

RESILIENT SOLAR CASE STUDY: The Marcus Garvey Apartments Microgrid

COMPLETED PROJECT

PROJECT SNAPSHOT

Location: Brownsville, Brooklyn, New York

System Owner: L+M Development Partners (Solar), Demand Energy (Storage), Bloom Energy (Fuel Cell)

Project Goal: Energy savings, backup power, and improved grid reliability

Date of Operation: April 2017

Equipment Type & Size: 400 kW solar; 300 kW/1.2 MWh lithium-ion battery storage; 400 kW fuel cell

Resilience Benefits: Backup power for outdoor lighting, management office, security and community space

Total Cost: The approximate cost of the PV for the project was \$3.50/W with battery costs estimated at \$1000/kWh.¹ The \$1.3 million project was part of a larger \$50 million rehabilitation and energy improvement project for the property.

ROI (and/or NPV): Anticipated 6.6 year system payback for the battery storage.

Performance Data: There is limited operational data as of the publishing of this case study. More information will be available after summer and winter demand management season.

¹ Estimates from interviews with project participants.

By Smart Distributed Generation Hub – Resilient Solar Project¹
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INTRODUCTION/BACKGROUND

The Marcus Garvey Apartments is a low and middle-income housing complex located in the Brownsville neighborhood of Brooklyn, NY, consisting of 32 buildings and 625 units spread over ten city blocks. In 2014, L+M Development Partners, Inc. (“L+M Development”) acquired the aging complex with a plan to update the apartments, buildings, and surrounding landscape while lowering energy consumption. In the past, L+M had successfully used energy efficiency programs from NYSERDA, and was interested in pursuing a comprehensive energy retrofit to improve the buildings’ performance.

The Brownsville neighborhood is located in an area of grid congestion. As L+M planned for the retrofit, the company was approached by New York City’s electric utility, Con Edison, to participate in the demand management incentive program for Brooklyn, known as the Brooklyn Queens Demand Management Program (BQDM). As part of this program, the complex is required to reduce its load between 8 p.m. to 12 a.m. when Con Edison calls for load reduction events to help support grid stability. To ensure performance, the retrofit project needed to include both energy generation and storage. L+M worked closely with Demand Energy, Bloom Energy and Bright Power to develop a microgrid system, consisting of energy storage, a fuel cell, and solar power.

Due to grid constraints, the Brownsville neighborhood experiences rolling blackouts more frequently than other parts of New York City. This factor, coupled with the apartment buildings’ high demand charges for its thermal and electrical loads, made the Marcus Garvey Apartments a suitable location for a resilient solar microgrid.

PROCESS & SYSTEM OVERVIEW

The last upgrades to the Marcus Garvey Apartments occurred over 40 years prior to the beginning of renovations in January 2015. The renovation’s scope of work included bringing vacant apartments back into service,

upgrading security and electrical systems, and implementing a series of energy efficiency projects with

¹ The Smart DG Hub was formed by Sustainable CUNY of the City University of New York (CUNY). The DG Hub’s Resilient Solar Project is a collaboration between CUNY, the National Renewable Energy Laboratory and Meister Consultants Group, funded by the U.S. Department of Energy and the State of New York.

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support from the multifamily efficiency program from the New York State Energy Research & Development Authority (NYSERDA). Since the building was undergoing repairs, contractors could readily access and upgrade wiring, distribution feeders, and switchgears to support distributed generation, and cost effectively implement the project.

As part of the project's rehabilitation, the 400 kW solar PV system was installed and completed in December 2016. Earlier in 2016, L+M connected with Demand Energy through GridMarket, a market intermediary that supports the deployment of battery energy storage in New York State.² The electric utility also included Bloom in discussions for thermal load support. Con Edison, GridMarket, L+M, Demand Energy, and Bloom determined that due to the facility's electric heating load and space constraints, a fuel cell and lithium ion battery would be the most suitable technologies to support the apartment complex and BQDM's needs. This steady electric load profile made the Marcus Garvey Apartments a desirable participant for both winter and summer peak demand management programs,³ enabling additional opportunities for revenue and improved system payback.



1 - Marcus Garvey Installation, Image provided by L+M Development

The apartment complex is on an electric heat rate that is designed to cover the cost of delivering peak energy in the winter season. The peak load in the winter is approximately 3 MW, which is almost double the facility's summer peak. The campus also has a unique metering arrangement - one master meter distributes power to all 625 units. Since no unit is sub metered, this simplified the system's configuration. Over the course of 2016 and through early 2017, the battery and fuel cell were permitted and added to the site; the project became fully operational in April 2017. The Marcus Garvey project includes the first outdoor lithium ion battery permitted within New York City. The process will pave the way for future lithium-ion applications in the City.

FINANCING

The project used several different financing mechanisms for the technologies in the microgrid, which are summarized in Table 1 below. The acquisition and rehabilitation of the property were funded by tax-exempt bonds from New York State Homes and Community Renewal (NYC HCR). Federal investment tax credit allocations for the solar PV and battery systems were supported by Wells Fargo, and the project received almost \$1 million in grant funding from NYSERDA's Multifamily Performance Program and NY-Sun programs for energy efficiency and solar, respectively. The New York Energy Efficiency Corporation (NYCEEC) provided a 10-year \$1.2 million energy services agreement loan (ESA) to Demand Energy for the battery. Since the Marcus Garvey Apartments are an affordable housing complex, L+M also leveraged low-income tax credits to support project financing.

The fuel cell and battery utilized no-money down, third-party ownership models. The fuel cell is contracted under a 20-year power purchase agreement between Bloom Energy and L+M Development. The lithium-ion storage system uses a shared savings model, with Demand Energy and L+M splitting the anticipated savings from demand charge for 20 years. The Complex will save 15% on its annual energy bills for electricity and heating, with savings growing as electricity prices rise.

Beyond the energy savings, the project will generate revenue through the Con Edison Brooklyn Queens Demand Management (BQDM) program, a Con Edison demand response program in the summer (DLRP), and an NYISO demand

² For more information see: <https://www.gridmarket.com/>

³ The summer program is the Con Edison Distribution Load Relief Program (DLRP), and the winter program is the NYISO Day Ahead Demand Response Program (DADRP). More information about DLRP can be found here: <https://www.coned.com/-/media/files/coned/documents/save-energy-money/smart-rewards/conedison-dlrp-tier-2-networks.pdf>. More information about DADRP can be found here: http://www.nyiso.com/public/markets_operations/market_data/demand_response/index.jsp.

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response program (SCR) in the winter.³ The project will receive performance-based payments for participation in these programs.⁴ The battery storage component of the project is anticipated to have a 6.6 year payback period. The return on investment for the other components of the microgrid was not available at the time of writing this case study as the project became operational recently.

Table 1 - Summary of Finance and Revenue Streams for the Marcus Garvey Microgrid

MICROGRID SYSTEM COMPONENTS	FUNDING & REVENUE SOURCE(S)
Property rehabilitation	<ul style="list-style-type: none">• NYS HCR tax-exempt bonds
Energy efficiency upgrades	<ul style="list-style-type: none">• A grant from the NYSERDA Multifamily Performance Program• Low income tax credits
Solar PV	<ul style="list-style-type: none">• Federal investment tax credit allocations supported by Wells Fargo• Incentives from the NY-SUN program
Lithium ion battery	<ul style="list-style-type: none">• Energy Services Agreement (ESA) loan from New York Energy Efficiency Corporation (NYCEEC)• Third party ownership under a shared savings agreement• Performance payments from Con Edison for the BQDM and DLRP programs, and NYISO SCR for demand response
Fuel cell	<ul style="list-style-type: none">• Third-party ownership under a Power Purchase Agreement (PPA)

BENEFITS

The energy savings provide L+M with more flexibility to offer amenities for tenants. The company plans to develop a new afterschool program in partnership with a non-profit using savings from the microgrid. The complex will reduce its peak demand by 25% allowing for a more sustainable property that can reallocate funds, if necessary, to cover budget increases. The microgrid will also reduce Con Edison's peak demand in the area by 207 kW.

Additionally, the energy storage system is designed to supply emergency power for the building's security office, management office, and community room to support tenants during power outages. This will provide residents a communal space to gather and support up to 100 kW of critical loads, which include heating, lighting, cell phone charging, and refrigeration for sensitive medicines. The microgrid can provide up to twelve hours of backup power for these spaces. In the future, L+M Development plans to increase the back-up capacity of the system by islanding a portion of the PV system.

LESSONS LEARNED

Similar resilient solar systems for multifamily housing may be replicable in communities with high demand charges, and demand management programs. While the BQDM program is no longer accepting enrollments, both NYISO and Con Edison still have available demand response options. Other communities interested in pursuing similar projects should engage key stakeholders, such as building departments, state agencies and utilities, as early as possible. This can streamline project development and identify avenues for support and partnership. Other states may also have energy efficiency financing corporations, investment authorities or development banks, which could provide project finance.

⁴ LBMP refers to the wholesale price of electricity in a given region. The total payment equals the LBMP multiplied by a facilities load reduction.

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