NYC Recovery | Community Development Block Grant Disaster Recovery

HUNTS POINT RESILIENCY

For CDBG-DR Funds
Disaster Relief Appropriations Act of 2013
(Public Law 113-2, January 29, 2013)

Proposed Action Plan Amendment 18
Published September 14, 2018
Approved by HUD: (TBD)

The City of New York Proposed Substantial Action Plan Amendment 18
Rebuild By Design – Hunts Point Resiliency Project

September 14, 2018

Dear Friends,

In 2012, Hurricane Sandy highlighted both existing and growing vulnerabilities in New York City neighborhoods due to the impacts of climate change and extreme weather events. Since then, the City of New York has launched an unparalleled effort to rebuild impacted neighborhoods and mitigate the risk from future events.

Hunts Point has been identified as a priority area due to its vulnerability to climate change and the critical importance of the local food markets to the region's overall food supply. The Hunts Point Resiliency Project aims to minimize disruptions caused by power outages from extreme weather.

With an eye to the future, the City is proposing new commitments in long-term planning and resilient infrastructure funded through the City's Community Development Block Grant – Disaster Recovery (CDBG-DR) funds, received from the Department of Housing and Urban Development (HUD). Proposed changes are presented in the following Action Plan Amendment.

The most substantial new addition to the Hunts Point Resiliency project is the commitment of an additional $26 million in City capital to support the project, bringing the total budget to $71 million. The additional funds will address community concerns that arose around the initial design of a combustion turbine engine. The City is now opting to install a combined heat and power (CHP) microgrid in order to reduce air contaminants and further the resiliency of the project.

These additional allocations and increased benefits, including increased energy efficiency and reliability of the power grid, are captured in updates to the Benefit Cost Analysis. Other updates include new Resilience Performance Standards for the Hunts Point project to measure the resilience benefits of the project.

The Hunts Point Resiliency project is a key step toward a more resilient and sustainable New York City. We still have much work to do, but we do so working together in partnership.

Jainey Bavishi

Director
Mayor's Office of Recovery and Resiliency

Overview

The City of New York ("City" or "NYC") is the recipient of $4.214 billion of Community Development Block Grant – Disaster Recovery (CDBG-DR) funding from the U.S. Department of Housing and Urban Development (HUD) to assist in disaster recovery and rebuilding efforts resulting from Hurricane Sandy. Included within that $4.214 billion is a $20 million Rebuild by Design award for what is now referred to as the Hunts Point Resiliency project. The City allocated an additional $25 million of CDBG-DR funds and $26 million in City capital to the project, so the proposed Action Plan details a $71 million project with a $45 million CDBG-DR investment, supplemented by an additional City capital commitment.

The City's Action Plan provides details on how the City plans to spend grant funds on eligible Hurricane Sandy disaster recovery and rebuilding activities, including the Hunt Point Resiliency project.

Any change greater than $1 million in funding committed to a certain program, the addition or deletion of any program, or change in eligibility criteria or designated beneficiaries of a program constitutes a substantial amendment and such amendment will be available for review by the public and approval by HUD.

The City is publishing proposed Amendment 18 for public comment. Amendment 18 makes the following changes to Hunts Point Resiliency project:

General

- Updates the City's Citizen Participation Plan to revise the public notice publication distribution for the Hunts Point Resiliency project, including adding an additional community newspaper.

Resiliency

- Updates the project description for Hunts Point Resiliency to include new resilient energy technologies that that reduce air contaminants and increase energy efficiency. This additional scope is enabled by adding City capital dollars to the $45 million CDBG-DR commitment, bringing the project total to $71 million.
- Defines new Resilience Performance Standards for the Hunts Point Resiliency project, as required by HUD. Resilience Performance Standards are the means by which the City assesses the effectiveness of a resiliency project and if it is meeting expectations.
- Updates the Benefit Cost Analysis to account for the additional funding allocated to the project and the additional benefits achieved from the new project design.

The comment period on the proposed CDBG-DR Action Plan Amendment 18 is now open. Comments must be received no later than October 22, 2018, at 11:59 PM (EST). The proposed CDBG-DR Action Amendment 18 and the public commenting forms are available at http://www.nyc.gov/cdbgdr. Individuals will be able to read the amendment and the currently approved Action Plan and comment on the amendment in English, Spanish, Russian and Chinese (simplified). The online materials will also be accessible for the visually impaired. Written comments may also be directed by mail to Calvin Johnson, Assistant Director, CDBG-DR, NYC Office of Management and Budget, 255 Greenwich Street, 8th Floor, New York, NY 10007. Public comments may be given in person at the public hearing listed below.

The public hearing schedule for proposed Amendment 18 is below. The schedule is subject to change. Please call 311 or 212-NEW-YORK (212-639-9675) from outside New York City or check http://www.nyc.gov/cdbgdr for the most updated information.

Thursday, October 4, 2018, at 7:00PM-8:30PM
The Point Community Center
940 Garrison Avenue
Bronx, NY 10474

Paper copies of the Action Plan Amendment 18, including in large print format (18pt. font size), are available at the following address in both English and the languages listed above:

New York City Office of Management and Budget
255 Greenwich Street, 8th Floor Reception Area
New York, NY 10007

At the end of the comment period, all comments shall be reviewed and a City response will be incorporated into the City's Responses to Public Comments document. A summary of the comments and the City's responses will be submitted to HUD for approval in the final CDBG-DR Action Plan Amendment 18. The revised Action Plan Amendment 18 including the public comments and responses will be posted on the City's CDBG-DR website at http://www.nyc.gov/cdbgdr.

Some notes about the formatting of this substantial Action Plan amendment document:
The changes that this substantial amendment (Amendment 18) proposes for the City of New York are described below. Changes will be made to the section of the Coastal Resiliency chapter that describes the Hunts Point Resiliency project within the currently approved Action Plan incorporating all prior amendments. This document can be found on the City's website at http://www.nyc.gov/cdbgdr.

Once Amendment 18 is approved by HUD, the text of this amendment will be incorporated into the City's overall approved Action Plan. Then, the approved Action Plan, without indication of the changes made through this amendment, will be published at http://www.nyc.gov/cdbgdr.

In addition to the current approved Action Plan, the City's CDBG-DR website includes a full history of all amendments associated with the Plan.

The Hunts Point chapter of the Action Plan will be revised in its entirety to read as follows:

Hunts Point Resiliency – Action Plan Amendment

September 14, 2018

Contents

I. Introduction - Hunts Point's Vulnerabilities to Flooding and Climate Change

When Hurricane Sandy hit New York City on October 29, 2012, it brought the vulnerabilities of coastal communities to climate change into stark relief. Following the storm, the Mayor of the City of New York established the "NYC Special Initiative for Rebuilding and Resiliency," which released a report in June 2013 describing the damages and hardships experienced as well as strategies moving forward to build back stronger. With regard to Hunts Point, the report stated damage was minimal due to the timing of the storm's arrival coinciding with low tide in the Long Island Sound. However:

> "According to modeling undertaken by the storm surge research team at the Stevens Institute of Technology, if Sandy had arrived earlier – near high tide in western Long Island Sound, rather than in the New York Harbor and along the Atlantic Ocean – the peak water level in the western Sound, measured at the King's Point gauge, which hit more than 14 feet above Mean Lower Low Water, or MLLW (over 10 feet above datum NAVD88) during Sandy, instead could have reached almost 18 feet above MLLW (almost 14 feet above NAVD88).
>
> The result would have been devastating for infrastructure providing critical services to the rest of the City. Flooding could have overwhelmed parts of the Hunts Point Food Distribution Center (FDC) in the Bronx, thereby threatening facilities that are responsible for handling as much as 60 percent of the City's produce."

Hurricane Sandy highlighted the potential flooding vulnerability of the peninsula's critical facilities, other businesses, and the residential community to the effects of climate change including sea level rise, storm surge, extreme precipitation events, extreme heat events, system-wide infrastructure outages, and building or sub-area level infrastructure outages.

Many areas in the City were significantly impacted by power outages caused by flooding. As a result of these outages, even the residents of buildings that were not flooded or had minimal damage were left without light, heat, refrigeration, or water for drinking, cooking, flushing toilets, or bathing. In high-rise buildings, elevators also ceased to function. As a result, many older or infirm residents who lived on higher floors were trapped in their apartments, in some cases unable to communicate or gain access to information through television or the Internet.

The original Hunts Point Lifelines Rebuild by Design proposal addressed resiliency through four Lifelines: Integrated Flood Protection, Livelihood and Community Resilience, Cleanways, and Maritime Supply Chain. Through a year-long community engagement process, the City of New York worked with stakeholders from community groups, elected offices, and local businesses to identify resilient energy as the priority for the pilot project. The revised project description in this Action Plan Amendment reflects the Hunts Point Lifelines "Cleanways" proposal to develop a tri-generation microgrid system to ensure that the Hunts Point residential community and the Food Distribution Center is resilient to power outages from flooding and other emergency events.

In June 2014, U.S. Department of Housing and Urban Development (HUD) announced Community Development Block Grant-Disaster Relief (CDBG-DR) funding awards for the implementation of selected Rebuild by Design (RBD) proposals. HUD granted the City a $20 million award for the Hunts Point Lifelines RBD proposal to advance "continued robust planning and study related to the future of the food market and a small pilot/demonstration project (to be selected by the City)." In an April 2015 amendment to the City's CDBG-DR Action Plan, the City supplemented the original RBD award with the allocation of an additional $25 million of CDBG-DR funds, bringing the total investment towards the first stage of resiliency improvements in Hunts Point to $45 million to address the flooding vulnerability identified post-Sandy. In the May 2018, the City added and additional $26 million in City capital funds, bringing the total project funding to $71 million.

In consultation with local elected officials, community and civic groups and business interests, the New York City Economic Development Corporation (NYCEDC), and Mayor's Office of Recovery and Resiliency (ORR) formed the Advisory Working Group (AWG) to further develop resiliency priorities and recommendations that build upon the ideas presented in the RBD proposal and other ongoing resiliency and planning initiatives in Hunts Point. From June to September 2015, the AWG convened for seven meetings (including two meetings with the general public), worked through exercises to better understand Hunts Point's vulnerabilities to flooding, developed selection criteria for identifying priority resiliency categories, and recommended principles to be pursued in the implementation of any resiliency projects (see Appendix A for the *Advisory Working Group Implementation Principles*).

Understanding that only one pilot project would be advanced through implementation with the total available $71 million in funding, but that additional resiliency categories could be concurrently advanced through the feasibility study phase, the AWG reached consensus on two priority categories – both to be advanced with further planning and feasibility analysis, and one to be advanced through implementation of a pilot project[1]. The two resiliency categories identified for further study by the AWG were "Power/Energy" and "Coastal Protection," referred to herein as "Energy Resiliency" and "Flood Risk Reduction." Based on these AWG recommendations, as well as *OneNYC: The Plan for a Strong and Just City* goals, HUD requirements and City resiliency priorities, the City identified the "Energy Resiliency" category for implementation through a pilot project.

[1] https://www.nycedc.com/sites/default/files/filemanager/Hunts_Point_Resiliency_Working_Group_Recommendations_FINAL.pdf

II. Project Description

The Hunts Point Resiliency pilot project outlined in detail below will provide reliable and sustainable power in the event of an emergency, such as a power outage caused by flood, by allowing identified critical facilities to continue operations. The Hunts Point Resiliency pilot project will reduce the vulnerability of the Hunts Point peninsula to impacts of coastal flooding by providing at least three days of reliable, resilient, and dispatchable power to critical local and citywide facilities during emergency events like Hurricane Sandy, power outages, and other threats.

Project Context

The Hunts Point Peninsula is an area of regional and local significance in the southeast of the Bronx borough of New York City, New York (see Figures 1 and 2 at the end of this document). The peninsula is surrounded by the Bronx River and the East River, an estuary of the Atlantic Ocean. The area is home to an active and engaged community of 12,300 residents as well as the Food Distribution Center (FDC), one of the largest wholesale food distribution centers in the United States, numerous light manufacturing and other businesses, and one of the City's larger wastewater treatment plants. The peninsula is divided by north-south oriented Halleck Street with the FDC to the east and a residential community and industrial zone to the west.

The recommendations from *A Stronger More Resilient New York, OneNYC, Hunts Point Vision Plan*, RBD, and other community-based and government efforts highlighted the vulnerability of the peninsula with respect to sea level rise, storm surge, extreme precipitation events, extreme heat events, system-wide infrastructure outages, and building or sub-area level infrastructure outages based on the experiences and lessons learned across the region since Hurricane Sandy.

The resiliency of the Hunts Point Peninsula is critical from both a local and citywide perspective. First, Hunts Point is an environmental justice community, which means that residents face disproportionate environmental burdens. Hunts Point is a low-income community of color, with a poverty rate of 40.5%—more than double the citywide poverty rate—and population that is 98% Hispanic and African American.[2] Like all of New York City, Hunts Point is classified as a moderate non-attainment area for 8-hour ozone.[3] Due to significant air quality emissions from trucking and other industrial sources, Hunts Point residents face asthma rates twice as high as New York City as a whole. Respiratory illness has led to 2.8 times more emergency room visits attributable to asthma from poor air quality in Hunts Point compared to the rest of the City. As outlined in the Section IV (Stakeholder Engagement Plan) and Appendix A (Advisory Working Group Implementation Principles), the City has prioritized meaningful involvement of the Hunts Point community with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The development of the pilot project for Hunts Point Resiliency aims for the Lowest Achievable Emission Rate that goes above and beyond mandated mitigation controls to address local air quality and sustainability concerns of the low- and moderate-income populations affected by the project.

The resiliency of Hunts Point also directly affects the resiliency of the citywide food supply. Hunts Point is the largest geographic hub for food distribution by volume in New York City. The 329-acre FDC campus houses a significant cluster of food distribution and manufacturing facilities, including large Produce, Meat, and Fish Markets. Together, these facilities distribute 4.5 billion pounds of food annually to New York City and the broader metropolitan area and provide 8,500 direct jobs. The Hunts Point Resiliency pilot project will help protect and ensure access to food for millions of New Yorkers. The FDC land is owned by the NYC Department of Small Business Services (SBS) and managed by the NYCEDC.

[2] American Community Survey – 5 Year Estimates, 2014.

[3] https://www3.epa.gov/airquality/greenbook/ancl.html.

Project Identification

In June 2016 the City completed a risk and vulnerability assessment of the Hunts Point peninsula and feasibility studies for energy resiliency and flood risk reduction project options to reduce those vulnerabilities. The scope of work also included the conceptual design and environmental review for the Hunts Point Resiliency project and a robust stakeholder and community engagement process to inform the study and pilot project.

The methodology used for the risk and vulnerability assessment was adapted from procedures established by the Federal Emergency Management Agency (FEMA) for identifying the likelihood and potential consequences of threats. For Hunts Point Resiliency, existing conditions data was overlaid with the latest projections from the New York City Panel on Climate Change (NPCC), FEMA Preliminary Flood Insurance Rate Map (PFIRM) data including potential inundation depths with sea level rise (see Figure 3), historic data reflecting actual storms and outage events, and newly collected data from stakeholders (utility system providers, businesses and residents) about critical facilities within the Hunts Point Peninsula. The study assessed facilities important to the continued provision of critical citywide and community services, such as emergency services, housing, mobility, power and water delivery, and social services, employment, and food distribution.

Each critical facility's vulnerability was assessed by identifying threats facing the facility, then multiplying the likelihood by the consequence of each relevant threat. Threats assessed included flooding as a result of sea level rise, coastal storm surge, and extreme precipitation events, as well as extreme heat events, system-wide infrastructure outages, and building-level infrastructure outages. A composite vulnerability score for each critical facility was then developed by adding the different threat-specific vulnerability scores together in order to compare and rank the vulnerability of each critical facility to another. Figure 4 maps the results of this vulnerability assessment.

Based on the risk and vulnerability assessment findings, building-level power outages were determined to be a significant and shared threat to residents and businesses in Hunts Point. In addition, the low-lying areas of the peninsula face significant threats from coastal flooding while the upland residential area does not due to considerable elevation change throughout the peninsula. Based on the composite vulnerability scores, the most vulnerable critical facilities include FDC facilities—a key economic and food distribution center—that is vulnerable to building-level energy outages, system-wide outages, storm surge, and extreme heat events (see Figure 4). Food Center Drive, the main thoroughfare within the FDC, would be flooded in a 100-year storm tide that accounts for sea level rise in the 2050s. Community facilities, specifically two local schools, PS 48 and MS 424 are vulnerable to energy outages and extreme heat. The Hunts Point Resiliency project reduces the vulnerability of Hunts Point to power outages caused by emergency events, such as a major flood, through the lens of resilient energy provisions.

The risk and vulnerability assessment results identified the critical facilities in greatest need and potential opportunities for resiliency projects. For energy resiliency, dozens of power generation, distribution and storage technologies were first screened to determine if technically feasible and those retained were further assessed based upon a set of criteria including:

- Resiliency: applicability to vulnerable, critical facilities, dispatchable, reliable for minimum of three days, independent utility
- Sustainability: emissions, efficiency, fuel sources
- Community benefits: workforce opportunity, scalability, potential to leverage other funds
- Constructability: suitable space, required infrastructure, permitting
- Implementability: schedule, cost to construct, cost/MWh

It is important to note that no single project meets all of the criteria above for all of the vulnerable facilities in the peninsula. These criteria identified technologies for detailed assessment that were then packaged into project options. The identified technologies included: solar photovoltaic (PV) plus energy storage, tri-generation microgrid, and mobile generators. For this reason, "project packages" were formed

to ensure resiliency, constructability and implementation, while at the same time maximizing sustainability and community benefits.

Upon further vetting of multiple project packages which included a Sustainable Return on Investment analysis (described further in the Benefit Cost Analysis section) and a financial analysis, a *tri-generation microgrid with solar plus energy storage* with a cumulative generating capacity of approximately 6.8 MW was selected as the energy resiliency pilot project. This pilot project, further described below, will advance to conceptual design and environmental review.

Project Objectives

The principal objectives of Hunts Point Resiliency Project are to:

- Address critical vulnerabilities for both community and industry
- Protect important citywide infrastructure during emergencies such as a major flood
- Protect existing and future industrial businesses and jobs
- Support the community's social, economic, and environmental assets
- Use sustainable, ecologically sensitive infrastructure

Description of Pilot Project

The Hunts Point Resiliency project will provide reliable, dispatchable, and sustainable power to identified critical facilities on the Hunts Point Peninsula for three days in the event of an emergency, such as a power outage caused by flood. In total, the project provides 6.8 megawatts (MW) of new resilient energy generation capacity for the peninsula. Each component of the pilot project has independent utility. These separate components do not rely on each other to provide resiliency to the intended facilities. At the same time, they are conceived as a suite of projects to provide resiliency to the most vulnerable and critical facilities within Hunts Point.

- Microgrid with Tri-Generation to support the Produce Market and Meat Market in the Food Distribution Center (FDC) – This component of the project involves a microgrid powered by a tri-generation system. The tri-generation system will supply full electrical power to the Produce Market, as well as re-capture and convert the waste heat to provide hot water for boilers at the Meat Market and chilled water for cooling at the Produce Market. The tri-generation system will consist of two 2.6 MW reciprocating internal combustion natural gas engine generators with heat recovery hot water generators, two 400-ton two-stage absorption chillers, and two 300-ton single stage absorption chillers. The microgrid will use Con Edison's existing infrastructure and will be completely separable from the larger grid so that the microgrid can operate independently in the event of an emergency. In the event of an emergency when the electrical grid is not available, a section of the Con Edison distribution system in the Hunts Pont area will be isolated from the grid via sectionalizing switches to form a microgrid.

  The tri-generation system will utilize natural gas. This technology was determined as the best approach to achieve the resiliency criteria while also maximizing efficiency and sustainability goals. In order to meet the stated project objectives, principles and criteria, emissions will be controlled to well below the allowable maximum emissions rates to ensure participation within the Con Edison Standby Rate Pilot, which requires more rigorous air quality criteria. The Standby Rate Pilot requires lower maximum nitrogen oxide (NOx) emission rates for new or expanded distributed generation projects in specific neighborhoods of New York City, including Hunts Point. To achieve lower emission rates, emissions controls including Selective Catalytic Reduction (SCR) systems for control of NOx emissions as well as the installation of oxidation

catalysts for control of carbon monoxide (CO) and volatile organic compounds (VOC) exiting the generating units are included as part of pilot project design. In addition to standby rate requirements, emissions rates will be a condition of the unit operating permit and will be enforced by both NYSDEC and NYCDEP. These emissions rates will be formally defined through the permitting process, specified to equipment suppliers and/or contractors, and will be guaranteed by the equipment suppliers as a condition of the facility installation. Ongoing compliance with these emissions rates will be a condition of unit operation.

In addition to its primary resiliency capabilities, the tri-generation system will provide significant air quality co-benefits because it is designed to operate during both emergency and blue sky conditions. As a significantly more efficient mode of energy production, the tri-generation system will reduce the Produce Market electrical load by an average of approximately 1.3 MW. The 1.3 MW of offset electrical capacity will be used to power truck trailer refrigeration units at the Produce Market that will be converted from diesel operation to electric operations. On the heating side, the exported hot water will replace the hot water generated by the existing gas boilers at the Meat Market. Both the electrification of the refrigerator trucks and the replacement of the gas boilers will enable this project to improve local air quality in the peninsula. Additional details on air quality are described below in Section III.

- Community Facility Solar/Storage Installations – To provide sustainable and resilient power supply to two primary community facilities, the project will involve the installation of rooftop solar photovoltaic (PV) generation and battery energy storage for both Middle School (MS) 424 and Primary School (PS) 48. The total supported installation is approximately 0.5 MW of solar capacity that will provide electricity to the schools during normal and emergency conditions. Battery energy storage systems will also be installed at the schools to provide electrical resiliency for critical loads during emergency conditions. This will enable the schools to provide shelter, refuge, or gathering spaces for the public in emergency situations. The solar and storage systems are also intended for use during blue sky days. The two rooftop solar sites are located at: MS 424, 730 Bryant Avenue, Bronx, NY 10474 on Block 2763, Lot 279; and at PS 48, 1290 Spofford Avenue, Bronx, NY 10474 on Block 2766, Lot 1.

- Emergency Backup Generation – To provide resilient power supply to other important citywide food distributors and employers in the Food Distribution Center, the project includes the purchase of four 275 kilowatt (kW) mobile diesel generators, with the installation of provisions to allow the connection of these generators to the electrical systems of the facilities during emergency periods. This fleet of mobile generators provides a total of 1.1 MW of electrical generation for emergency conditions only, and enables immediate energy resiliency with minimal capital construction and costs for facilities that are critical to the city's food supply chain. Generating units will be provided with low emissions combustion systems. Emissions rates will be a condition of the unit operating permit and will be enforced by both NYSDEC and NYCDEP. These emissions rates will be formally defined through the permitting process, specified to equipment suppliers and/or contractors, and will be guaranteed by the equipment suppliers as a condition of the facility installation. Ongoing compliance with these emissions rates will be a condition of unit operation. The proposed mobile generators would be located throughout the FDC.

Meeting the Purpose and Need

The Hunts Point Resiliency project will reduce the vulnerability of the Hunts Point peninsula to impacts of coastal flooding by providing at least three days of reliable, resilient, and dispatchable power to critical local and citywide facilities during emergency events like Hurricane Sandy, power outages, and other threats.

The Hunts Point Resiliency project addresses the critical facilities most vulnerable to climate change and has independent utility to protect important local and citywide infrastructure under future conditions. The analysis accounts for baseline data of historic outage frequencies and durations, as well as anticipated outage frequencies and durations in the future due to an expected increase in flood-related events.

Due to the critical nature of facilities within the Hunts Point peninsula and based upon policy guidelines and precedents, the City of New York has defined resiliency as the ability to provide a reliable source of power for a given facility's critical load for a minimum of three days in the event of a major flood or other emergency. The overall project incorporates a combination of solar PV solutions with battery energy storage, a tri-generation-powered microgrid, and mobile and back-up generation. The configuration of these technology packages means that each protected facility will have dispatchable energy resiliency for at least three days in the event of an emergency.

The Hunts Point Resiliency project will be designed to incorporate flood protection measures and will be able to withstand impacts from flood events. The Hunts Point Resiliency project will protect food-related inventory and enable citywide food distribution for facilities within the FDC, as well as allow the schools in the Hunts Point residential neighborhood to serve as shelters, refuge, or gathering spaces during floods, outages, heat waves, or other emergency situations.

The pilot project will address air quality and environmental justice concerns in recognition of the importance of emissions and air quality in Hunts Point. Hunts Point (like all of New York City) is considered to be a moderate non-attainment area for 8-hour ozone. This classification mandates emission control technologies to meet the Lowest Achievable Emission Rate. Due to the air quality and environmental justice concerns in the neighborhood, the pilot project will employ emission control technologies for the fossil-fueled generation technologies that reduce emissions above and beyond the required emission rates. In addition, it is important that the mobile generators would be utilized only in the event of an emergency, such as a major flood or storm event.

Resilience Performance Standards

The City of New York is committed to developing and implementing resilience performance standards for all infrastructure projects, including the Hunts Point Resiliency pilot project, and looks to the best available science and promising practices in resiliency to inform the development of these standards.

The City utilizes the following performance standards to measure resiliency within a project:

- Robustness: ability to absorb and withstand stressors and shocks
- Redundancy: additional channels to enable maintenance of the core functionality in an event of disturbance or system failure
- Resourcefulness: ability to adapt and respond in a flexible manner during stressors and shocks.
- Response: ability to mobilize quickly in the face of stressors and shocks
- Recovery: ability to regain functionality after stressors and shocks

As design progress, the specific application of these standards to the Hunts Point Resiliency project will continue to be further developed and refined to accurately capture the effectiveness and efficiencies of the resilient technologies once installed.

To ensure that the energy infrastructure is itself resilient to flooding and to ensure compliance with the City's resilience performance standards, all of the energy systems will be flood-protected, elevated, or located outside identified flood hazard areas. The tri-generation microgrid infrastructure, which will be situated at Site D in the 100-year floodplain, will be elevated out of the floodplain to 19 feet NAVD88. Conduits that are at risk of flooding will be hardened. Each component of the Hunts Point Resiliency project provides an added level of energy redundancy to the facility it is designed to protect. As a result of the Hunts Point Resiliency project, critical facilities will have the redundancy to obtain energy supply even there is a broader power outage in the larger grid network. The capital components of the project that provide resiliency and redundancy benefits will be paired with an operations plan for the City and Food Distribution Center tenants. The project enables the schools and Food Distribution Center facilities to be responsive to and recover from shocks and stresses because the project components will be equipped with black start capabilities, which refers to the ability to restoring power from a total or partial shut-down.

Rooted in these resiliency performance standards, the City will advance a plan to monitor and evaluate the energy resiliency infrastructure developed through this Rebuild by Design initiative. The purpose of this plan is to convey how the City will monitor the planning, implementation, and achievement of key milestones in the delivery of the completed Covered Project. The plan will include inspection requirements for the resilient energy infrastructure based upon manufacturer specifications around inspection frequency and process. The specific inspection requirements will be finalized once equipment specifications are determined during final design.

During implementation of the monitoring plan, the City will ensure that all the appropriate mitigation measures are put into place and meet government standards. The plan will also include evaluation methodology, which the City will implement after the projects are complete. The purpose of the evaluation methodology is to determine the Covered Project's efficacy level in addressing the community needs over a period of time. Components of the evaluation methodology may include the use of data to establish a baseline, monitor progress over a designated period of time, and establish benchmarks to gauge the effectiveness of the project against anticipated outcomes.

The City will be vigilant in doing immediate assessments after future storms events. The City will provide monitoring or assessment of the structures and equipment to see if they can withstand storm and hurricane conditions. This will be reported to the appropriate City departments to address any failures in structures and equipment. Additionally, the City will explore standards for the replicability of this type of infrastructure.

Project Feasibility and Effectiveness

The feasibility assessment conducted as part of the Hunts Point Resiliency Project was a key part of the process to identify the pilot project for energy resiliency. The packaging of different technologies into the Hunts Point Resiliency project optimizes the resiliency goals set forth in this project with community's sustainability goals and environmental justice concerns. The Hunts Point Resiliency project includes latest emission control technologies and flood protection measures in capital costs and designs. To ensure that the energy infrastructure is itself resilient to flooding and to ensure compliance with the City's resilience performance standards, all of the energy systems will be flood-protected, elevated, or located outside identified flood hazard areas.

Feasibility assessments considered the appropriate code and industrial design and construction standards to implement packages of energy resiliency technologies. These codes and standards will be adhered to during final design of the pilot project, and a registered professional engineer will certify that the final design meets all applicable codes and standards prior to the obligation of HUD funds by the City for construction.

Con Edison is a key partner for the design and construction of the Hunts Point Resiliency project. A series of meetings with Con Edison's regional engineering team were held to review the specifications to the

Hunts Point Resiliency project. In particular, Con Edison has specific requirements for the microgrid component. Con Edison's draft Technical Requirements for Microgrid Systems Interconnected with the Con Edison Distribution System (Specification EO-2161 dated November 15, 2016) states that "the MicroGrid should not rely exclusively on renewable energy resources as it may not provide electric power during grid outages with the level of reliability required for emergency loads." This requirement is satisfied by the pilot project via the inclusion of the tri-generation source. The City will also establish an agreement with Con Edison regarding the terms and conditions of equipment utilization and system control, including the conditions under which Con Edison will depower its lines—for example, during a tidal surge when generation might be needed. The City and Con Edison are continuing to coordinate regularly to ensure successful implementation of the pilot project.

Once the Hunts Point Resiliency project is constructed, the City will operate and maintain the energy systems. The NYC Economic Development Corporation, which manages the FDC on behalf of the City, will oversee the operations and maintenance of the energy systems. This will include regular inspections in accordance with appropriate industry codes and regulations. The City of New York hereby certifies that funding will be made available to cover the long-term operations and maintenance costs associated with the Hunts Point Resiliency pilot project.

Project Funding

A total investment of $71 million in CDBG-DR funds ($20 million via the Rebuild by Design program, $25 million contribution from New York City's CDBG-DR allocation, and $26 million from New York City capital funds) is dedicated to the "continued robust planning and study related to the future of the food market and a small pilot/demonstration project (to be selected by the City)." These funds will be used for planning, design, and project construction of the Hunts Point Resiliency project, and are eligible for reimbursement under HUD's RBD program. Planning work includes feasibility analyses, conceptual design and environmental review; design includes contracting, permitting and full design; and project construction includes procurement, construction and construction management activities. If the project generates program income, the City would make sure to coordinate with HUD that the program income would flow back to the appropriate Entitlement community or its subrecipients. All budget allocations in Table 2 are estimates and will be amended as needed to implement the project.

Table 2: Proposed Project Funding Schedule

	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	Total
Planning	$570,000	$2,480,000	$750,000					3,800,000
Design				$1,800,000	$1,500,000			$3,300,000
Project Construction				$2,300,000	$12,600,000	$44,700,000	$4,300,000	$63,900,000
Total	**570,000**	**2,480,000**	**$750,000**	**$4,100,000**	**$14,100,000**	**$44,700,000**	**$4,300,000**	**$71,000,000**

Table 3 below provides a cross-walk of the funding by project component.

Table 3: Funding by Project Component

Item			**Portion of Cost Funded by HUD ($ million)**	**Portion of Cost Funded by Other Sources ($ million)**	**Total Cost ($ million)**

Planning Study			$3.8		$3.8
Project Location	**Generation Type**	**Capacity (MW)**	**Cost ($ million)**		
Site D with connections to Produce and Meat Markets	Reciprocating Internal Combustion Natural Gas Engine Generators with Microgrid	5.2	$35	$26	$61
MS 424	Rooftop Solar PV	0.45	$3.0	$0	$3.0
	Battery Storage	0.09			
PS 48	Rooftop Solar PV	0.04	$1.6	$0	$1.6
	Battery Storage	0.06			
Businesses	Mobile Diesel Generators	1.1	$1.6	$0	$1.6
Total		**11.6**	**$45**	**$26**	**$71**

Federal, State, and Local Coordination

Implementation of the Hunts Point Resiliency Project will involve federal, state, and local permits and authorizations. As described above (under Project Identification), the scope of work for the Hunts Point Resiliency Project included multiple assessments and evaluations to identify the energy resiliency pilot project. The pilot project has been identified, and the project is advancing to conceptual design and environmental review.

With this Substantial Action Plan Amendment, the pilot project is identified and described as well as the permits and authorizations that will be obtained as design begins and the awarded contractors prepare for construction. If any changes to the pilot project described in this Substantial Action Plan Amendment result from coordination or approvals by permitting agencies, NYCEDC and ORR will submit a subsequent Substantial Action Plan Amendment to HUD describing these changes and the modified pilot project.

The agencies to be involved in the environmental review, permitting and approvals for the pilot project and the timing of these processes are described below in Table 4. The process mapped below is based on the identification of the energy resiliency pilot project and HUD funding schedule (described in the Project Funding section above). Additional design and construction schedule information for the pilot project is provided below in Section V. Project Timeline.

The City is currently working with the Sandy Regional Infrastructure Resilience Coordination (SRIRC) to coordinate design, permitting, construction and operation of this project to align and integrate with other recovery projects in the area. Additionally, the City will continue to work with the SRIRC's Technical Coordination Team (TCT) and the Federal Review and Permitting (FRP) Team as the project is further defined during the design and environmental review process.

Table 4: Permits/Approvals and Related Schedule Information

Agency/Authority	Permit/Approval	Timing
Federal		
U.S. Department of Housing and Urban Development (HUD)	Federal funding agency; Approval of this Substantial Action Plan Amendment; and final issuance of Authority to Use Grant Funds (AUGF) for the CDBG-DR funds.	Substantial Action Plan Amendment Approval: Fall 2018
U.S. Fish and Wildlife Service	Advisory agency for Section 7 of the Endangered Species Act	Fall 2018 to Winter 2018
State		
NY State Energy Research and Development Authority (NYSERDA)	Issuance of a combined building and electrical permit for a grid-tied solar electric system.	Fall 2018 to Fall 2019
Office of Parks, Recreation and Historic Preservation (OPRHP)	Section 106 consultation required per the National Historic Preservation Act (NHPA) with respect to eligible and listed properties on the State & National Registers of Historic Places.	Fall 2018 to Spring 2019
New York State Public Service Commission (NYSPSC): Article VII	Certificate of Environmental Compatibility and Public Need (for projects generating 10 MW or <)	Fall 2018 to Fall 2019
NY Independent System Operator (NYISO)	Performance of Interconnection Process and Study.	Fall 2018 to Fall 2019
Department of Environmental Conservation (NYSDEC)	State Facility Air Permit (Subpart 201-5)/ Subpart 201-4: Registration of Minor Facility	State Facility Air Permit: Fall 2018 to Fall 2019 (by Contractor)
	Petroleum Bulk Storage Program Registrations Issuance of permits related to the State Pollutant Discharge Elimination System (SPDES) General Permit for	Petroleum Bulk Storage Program Registrations: Spring 2021 to Fall 2021 (by Contractor)
	Stormwater Discharges from Construction Activity	SPDES GP: Fall 2018 to Winter 2019 (by Contractor)
	Advisory agency on State-listed plant or animal species or significant natural communities	Fall 2018 to Winter 2018
Department of State (NYSDOS)	NYS Coastal Zone Consistency Determination	Fall 2018 to Winter 2018
Department of Transportation (NYSDOT)	Issuance of Highway Work Permit, Special Hauling Permit/Divisible Load Overweight Permit and Evocable Consent.	Fall 2020 to Winter 2021 (by Contractor)

City

Department of City Planning (DCP)	NYC Waterfront Revitalization Program (WRP) Consistency Determination,	WRP Consistency: Fall 2018 to Winter 2018
Department of Environmental Protection (DEP)	Air Pollution Registration (Engines, Generators, Turbines) Asbestos Abatement Compliance through the Asbestos Reporting and Tracking System (ARTS)	Air Pollution Registration: Fall 2020 to Winter 2021 (by Contractor) ARTS Compliance: Fall 2020 to Winter 2021 (by Contractor)
	Approval of City sewer and water connections for new connections or modifications of existing connections.	Water and Sewer Connections/ Modifications: Fall 2020 to Winter 2021 (by Contractor)
Department of Buildings (DOB)	Review of design and issuance of Certification of Occupany (CO) permits related to buildings including compliance with the City's Building, Electrical, and Zoning Codes.	CO Permit(s): Winter 2021 to Spring 2022 (by Contractor) Construction Permits: Fall 2020 to Spring 2021 (by Contractor)
	Construction related permits for cranes, scaffolding, and other temporary works.	
Department of Transportation (NYCDOT)	Approval of Maintenance and Protection of Traffic Plan (MPT).	Fall 2020 to Winter 2021 (by Contractor)
Public Design Commission (PDC)	Review of project design	Initial coordination begins with concept design in Spring 2017; final approvals would be required for final design completion in Summer 2019
Landmarks Preservation Commission (LPC)	Advisory agency for activities on or near sites of historic or archaeological value.	Summer 2018 to Fall 2018
New York City Fire Department (FDNY)	Design Approval of high pressure gas permit; review according to fire code; review of battery storage plans by FDNY Technology Unit.	Fall 2017 to Spring 2018
Office of Management and Budget (OMB)	Responsible Entity (RE) for the disbursement of CDBG-DR funds for Hurricane Sandy from HUD to City agencies and NEPA Lead Agency.	NEPA Review: Summer 2018 to Spring 2019
Mayor's Office of Recovery and Resiliency (ORR)	Design review of activities and projects proposed to increase resiliency, including strengthening neighborhoods, upgrading	Summer 2017 to Spring 2018

	buildings, adapting infrastructure and critical services, and strengthening coastal defenses.	
New York City Emergency Management (NYCEM)	Review of plans related to emergency preparedness, response, and operations under storm conditions.	Summer 2017 to Spring 2018
Small Business Services(SBS)	CEQR lead agency; help City agencies fulfill their environmental review responsibilities.	Summer 2017 to Spring 2018 (CEQR/SEQRA review period)
	Issuance of Waterfront Permit for developments within the NYC waterfront, and review of resiliency related design coordinated with the DOB's permit(s).	Fall 2018 to Spring 2019 (by Contractor, as applicable)
Other		
Natural Gas Companies Approvals (Iroquois)	Issuance of permission to cross right of way.	Fall 2018 to Spring 2019 (by Contractor, as applicable)
Railroad Companies Approvals (CSX)	Issuance of permission to cross right of way.	Fall 2018 to Spring 2019 (by Contractor, as applicable)
Utility Companies Approvals (Con Edison)	Issuance of permission to cross existing utilities.	Fall 2018 to Spring 2019 (by Contractor, as applicable)

National Objective

Per Section 101(c) of the Housing and Community Development Act (HCDA) of 1974, as amended, a CDBG-assisted activity must meet one of three national objectives: (1) benefiting low- and moderate-income persons; (2) preventing or eliminating slums or blight; and (3) meeting urgent needs. In addition, Section 105(a) of the HCDA requires that only certain eligible activities may be assisted with CDBG funds. The National Objective and Eligible Activity for the Hunts Point Resiliency Project are listed below:

- National Objective: Low-Moderate Income Area Benefit
- Eligible Activity: Rebuild by Design

Hunts Point is a low-moderate income community. The median household income is $24,780, less than half of the median household income of New York City ($58,820). Hunts Point contains a high proportion of very low income households: the largest share of Hunts Point households earn less than $15,000, which more than double the share of NYC households with the same level of income. Hunts Point's poverty rate is twice that of New York City's and 50% higher than in the Bronx overall.[4] Additional information for the Hunts Point Resiliency Project can be found on the City's website: www.huntspointresiliency.nyc.

[4] American Community Survey – 5 Year Estimates, 2014

III: Benefit-Cost Analysis

In accordance with HUD's RBD requirements, the Hunts Point Resiliency Pilot Project has been examined through a Benefit-Cost Analysis, using methodologies and approaches acceptable to HUD.[5] The Benefit-Cost Analysis demonstrates the degree to which Hunts Point Resiliency Project achieves resiliency, social, economic, and environmental project benefits in comparison to the costs of the project. The Hunts Point Resiliency project has a benefit-cost ratio of 1.29, and therefore meets the requirements of the RBD funding of needing a benefit-cost ratio greater than one. The BCA also shows internal rate of return of 13.6%, which is above the 7% rate required. The technical Benefit-Cost Analysis is included in the Appendix B to this document.

A. Introduction and Project Description

The Hunts Point Resiliency Project meets the project purpose and need by identifying an energy resiliency pilot project and providing a sustainable, reliable and resilient energy solution to the Hunts Point area through a combination of power generation solutions. The pilot project incorporates rooftop solar photovoltaic (PV) generation with battery energy storage systems, a tri-generation powered microgrid, and backup generators for the supply of short- and long-term, dispatchable energy resiliency. All of the individual energy components that make up the complete Hunts Point Resiliency project have independent utility.

In conjunction with the implementation of the pilot project, there is a separate but related initiative to add rooftop solar PV generation to a number of businesses under a community solar structure that would provide residents the option to purchase power directly from a solar developer and, in turn, receive monthly deductions on their Con Edison bills. The community shared solar project does not affect the independent utility of the Hunts Point Resiliency project.

The Benefit-Cost Analysis (BCA) of the pilot project was prepared in accordance with U.S. Department of Housing and Urban Development (HUD) requirements, other federal guidelines, and industry best practices. The **analysis period of 20 years** reflects the average useful life of equipment, all values are estimated using **constant 2016 prices** (depicted as 2016$), **no general inflation** is used to escalate any values, and a **7% base discount rate** is used to bring all future values to a present value (PV) in 2016$. A complete technical report is attached as an appendix for additional information about the BCA completed for the pilot project.

B. Base and Alternative Cases

1. Base Case

The Base Case is defined as existing conditions and without the pilot project. The Hunts Point Resiliency study area as a whole faces its greatest threats from storm surge along areas of the coastline, building and system-level outages, and extreme heat. Economic resilience in the industrial area depends on physical resilience, i.e., staying in business, and the Food Distribution Center (FDC) businesses are part of a regional network of sellers and purchasers. Social resilience is directly dependent on the physical resiliency of community facilities and the ability of any new proposed project to address environmental justice concerns within the community.

Key points pertaining to the Base Case conditions are as follows:

1. Building- and system-level power outages are a significant and shared threat to residents and businesses in Hunts Point.

[5] Per HUD Notice CPD-16-06, CDBG-DR-RBD: Guidance regarding content and format of materials for approval of CDBG-DR Action Plan Amendments releasing funds for construction of RBD projects, including guidance for Benefit-Cost Analysis (issued April 20, 2016).

2. Due to considerable elevation change, the low-lying areas face significant threats from coastal flooding while the upland residential area does not.
3. Extreme rain/snow storms are not a major threat in Hunts Point.
4. The number of community organizations and history of organizing in Hunts Point can lay the foundation for strong social resiliency.

Figure 1: Base Case Critical Facilities and Threats

Several key economic centers including FDC facilities are vulnerable to a combination of building and system-level energy outages, storm surge, and extreme heat events. Food Center Drive, the main street to and from the FDC, would be under water in a 100-year storm tide and 2050 sea level rise. Social services in the residential areas and, specifically, the schools that serve as community centers and emergency shelters (PS 48 and MS 424), are vulnerable to energy outages and extreme heat due to the potential displacement of schoolchildren and employees during an outage or if these facilities could not be used during an emergency because of a lack of power or air conditioning.

2. Alternative Case

The Alternative Case assumes that the Hunts Point Resiliency project is implemented as described above in the Introduction and Project Description. A summary of the implemented solutions is presented below.

Table 5: Project Equipment Specifications

Project Location	Generation Type	Capacity (MW)
Microgrid with Tri-Gen	Tri-Generation	5.2
MS 424	Rooftop Solar PV	0.45
	Battery Storage	0.09
PS 48	Rooftop Solar PV	0.04
	Battery Storage	0.06
Other Businesses	Mobile Diesel Generators	1.1
Total Installed Capacity		**6.9 MW**

C. BCA Overview and Approach

This section summarizes the BCA of the energy resiliency pilot project for the Hunts Point Resiliency Project. Several technologies and project packages were developed, screened and evaluated, of which three project packages were formally evaluated using BCA and subsequently reviewed, discussed and refined during a workshop session with the City, project team, and stakeholders. Based on this evaluation, one preferred pilot project was identified. The pilot project and BCA is summarized in the sections that follow.

The BCA of the energy resiliency project is developed using a Sustainable Return on Investment (SROI) process whereby the analysis and assumptions are developed and then reviewed and refined with key stakeholders in a workshop environment. Using this approach, effects that can be quantified and

expressed in monetary terms are monetized. Other effects which are relevant but which cannot be expressed in monetary terms are discussed qualitatively.

The BCA methodology employed is consistent with the general principles outlined in Office of Management and Budget (OMB) Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs" as well as National Disaster Resilience Competition (NDRC) and other BCA guidelines relevant to the energy generation sector.[6]

The specific methodology developed for the Hunts Point Resiliency project was developed using core BCA principles and is consistent with HUD guidelines. In particular, the methodology involves:

- Establishing existing and future conditions under the alternative (build) and base (no-build) scenarios,
- Assessing benefits with respect to each of the five long-term outcomes identified in HUD's requirements for Rebuild by Design (RBD) projects[7] and in accordance with NDRC BCA Guidance,
- Measuring benefits in dollar terms, whenever possible, and expressing benefits and costs in a common unit of measurement,
- Using standard benefit value assumptions adopted by federal agencies including Federal Emergency Management Agency (FEMA) and the Department of Transportation, while relying on industry best practices for the valuation of other effects,
- Estimating benefits and costs over a project life cycle that includes the project development period plus 20 years of operations consistent with the expected useful life of project assets,
- Discounting future benefits and costs with the real discount rates recommended by HUD (7 percent, and an alternative of 3 percent based on common industry practices and informed by federal guidance), and
- Engaging the City, technical experts and stakeholders in a workshop review to vet and refine project packages, types of benefit and cost impacts, and key assumptions.

[6] This includes HUD BCA Guidelines, the New York Public Service Commission Order establishing the Benefit Cost Analysis Framework Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision (January 21, 2016) and the New York State Energy Research and Development Authority's Community Microgrid Benefit-Cost Analysis guide.

[7] U.S. Department of Housing and Urban Development: Community Development Block Grant Disaster Recovery (CDBGDR)-Rebuild by Design: Guidance regarding content and format of materials for approval of CDBGDR Action Plan Amendments releasing funds for construction of Rebuild by Design (RBD) projects, including guidance for Benefit-Cost Analysis, April 2016.

D. Results Summary

Overall, the **BCA shows positive outcomes with a $27.2 million net present value, 1.29 benefit-cost ratio (BCR), and an internal rate of return (13.6%)** that is well above the 7% hurdle rate. With a 3% discount rate commonly used to assess publicly funded projects, the NPV increases to $69 million and a BCR of 1.51. The top monetized project impacts are summarized in the table on the following pages and described in detail throughout this summary.

Table 6: Table Describing BCA Costs and Benefits

Cost and Benefit by Category	Qualitative Description of Effect and Rationale for Including in BCA	Quantitative Assessment	Monetized Effect, NPV ($000s)	Uncer-tainty[8]
Life Cycle Costs				
Capital Costs	Upfront one-time costs to implement the project and bring to operations.	Estimated by the Energy Resiliency Engineering Team based on costs of comparable recent project costs.	**($45,683)**	**2**
O&M Costs	Costs required to operate and maintain the system in a state of good repair during its service life.	Estimated by the Energy Resiliency Engineering Team based on costs of comparable recent project costs.	**($16,778)**	**2**
Fuel Costs	Cost of fuel (diesel or natural gas) consumed by power generating equipment.	Fuel consumption estimated by the Energy Resiliency Engineering Team. Fuel price forecasts from NY State Energy Plan and EIA 2017 Annual Energy Outlook.	**($30,615)**	**2**
Energy Cost Savings	Reduction in demand for electricity from the grid.	Electricity price are based on Bronx location-based marginal price forecasts from the NYISO 2015 CARIS.	**$27,931**	**2**
Generation Capacity Cost Savings	Avoided costs from deferring the need to invest in new bulk power generation.	Estimated reduction in demand for peaking capacity through demand response program participation and NYISO 2015 CARIS cost of generation.	**$7,162**	**2**
Resiliency Value				
Power Outage Reduction Benefits -	Avoided revenue and inventory losses from shut down	Revenue loss and inventory loss estimated based on market data and interviews	**$57,208**	**4**

[8] Based on HUD guidelines – assessment of the certainty of the effect on a scale from 1 (very certain) to 5 (very uncertain).

Markets and Businesses	operations during a major power outage event.	with market representatives.		
Power Outage Reduction Benefits - Direct Wages	Reduced impacts on FDC businesses prevent the loss of wages of workers that would be out of work until the market could come back online.	Wage losses derived based on the number of employees obtained from NYCEDC Business Reporting and average employee wages – EMSI labor market data.	**$1,694 (excluded from BCA total)**	**4**
Power Outage Reduction Benefits - Indirect Impacts	Indirect losses from impacts on FDC businesses' sales.	Direct revenue losses derived from the market impacts; Regional multipliers obtained from IMPLAN.	**$12,357 (excluded from BCA total)**	**4**
Power Outage Reduction Benefits - Community Facilities	Energy packages enable community facilities to provide refuge to those in need during major weather and outage events, and other services to community members.	Estimated based on 1,200 person capacity and a value of $331 per person per day based on U.S. General Services Administration guidelines for federal per diem reimbursable expenses.	**$459**	**4**
Reliability Improvements	Avoided costs associated with the reduction in the frequency or duration of minor power outages.	Estimated annual cost of service interruption for each class of electricity customer with state-specific inputs using the U.S. Department of Energy Interruption Cost Estimate Calculator.	**$65.10**	**2**
Environmental Values				
Greenhouse Gas Emissions	Change in environmental damages from greenhouse gas emissions, net impacts of avoided GHG emissions from bulk energy suppliers, and increased emissions from implemented energy solutions.	Emission allowance prices are based on the NYISO 2015 CARIS. CO_2 emission damage costs are based on the Interagency Working Group on Social Cost of Greenhouse Gases, Technical Update of the Social Cost of Carbon for Regulatory Impact. NY grid marginal emission rates derived from the New York Public Service Commission Case 15-E-0703, EPA National Emissions Inventory and the Commission for Environmental Cooperation (North American Power Plant Emissions).	**$3,285**	**2**
Social Values				

Health Impacts	Net impacts of avoided criteria air pollutants causing mortality and respiratory issues from bulk energy suppliers and increased pollution from implemented energy solutions.	Criteria air contaminant emission costs are estimated based on EPA Cost-Benefit Risk Assessment Screening Model.	**$27,212**	**2**
Food Supply	Maintaining power to the markets would maintain food distribution to the region and avoid supply disruptions that could result in higher food prices.	+ (qualitative scale)	**n/a**	**4**
Economic Revitalization				
Employment Opportunity	The project will create temporary and permanent job opportunities during construction and operations.	+ (qualitative scale)	**55 people construction + 8 permanent & 6 on-call**	**2**

E. Benefits Measurement, Data, and Assumptions

Implementation of the Hunts Point Resiliency project would have several impacts including life cycle costs, resiliency, environmental, social, and economic impacts.

1. Life Cycle Costs

Capital Costs

Table 7: Capital Costs

Capital Costs	$Millions
Total capital costs, excluding credits ($2016)	$62.97
Total capital costs, excluding credits ($YOE)	$71.00
Present Value ($2016)	$45.68
Equipment Life	20 years

The capital costs (Table 7) represent the full upfront one-time costs to implement the project and bring it to operations (regardless of ownership or funding structure). While all cost estimates are presented in 2016$, construction is not anticipated to begin until the year 2020 with the bulk of it spent in 2021. Therefore, the estimated total expended capital cost value, accounting for escalation over the duration of the project execution, is $45 million. The capital costs make up the far majority of the project costs. For the purposes of the BCA, the capital costs are presented exclusive of any financial credits or incentives for solar PV installations.

2. Annual Costs

Operating & Maintenance Costs

The operating and maintenance (O&M) costs include both fixed and variable costs to operate and maintain the system in a state of good repair during its service life, including costs directly associated with power generation and excluding fuel. These costs will begin to be incurred once the project is operational in 2022 and through the final year of operation in 2041. The costs are assumed to escalate at the general level of inflation over the study period (and thus remain constant for the purposes of the BCA).

Fuel Costs

Fuel costs were estimated based on the expected fuel consumption according to the equipment efficiency, frequency of use, and capacity utilization. Price forecasts for delivered fuel to the region were based on information from the New York State Energy Plan and the latest U.S. Energy Information Administration (EIA) 2017 Annual Energy Outlook price forecasts described below.

Table 8: Annual Costs

Millions 2016$	Present Value	Annual Average
O&M Costs	$16.78	$2.23
Fuel Costs	$30.62	$4.15
Total Annual Costs	$47.39	$6.38

The sum of O&M and fuel costs adds up to approximately $6.38 million per year. Given the 2022 in service date and a 7% discount rate, the discounted costs over 20 years sum to a total of $47.39 million.

3. Annual Savings

Energy Cost Savings

The main financial benefits offsetting ongoing costs are the energy cost savings, which represent the avoided cost of generating electricity on the grid and delivering it to Hunts Point. The project is anticipated to generate approximately 46,178 MWh per year.

In order to estimate the actual gross generation displaced from the grid, the annual generation is marked up by an average distribution loss factor of 3.5%[9] while it is assumed that transmission losses are

[9] NYSERDA, Assessment of Transmission and Distribution Losses in New York.

internalized in the Location Based Marginal Prices (LBMP) which reflect the marginal cost of generating electricity at a given point in time.

The actual value of avoided electricity generation from the grid was estimated based on the 5-year real time average LBMP in the Bronx during the hours the equipment is expected to operate. The 5-year average spread between the LBMP at those times and the average New York City zonal LBMP was then applied to the NYC zonal forecast in the latest New York Independent System Operator (NYISO) 2015 Congestion Assessment and Resource Integration Study (CARIS). The average price forecast is presented through year 2024 in the BCA Technical Appendix. For subsequent years, the prices are escalated using the wholesale natural gas price forecast from the EIA since the majority of marginal generators at peak times are natural gas.

Generation Capacity Cost Savings

In addition to avoided costs of generating electricity, it is possible for energy solutions to reduce load on the system during coincident peak periods, and as a result displace or defer future investments in generation or distribution capacity (e.g. the need to install new infrastructure required to meet peak system loads). Given substantial investments in local distribution infrastructure by Con Edison, it is not anticipated that distribution capacity cost savings could be reasonably attributed as a benefit; however the participation in a demand response (DR) program does yield some capacity cost savings.

The cost savings were calculated by multiplying the 5,200 kW tri-generation system capacity and the and the estimated 712 kW contribution from the solar and energy storage installations that are expected to participate in Demand Response by the installed capacity price forecasts in line with NY DPS BCA Guidance[10] based on 2015 Gold Book with updates through January 2016 as presented in the charts above. The estimates account for the reserve margin that regulated utilities must maintain above anticipated peak load and are relatively small in comparison to the energy cost savings.

Table 9: Annual Savings

Millions 2016$	Present Value	Annual Average
Energy Cost Savings	$27.93	$3.80
Generation Capacity Cost Savings	$7.16	$0.95
Total Annual Savings	$35.09	$4.75

4. Life Cycle Costs Summary

Overall, the project is expected to cost $29 million over its life cycle from a societal perspective (without accounting for renewable energy financial incentives or customer electricity bill savings which are considered to be a transfer of wealth with no impact on society as a whole). Once operational, the project is expected to offset nearly all ongoing costs with energy and generation capacity cost savings.

Table 10: Life Cycle Costs Summary

Life Cycle Costs	Present Value (Millions 2016$)	Annual Average (Millions 2016$)
Capital Costs	($45.68)	
O&M Costs	($16.78)	($2.23)
Fuel Costs	($30.62)	($4.15)
Energy Cost Savings	$27.93	$3.80
Generation Capacity Cost Savings	$7.16	$0.95

[10] New York Public Service Commission Case 14-M-0101 – Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, Order Establishing the Benefit Cost Analysis Framework.

Total Life Cycle Costs	($57.98)	($1.63)

5. Resiliency Value

The project provides several resiliency benefit streams, some of which can reasonably be monetized. Specifically, new local generation will allow the local markets and businesses to continue operating (or at least maintain critical loads to prevent inventory losses) during a major power outage and provide shelter at community facilities. Installed permanent generation (like solar PV and the Produce Market turbines) will further improve power reliability for those facilities in cases of minor power outages.

Methodology and Key Assumptions

Major Outage Probability

The probability of a major power outage due to storm surge was estimated based on anticipated inundation rates of Con Edison transformers at Hunts Point and floodplain data for each transformer and the impacted facilities from FEMA Preliminary Flood Insurance Rate Maps. It was determined that Krasdale, Sultana, and Citarella could benefit most from mobile generators during a major inundation event, which would allow them to preserve inventory for up to three days. In discussions with Con Edison, it was established that in the event of a major storm event power may be shut off a few of hours in advance as a preventative measure, and it could take as long as 48 hours to reinstate assuming that the transformer is not completely inundated (and would thus have to be replaced with an even longer outage time). Subsequently, storm surge durations of 6 to 24 hours are anticipated to result in a 2-3 day outage to the impacted facilities.

In addition to storm surge modeling estimates, it was assumed that a major outage event would occur once every 20 years (in other words with a 5% probability per year) and would cause a 3-day power outage to the peninsula. The event could range from a major Hurricane Sandy-like event to extreme heat, or anything else that causes a major system shut down. The assumption was deemed to be a reasonable representation of the project's true resiliency benefits.

All power outage reduction benefits in this section are estimated based on these major outage probabilities, while reliability improvements are estimated based on Con Edison minor outage statistics for the Bronx.

Power Outage Reduction – Markets and Businesses

Preventing and reducing power outages to local markets and businesses is the overall biggest benefit to the project. Avoiding revenue and inventory losses from shutting down operations during a storm or other major outage event preserves the substantial economic activity generated by the facilities.

The impacts of major outages on specific FDC facilities were estimated in discrete blocks of outage time (12 hours, 24 hour, 36 hours, and 72 hours without power) based on certain assumptions that were derived from interviews with market representatives and subsequently vetted with stakeholders for reasonableness. The key assumptions included the share of inventory lost due to spoilage (based on the type of inventory, turnover rates, ability to use existing backup generators, etc.), and the days to return to business (influenced by facility lighting, cleanup of lost stock, ability to conduct offsite operations, etc.) which generated direct revenue and inventory loss estimates.

Only the direct revenue and inventory economic impacts were considered for the BCA as they represent the consumer willingness to pay for these goods and services. The direct impacts were subsequently used to derive other key economic impact metrics that are not additive benefits within the BCA as they serve to measure the impact on economic activity rather than social welfare. The first derived impact is "wage losses" based on the number of employees from New York City Economic Development Corporation (NYCEDC) Business Reporting and average employee wages based on EMSI labor market data. The

other derived is "regional economic benefits" based on the multiplier effect of reduced FDC business sales using IMPLAN economic multipliers.

Power Outage Reduction - Community Facilities

The rooftop solar PV and energy storage installations at MS 424 and PS 48 will add redundancy and allow the community facilities to ensure the provision of refuge to those in need during major weather and outage events, and other services to community members (cell phone charging, bathrooms, gathering point, information, etc.). Through data from NYC Emergency Management, the BCA accounted for at least 1,200 people to be accommodated at the schools in a major event. (Additional discussions with stakeholders indicated that the capacity could even accommodate more.) A monetary value of $331 per person per day was used based on U.S. General Services Administration guidelines for federal per diem reimbursable expenses (including an average of $257 for lodging and $74 for meals and incidentals in New York City).

Reliability Improvements

Reliability improvements were estimated using average annual frequency (SAIFI[11] of 16.56 outages per 1000 customers served) and duration (CAIDI[12] of 384.6 minutes) of minor outages based on Con Edison's 5 year historical performance statistics in the Bronx. The outage statistics along with other customer attributes were entered into the U.S. Department of Energy Interruption Cost Estimate (ICE) Calculator to generate the avoided annual cost of service interruptions. The value of interruption costs is based on econometric modeling of several surveys and studies of customer willingness-to-pay to avoid service unreliability or willingness to accept compensation for service interruptions.

Benefit Estimates

Overall, the power outage reduction benefits to the local markets and businesses is the biggest monetized resiliency benefit of the project, and collectively, resiliency benefits make up the majority of the total project benefits.

Table 11: Resiliency Value Impacts Summary

Millions 2016$	**Present Value**	**Annual Average**
Power Outage Reduction – Markets and Businesses	$57.21	$7.57
Power Outage Reduction - Community Facilities	$0.459	$0.0608
Reliability Improvements	$0.065	$0.0086
Total Resiliency Benefits	**$57.73**	**$7.64**

Table 12: Indirect Economic Impacts from Resiliency Improvements

Millions 2016$	**Present Value**	**Annual Average**
Avoidance of Wage Losses	$1.69	$0.13
Regional Economic Benefits	$12.36	$0.96

[11] System Average Interruption Frequency Index.

[12] Customer Average Interruption Duration Index.

6. Environmental Value

Because all ongoing generation associated with the Hunts Point Resiliency project is from solar PV installations or will offset existing air emissions (by converting approximately 50 truck trailer refrigeration units at the Produce Market from diesel operation to electric operation and exporting hot water to the Meat Market to replace boiler use), another benefit is the reduction in fossil fuel energy consumption and the reduction in greenhouse gas (GHG) emissions compared to the base case that relies upon fossil fuels. All of the energy system components that make up the Hunts Point Resiliency project also have environmental benefits because they provide energy at the source and avoid transmission and distribution losses, which would require additional gross generation from the grid.

Methodology and Key Assumptions

Local GHG emissions were estimated based on technical specifications for the turbines and generators, as well as their operating characteristics, while emissions savings were estimated based on the equivalent amount of generation displaced from the grid (adjusted for transmission and distribution losses). The emission rates for the grid were based on the probable types of fuel on the margin and the average emission rates of plants with the same primary fuel source in New York State. The emission rates were compiled and cross-examined primarily from the U.S. Environmental Protection Agency (EPA) National Emissions Inventory; Commission for Environmental Cooperation (North American Power Plant Emissions),[13] and net metering case documents from the New York State Public Service Commission published in December 2015.[14]

Table 13: Environmental and Social Value Key Inputs

Emission Factors (lb/MWh)	**Grid**	**Turbines/Generators**
CO_2 Emissions	1,077	Varies by Equipment
NOx Emissions	0.5616	
SO_2 Emissions	0.5609	
$PM_{2.5}$ Emissions	0.0601	
VOC Emissions	0.0435	
Emission Damage Cost ($/ton)		
CO_2	$43.49	$43.49
NOx	$13,288	$49,661
SO_2	$58,254	$201,216
$PM_{2.5}$	$410,548	$1,973,626
VOC	$287	$1,843
Emission Allowance Prices ($/ton)		
CO_2 Emission Allowance per Ton	$6.53	n/a

[13] Data last accessed and extracted January 2017.

[14] New York Public Service Commission Case 15-E-0703 – In the Matter of Performing a Study on the Economic and Environmental Benefits and Costs of Net Metering Pursuant to Public Service Law §66-n.

NOx Emission Allowance per Ton	$154.64	n/a
SO_2 Emission Allowance per Ton	$0	n/a

The value of net GHG emissions in CO_2-equivalent (CO_{2e}) tons was determined based on value per ton from the Interagency Working Group on Social Cost of Greenhouse Gases, Technical Update of the Social Cost of Carbon for Regulatory Impact using the widely recommended 3% discount rate.

In addition to the estimated social value of GHG emissions, utilities in New York are subject to certain emission allowance costs for CO_2, NOx, and SO_2 emissions which are internalized in LBMP prices. Consequently, while the approach to estimating the social value of changes in GHG emissions (as well as the social value or the health impacts of other pollutants in the next section) is appropriate, the benefits of avoided allowance costs are already captured as part of the LBMP in the "energy cost savings" impact category. As such, an adjustment is made to the overall BCA analysis results to deduct the overlap in benefits. A forecast for the actual values of allowances by pollutants were derived from the same NYISO 2015 Congestion Assessment and Resource Integration Study as the average LBMP price forecast. The table below outlines the key inputs for estimating the environmental and social values of the project.

Benefit Estimates

Unlike the impacts of criteria air contaminants which have more localized impacts, GHG emissions have a much broader impact on the Earth's atmosphere. The project is anticipated to reduce overall GHG emissions by 260 tons per year resulting in a total benefit of $113 thousand over the study period.

Table 14: Environmental Value Impacts Summary

Net Greenhouse Gas Emissions Impacts	
Present Value (thousand 2016$)	$3.29
Annual Average (thousand 2016$)	$452
Change in GHG Emissions (CO_{2e} tons/yr)	(7,626)

7. Social Value

The project is anticipated to generate social value through a reduction in pollution, resilient community development, potential economic savings that could be passed on to low-moderate income residents and households in the area, increased public awareness fostering energy savings, and maintenance of food supply during power outages – all of which are primarily qualitative considerations either due to the difficulty to defensibly monetize the impacts, or due to a lack of reliable and accurate data. The impacts on health from exposure to pollution are estimated for the purposes of the BCA. To account for existing air quality concerns in the Hunts Point community, the BCA took a conservative approach weighing negative health impacts in the local project area more heavily than the benefits for the greater regional area.

Methodology and Key Assumptions

Criteria air contaminant (CAC) emissions were derived using the same approach as the greenhouse gas emissions in the Environmental Value section above, and included NOx, SO_2, $PM_{2.5}$, and VOC emissions. The social value of each pollutant per ton of emissions was estimated using EPA's Co-Benefit Risk Assessment Screening Model (COBRA). The model estimates the potential risk of health issues including asthma, heart or lung disease, and other respiratory issues associated with a change in levels of specific pollutants.

Table 15: Social Value Impacts Summary

Net Health Impacts	
Present Value (thousand 2016$)	$27.21
Annual Average (thousand 2016$)	$3.60
Change in CAC Emissions (tons/yr)	
NOx Emissions	(23.54)
SO_2 Emissions	(13.69)
PM Emissions	(2.27)
VOC Emissions	4.26

The BCA aimed to properly reflect differences of localized emissions in the more densely populated and environmental justice community of Hunts Point relative to offsetting emissions from the grid, which could impact utilities all across the State. Industry and federal BCA guidance typically uses a single average value of CAC emissions (which would have yielded a net health benefit). However, for this BCA, ncreases in local emissions were estimated based on Bronx County values to account for existing air quality concerns in the Hunts Point community, while reduction in grid emissions were estimated based on New York State-wide values. The resulting estimates were substantially higher for the Bronx, valuing local emissions nearly five times higher than those displaced from the grid.

Benefit Estimates

A reduction in net project emissions yields regional benefits in the form of a net reduction in pollution. Even with localized criteria air contaminant emissions conservatively valued approximately 4.8 times higher than New York State averages for generation displaced from the power grid, overall health impacts of the project result in a net benefit of $27.2 million.

8. Economic Revitalization

The project will create both temporary and permanent job opportunities during construction and operations which were estimated based on labor required for past comparable installation projects. The project construction duration varies from only 2 months for the community generators, to 6-18 months for solar PV and energy storage installations, and 20 months for the Produce Market turbine resulting in an estimated peak construction workforce of 55 people, as well as 8 permanent and 6 on-call employees going forward. These estimates assume staff required for individual installations and do not account for potential efficiencies between buildings where the same employees could service different equipment simultaneously. In addition to direct employment, the project will provide training and development opportunities as well as serve to improve the competitive advantage of the peninsula.

9. Other Non-monetized Impacts

There are other potential effects that have not been monetized in the analysis that provide value to the community. These include:

- The ability for the Middle School (MS) 424 and Primary School (PS) 48 to support community and emergency functions in major power outages. This will enable the schools to either be used as emergency gathering locations for the community, or to maintain core administrative functions. The BCA does not anticipate that the schools will stay open for students in major power outage circumstances.
- The FDC provides food products throughout NYC. Maintaining business function in major power outages secures food supply to the region. Without a secure supply during major outages, there will be food shortages that potentially result in higher food prices throughout the study area.

F. Project Risks and Implementation Challenges

1. Risks to Ongoing Project Benefits

The major ongoing benefit from Hunts Point Resiliency project is maintaining business functions at the Produce and Fish Markets in the FDC, including the preservation of existing inventories at these facilities.

One risk that could disrupt this benefit is a major flood or storm event that disrupts business activity at the markets such that one cannot access the markets for an extended period of time or an event that results in significant property damage at the facilities that requires operations to be shut down for repairs. In this situation, while power is maintained from the energy resiliency pilot project which includes flood protections as part of conceptual design, there could still be a loss of business function. The inventory would still be maintained, but ongoing revenues would not be preserved.

2. Project Implementation Challenges

The screening of energy resiliency technologies and project packages considered constructability and implementation challenges as key criteria. Overall, the screening criteria were developed based on HUD funding requirements, the AWG's Implementation Principles (see Appendix A), and industry standards as referenced. The output of this screening process was a list of technologies with limited implementation challenges. In addition, only proven technologies were considered; project technologies were evaluated for their proven capability to provide the intended service.

From a constructability perspective, the following was considered:

- Available & Suitable Space: Project space requirements were evaluated against available useable space in the vicinity of the proposed application. Functionality was evaluated based on sufficient space, disposition (purchase, easement, or other agreement), geotechnical, hazardous waste, and underground utility constraints.
- Ease of Permitting: Projects were evaluated for regulatory and permitting considerations that may require more significant coordination, approvals, and/or schedules for implementation due to anticipated environmental impact or administrative considerations.
- Required Infrastructure: Projects were evaluated against the quantity and types of infrastructure improvements that would be required for the installation and operation of the facility. Availability of gas, water, structures, electrical interconnection, and other factors were considered.

From an implementation perspective, the following was considered:

- Potential to Leverage Public or Private Funds: Projects were evaluated for their potential to leverage public or private funds, with the identification of potential funding sources that have been successfully utilized for precedent projects/investments being evaluated more highly. Projects could also be evaluated highly for potential to capitalize upon avoided losses, such as lowered flood insurance premiums.
- Schedule (in years) to Plan, Design and Construct: Projects were evaluated on the estimated time to plan, design, permit, and construct from completion of conceptual design in 2017.

As such, only the most realistic and feasible energy resiliency technologies passed the screening process at the outset. Some key requirements or risks to implementation are outlined below.

- **Con Edison Agreement**: Con Edison is a key partner for the design and construction of a first phase microgrid and solar plus storage project package. In addition, significant dependence upon utilization of the existing Con Edison infrastructure for the microgrid will require agreement on the terms and conditions of equipment utilization and system control, including the conditions under which Con Edison will depower its lines (for example, during a tidal surge when generation

might be needed). This is not expected to be an issue with the pilot project as the initial microgrid infrastructure is outside identified flood zone areas. The City and Con Edison have also been coordinating regularly to ensure successful design and implementation of the pilot project and plan to draft an agreement regarding the terms and conditions of the project.

- **Regulatory**: Implementation of the Hunts Point Resiliency Project will involve federal, state, and local permits and authorizations. Permits and authorizations cannot be obtained until the project design is further advanced. Coordination with federal, state, and city agencies that are potentially involved in the environmental review and regulatory permitting processes have already begun. Further coordination will continue after the identification of the pilot project to ensure that all required permits and authorizations will be obtained prior to groundbreaking.
- **Stakeholder buy-in**: The City is conducting a robust stakeholder engagement process with design and facilitation support from the Interaction Institute for Social Change and additional outreach and engagement leadership from The Point Community Development Corporation. The City and community's engagement activities began in 2015 to inform the project scope before kickoff. Building upon efforts in 2015, engagement for the Hunts Point Resiliency Project now includes a multi-pronged approach designed to:
    - Disseminate information in order to educate the public,
    - Incorporate input directly into technical analyses, and
    - Coordinate with other community-based resiliency efforts, leadership training, and workforce/ economic development opportunities.

The extensive outreach activities that have been conducted to date are described in more detail in the Section IV of the Action Plan Amendment. The engagement process and structure for this project are viewed as contributing factors to resiliency in the Hunts Point community by ensuring transparency, robust information flows, social learning, skill development and relationship/trust building. The stakeholders will continue to be engaged throughout conceptual design and environmental review for the pilot project.

G. Summary of Findings and BCA Outcomes

Overall, the BCA shows positive outcomes with a $39 million net present value, 1.29 BCR, and an internal rate of return (20.8%) that is well above the 7% hurdle rate. The tables and figure below summarize the results by monetized impact category. Using a 3% discount rate - as is common practice for publicly funded projects as a proxy for the long-term federal government borrowing rate - results in an NPV of $80 million and a BCR of 3.03.

Table 16: BCA Results

Millions of 2016$ - Discounted at 7%	
Present Value of Benefits (PV)	$120.26
Present Value of Costs (PV)	($93.08)
Net Present Value (NPV)	**$27.18**
Benefit-Cost Ratio (BCR)	1.29
Internal Rate of Return (IRR)	13.6%
Discounted Pay-back Period (years)	10.23

Table 17: Summary of Monetized Impacts

All Monetized Impacts (M 2016$)	**Undiscounted**	**NPV (7%)**
Energy Cost Savings	$76.02	$27.93
Generation Capacity Cost Savings	$18.96	$7.16
Power Outage Reduction Benefits - Markets and Businesses	$151.48	$57.21
Power Outage Reduction Benefits - Community Facilities	$1.22	$0.46
Reliability Improvements	$0.17	$0.07
Greenhouse Gas Emissions	$9.05	$3.29
Health Impacts	$72.05	$27.21
Adjustment for Grid Emission Compliance Costs	($8.13)	($3.06)
Total Benefits	**$320.80**	**$120.26**
Capital Costs	($62.97)	($45.68)
O&M Costs	($44.53)	($16.78)
Fuel Costs	($83.03)	($30.62)
Total Costs	**($190.52)**	**($93.08)**
Net Impact	**$130.28**	**$27.18**

IV. Internal Implementation Partnership

The New York City Economic Development Corporation, in partnership with the Mayor's Office of Recovery and Resiliency (ORR) – the "Project Team" – is overseeing the implementation of the Hunts Point Resiliency Project.

ORR and NYCEDC executed a Subrecipient Agreement on May 26, 2016 to administer the funding for the project. To implement the project per the requirements associated with the CDBG-DR funds and the schedule set forth by the City (to spend of all CDBG-DR dollars by 2022), NYCEDC has contracted with an engineering consultant firm to conduct a feasibility study for the resilient energy pilot project. This scope of work includes a risk and vulnerability assessment, feasibility assessment, conceptual design, environmental review, and community engagement. Future contracts will be issued for schematic design and construction.

Partner Agencies

Mayor's Office of Recovery and Resiliency

The Mayor's Office of Recovery and Resiliency leads the effort to build a stronger and more resilient New York through the implementation of recommendations described in resiliency planning policies building on a foundation of public collaboration and analysis. ORR routinely executes complex programs and successful projects with a wide array of State and Federal agencies, including the New York State Governor's Office of Storm Recovery, the New York State Division of Homeland Security and Emergency Services, NYSDEC, HUD, FEMA, and USACE, among others. ORR's multi-billion-dollar portfolio includes appropriations from Public Law 113-2 and requires careful coordination with State and Federal agencies. ORR is part of Climate Policy and Programs, a unit of the New York City Mayor's Office that leads the City's program for integrated climate actions, and includes the Office of Recovery and Resiliency, the Office of Sustainability, the Office of Environmental Coordination, and the coordination of the OneNYC Program.

New York City Economic Development Corporation

NYCEDC is a not-for-profit public benefit corporation that serves as the City's primary engine for economic development, charged with leveraging the City's assets to drive growth, create jobs, and improve quality of life. NYCEDC is currently working with ORR to advance design and planning for resiliency projects across the City, including in Hunts Point. NYCEDC's partnership with ORR provides capacity and support through the ability to procure and manage consultant teams, deliver technical analyses to diverse stakeholders, and provide needed interagency coordination to advance project goals. NYCEDC manages the FDC in Hunts Point on behalf of the City. This role includes capital improvements and management of leases to FDC tenants.

V. Stakeholder Engagement Plan

NYCEDC, ORR and the consultants are conducting a robust stakeholder engagement process with design and facilitation support from the Interaction Institute for Social Change and additional outreach and engagement leadership from The Point Community Development Corporation. Building upon efforts in the summer of 2015, engagement for the Hunts Point Resiliency Project includes a multi-pronged approach designed to:

- Disseminate information in order to educate the public,
- Incorporate input directly into technical analyses, and
- Coordinate with other community-based resiliency efforts, leadership training, and workforce/economic development opportunities.

In general, stakeholders for this project are defined as groups and individuals who, with respect to decisions being made about HUD or otherwise funded resiliency projects in Hunts Point:

- Are likely to be impacted by the outcome of the decision,
- Are typically unheard or have typically marginalized perspectives,
- Function as connectors in or across sector(s)/field(s),
- Are in a position to implement relevant and related decisions,
- Are in a position to prevent decisions from being implemented,
- Have relevant information, expertise and/or lived experience, and
- Have informal influence without authority.

The engagement process and structure for this project are viewed as *contributing factors to resiliency* in the Hunts Point community by ensuring transparency, robust information flows, social learning, skill development and relationship/trust building. The stakeholders have been and will continue to be approached and engaged in a wide array of means including:

- An Engagement Strategy Team (EST) that will continue to meet, to finalize and oversee implementation of the Stakeholder Engagement plan to ensure robust engagement throughout the Hunts Point Resiliency Project process, including input into key technical deliverables and incorporation of resiliency knowledge and skills into local programming (education, workforce development, cultural outlets).
- The AWG, to give strategic input into key technical deliverables that will inform the City's selection of priority resiliency projects, while upholding the AWG's Implementation Principles (Appendix A) throughout the Hunts Point Resiliency process and project implementation.
- Public Meetings, to convey project related information to all those who live and work in Hunts Point, and gather public feedback to support key decision points around project deliverables.
- A Neighborhood Outreach Team, composed of diverse community members who each receive a stipend, to implement the Hunts Point Resiliency Stakeholder Engagement Plan at the neighborhood/ residential level through extensive outreach and education.
- "Tabling" at public events, to share information about the project at events and venues where people are organizing, networking, and gathering.
- Ongoing communications, including the collection and dissemination of "connection stories" to help agency staff and elected officials understand the fuller picture of resiliency in Hunts Point.
- A "collaboration lab," designed with input from EST and Neighborhood Outreach members, to build more connections between residents and City officials and to help individuals and groups to prototype and test new innovations to expand collaborative spirit and skills and to realize greater engagement so that everyone in a community can act on the issues that impact their lives.

The timing, frequency and structure of the meetings serves to engage the stakeholders in two-way communications allowing for feedback to be provided to the City and the HDR Team and vice versa during each task of the project. To date, the following meetings have occurred with meeting summaries available for each:

- AWG Meeting #1[15] ─ Monday, May 23, 2016 at 9:30a – 11:30a
- EST Meeting #1 ─ Wednesday, September 21, 2016 at 10:30a – 12:30p
- AWG Meeting #2 ─ Tuesday, September 27, 2016 at 9:30a – 11:30a
- Public Meeting #1 ─ Wednesday, October 19, 2016 at 6:00p – 8:00p
- EST Meeting #2 ─ Tuesday, November 1, 2016 at 10:30a – 12:30p
- AWG Meeting #3 ─ Wednesday, December 14, 2016 at 9:30a – 11:30a
- Public Meeting #2 ─ Tuesday, January 17, 2017 at 6:00p – 8:00p
- EST Meeting #3 ─ Wednesday, February 15, 2017 at 10:30a – 12:30p

[15] This meeting was scheduled in advance of the project start date to introduce the AWG to the HDR Team and get upfront direction on risk and vulnerability metrics.

- Public Meeting #3 ─ Wednesday, March 8, 2017 at 6:00p – 8:00p
- AWG meeting #4 ─ Tuesday, May 23, 2017 at 9:30a – 11:30a
- Public meeting #4 ─ Tuesday, June 20, 2017 at 6:00p – 8:00p
- AWG meeting #5 ─ Monday, July 23, 2018 at 9:30a – 11:30a

The City maintains a list of meeting and workshop dates on the project website, which can be accessed here. The City also uploads copies of meeting presentations to the website. (Full URL: https://www.nycedc.com/project/hunts-point-resiliency-implementation)

The full Hunts Point Resiliency Citizen Participation Plan can be found in the approved Action Plan beginning on pg.166 in the "Other Program Criteria" section.

VI. Project Timeline

The project timeline for design and construction is provided in additional detail below.

- Conceptual Design – Spring to Fall 2018
    - Public meeting / Community Board Review – Fall 2018
    - PDC Conceptual Design Submission – Winter 2019
    - PDC Conceptual Design Presentation – Winter 2019
- Environmental Assessment (EA) – Fall 2018 to Summer 2019
    - Draft EA Published –Winter/Spring 2019
    - Final EA Published – Spring 2019
    - Negative Declaration / Findings of No Significant Impact (FONSI) – Spring 2019
    - Request for Release of Funds (RROF) –Spring 2019
    - Authority to Use Grant Funds (AUGF) – Summer 2019
- Air Permitting Process – Fall 2018 to Summer 2019
- RFP and Contracting for Full Design and Construction Manager – Fall/Winter 2018 to Spring 2019
- Contractor Notice to Proceed (NTP) – Spring 2019
    - Preliminary and Final Design – Spring 2019 to Fall
    - Public meeting / Community Board Review – Fall 2019 to Winter 2020
    - PDC Preliminary Design Submission – Winter 2019
    - PDC Preliminary Design Presentation –Winter 2019
    - Community Board Review – Spring 2019 to Summer 2019
    - PDC Final Design Submission – Summer 2019
    - PDC Final Design Presentation – Summer 2019
- Site Development and Construction – Spring 2020 to Summer 2022
    - Construction Permitting – Spring 2020 to Fall 2020
    - Procurement (Materials and Equipment) – Spring 2020 to Spring 2021
    - Mobilization and Groundbreaking – Spring 2021
    - Installation – Spring 2021 – Spring 2023
    - Project Completion – Spring 2023

VII. Leveraged or Reasonably Anticipated Funds

As described in the Project Funding section above, a total of $20 million was allocated to this activity by HUD through the RBD competition. The City has dedicated an additional $25 million of CDBG-DR funding and an additional $26 million in City capital to support the implementation of this project. This total CDBG-DR Allocation of $ 45,000,000 is to be spent by 2022, with the remaining $26 million in City capital funding available after the HUD deadline.

As previously noted, alternative funding sources will be investigated for the implementation of the community solar program associated with the pilot microgrid and solar plus energy storage project.

VIII. List of Figures

A list of figures included with this draft Project Description is as follows:

1. Hunts Point Resiliency Project Study Area and Context
2. Hunts Point Resiliency Project Study Area
3. FEMA Preliminary Flood Hazard Area with 2050s Sea Level Rise
4. Critical, Vulnerable Facilities within Flood Hazard Area
5. Proposed Site Plan for Simple Cycle Microgrid Turbine

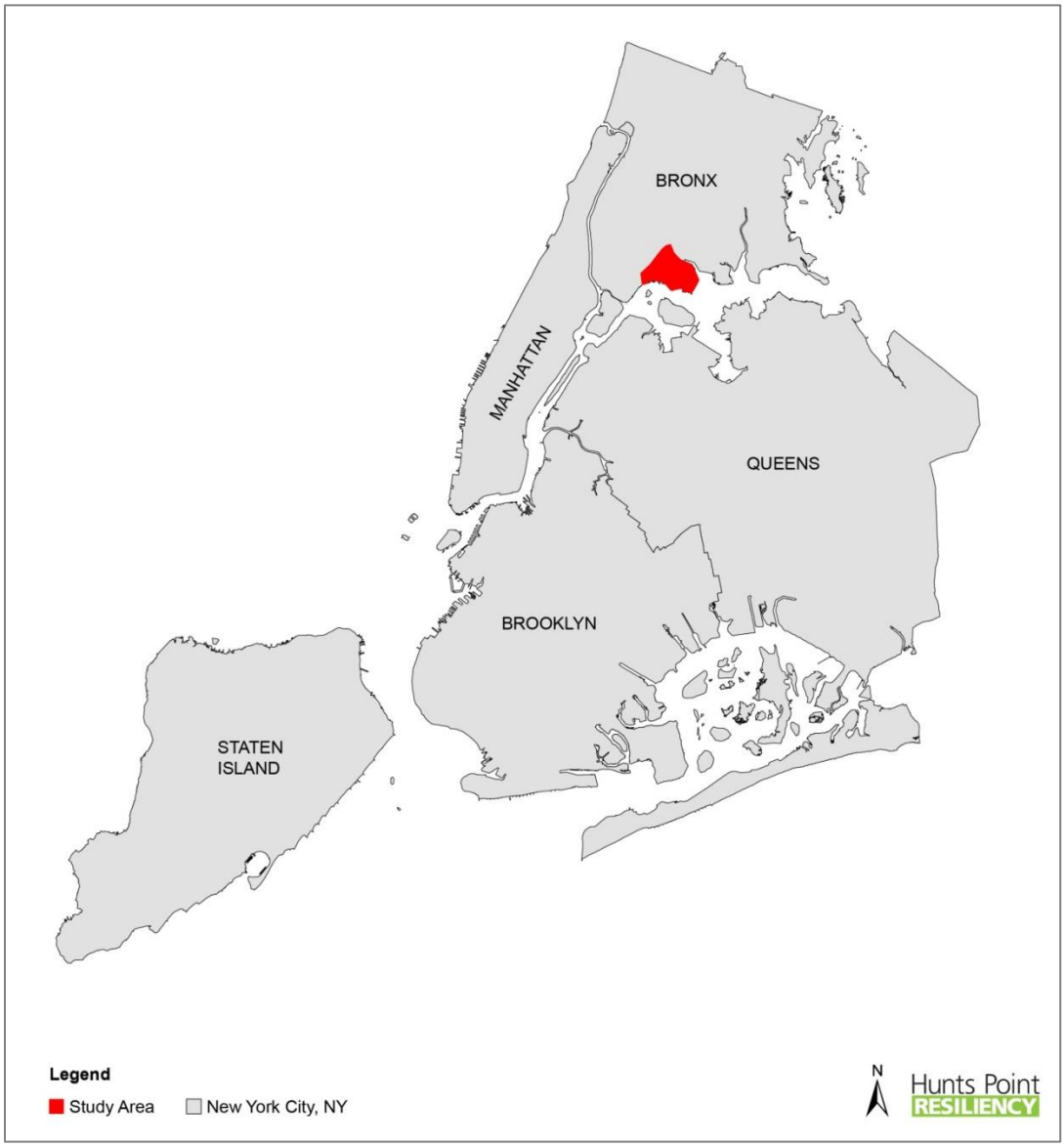

Figure 1: Hunts Point Resiliency Project Study Area and Context

Figure 2. Hunts Point Resiliency Project Study Area

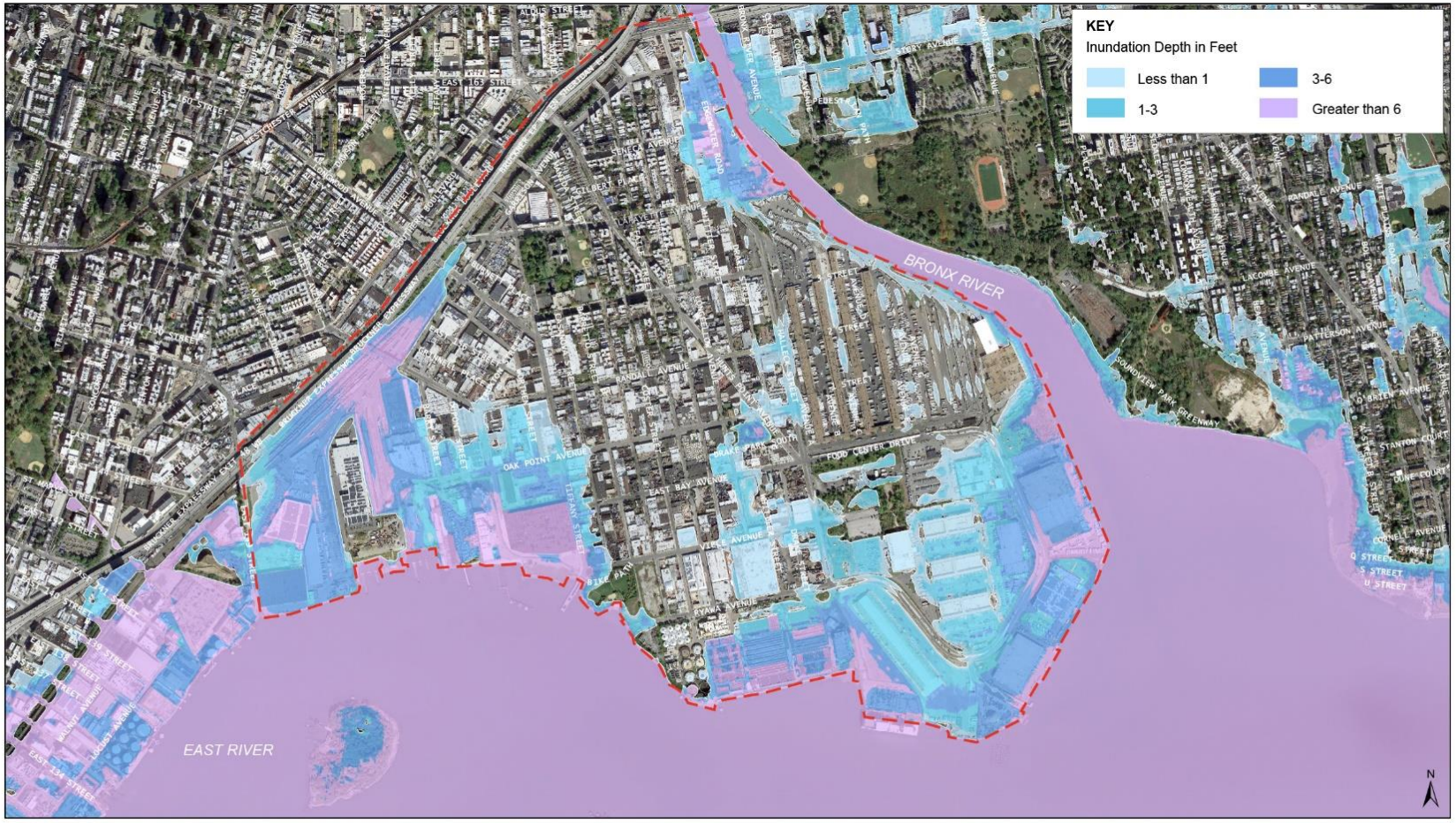

Figure 3. FEMA Preliminary Flood Hazard Area with 2050s Sea Level Rise

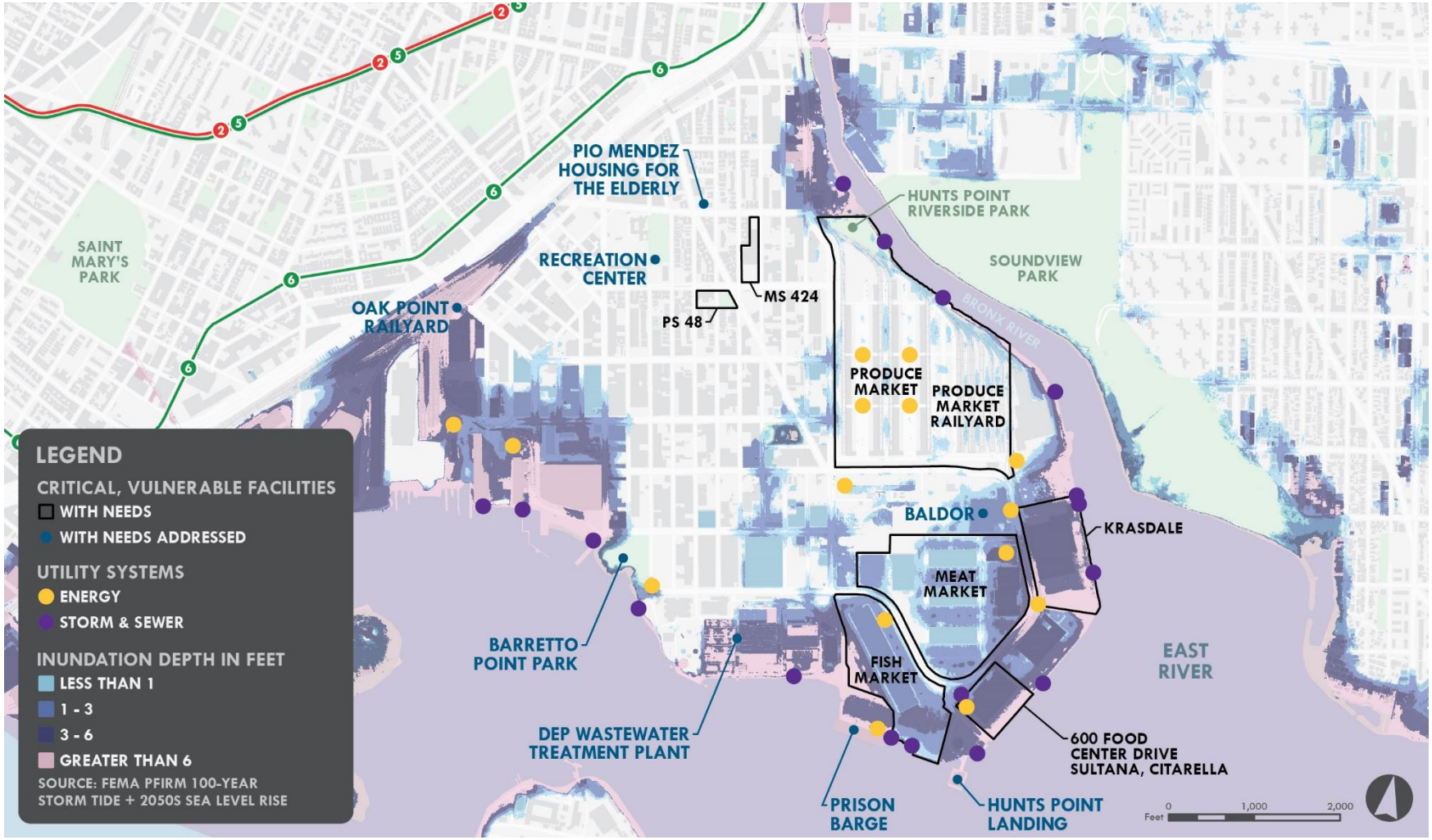

Figure 4. Critical, Vulnerable Facilities within Flood Hazard Area

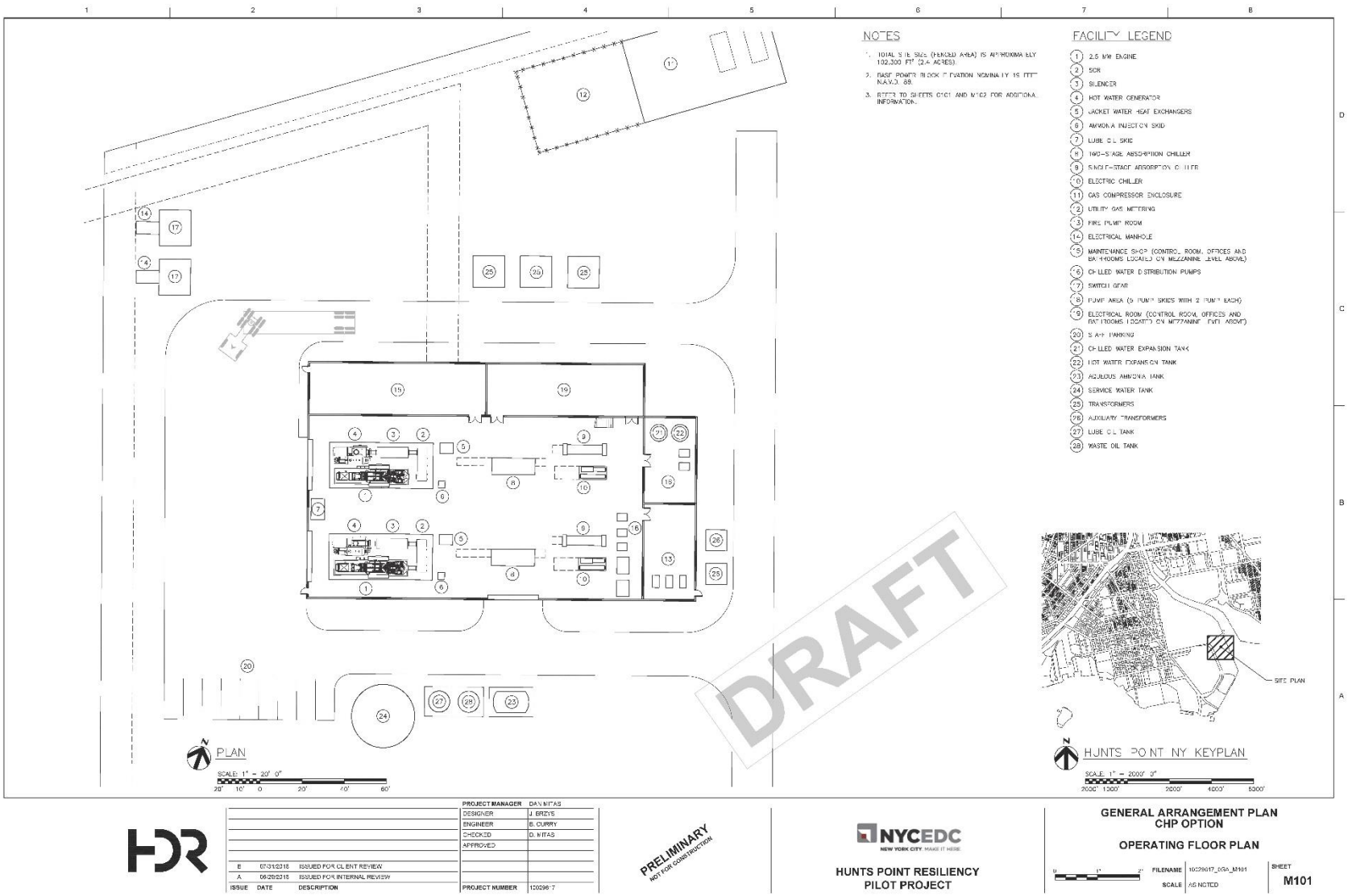

Figure 5. Proposed Site Plan Tri-Generation Microgrid

Appendix A: Advisory Working Group Implementation Principles

The following set of *implementation principles* were established by the Advisory Working Group, the City, and the project team and have served as guiding principles for the planning, implementation and ongoing operation of the Hunts Point Resiliency Project:

- Leadership Development - Embedded in any project, Advisory Working Group members would like there to be some intention around who will carry the work forward in the future, including considerations of leadership training opportunities.
- Emergency Preparedness – How can we leverage these kinds of opportunities to build human capital and help people grow their skills along with the infrastructure in the direction of preparedness for future events?
- Sustainability – Group members expressed a strong interest in sustainable, ecologically-sensitive materials, soft infrastructure over hard, renewable energy.
- Leverageable – Given that the available funds for this project are small in comparison to the need, how can we choose projects that will draw investment from the City, State, Federal and other interested parties?
- Stakeholder participation in an ongoing way – Engagement should not end "when the shovel goes in the ground." There has to be an ongoing sense of accountability and participation from key stakeholders from the community and industry.
- Transparency from City agencies with regards to other capital investment projects/studies - Advisory Working Group members would like to be made aware of other capital investments on the horizon, making budgetary information as transparent as possible on an ongoing basis.
- Integrate these principles/criteria into other City projects - How can these principles and criteria be integrated into other City projects? Is this a model, how can it be a model?
- Local procurement - Where does the cement come from? The labor? The services to get things built? Advisory Working Group members want to make sure money invested from the government circulates in the South Bronx.
- Training - How do we leverage this process and project to ensure that people who are ready to enter the workforce can learn and find jobs?
- High road economic development project – Union jobs, prevailing wage, reward people for their efforts and the sweat of their brow. Any jobs related to these projects should be living wage jobs.
- Multiple benefits – Projects should be of broad benefit, for example serving needs and interests of both business and community and/or providing protection against major climate events while also providing everyday benefits
- Ongoing mechanism for translation of terms/categories/concepts – Everyone in the room should have enough information to participate. Make sure everyone understands what is being discussed.
- Scalability - Find ways to scale projects in an orderly fashion and in a way that does not overrun the budget.
- Consider critical vulnerabilities of the community for people who live in the neighborhoods.

Appendix B: Technical Benefit Cost Analysis

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Executive Summary

A total investment of $71 million in Community Development Block Grant Disaster Recovery (CDBG-DR) funds ($20 million via the Rebuild by Design program, $25 million contribution from New York City's larger CDBG-DR allocation, and $26 million from New York City capital funds) is dedicated to the "continued robust planning and study related to the future of the food market and a small pilot/demonstration project (to be selected by the City)" in Hunts Point. The Hunts Point Resiliency Project meets the project purpose and need by identifying an energy resiliency pilot project and providing a sustainable, reliable and resilient energy solution to the Hunts Point area through a combination of power generation solutions. The pilot project comprises rooftop solar photovoltaic (PV) generation with battery energy storage systems, a microgrid with tri-generation, and backup generators for the supply of short- and long-term, dispatchable energy resiliency. All of the individual energy components that make up the complete Hunts Point Resiliency project have independent utility.

In conjunction with the implementation of the pilot project, there is a separate but related initiative to add rooftop solar PV generation under a community solar structure that would provide residents the option to purchase power directly from a solar developer and, in turn, receive monthly deductions on their Con Edison bills. The community shared solar project does not affect the independent utility of the Hunts Point Resiliency project.

The pilot project consists of the following components:

Microgrid with Tri-Generation – This component of the project involves a microgrid powered by a tri-generation system. The tri-generation system will supply full electrical power to the Produce Market, as well as re-capture and convert the waste heat to provide hot water for boilers at the Meat Market and chilled water for cooling at the Produce Market. In the event of an emergency when the electrical grid is not available, a section of the Con Edison distribution system in the Hunts Pont area will be isolated from the grid via sectionalizing switches to form a microgrid.

Community Facility Solar/Storage Installations – To provide sustainable and resilient power supply to some of the primary community facilities, the project will involve the installation of rooftop solar photovoltaic generation and battery energy storage for both the Middle School (MS) 424 and Primary School (PS) 48.

Emergency Backup Generation for Businesses – To provide resilient power supply to some of the other buildings outside of the markets, the project includes the purchase of nominally four mobile diesel generators with the installation of transfer switches to allow the connection of these generators during emergency periods.

The Benefit-Cost Analysis (BCA) of the pilot project was prepared in line with US Department of Housing and Urban Development (HUD) requirements, other federal guidelines, and industry best practices. The **analysis period of 20 years** reflects the average useful life of equipment, all values are estimated using **constant 2016 prices** (depicted as 2016$), **no general inflation** is used to escalate any values, and a **7% base discount rate** is used to bring all future values to a present value (PV) in 2016$. The sensitivity section of the report also presents results using a 3% discount rate as is common practice for publicly funded projects as a proxy for the long-term federal government borrowing rate.

Overall, the **BCA shows positive outcomes with a $27.2 million net present value, 1.29 benefit-cost ratio (BCR), and an internal rate of return (13.6%)** that is well above the 7% hurdle rate. With a 3% discount rate commonly used to assess publicly funded projects, the NPV increases to $69 million and a BCR of 1.51. The top monetized project impacts are summarized in Table 1 and described in detail throughout this appendix.

Table 1: Table Describing BCA Costs and Benefits

Cost and Benefit by Category	Page # in Narrative Description	Qualitative Description of Effect and Rationale for Including in BCA	Quantitative Assessment	Monetized Effect, NPV ($000s)	Uncer-tainty[16]
Life Cycle Costs					
Capital Costs	Pg. 7	Upfront one-time costs to implement the project and bring to operations.	Estimated by the Energy Resiliency Engineering Team based on costs of comparable recent project costs.	**($45,683)**	**2**
O&M Costs	Pg. 8	Costs required to operate and maintain the system in a state of good repair during its service life.	Estimated by the Energy Resiliency Engineering Team based on costs of comparable recent project costs.	**($16,778)**	**2**
Fuel Costs	Pg. 8	Cost of fuel (diesel or natural gas) consumed by power generating equipment.	Fuel consumption estimated by the Energy Resiliency Engineering Team. Fuel price forecasts from NY State Energy Plan and EIA 2017 Annual Energy Outlook.	**($30,615)**	**2**
Energy Cost Savings	Pg. 9	Reduction in demand for electricity from the grid.	Electricity price are based on Bronx location-based marginal price forecasts from the NYISO 2015 CARIS.	**$27,931**	**2**
Generation Capacity Cost Savings	Pg. 10	Avoided costs from deferring the need to invest in new bulk power generation.	Estimated reduction in demand for peaking capacity through demand response program participation and NYISO 2015 CARIS cost of generation.	**$7,162**	**2**
Resiliency Value					
Power Outage Reduction Benefits - Markets and Businesses	Pg. 13	Avoided revenue and inventory losses from shut down operations during a major power outage event.	Revenue loss and inventory loss estimated based on market data and interviews with market representatives.	**$57,208**	**4**
Power Outage Reduction Benefits - Direct Wages	Pg. 13	Reduced impacts on FDC businesses prevent the loss of wages of workers that would be out of work until the market could come back online.	Wage losses derived based on the number of employees obtained from NYCEDC Business Reporting and average employee wages – EMSI labor market data.	**$1,694 (excluded from BCA total)**	**4**
Power Outage Reduction Benefits - Indirect Impacts	Pg. 13	Indirect losses from impacts on FDC businesses' sales.	Direct revenue losses derived from the market impacts; Regional multipliers obtained from IMPLAN.	**$12,357 (excluded from BCA total)**	**4**
Power Outage Reduction Benefits - Community Facilities	Pg. 19	Energy packages enable community facilities to provide refuge to those in need during major weather and outage events, and other services to community members.	Estimated based on 1,200 person capacity and a value of $331 per person per day based on US General Services Administration guidelines for federal per diem reimbursable expenses.	**$459**	**4**
Reliability Improvements	Pg. 19	Avoided costs associated with the reduction in the frequency or duration of minor power outages.	Estimated annual cost of service interruption for each class of electricity customer with state-specific inputs using the US Department of Energy Interruption Cost Estimate Calculator.	**$65.10**	**2**
Environmental Values					
Greenhouse Gas (GHG) Emissions	Pg. 19	Change in environmental damages from GHG emissions, net impacts of avoided GHG emissions from bulk energy suppliers, and increased emissions from implemented energy solutions.	Emission allowance prices are based on the NYISO 2015 CARIS. CO_2 emission damage costs are based on the Interagency Working Group on Social Cost of Greenhouse Gases, Technical Update of the Social Cost of Carbon for Regulatory Impact. NY grid marginal emission rates derived from the New York Public Service Commission Case 15-E-0703, the USEPA National Emissions Inventory and the Commission for Environmental Cooperation (North American Power Plant Emissions).	**$3,285**	**2**
Social Values					
Health Impacts	Pg. 20	Net impacts of avoided criteria air pollutants causing mortality and respiratory issues from bulk energy suppliers and increased pollution from implemented energy solutions.	Criteria air contaminant emission costs are estimated based on the USEPA Cost-Benefit Risk Assessment Screening Model.	**$27,212**	**2**
Food Supply	Pg. 22	Maintaining power to the markets would maintain food distribution to the region and avoid supply disruptions that could result in higher food prices.	+ (qualitative scale)	**n/a**	**4**

[16] Based on HUD guidelines – assessment of the certainty of the effect on a scale from 1 (very certain) to 5 (very uncertain).

Economic Revitalization					
Employment Opportunity	Pg. 22	The project will create temporary and permanent job opportunities during construction and operations.	+ (qualitative scale)	**55 people construction + 8 permanent & 6 on-call**	**2**

1 Introduction

This report presents the technical BCA of the energy resiliency pilot project for the Hunts Point Resiliency Project. This overall study process has been guided by a Sustainable Return on Investment (SROI) approach where several technology and project packages were developed, screened and evaluated. Ultimately, four project packages were formally evaluated using SROI, where preliminary BCA results for each package were reviewed, discussed and refined during a workshop session with the City, project team, and stakeholders. Based on this evaluation, one preferred pilot project was identified. The pilot project and BCA is summarized in the sections that follow.

2 BCA Overview and Approach

The BCA of the Hunts Point Resiliency project is developed using a SROI process whereby the analysis and assumptions are developed and then reviewed and refined with key stakeholders in a workshop environment. Using this approach, effects that can be quantified and expressed in monetary terms are monetized. Other effects which are relevant but which cannot be expressed in monetary terms are discussed qualitatively.

The BCA methodology employed is consistent with the general principles outlined in Office of Management and Budget (OMB) Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs" as well as National Disaster Resilience Competition (NDRC) and other BCA guidelines relevant to the energy generation sector.[17]

BCA is a conceptual framework that quantifies in monetary terms as many of the costs and benefits of a project as possible. Benefits are broadly defined. They represent the extent to which people impacted by the project are made better off. In other words, central to BCA is the idea that people are best able to judge what is "good" for them, or what improves their well-being or welfare.

BCA also adopts the view that a net increase in welfare (as measured by the summation of individual welfare changes) is a good thing, even if some parties benefit, while others do not. A project or proposal would be rated positively if the benefits to some are large enough to compensate the losses of others.

Finally, BCA is typically a forward-looking exercise, seeking to anticipate the welfare impacts of a project or proposal over its entire life cycle. Future welfare changes are weighted against today's changes through discounting, which is meant to reflect society's general preference for the present, as well as broader inter-generational concerns.

The specific methodology developed for this energy resiliency pilot project was developed using core BCA principles and is consistent with HUD guidelines. In particular, the methodology involves:

- Establishing existing and future conditions under the alternative (build) and base (no-build) scenarios;

[17] This includes HUD BCA Guidelines, the New York Public Service Commission Order establishing the Benefit Cost Analysis Framework Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision (January 21, 2016) and the New York State Energy Research and Development Authority's Community Microgrid Benefit-Cost Analysis guide.

- Assessing benefits with respect to each of the five long-term outcomes identified in HUD's requirements for Rebuild by Design projects[18] which are in line with NDRC BCA Guidance;
- Measuring benefits in dollar terms, whenever possible, and expressing benefits and costs in a common unit of measurement;
- Using standard benefit value assumptions adopted by federal agencies (i.e., Federal Emergency Management Agency - FEMA, Department of Transportation - DOT, etc.) while relying on industry best practices for the valuation of other effects;
- Estimating benefits and costs over a project life cycle that includes the project development period plus 20 years of operations consistent with the expected useful life of project assets;
- Discounting future benefits and costs with the real discount rates recommended by HUD (7%, and an alternative of 3% based on common industry practices and informed by federal guidance); and
- Engaging the City, technical experts and stakeholders in a workshop review to vet and refine project options, types of benefit and cost impacts, and key assumptions.

3 Project Description

The Hunts Point Resiliency Project meets the project purpose and need by reducing the peninsula's vulnerability to coastal flooding through a pilot project that provides a reliable and resilient energy solution to the Hunts Point area through a combination of power generation solutions. The pilot project incorporates rooftop solar photovoltaic (PV) generation, battery energy storage, a CHP facility with microgrid, and other fossil fueled energy generation technologies for the supply of short- and long-term, dispatchable energy resiliency. In conjunction with the implementation of the pilot project, there is a separate but related initiative to add rooftop solar PV generation to a number of businesses under a community solar structure that would provide residents the option to purchase power directly from a solar developer and, in turn, receive monthly deductions on their Con Edison electricity bills.

The pilot project outlined herein consists of the following components, all of which offer independent utility.

Produce Market and Anchor Microgrid – This component of the Proposed Project involves a combined heat and power (CHP) facility consisting of two 2.6 MW reciprocating internal combustion natural gas engine generators with heat recovery hot water generators, two 400-ton two-stage absorption chillers, and two 300-ton single stage absorption chillers. The CHP facility will operate year round and supply electricity to the Con Edison grid that will offset a significant portion of the electrical loads of the Produce and Meat Markets, while exporting hot water to the Meat Market and chilled water to the Produce Market. The microgrid will use a portion of Con Edison's existing infrastructure and will be completely separable from the larger grid so that the microgrid can operate independently from Con Edition in the event of an emergency. The CHP facility will control criteria air contaminants via the use of the latest emissions control equipment. The microgrid has independent utility and can provide full resiliency to the Produce Market. The microgrid would prevent inventory spoilage and enable the Produce Market to continue full produce distribution operations in the event of an emergency. When operating under emergency conditions, the CHP facility will also be able to continue export of about 1,100 tons of chilling load to the Produce Market. If necessary during emergency operations, the CHP facility will prioritize the use of hot water for purposes of producing chilled water to the Produce Market and limit the amount of hot water exported to the Meat Market. In this

[18] US Department of Housing and Urban Development: CDBG-DR Rebuild by Design: Guidance regarding content and format of materials for approval of CDBG-DR Action Plan Amendments releasing funds for construction of Rebuild by Design projects, including guidance for Benefit-Cost Analysis, April 2016.

case, the existing gas boilers at the Meat Market will be used to make-up the deficit in hot water to maintain operation of the Meat Market.

Community Facility Solar/Storage Installations – To provide sustainable and resilient power supply to two primary community facilities, the project will involve the installation of rooftop solar PV generation and battery energy storage for both the Middle School (MS) 424 and Primary School (PS) 48. The total supported installation is approximately 0.5 MW of solar capacity with eight hours of energy storage capacity for facility critical loads. This level of power will enable the facilities to provide shelter, refuge, or gathering spaces in emergency situations.

Emergency Backup Generation – To provide resilient power supply to other important citywide food distributors and employers in the Food Distribution Center that are also, the energy resiliency pilot project includes the purchase of four 275 kW, mobile diesel generators with the installation of transfer switches to allow the connection of these generators during emergency periods. This fleet of mobile generators enables immediate energy resiliency with minimal capital construction and costs for additional facilities that are critical to the city's food supply chain.

The locations, capacities, and utilization of the various installations are summarized below in Table 2.

Table 2: Project Equipment Specifications

Project Location	Generation Type	Capacity (MW)	Purpose
Produce Market	CHP Facility	5.2	Produce and Meat Markets Resiliency / Microgrid
MS 424	Rooftop Solar PV Battery Storage	0.45 0.09	Community Resiliency
PS 48	Rooftop Solar PV Battery Storage	0.04 0.06	
Other Businesses	Mobile Diesel Generators	1.1	Business Resiliency
Total Installed Capacity		**6.9 MW**	

3.1 Base Case and Alternative

Base Case

The Base Case is defined as existing conditions and without the pilot project. The Hunts Point Resiliency study area as a whole faces its greatest threats from storm surge along areas of the coastline, building and system-level outages, and extreme heat. Economic resilience in the industrial area depends on physical resilience, i.e., staying in business, and the Food Distribution Center (FDC) businesses are part of a regional network of sellers and purchasers. Social resilience is directly dependent on the physical resiliency of community facilities and the ability of any new proposed project to address environmental justice concerns within the community.

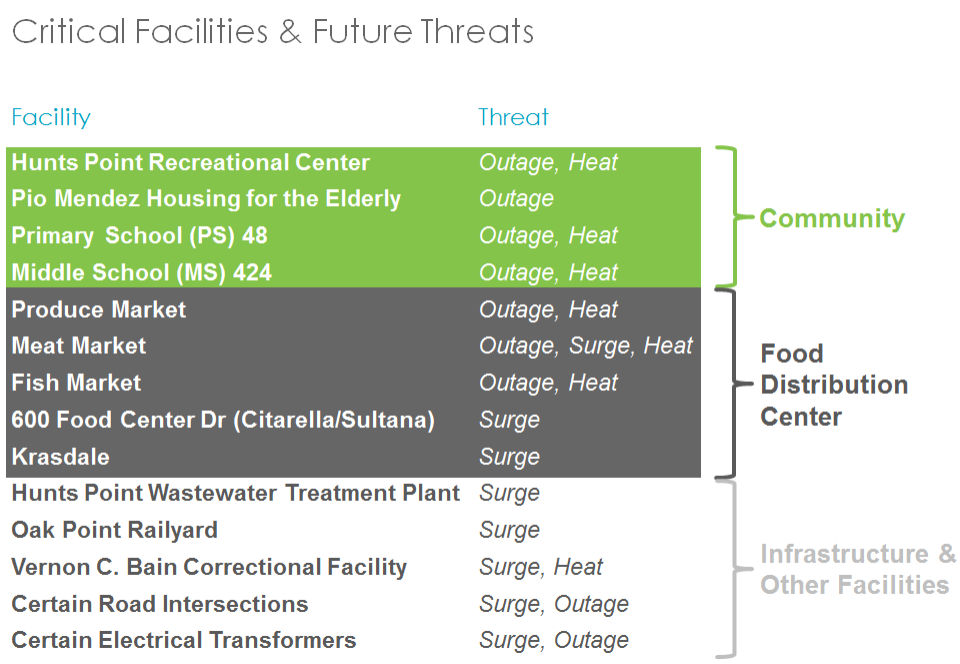
Key points pertaining to the Base Case conditions include:

1. Building and system-level power outages are a significant and shared threat to residents and businesses in Hunts Point.
2. Due to considerable elevation change, the low-lying areas face significant threats from coastal flooding while the upland residential area does not.
3. Extreme rain/snow storms are not a major threat in Hunts Point.

4. The number of community organizations and history of organizing in Hunts Point can lay the foundation for strong social resiliency.

Several key economic centers including FDC facilities are vulnerable to a combination of building and system-level energy outages, storm surge, and extreme heat events. Food Center Drive, the main street to and from the FDC, would be under water in a 100-year storm tide and 2050 sea level rise. Social services in the residential areas and, specifically, the schools that serve as community centers and emergency shelters (PS 48 and MS 424), are vulnerable to energy outages and extreme heat due to the potential displacement of schoolchildren and employees during an outage or if these facilities could not be used during an emergency because of a lack of power or air conditioning. The future threats and vulnerable critical facilities based on an assessment of the base case completed for the Hunts Point Resiliency Project are summarized in Figure 1.

Figure 1: Base Case Critical Facilities and Threats



Alternative Case

The Alternative Case assumes that Hunts Point Resiliency project is implemented as described above in the Introduction and Project Description.

3.2 Project Impacts

Implementation of Hunts Point Resiliency project would have several impacts including life cycle costs, resiliency, environmental, social, and economic impacts. These are briefly summarized below (Table 3) and are explored in more detail in the following section.

Table 3: Project Impacts

Category	Cost and Benefit by Category	Description of Effect

Life Cycle Costs	Capital Costs	Upfront one-time costs to implement the Energy Resiliency pilot project and bring the project to operation.
Life Cycle Costs	O&M Costs	Costs required to operate and maintain the system in a state of good repair during its service.
Life Cycle Costs	Fuel Costs	Cost of fuel (diesel or natural gas) consumed by power generating equipment.
Life Cycle Costs	Energy Cost Savings	Reduction in demand for electricity from the grid after pilot project implementation.
Life Cycle Costs	Generation Capacity Cost Savings	Avoided costs from deferring the need to invest in new bulk power generation after pilot project implementation.
Resiliency	Reliability Improvements	Avoided costs associated with the reduction in the frequency or duration of power outages after pilot project implementation.
Resiliency	Power Outage Reduction Benefits - Markets and Businesses	Avoided revenue and inventory losses from shut down operations during a major power outage event after pilot project implementation.
Resiliency	Power Outage Reduction Benefits - Direct Wages	Reduced impacts on FDC businesses prevent the loss of wages of workers that would be out of work until the market could come back online after pilot project implementation.
Resiliency	Power Outage Reduction Benefits - Indirect Impacts	Reduction in indirect losses from impacts on FDC businesses sales including avoided loss of economic activity by suppliers and consumers of the markets, as well as employee spending.
Resiliency	Power Outage Reduction Benefits - Community Facilities	Pilot project implementation enables the community facilities to provide refuge to those in need during major weather and outage events, and other services to community members.
Environmental	GHG Emissions	Change in environmental damages from GHG emissions, net impacts of avoided GHG emissions from bulk energy suppliers and local emissions offsets, and increased emissions from implemented energy solutions.
Social	Health Impacts	Net impacts of avoided criteria air pollutants causing mortality and respiratory issues from bulk energy suppliers and local emissions offsets, increased pollution from implemented energy solutions.
Social	Food Supply	Maintaining power to the markets would maintain food distribution to the region and avoid supply disruptions that could result in higher food prices.
Economic Revitalization	Employment Opportunity	The project will create temporary and permanent job opportunities during construction and operations.

4 Benefits Measurement, Data, and Assumptions

The BCA was prepared in line with HUD requirements, other federal guidelines, and industry best practices. The **analysis period of 20 years** reflects the average useful life of equipment, all values are estimated using **constant 2016 prices** (depicted as 2016$), **no general inflation** is used to escalate any values, and a **7% base discount rate** is used to bring all future values to a present value (PV) in 2016$. The sensitivity section of the report also presents results using a 3% discount rate as is common practice for publicly funded projects as a proxy for the long-term federal government borrowing rate.

4.1 Life Cycle Costs

4.1.1 Capital Costs

The capital costs (Table 4) represent the full upfront one-time costs to implement the project and bring it to operations (regardless of ownership or funding structure). While all cost estimates are presented in 2016$, construction is not anticipated to begin until the year 2020 with the bulk of it spent in 2021. Therefore, the

estimated total expended capital cost value, accounting for escalation over the duration of the project execution, is $71 million. The capital costs make up the far majority of the project costs. For the purposes of the BCA, the capital costs are presented exclusive of any financial credits or incentives for solar PV installations.

Table 4: Capital Costs

Capital Costs	$Millions
Total capital costs, excluding credits (2016$)	$62.97
Total capital costs, excluding credits (YOE$)	$71.00
Present Value (2016$)	$45.68
Equipment Life	20 years

4.1.2 Annual Costs

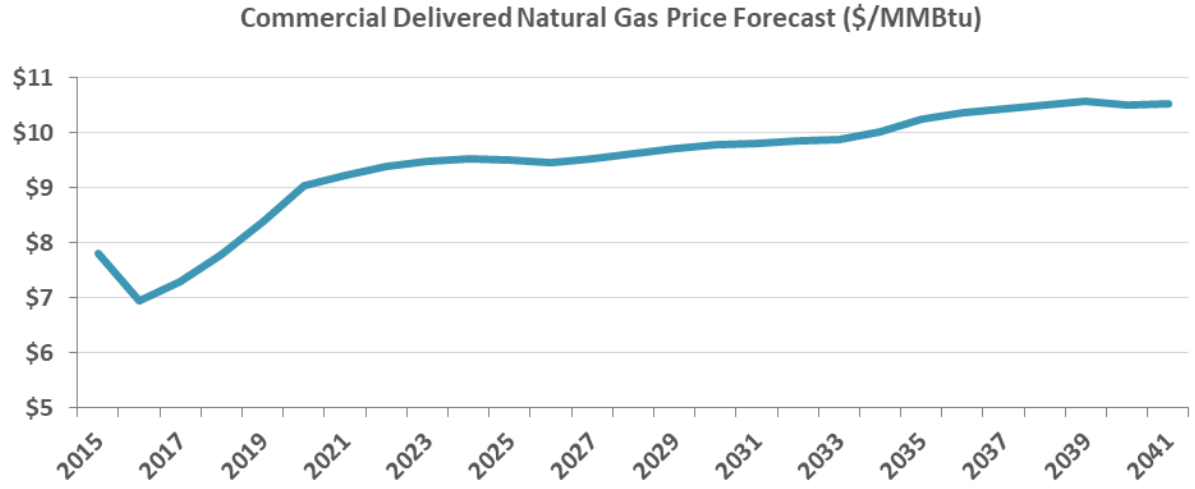
4.1.2.1 Operating & Maintenance Costs

The operating and maintenance (O&M) costs include both fixed and variable costs to operate and maintain the system in a state of good repair during its service life, including costs directly associated with power generation and excluding fuel. These costs will begin to be incurred once the project is operational in 2022 and through the final year of operation in 2041. The costs are assumed to escalate at the general level of inflation over the study period (and thus remain constant for the purposes of the BCA).

4.1.2.2 Fuel Costs

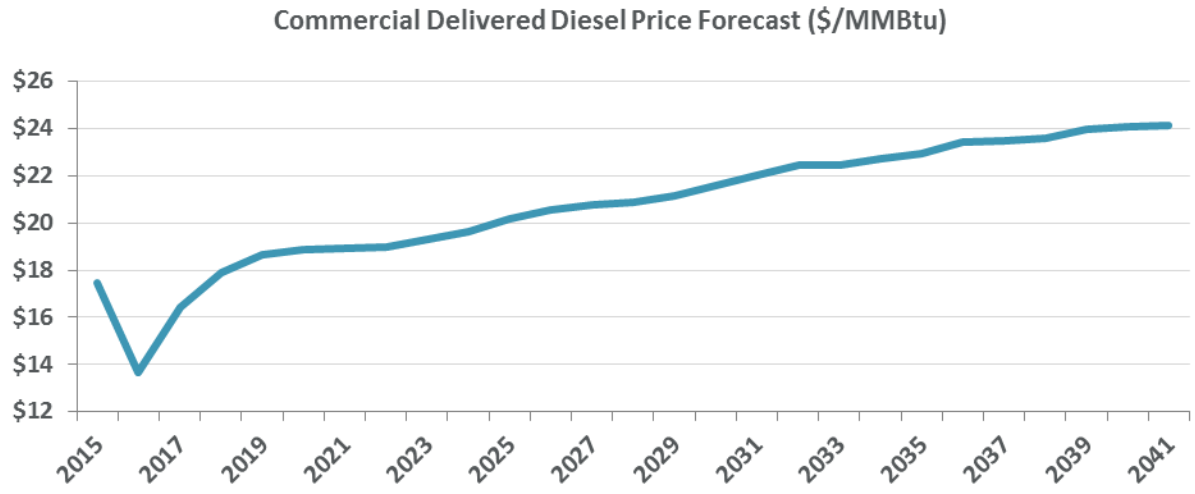
Fuel costs were estimated based on the expected fuel consumption according to the equipment efficiency, frequency of use, and capacity utilization. Price forecasts for delivered fuel to the region were based on information from the New York State Energy Plan and the latest US Energy Information Administration (EIA) 2017 Annual Energy Outlook price forecasts presented below in Figures 3 and 4.

Figure 2: Natural Gas Price Forecast



Source: EIA Annual Energy Outlook 2017, census division 2 - NY, NJ, PA; 2016$

Figure 3: Diesel Price Forecast



Source: EIA Annual Energy Outlook 2017, census division 2 - NY, NJ, PA; 2016$

The sum of O&M and fuel costs adds up to approximately $6.38 million per year. Given the 2022 in service date and a 7% discount rate, the discounted costs over 20 years sum to a total of $47.39 million (Table 5).

Table 5: Annual Costs

Millions 2016$	Present Value	Annual Average
O&M Costs	$16.78	$2.23
Fuel Costs	$30.62	$4.15
Total Annual Costs	**$47.39**	**$6.38**

4.1.3 Annual Savings

4.1.3.1 Energy Cost Savings

The main financial benefits offsetting ongoing costs are the energy cost savings, which represent the avoided cost of generating electricity on the grid and delivering it to Hunts Point. The project is anticipated to generate approximately 46,178 MWh per year.

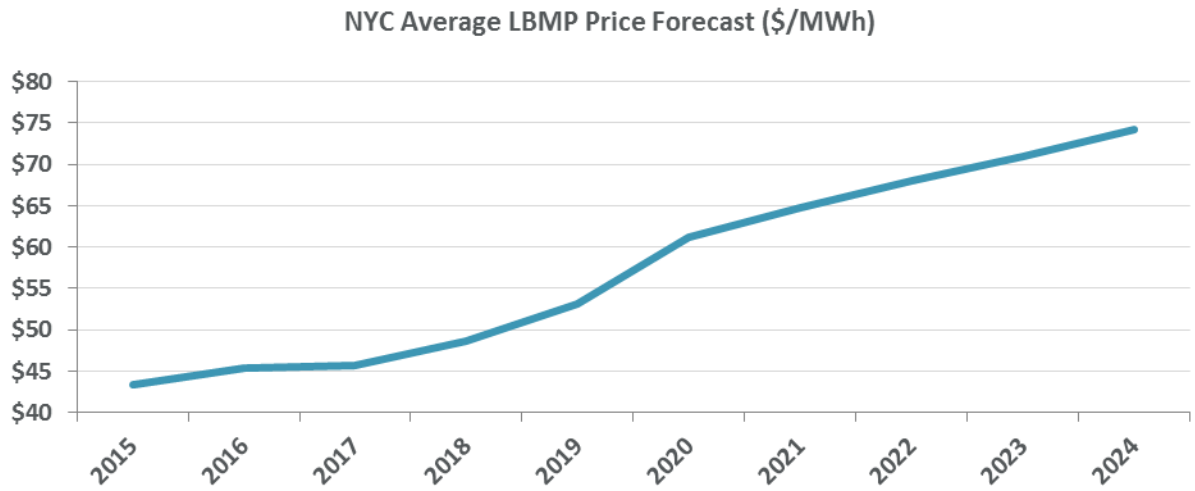
In order to estimate the actual gross generation displaced from the grid, the annual generation is marked up by an average distribution loss factor of 3.5%[19] while it is assumed that transmission losses are internalized in the Location Based Marginal Prices (LBMP) which reflect the marginal cost of generating electricity at a given point in time.

The actual value of avoided electricity generation from the grid was estimated based on the 5-year real time average LBMP in the Bronx during the hours the equipment is expected to operate. The 5-year average spread between the LBMP at those times and the average New York City zonal LBMP was then applied to the NYC zonal forecast in the latest New York Independent System Operator (NYISO) 2015 Congestion

[19] NYSERDA, Assessment of Transmission and Distribution Losses in New York.

Assessment and Resource Integration Study (CARIS). The average price forecast is presented through year 2024 in Figure 5. For subsequent years, the prices are escalated using the wholesale natural gas price forecast from the EIA since the majority of marginal generators at peak times are natural gas.

Figure 4: New York City Average LBMP Price Forecast



Source: NYISO, 2015 Congestion Assessment and Resource Integration Study; 2016$

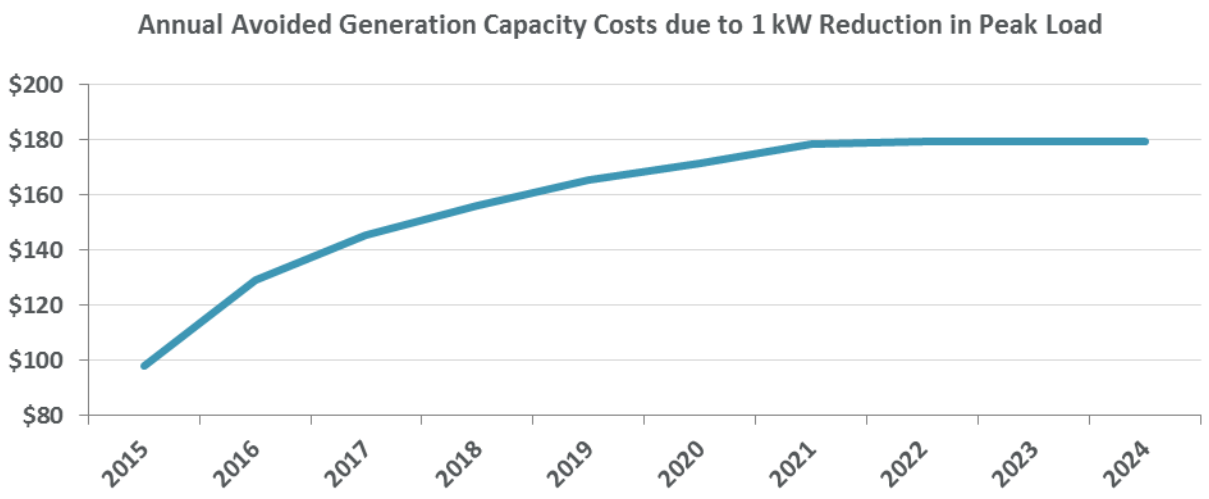
4.1.3.2 Generation Capacity Cost Savings

In addition to avoided costs of generating electricity, it is possible for energy solutions to reduce load on the system during coincident peak periods, and as a result displace or defer future investments in generation or distribution capacity (e.g. the need to install new infrastructure required to meet peak system loads). Given substantial investments in local distribution infrastructure by Con Edison, it is not anticipated that distribution capacity cost savings could be reasonably attributed as a benefit.

The cost savings were calculated by multiplying the 5,200 kW CHP system capacity and the 712 kW contribution from the solar and energy storage installations that are expected to participate in Demand Response by the installed capacity price forecasts in line with NY DPS BCA Guidance[20] based on 2015 Gold Book with updates through January 2016 as presented in the charts above. The estimates account for the reserve margin that regulated utilities must maintain above anticipated peak load and are relatively small in comparison to the energy cost savings. See Figure 7 and Table 6 below.

[20] New York Public Service Commission Case 14-M-0101 – Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, Order Establishing the Benefit Cost Analysis Framework.

Figure 5: Generation Capacity Cost Estimates



Source: NY DPS Guidance, Based on 2015 Gold Book with Updates through January 2016; 2016$

Table 6: Annual Savings

Millions 2016$	Present Value	Annual Average
Energy Cost Savings	$27.93	$3.80
Generation Capacity Cost Savings	$7.16	$0.95
Total Annual Savings	**$35.09**	**$4.75**

4.1.4 Life Cycle Costs Summary

Overall, the project is expected to cost $58 million over its life cycle from a societal perspective (without accounting for renewable energy financial incentives or customer electricity bill savings which are considered to be a transfer of wealth). Once operational, the project is expected to offset nearly all ongoing costs with energy and generation capacity cost savings (Table 7).

Table 7: Life Cycle Costs Summary

Millions 2016$	Present Value	Annual Average
Capital Costs	($45.68)	
O&M Costs	($16.78)	($2.23)
Fuel Costs	($30.62)	($4.15)
Energy Cost Savings	$27.93	$3.80
Generation Capacity Cost Savings	$7.16	$0.95
Total Life Cycle Costs	**($57.98)**	**($1.63)**

4.2 Resiliency Value

The project provides several resiliency benefit streams, some of which can reasonably be monetized. Specifically, new local generation will allow the local markets and businesses to continue operating, or at

least maintain critical loads to prevent inventory losses, during a major power outage and provide shelter at community facilities. Installed permanent generation (like solar PV and the CHP facility with microgrid) will further improve power reliability for those facilities in cases of minor power outages.

4.2.1 Methodology and Key Assumptions

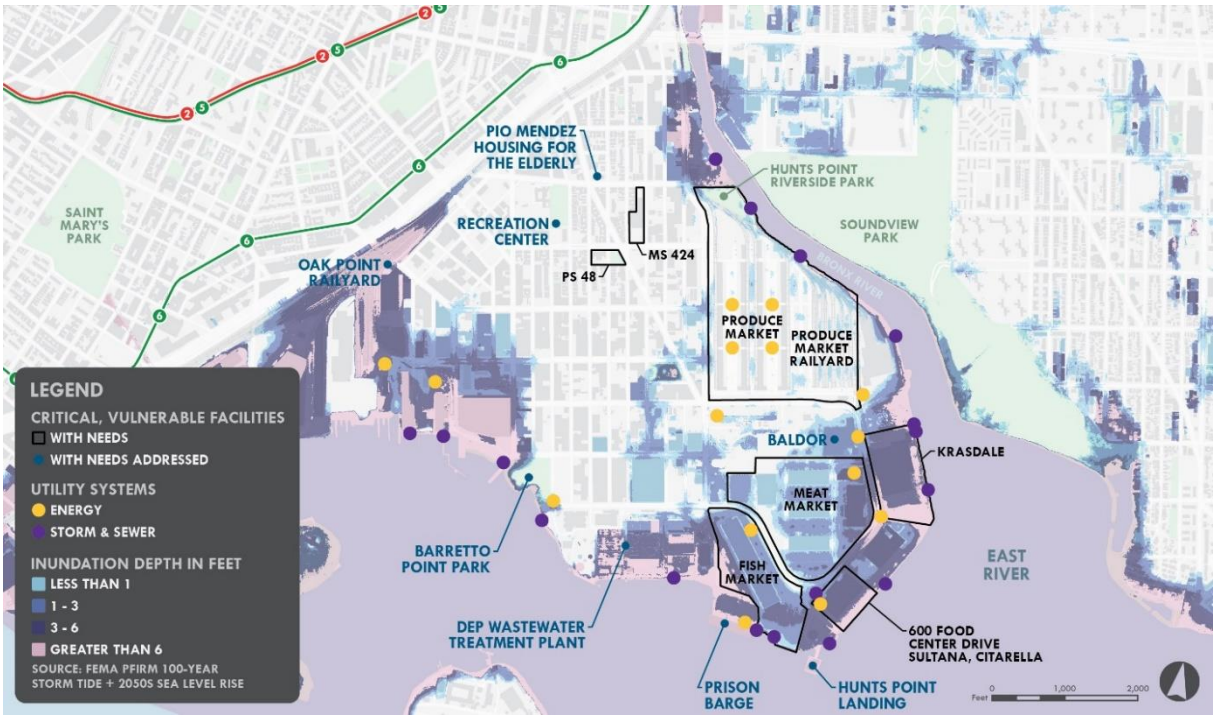
Major Outage Probability

The probability of a major power outage due to storm surge was estimated based on anticipated inundation rates of Con Edison transformers at Hunts Point and floodplain data for each transformer and the impacted facilities from FEMA Preliminary Flood Insurance Rate Maps. It was determined that Krasdale, Sultana, and Citarella could benefit most from mobile generators during a major inundation event, which would allow them to preserve inventory for up to three days. In discussions with Con Edison, it was established that in the event of a major storm event power may be shut off a few of hours in advance as a preventative measure, and it could take as long as 48 hours to reinstate assuming that the transformer is not completely inundated (and would thus have to be replaced with an even longer outage time). Subsequently, storm surge durations of 6 to 24 hours are anticipated to result in a 2-3 day outage to the impacted facilities.

In addition to storm surge modeling estimates, it was assumed that a major outage event would occur once every 20 years (in other words with a 5% probability per year) and would cause a 3-day power outage to the peninsula. The event could range from a major Hurricane Sandy-like event to extreme heat, or anything else that causes a major system shut down. Based on historical data on the frequency and duration of outages, the assumption was deemed to be a reasonable representation of the project's true resiliency benefits.

All power outage reduction benefits in this section are estimated based on these major outage probabilities, while reliability improvements are estimated based on Con Edison minor outage statistics for the Bronx.

Figure 6: Hunts Point Floodplain Map



Power Outage Reduction – Markets and Businesses

Preventing and reducing power outages to local markets and businesses is the overall biggest benefit to the project. Avoiding revenue and inventory losses from shutting down operations during a storm or other major outage event preserves the substantial economic activity generated by the facilities.

The impacts of major outages on specific FDC facilities were estimated in discrete blocks of outage time (12 hours, 24 hour, 36 hours, and 72 hours without power) based on certain assumptions that were derived from interviews with market representatives and subsequently vetted with stakeholders for reasonableness. The key assumptions included the share of inventory lost due to spoilage (based on the type of inventory, turnover rates, ability to use existing backup generators, etc.), and the days to return to business (influenced by facility lighting, cleanup of lost stock, ability to conduct offsite operations, etc.) which generated direct revenue and inventory loss estimates.

Only the direct revenue and inventory economic impacts were considered for the BCA as they represent the consumer willingness to pay for these goods and services. The direct impacts were subsequently used to derive other key economic impact metrics that are not additive benefits within the BCA as they serve to measure the impact on economic activity rather than social welfare. "Wage losses," a derived impact, was based on the number of employees from New York City Economic Development Corporation (NYCEDC) Business Reporting and average employee wages based on EMSI labor market data. The other derived is "regional economic benefits" based on the multiplier effect of reduced FDC business sales using IMPLAN economic multipliers.

Table 8: Estimated Economic Impacts of a 12-hour Power Outage to the Markets and Businesses

	Produce Market	Hunts Point Cooperative Meat Market	New Fulton Fish Market	Krasdale	Baldor Specialty Foods	Sultana + Citarella	Anheuser-Busch	GrowNYC Regional Greenmarket	Dairyland/ Chef's Warehouse
Days Power Outage	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Inventory Lost	0.5	0.25	0.15	0	0	0	0	0	0
Days to return to business	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Assumptions on inventory lost and number of days to return to business based upon interviews with Market representatives. Number of days to return to business may be influenced by facility lighting (daylight versus all indoor lighting), cleanup of lost stock, or ability to conduct offsite operations. Greenmarket inventory and operations are assumed to be similar to the Produce Market. Baldor and Dairyland have emergency generators that would prevent damages for 24 hours.

Direct Damages

Building Damage									
Other Property Damage									
Inventory Loss	$13,800,000	$5,000,000	$1,260,000	$0	$0	$0	$0	$0	$0
Revenue Loss	$4,600,000	$3,334,000	$2,800,000	$4,166,000	$1,044,000	$1,016,000	$994,000	$404,000	$1,320,000
Wages Loss	$330,000	$224,000	$105,400	$34,760	$110,000	$11,000	$45,500	$9,680	$16,830
Estimated Direct Damages	**$18,400,000**	**$8,334,000**	**$4,060,000**	**$4,166,000**	**$1,044,000**	**$1,016,000**	**$994,000**	**$404,000**	**$1,320,000**

Lost wages are provided for reference and are not included in the total since wages paid are a component of Total Revenue.

Indirect Damages

Building Damage									
Other Property Damage									
Inventory Loss									
Revenue Loss	$2,324,453	$1,475,357	$1,414,884	$2,105,146	$527,550	$513,401	$502,284	$204,148	$667,017
Impacts of Wages Lost	$82,670	$83,164	$26,404	$8,708	$27,557	$2,756	$11,398	$2,425	$4,216
Estimated Indirect Damages	**$2,324,453**	**$1,475,357**	**$1,414,884**	**$2,105,146**	**$527,550**	**$513,401**	**$502,284**	**$204,148**	**$667,017**

Lost wages are provided for reference and are not included in the total since wages paid are a component of Total Revenue.

Table 9: Estimated Economic Impacts of a 24-hour Power Outage to the Markets and Businesses

	Produce Market	Hunts Point Cooperative Meat Market	New Fulton Fish Market	Krasdale	Baldor Specialty Foods	Sultana + Citarella	Anheuser-Busch	GrowNYC Regional Greenmarket	Dairyland/ Chef's Warehouse
Days Power Outage	1	1	1	1	1	1	1	1	1
Inventory Lost	1	0.75	0.45	0.5	0	0.25	0	0.75	0
Days to return to business	1.5	1	1	1	1	1	0.5	1.5	1.5

Assumptions on inventory lost and number of days to return to business based upon interviews with Market representatives. Number of days to return to business may be influenced by facility lighting (daylight versus all indoor lighting), cleanup of lost stock, or ability to conduct offsite operations. Greenmarket inventory and operations are assumed to be similar to the Produce Market. Baldor and Dairyland have emergency generators that would prevent damages for 24 hours.

Direct Damages

Building Damage									
Other Property Damage									
Inventory Loss	$27,600,000	$15,000,000	$3,780,000	$12,500,000	$0	$3,556,000	$0	$1,818,000	$0
Revenue Loss	$13,800,000	$6,668,000	$5,600,000	$8,332,000	$2,088,000	$2,032,000	$994,000	$1,212,000	$3,960,000
Wages Loss	$990,000	$448,000	$210,800	$69,520	$220,000	$22,000	$45,500	$29,040	$50,490
Estimated Direct Damages	**$41,400,000**	**$21,668,000**	**$9,380,000**	**$20,832,000**	**$2,088,000**	**$5,588,000**	**$994,000**	**$3,030,000**	**$3,960,000**

Lost wages are provided for reference and are not included in the total since wages paid are a component of Total Revenue.

Indirect Damages

Building Damage									
Other Property Damage									
Inventory Loss									
Revenue Loss	$6,973,359	$2,950,713	$2,829,769	$4,210,292	$1,055,100	$1,026,802	$502,284	$612,443	$2,001,051
Impacts of Wages Lost	$248,010	$166,327	$52,809	$17,416	$55,113	$5,511	$11,398	$7,275	$12,648
Estimated Indirect Damages	**$6,973,359**	**$2,950,713**	**$2,829,769**	**$4,210,292**	**$1,055,100**	**$1,026,802**	**$502,284**	**$612,443**	**$2,001,051**

Lost wages are provided for reference and are not included in the total since wages paid are a component of Total Revenue.

Table 10: Estimated Economic Impacts of a 36-hour Power Outage to the Markets and Businesses

	Produce Market	Hunts Point Cooperative Meat Market	New Fulton Fish Market	Krasdale	Baldor Specialty Foods	Sultana + Citarella	Anheuser-Busch	GrowNYC Regional Greenmarket	Dairyland/ Chef's Warehouse
Days Power Outage	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Inventory Lost	1	0.75	0.65	0.5	0.75	0.5	0	1	0.5
Days to return to business	2	2	1.5	2	2	2	1.5	2	2

Assumptions on inventory lost and number of days to return to business based upon interviews with Market representatives. Number of days to return to business may be influenced by facility lighting (daylight versus all indoor lighting), cleanup of lost stock, or ability to conduct offsite operations. Greenmarket inventory and operations are assumed to be similar to the Produce Market.

Direct Damages

Building Damage									
Other Property Damage									
Inventory Loss	$27,600,000	$15,000,000	$5,460,000	$12,500,000	$4,698,000	$7,112,000	$0	$2,424,000	$3,960,000
Revenue Loss	$18,400,000	$13,336,000	$8,400,000	$16,664,000	$4,176,000	$4,064,000	$2,982,000	$1,616,000	$5,280,000
Wages Loss	$1,320,000	$896,000	$316,200	$139,040	$440,000	$44,000	$136,500	$38,720	$67,320
Estimated Direct Damages	**$46,000,000**	**$28,336,000**	**$13,860,000**	**$29,164,000**	**$8,874,000**	**$11,176,000**	**$2,982,000**	**$4,040,000**	**$9,240,000**

Lost wages are provided for reference and are not included in the total since wages paid are a component of Total Revenue.

Indirect Damages

Building Damage									
Other Property Damage									
Inventory Loss									
Revenue Loss	$9,297,812	$5,901,427	$4,244,653	$8,420,584	$2,110,199	$2,053,604	$1,506,852	$816,590	$2,668,068
Impacts of Wages Lost	$330,680	$332,654	$79,213	$34,832	$110,227	$11,023	$34,195	$9,700	$16,865
Estimated Indirect Damages	**$9,297,812**	**$5,901,427**	**$4,244,653**	**$8,420,584**	**$2,110,199**	**$2,053,604**	**$1,506,852**	**$816,590**	**$2,668,068**

Lost wages are provided for reference and are not included in the total since wages paid are a component of Total Revenue.

Table 11: Estimated Economic Impacts of a 72-hour Power Outage to the Markets and Businesses

	Produce Market	Hunts Point Cooperative Meat Market	New Fulton Fish Market	Krasdale	Baldor Specialty Foods	Sultana + Citarella	Anheuser-Busch	GrowNYC Regional Greenmarket	Dairyland/ Chef's Warehouse
Days Power Outage	3	3	3	3	3	3	3	3	3
Inventory Lost	1	1	1	0.5	1	0.5	0	1	1
Days to return to business	4	4	3	4	4	4	2.5	4	4

Assumptions on inventory lost and number of days to return to business based upon interviews with Market representatives. Number of days to return to business may be influenced by facility lighting (daylight versus all indoor lighting), cleanup of lost stock, or ability to conduct offsite operations. Greenmarket inventory and operations are assumed to be similar to the Produce Market.

Direct Damages

Building Damage									
Other Property Damage									
Inventory Loss	$27,600,000	$20,000,000	$8,400,000	$12,500,000	$6,264,000	$7,112,000	$0	$2,424,000	$7,920,000
Revenue Loss	$36,800,000	$26,672,000	$16,800,000	$33,328,000	$8,352,000	$8,128,000	$4,970,000	$3,232,000	$10,560,000
Wages Loss	$2,640,000	$1,792,000	$632,400	$278,080	$880,000	$88,000	$227,500	$77,440	$134,640
Estimated Direct Damages	**$64,400,000**	**$46,672,000**	**$25,200,000**	**$45,828,000**	**$14,616,000**	**$15,240,000**	**$4,970,000**	**$5,656,000**	**$18,480,000**

Lost wages are provided for reference and are not included in the total since wages paid are a component of Total Revenue.

Indirect Damages

Building Damage									
Other Property Damage									
Inventory Loss									
Revenue Loss	$18,595,624	$11,802,853	$8,489,307	$16,841,167	$4,220,398	$4,107,207	$2,511,420	$1,633,181	$5,336,136
Impacts of Wages Lost	$661,359	$665,308	$158,426	$69,663	$220,453	$22,045	$56,992	$19,400	$33,729
Estimated Indirect Damages	**$18,595,624**	**$11,802,853**	**$8,489,307**	**$16,841,167**	**$4,220,398**	**$4,107,207**	**$2,511,420**	**$1,633,181**	**$5,336,136**

Lost wages are provided for reference and are not included in the total since wages paid are a component of Total Revenue.

Power Outage Reduction - Community Facilities

The rooftop solar PV and energy storage installations at MS 424 and PS 48 will add redundancy and allow the community facilities to ensure the provision of refuge to those in need during major weather and outage events, and other services to community members (cell phone charging, bathrooms, gathering point, information, etc.). Informed directly by NYC Emergency Management, the BCA accounted for at least 1,200 people to be accommodated at the schools in a major event. (Additional discussions with stakeholders indicated that the capacity could even accommodate more.) A monetary value of $331 per person per day was used based on U.S. General Services Administration guidelines for federal per diem reimbursable expenses (including an average of $257 for lodging and $74 for meals and incidentals in New York City).

Reliability Improvements

Reliability improvements were estimated using average annual frequency (SAIFI[21] of 16.56 outages per 1000 customers served) and duration (CAIDI[22] of 384.6 minutes) of minor outages based on Con Edison's 5 year historical performance statistics in the Bronx. The outage statistics along with other customer attributes were entered into the U.S. Department of Energy Interruption Cost Estimate (ICE) Calculator to generate the avoided annual cost of service interruptions.

The value of interruption costs is based on an econometric modeling of several surveys and studies of customer willingness-to-pay to avoid service unreliability or willingness to accept compensation for service interruptions.

4.2.2 Benefit Estimates

Overall, the power outage reduction benefits to the local markets and businesses is the biggest monetized resiliency benefit of the project, and collectively, resiliency benefits make up the majority of the total project benefits. See Table 12 and 13.

Table 12: Resiliency Value Impacts Summary

Millions 2016$	Present Value	Annual Average
Power Outage Reduction – Markets and Businesses	$57.21	$7.57
Power Outage Reduction - Community Facilities	$0.459	$0.0608
Reliability Improvements	$0.065	$0.0086
Total Resiliency Benefits	**$57.73**	**$7.64**

Table 13: Indirect Economic Impacts from Resiliency Improvements

Millions 2016$	Present Value	Annual Average
Avoidance of Wage Losses	$1.69	$0.13
Regional Economic Benefits	$12.36	$0.96

4.3 Environmental Value

Because ongoing generation associated with the Hunts Point Resiliency project is from solar PV installations or from the high efficiency CHP facility, which will offset existing air emissions, another benefit is the reduction in fossil fuel energy consumption and the reduction in criteria pollutant and greenhouse gas (GHG) emissions compared to the base case. Local emissions offsets will occur by converting approximately 50 truck trailer refrigeration units at the Produce Market from diesel operation to electric operation and exporting hot water to the Meat Market to replace gas boiler use with the operation

[21] System Average Interruption Frequency Index.

[22] Customer Average Interruption Duration Index.

of the CHP facility. All of the energy system components that make up the Hunts Point Resiliency project also have environmental benefits because they provide energy at the source and avoid transmission and distribution losses, which would require additional gross generation from the grid.

4.3.1 Methodology and Key Assumptions

Local GHG emissions were estimated based on technical specifications for the proposed engines and generators, as well as their operating characteristics, while emissions savings were estimated based on the equivalent amount of generation displaced from the grid (adjusted for transmission and distribution losses). The emission rates for the grid were based on the probable types of fuel on the margin and the average emission rates of plants with the same primary fuel source in New York State. The emission rates were compiled and cross-examined primarily from the U.S. Environmental Protection Agency (EPA) National Emissions Inventory; Commission for Environmental Cooperation (North American Power Plant Emissions),[23] and net metering case documents from the New York State Public Service Commission published in December 2015.[24]

The value of net GHG emissions in CO_2-equivalent (CO_{2e}) tons was determined based on value per ton from the Interagency Working Group on Social Cost of Greenhouse Gases, Technical Update of the Social Cost of Carbon for Regulatory Impact using the widely recommended 3% discount rate.

In addition to the estimated social value of GHG emissions, utilities in New York are subject to certain emission allowance costs for CO_2, NOx, and SO_2 emissions which are internalized in LBMP prices. Consequently, while the approach to estimating the social value of changes in GHG emissions (as well as the social value or the health impacts of other pollutants in the next section) is appropriate, the benefits of avoided allowance costs are already captured as part of the LBMP in the "energy cost savings" impact category. As such, an adjustment is made to the overall BCA analysis results to deduct the overlap in benefits. A forecast for the actual values of allowances by pollutants were derived from the same NYISO 2015 Congestion Assessment and Resource Integration Study as the average LBMP price forecast.

Table 14 outlines the key inputs for estimating the environmental and social values of the project.

[23] Data last accessed and extracted January 2017.

[24] New York Public Service Commission Case 15-E-0703 – In the Matter of Performing a Study on the Economic and Environmental Benefits and Costs of Net Metering Pursuant to Public Service Law §66-n.

Table 14: Environmental and Social Value Key Inputs

Emission Factors (lb/MWh)	Grid	Engines/Generators
CO_2 Emissions	1,077	Varies by Equipment
NOx Emissions	0.5616	
SO_2 Emissions	0.5609	
$PM_{2.5}$ Emissions	0.0601	
VOC Emissions	0.0435	
Emission Damage Cost ($/ton)		
CO_2	$43.49	$43.49
NOx	$13,288	$49,661
SO_2	$58,254	$201,216
$PM_{2.5}$	$410,548	$1,973,626
VOC	$287	$1,843
Emission Allowance Prices ($/ton)		
CO_2 Emission Allowance per Ton	$6.53	n/a
NOx Emission Allowance per Ton	$154.64	n/a
SO_2 Emission Allowance per Ton	$0	n/a

4.3.2 Benefit Estimates

Unlike the impacts of criteria air contaminants which have more localized impacts, GHG emissions have a much broader impact on the Earth's atmosphere. The project is anticipated to reduce GHG emissions by 7,626 tons per year resulting in a total benefit of $3.29 million over the study period (Table 15).

Table 15: Environmental Value Impacts Summary

Net GHG Emissions Impacts	
Present Value (millions 2016$)	$3.29
Annual Average (thousand 2016$)	$452
Change in GHG Emissions (CO_{2e} tons/year)	(7,626)

4.4 Social Value

The project is anticipated to generate social value through a reduction in pollution, resilient community development, potential economic savings that could be passed on to low-moderate income residents and households in the area, increased public awareness fostering energy savings, and maintenance of food supply during power outages – all of which are primarily qualitative considerations either due to the difficulty to defensibly monetize the impacts, or due to a lack of reliable and accurate data. The impacts on health from exposure to pollution are estimated for the purposes of the BCA. To account for existing air quality concerns in the Hunts Point community, the BCA took a conservative approach weighing negative health impacts in the local project area more heavily than the benefits for the greater regional area.

4.4.1 Methodology and Key Assumptions

Criteria air contaminant (CAC) emissions were derived using the same approach as the greenhouse gas emissions in the Environmental Value section above, and included NOx, SO_2, $PM_{2.5}$, and VOC emissions. The social value of each pollutant per ton of emissions was estimated using EPA's Co-Benefit Risk Assessment Screening Model (COBRA). The model estimates the potential risk of health issues including

asthma, heart or lung disease, and other respiratory issues associated with a change in levels of specific pollutants.

The BCA aimed to properly reflect differences of localized emissions in the more densely populated and environmental justice community of Hunts Point relative to offsetting emissions from the grid, which could impact utilities all across the State. Industry and federal BCA guidance typically uses a single average value of CAC emissions (which would have yielded a net health benefit). However, for this BCA, increases in local emissions were estimated based on Bronx County values to account for existing air quality concerns in the Hunts Point community, while reduction in grid emissions were estimated based on New York State-wide values. The resulting estimates were substantially higher for the Bronx, valuing local emissions nearly five times higher than those displaced from the grid.

4.4.2 Benefit Estimates

A reduction in net project emissions yields regional benefits in the form of a net reduction in pollution. Even with localized criteria air contaminant emissions conservatively valued approximately 4.8 times higher than New York State averages for generation displaced from the power grid, overall health impacts of the project result in a net benefit of $27.2 million (Table 16 and Figures 8 and 9).

Table 16: Social Value Impacts Summary

Net Health Impacts	
Present Value (millions 2016$)	$27.21
Annual Average (millions 2016$)	$3.60
Change in CAC Emissions (tons/year)	
NOx Emissions	(23.54)
SO_2 Emissions	(13.69)
PM Emissions	(2.27)
VOC Emissions	4.26

Figure 7: Criteria Air Contaminant Emissions

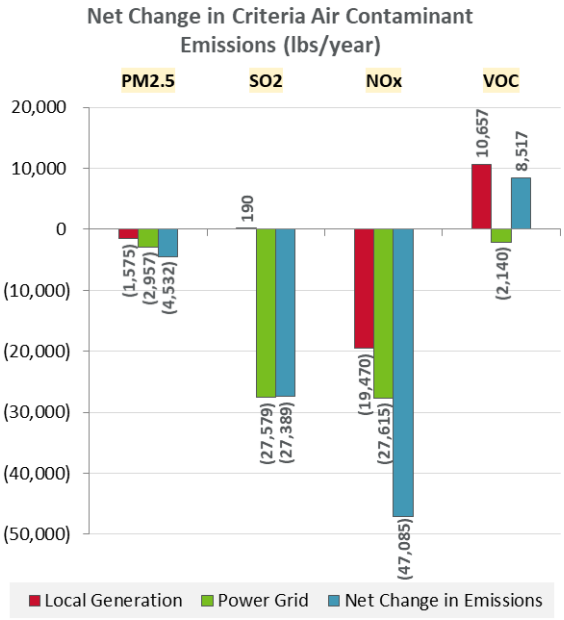
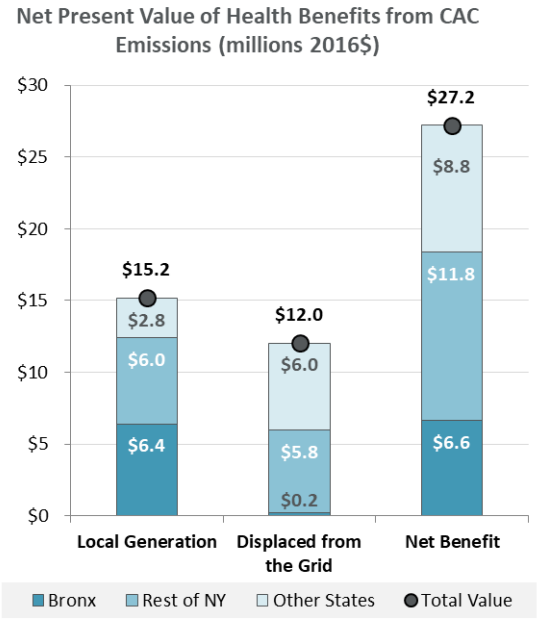


Figure 8: Monetized Health Impacts



4.5 Economic Revitalization

The project will create both temporary and permanent job opportunities during construction and operations. These employment estimates are based on labor required for past comparable installation projects. The project construction duration varies from only 2 months for the community generators, to 6-18 months for solar PV and energy storage installations, and 20 months for the CHP facility with microgrid resulting in an estimated average construction workforce of 55 people, as well as 10 permanent and 6 on-call employees going forward. These estimates assume staff required for individual installations and do not account for potential efficiencies between buildings where the same employees could service different equipment simultaneously.

In addition to direct employment, the project will provide training and development opportunities as well as serve to improve the competitive advantage of the Peninsula (Table 17).

In addition to direct employment, the project will provide training and development opportunities as well as serve to improve the competitive advantage of the Peninsula (Table 17).

Table 17: Employment

Construction Jobs	
Construction Workforce	55
Permanent Employment	10 permanent, 6 on-call

4.6 Other Non-monetized Impacts

There are other potential effects that have not been monetized in the analysis that provide value to the community. These include:

- The ability for the Middle School (MS) 424 and Primary School (PS) 48 to support community and emergency functions in major power outages. This will enable the schools to either be used

as emergency gathering locations for the community, or to maintain core administrative functions. The BCA does not anticipate that the schools will stay open for students in major power outage circumstances.

- The FDC provides food products throughout NYC. Maintaining business function in major power outages secures food supply to the region. Without a secure supply during major outages, there will be food shortages that potentially result in higher food prices throughout the study area.

5 Project Risks and Implementation Challenges

5.1 Risks to Ongoing Project Benefits

The major ongoing benefit from Hunts Point Resiliency project is maintaining business functions at the Produce Market in the FDC, including the preservation of existing inventories at the market and other commercial facilities.

One risk that could disrupt this benefit is a major flood or storm event that disrupts business activity at the markets such that one cannot access the markets for an extended period of time or an event that results in significant property damage at the facilities that requires operations to be shut down for repairs. In this situation, while power is maintained from Hunts Point Resiliency project which includes flood protections as part of conceptual design, there could still be a loss of business function. The inventory would still be maintained, but ongoing revenues would not be preserved.

5.2 Project Implementation Challenges

The screening of energy resiliency technologies and project packages considered constructability and implementation challenges as key criteria. Overall, the screening criteria were developed based on HUD funding requirements, the AWG's Implementation Principles (see Appendix A), and industry standards as referenced. The output of this screening process was a list of technologies with limited implementation challenges. In addition, only proven technologies were considered; project technologies were evaluated for their proven capability to provide the intended service.

From a constructability perspective, the following was considered:

- Available & Suitable Space: Project space requirements were evaluated against available useable space in the vicinity of the proposed application. Functionality was evaluated based on sufficient space, disposition (purchase, easement, or other agreement), geotechnical, hazardous waste, and underground utility constraints.
- Ease of Permitting: Projects were evaluated for regulatory and permitting considerations that may require more significant coordination, approvals, and/or schedules for implementation due to anticipated environmental impact or administrative considerations.
- Required Infrastructure: Projects were evaluated against the quantity and types of infrastructure improvements that would be required for the installation and operation of the facility. Availability of gas, water, structures, electrical interconnection, and other factors were considered.

From an implementation perspective, the following was considered:

- Potential to Leverage Public or Private Funds: Projects were evaluated for their potential to leverage public or private funds, with the identification of potential funding sources that have been successfully utilized for precedent projects/investments being evaluated more highly.

Projects could also be evaluated highly for potential to capitalize upon avoided losses, such as lowered flood insurance premiums.

- Schedule (in years) to Plan, Design and Construct: Projects were evaluated on the estimated time to plan, design, permit, and construct from completion of conceptual design in 2017.

As such, only the most realistic and feasible energy resiliency technologies and project packages passed the screening process at the outset. Some key requirements or risks are outlined below.

- **Con Edison Agreement**: Con Edison is a key partner for the design and construction of a first phase microgrid and solar plus storage project package. In addition, significant dependence upon utilization of the existing Con Edison infrastructure for the microgrid will require agreement on the terms and conditions of equipment utilization and system control, including different conditions under which Con Edison will depower its lines. A tidal surge, for example, could be such a condition when depowering and back up generation might be needed. However, tidal surge is not expected to impact the proposed microgrid infrastructure as Con Edison assessed the vulnerability of this infrastructure to coastal flooding and hardened transformers that were determined to be potentially vulnerable (that is, infrastructure below the design flood elevation). The City and Con Edison have also been coordinating regularly to ensure successful design and implementation of the pilot project and plan to draft an agreement regarding the terms and conditions of the project.
- **Regulatory**: Implementation of the Hunts Point Resiliency Project will involve federal, state, and local permits and authorizations. Permits and authorizations cannot be obtained until the project design is further advanced. Coordination with federal, state, and city agencies that are potentially involved in the environmental review and regulatory permitting processes have already begun. Further coordination will continue after the identification of the pilot project to ensure that all required permits and authorizations will be obtained prior to groundbreaking.
- **Stakeholder buy-in**: The City is conducting a robust stakeholder engagement process with design and facilitation support from the Interaction Institute for Social Change and additional outreach and engagement leadership from The Point Community Development Corporation. The City and community's engagement activities began in 2015 to inform the project scope before kickoff. Building upon efforts in 2015, engagement for the Hunts Point Resiliency Project now includes a multi-pronged approach designed to:
    - Disseminate information in order to educate the public;
    - Incorporate input directly into technical analyses; and
    - Coordinate with other community-based resiliency efforts, leadership training, and workforce/ economic development opportunities.

The engagement process and structure for this project are viewed as contributing factors to resiliency in the Hunts Point community by ensuring transparency, robust information flows, social learning, skill development and relationship/trust building. The stakeholders will continue to be engaged throughout conceptual design and environmental review for the pilot project.

6 Summary of Findings and BCA Outcomes

Overall, the BCA shows positive outcomes with a $27 million net present value, 1.29 BCR, and a 13.6% internal rate of return that is well above the 7% hurdle rate. Tables 18 and 19 as well as Figure 10 below summarize the results by monetized impact category.

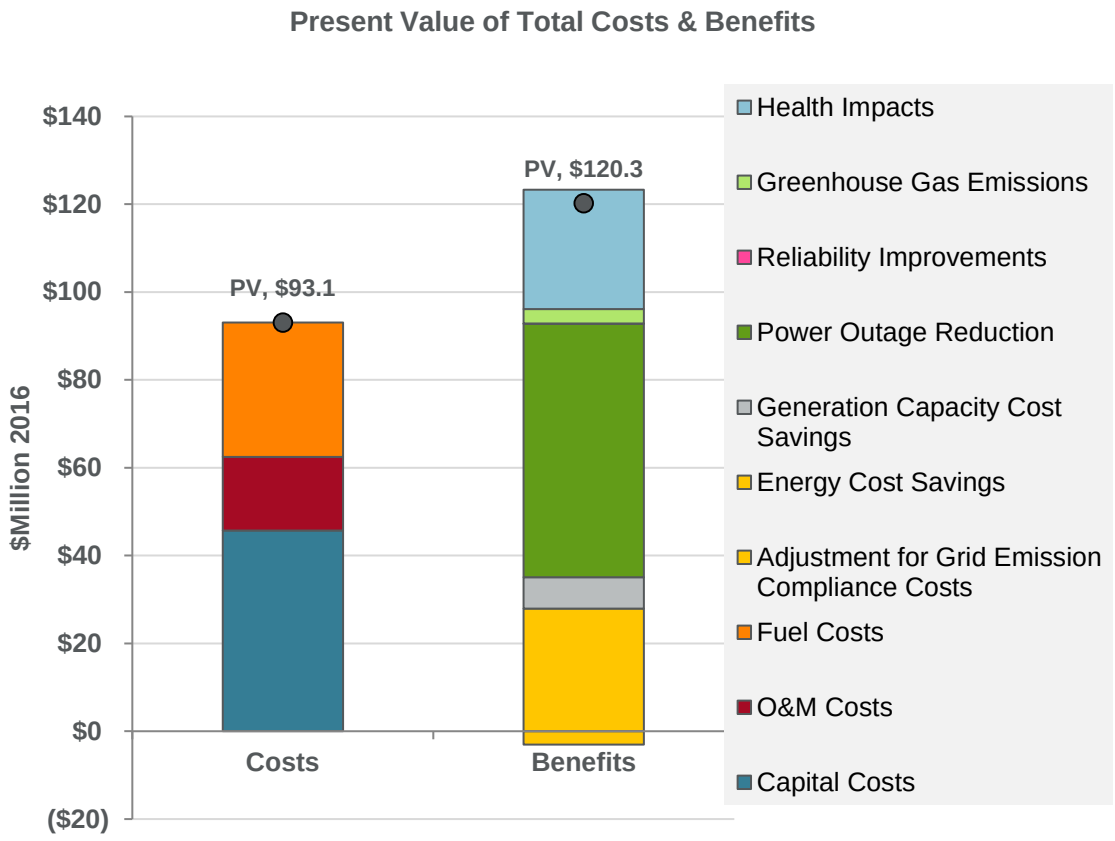
Table 18: Summary of Monetized Impacts

All Monetized Impacts (Millions 2016$)	Undiscounted	NPV (7%)
Energy Cost Savings	$76.02	$27.93
Generation Capacity Cost Savings	$18.96	$7.16
Power Outage Reduction Benefits - Markets and Businesses	$151.48	$57.21
Power Outage Reduction Benefits - Community Facilities	$1.22	$0.46
Reliability Improvements	$0.17	$0.07
GHG Emissions	$9.05	$3.29
Health Impacts	$72.05	$27.21
Adjustment for Grid Emission Compliance Costs	($8.13)	($3.06)
Total Benefits	**$320.80**	**$120.26**
Capital Costs	($62.97)	($45.68)
O&M Costs	($44.53)	($16.78)
Fuel Costs	($83.03)	($30.62)
Total Costs	**($190.52)**	**($93.08)**
Net Impact	**$130.28**	**$27.18**

Table 19: BCA Results

Millions 2016$ - Discounted at 7%	
Present Value of Benefits	$120.26
Present Value of Costs	($93.08)
Net Present Value (NPV)	**$27.18**
Benefit-Cost Ratio (BCR)	1.29
Internal Rate of Return (IRR)	13.6%
Discounted Pay-back Period (years)	10.23

Figure 9: Summary of Monetized Costs and Benefits



7 Sensitivity Analysis

7.1 Results Using a 3% Discount Rate

Presented below (Tables 20 and 21 and Figure 11) are sensitivity results using a 3% discount rate as is common practice for publicly funded projects as a proxy for the long-term federal government borrowing rate. In general, a higher discount rate typically impacts project benefits (which accrue over many years) more than costs (the bulk of which are up-front capital costs). As a result, the lower discount rate would substantially increase project benefits, resulting in a net present value of $69 million and a BCR of 1.51.

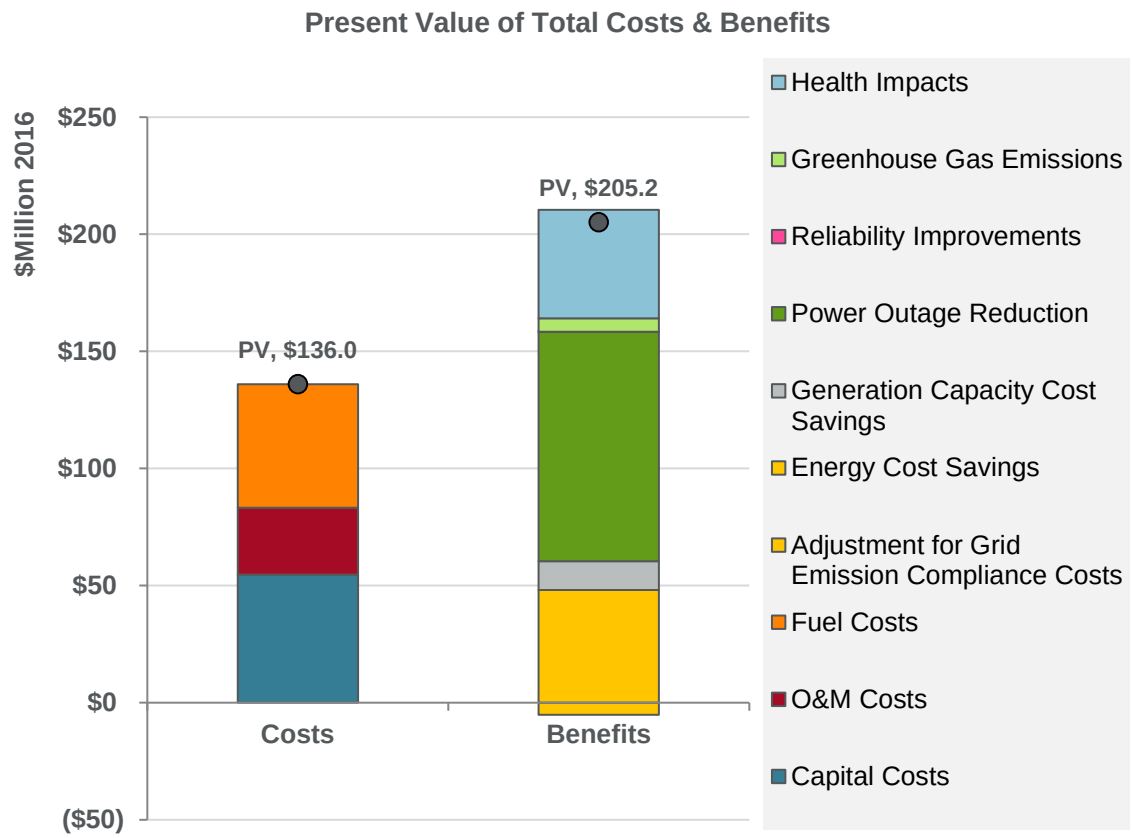
Table 20: Summary of Monetized Impacts (Sensitivity – 3% Discount Rate)

All Monetized Impacts (Millions 2016$)	**NPV (3%)**
Energy Cost Savings	$48.18
Generation Capacity Cost Savings	$12.17
Power Outage Reduction Benefits - Markets	$97.20
Power Outage Reduction Benefits - Community Facilities	$0.78
Reliability Improvements	$0.11
GHG Emissions	$5.70
Health Impacts	$46.23
Adjustment for Grid Emission Compliance Costs	($5.21)
Total Benefits	**$205.17**
Capital Costs	($54.73)
O&M Costs	($28.54)
Fuel Costs	($52.70)
Total Costs	**($135.97)**
Net Impact	**$69.19**

Table 21: BCA Results (Sensitivity – 3% Discount Rate)

Millions 2016$ - Discounted at 3%	
Present Value of Benefits	$205.17
Present Value of Costs	($135.97)
Net Present Value (NPV)	**$69.19**
Benefit-Cost Ratio (BCR)	1.51
Internal Rate of Return (IRR)	13.6%
Discounted Pay-back Period (years)	8.86

Figure 10: Summary of Monetized Costs and Benefits (Sensitivity – 3% Discount Rate)



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