000
Total:	**$28,842,000**

4.7 General Description of Tariffs Required

The interconnection standards in the JCP&L/BPU tariff is based, in part, on the IEEE 1547 series that addresses the interconnection of distributed resources to the distribution grid. As the use of distributed generation clusters, embedded networks and microgrids (especially advanced microgrids) have grown, there has been additional work done on advanced topics, such as IEEE 1547.4, which addresses the standard related to islanding of microgrids. As such, the microgrid can move forward with no changes in tariff law. However, special microgrid tariffs have been proposed in certain jurisdictions to address the unique nature of the emerging business models. These tariffs would more easily address factors that have inhibited the implementation of advanced microgrids and potentially improve project financial performance. These changes generally include removing technical barriers to interconnection and establishing standard terms for the value of services exchanged between the microgrid operator and the utility.

The new tariffs should recognize the value imparted by the microgrid to the distribution grid, including avoided costs for maintenance and capacity expansion as well as increased reliability and resilience. This could be accomplished through approval of special microgrid rates for imported power and by eliminating (or mitigating) standby and demand charges. The new microgrid tariffs should also allow utilities to participate in creating the microgrids as well as collecting a similar, current distribution fee. This would allow the utilities to cede some of their franchise rights to a municipal authority and/or owner and operator of the advanced microgrid to allow for non-tariff distribution of microgrid generated energy. Effectively, a new tariff rate would benefit the utilities, the governor's master plan, and the development of the microgrid, as a whole. With a new tariff rate, the utility would not only be providers of energy to individual homes but would be able to distribute energy in the best possible way that would maximize the storage of renewables and other components toward the goal to zero out greenhouse gases. Overall, the tariffs need to recognize the important public policy served by creating a redundant and resilient power generation and distribution system. Rates need to adequately provide for the financing of the construction, operation, and maintenance of these facilities. They need to support an economic model that is significantly different than traditional utilities but vital to the future of the state.

The new tariffs should recognize the value imparted by the microgrid to the distribution grid, including avoided costs for maintenance and capacity expansion as well as increased reliability and resilience. This could be accomplished through approval of special microgrid rates for imported power and by eliminating (or mitigating) standby and demand charges. The new microgrid tariffs should also allow utilities to participate in creating the microgrids as well as collecting a similar, current distribution fee. This would allow the utilities to cede some of their franchise rights to a municipal authority and/or owner and operator of the advanced microgrid to allow for non-tariff distribution of microgrid generated energy. Effectively, a new tariff rate would benefit the utilities, the governor's master plan, and the development of the microgrid, as a whole. With a new tariff rate, the utility would not only be providers of energy to individual homes but would be able to distribute energy in the best possible way that would maximize the storage of renewables and other components toward the goal to zero out greenhouse gases. Overall, the tariffs need to recognize the important public policy served by creating a redundant and resilient power generation and distribution system. Rates need to adequately provide for the financing of the construction, operation, and maintenance of these facilities. They need to support an economic model that is significantly different than traditional utilities but vital to the future of the state.

4.8 Who Benefits, Who Pays, and Project Cost Allocation

One purpose of the business model described in ***Question 3.4.5*** is the levelling of costs and benefits of connected microgrids to assure that the benefits are real and have real quantifiable value and that those who receive those benefits (and *only* those who receive the benefits) pay for them at the correct price. This is meant to address the concern for balancing microgrid benefits and costs and associated fairness issues. This plan will avoid socializing the costs of microgrids across all ratepayers, as is common practice for other utility infrastructure investments. Clearly, costs should be borne by those who receive back-up power from the microgrid during grid outage. These customers would include primary critical loads and secondary loads associated with the microgrid but existing outside of its normal boundaries in a "virtual" microgrid connected by feeders to the microgrid generation resources.

Using the JCP&L Level 3 interconnection these microgrid resources will be able to energize connected feeders and brings loads back on line in the case of contingencies lasting anywhere from a few minutes to several days or weeks. It should be noted that there are multiple technical challenges involved with making this potential revenue stream a reality, including access to the meshed network in a way that is safe and reliable. [Primary critical loads are those that provide critical services and are the priority targets for service restoration in contingencies. Secondary loads are those loads on the feeder between the critical loads and the microgrid that will be energized incidentally as primary critical loads are brought back on line]. These loads will continue to pay for their service under normal tariffs to the distribution company (JCP&L) however, a tariff rider that compensates the microgrid distributed resource asset owners for the reliability and resiliency services must also be developed.

4.9 Blue-Sky Operations

The Microgrid is expected to operate in Blue-sky conditions nearly all the time. During Blue-sky conditions, the Microgrid can earn regular revenues through energy sales to pay the Microgrid owner for the initial capital investment. Minimum annual earnings are required to show a viable Project and attract investment in the Microgrid. In addition, the Microgrid customers are likely unwilling to pay significantly more for energy than they pay today. There is generally a case to be made that a premium should be charged for the resiliency benefits that a Microgrid delivers. Yet, it should not be assumed that customers are willing to bear additional costs beyond what they pay under a business as usual scenario. Therefore, to be conservative, energy sold from the Microgrid to customers should be fixed as close as possible to what they pay today.

Besides adding additional generation within the proposed NTAM, the Project proposes the addition of an electrical connection between HMUMC and JCP&L's feeder 57498. This additional feeder would allow the new CHP system at the Medical Center to provide power to all other Area A customers during a Black-sky condition. Under Blue-sky conditions, the new feeder being proposed would simultaneously serve as a redundant feeder to the Medical Center and provide an alternate source of utility power to the Medical Center in the event that the J-88 feeder to the Medical Center fails. If configured as a redundant utility feeder to the Medical Center, along with the resiliency benefits to the non-HMUMC loads during Black-sky events, the business model predicates that JCP&L owns the new feeder and ultimately pay for that upgrade through traditional rate recovery mechanisms, at vastly lower cost than a new independent 34kV supply to the Medical Center. This ownership model for the new feeder would reduce capital costs for the Microgrid Project and the cost burden on the Microgrid customers, while benefiting a broad group of ratepayers that rely on emergency services from the Medical Center and the Township.

4.10 EDC and GDC Involvement in Project Design

As we have during the feasibility phase, the NTAM implementation team will continue to work with the local Electric Distribution Company (EDC) and local Gas Distribution Company (GDC) throughout the design process, utilizing the standard process and procedures for projects of this type. Both the EDC and GDC will be engaged early and often throughout the design process, to clarify the exact interconnection pathway and design requirements to interconnect as desired, provide NTAM design for review, and modify accordingly.

NTAM implementation priority is to identify and plan for the complete interoperability of the DER resources and facilities within the proposed NTAM while providing maximum benefit to the local grid circuits. The information developed to that end will be included within the overall NTAM investment-grade implementation plan.

Appendix A

Appendix B

Appendix C