It takes a microgrid: Powering Marcus Garvey Village and transforming New York's electricity system

by Doug Staker, Demand Energy

In the heart of one of the more constrained segments of New York City utility Consolidated Edison's service territory, Demand Energy and L+M Development Partners have developed a microgrid to provide load relief on days when the grid is stressed by air conditioning demand.

Marcus Garvey Village is a low- and middle-income apartment complex located in the Brownsville section of New York City, an area that is home to a constrained substation that serves the area. L+M's overall development goal is to transform specific low-income neighborhoods into healthy, vibrant and economically secure communities. When L+M started the project, they did not know they were in an impacted area for power service. The company had planned to deploy a 400 kW solar PV system, along with completely rewiring the electrical service that serves the campus. For L+M, adding solar was just the right thing to do in this revitalisation project. At the time, however, they were unaware that this project would become a leading example of the path forward in advancing the city's evolving digital grid.

New York City is one of the most energy-intensive urban environments in the world. The peak summer loading of Con Edison's service territory (NYC and Westchester County) approaches 14 GW of demand. By comparison, that is almost a quarter of the peak demand for the entire state of California. This mainly urban grid delivers energy through an underground network, which makes managing and maintaining the system an expensive and challenging endeavor to continue to meet a growing peak load.

As loads grow over time, different networks become constrained. In Brooklyn and Queens, there are three networks served by the Brownsville substation that have reached their capacity and are expected to be stressed by 53 MW of additional load in the summer of 2018. This region within Con Edison's service territory is known as the Brooklyn-Queens Demand Management (BQDM) program.

BQDM is an area that peaks at night due to the high load levels created by multi-family building air conditioners. Con Edison's service territory has four types of load pockets that peak at different times of the day, depending upon the load category being served. Residential networks peak from 20h00 until midnight. As L+M started the development of their solar project, their project partners Bright Power, Con Edison, Grid Market, and Demand Energy started to lay out a microgrid system to support the need to time shift solar production into the evening to support the peak.

Marcus Garvey Village is a unique facility in that it has a larger winter peak due to the use of electric heat. In the winter, its peak load is in excess of 3 MW. During summer, its air conditioning peak is 1,5 MW, and is part of the problem being addressed by the BQDM program. By coupling the 400 kW of solar production with a 300 kW/1,2 MWh lithium battery system, the solar-plus-storage system can provide four hours of load reduction from 20h00 to midnight on days that Con Edison calls a Commercial Service Reduction Plan (CSRP) event under the BQDM programme. Con Edison also brought Bloom Energy into the project to install a fuel cell to reduce the base load. The integration of solar plus storage and a fuel cell into a microgrid drove the need to have an intelligent control system to manage these distributed energy resources supporting the varying load throughout the four seasons.

The microgrid is controlled by Demand Energy's Distributed Energy Network Operating System (DEN.OS), which optimizes how the various resources interact and perform. A key technical aspect of the project is the ability of DEN.OS to ensure that the housing development self-consumes any energy it generates, without exporting to the grid. That capability directly aligns with Con Edison's BQDM requirements, which helped facilitate the interconnection and permitting process.

After Hurricane Sandy battered the East Coast of the US in 2012, New York City began a focused effort to provide resilient facilities able to support neighborhoods with power during extended outages. The microgrid at Marcus Garvey supports the main office and community space with enough power to maintain the facility during extended outages, as well as provide electricity to support phone charging and HVAC systems.

The Marcus Garvey Village microgrid is a prime example of how a major city can build an intelligently controlled distributed digital power grid, provide local resiliency and other grid-supporting capabilities, and transform the energy supply chain. Such systems also lower energy costs, deliver essential load relief for utilities, and help reduce greenhouse gas emissions.

Rethinking grid infrastructure

The BQDM program offered a new way for New York-based utilities to think about how to design and operate grid infrastructure projects. Without initiatives like BQDM, the Brownsville substation would need a $1,2-billion upgrade to meet the stress created from the projected overload of 53 MW in 2018. To make such an expenditure even more difficult to justify is the fact that the overloading is predicted to only occur on average for four days in the summer cooling season. But under a new direction from the New York Public Service Commission (PSC) and as part of the statewide Reforming the Energy Vision (REV) initiative, Con Edison has been empowered to solve the problem by making the grid more efficient, creating a new model for earning returns for shareholders.

Utilities have traditionally only had one way to earn a profit for their shareholders. To align the interests of ratepayers and utilities to ensure that we have a grid that can meet peak demand, utilities have been allowed to earn set returns on capital equipment deployed. Under this type of incentive structure, utilities have been encouraged to “build to meet the peak.” Prior to the introduction of energy storage and the wider deployment of solar and other distributed energy resources, the grid was a perfect “just-in-time” inventory system. Supply needed to match demand or the grid would become unstable. Energy flowed in one direction, from generation through transmission and local distribution to load. Today as we introduce new distributed resources at the edge of the grid, we can balance the grid with a “managed inventory” method.

In Brownsville, the peak load growth was faster than anticipated and the urgency heightened. However, this section of the grid doesn’t peak in the daytime, but rather from 8:00 pm to midnight when most of the load served is residential and the peak is driven by air conditioning demand. The outer boroughs have the best potential for distributed solar in the city, but unfortunately solar peaking production at noon doesn’t solve the local system peaking challenge. By coupling solar with energy storage, renewable resources can be shifted to a time in the day when they provide the greatest value.

To understand just how high that value is, the PSC stated the following regarding the cost of building to meet peak demand:

“Stabilising customer bills. The pressure on rates that will be caused by aging infrastructure replacement, reliability and security needs, carbon rules, and other factors can be mitigated by the cost reductions that are available through increased system efficiency achieved through markets and improved regulation. Increasing the responsiveness of demand will reduce price volatility in the near term and price inefficiency in the long term. If, for example, the 100 hours of greatest peak demand were flattened, long term avoided capacity and energy savings would range between $1,2-billion and $1,7-billion per year. Avoided line losses achieved by distributed generation can further improve system efficiency. Total line losses cost approximately $200 to 400-million per year. Beyond these examples of direct cost reductions, markets established under REV will enable a range of options that will reward customers for participating in system optimisation, and assist in control of customer bills.” – REV Order Adopting Regulatory Policy Framework (p. 20)

To encourage Con Edison to seek “non-wire alternatives” to solve this problem, the PSC have created a new method for the utility to increase its earnings. Under the REV initiative, they can achieve this by making the grid more efficient. By reducing the load at peak, the local grid becomes more balanced. It also improves utilisation and will not require expansion to handle peak traffic.

Achieving the end goal of transforming New York’s 100-year-old power grid into a decentralised, digitised and decarbonised transactional network will require a combination of proper policies, codes and safety standards; next-level rate structures; and advanced technology solutions like the ones being deployed at Marcus Garvey Village. Stakeholders across the entire energy system spectrum, from municipalities to industry to end users, will need to be educated on the costs, benefits, and value of distributed resources, two-way energy, and resiliency. The result will be a true 21st-century grid, built on distributed generation, backed by energy storage, and boosted by enhanced value and better returns.

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