CASE STUDY

Ludlow-Taylor Elementary:
Dynamic Distributed Energy - 659 G Street NE

Ludlow-Taylor Elementary School is in Ward 6 and serves students from PK3 to 5th grade. In 2019, the school installed a 230-kW solar PV system made up of three rooftop solar arrays and one solar canopy over the playground. The school now boasts a 129-kW battery that is tied to the solar array with a sophisticated energy management system. While the original purpose of the solar installation was to meet the school's energy needs, the project has transformed into an example of reliable, equitable, and educational grid innovation.

—KEY STATS—

Cost:
$943,000
(Solar system)
$230,000
(Battery system)

Solar PV system size:
230 kW

Battery storage:
129 kW

Onsite solar generation:
162 MWh (2022)

Solar for All subscribers served:
106

Average annual utility bill reduction for Solar for All subscribers:
Continues to provide at least $500/year

Green building features:
Solar PV arrays and canopy, battery storage, Heila Edge distributed energy resource control software

Interview with New Partners Community Solar:

What makes this project innovative?

This project incorporated a photovoltaic solar energy system with energy storage through lithium ferro phosphate batteries and an active energy management system. The four separate solar arrays produce energy while the energy management system responds in real-time to load conditions within the area-network to determine whether energy is fed into the grid, fed into the batteries, or if the inverters need to be shut off to prevent overloading the grid. The system is designed to offset as much load as possible when solar panels can produce energy while storing any excess. The excess is used during peak evening hours to continue to offset load, maximizing the amount of solar energy the area-network is consuming by accounting for variability in its production. These technologies enable the school and surrounding community on the area-network to benefit from more resilient and affordable energy distribution.

What were the biggest challenges associated with this project?

Ludlow-Taylor is located on a small area-network within the Pepco grid which draws energy from the larger grid but limits the amount of distributed energy that can be sent back into the grid. The biggest challenge arose when the COVID-19 pandemic hit and schools shut down, leading to a reduction in energy demand for the building. The solar array was producing far more than the area-network could consume and exceeded the amount that could be exported to the grid. The team decided to add battery storage which allows the system to control the building demand and distribute energy to match the load within daily cycles. The team also added the Heila Edge platform, a dynamic management system that integrates the solar array, batteries, and grid interconnection to align the output. The controls are constantly producing and analyzing data to understand the building and area-network's needs and determine when shifts in output are appropriate.

A similar challenge occurred when DCPS replaced the lighting, water, and space heating systems in the school with more efficient versions. These energy efficiency upgrades resulted in a 25% reduction in the building energy load. The project team found the building energy load no longer aligned with the solar energy production and adjusted the control system's algorithm to meet the building and area-network's needs without overburdening the grid. The project used energy modeling tools, including System Advisory Model, PVWatts Calculator, and RETScreen, to make this possible. Finally, the District is situated on low lying land that contains a lot of infill. The project team found that deeper digging was required than originally thought to ensure sufficient support for the solar canopy's columns.

What elements did you consider when selecting a battery system?

The project team considered safety and technology when selecting the lithium ferro phosphate battery system. First, it was crucial to ensure there was not a risk of fire given the system's location at a school. Next, the team wanted an expandable battery system that could scale up or down based on the building energy load. Finally, the battery system needed to be able to integrate with the solar system and electric grid at the speed necessary to keep up with changing demand.

What are the benefits of the project's clean energy and green building beyond energy and carbon emissions reductions?

The billing credits that the solar system earns from the electric utility are distributed for free to low-income households to help alleviate their energy burdens through the Solar for All program. Solar for All connects low to moderate income residents with affordable energy from onsite solar arrays or community solar projects, like the one at Ludlow-Taylor Elementary School. The system has served 106 Solar for All subscribers in the area and continues to save at least $500 per year in utility bills. The project also supports green jobs and workforce development in the District by working with WDC Solar, a solar installation company that offers solar training at no cost to low-income residents.

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GOVERNMENT OF THE DISTRICT OF COLUMBIA
MURIEL BOWSER, MAYOR

—PROJECT TEAM—

Department of General Services
Owner

DC Public Schools and Department of Energy and Environment
Public Partners

New Partners Community Solar
Solar PV Design

SimpliPhi Power
Battery Design

WDC Solar
Solar EPC, Maintenance, and Green Jobs Trainer

Jubilee Housing, National Housing Trust, and Montgomery Housing Partnership
Affordable Housing Partners