



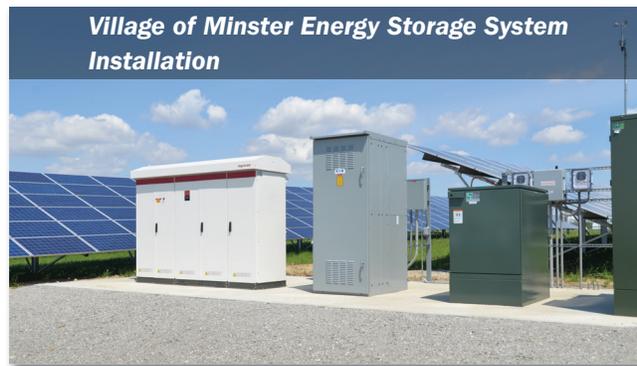
# Capturing the Multi-Faceted Value of Energy Storage

**S&C Featured Solution:** Engineering Services

**Location:** Minster, Ohio

## Customer Challenge

The village of Minster, located in western Ohio, owns its own electrical distribution system. It serves approximately 2,800 residents and a number of high-profile industrial customers, including the largest



U.S. yogurt factory. In late 2014, Minster executed a power purchase agreement with Half Moon Ventures for the supply of power from a new 4.2-MW photovoltaic solar facility. The project goal was to expand the city's electrical department footprint in renewable energy and provide cost-effective power. During design of the photovoltaic plant, Half Moon Ventures recommended expanding the project scope to include energy storage. For the inclusion of energy storage to make financial sense, the system had to capture multiple revenue streams.

## S&C Solution

Requiring an experienced energy storage integrator, Half Moon Ventures turned to S&C Electric Company, which supplied complete engineering, procurement, and construction (EPC) services for the project.

Half Moon Ventures chose S&C because, instead of using a piecemeal approach that involved packaging batteries, inverters, and the balance of plant equipment together, S&C could deliver one cohesive solution. Half Moon Ventures preferred this approach because it would help eliminate scope gaps, reduce project expenses, and ensure the Minster Electrical Department received the best long-term value. As an EPC provider, an experienced integrator, and a medium-voltage switching and protection expert, S&C was well positioned to tackle the sophisticated system.

S&C, with input from project stakeholders, selected a 7-MW/3-MWh energy storage system for the project. The system included an energy storage management system and an LG Chem lithium-ion (nickel manganese cobalt chemistry) battery system. S&C engineers designed an interconnect system that includes medium-voltage transformers and S&C switchgear to complement the energy storage system.

During the initial design phase, S&C engineers collaborated with project partners to integrate three customized services into the system design. As the primary service, S&C designed the system to provide frequency regulation in the PJM Frequency RegD Market. To accomplish this, the battery system was sized for frequent charging and discharging cycles.

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*“S&C helped us prove that multiple revenue streams in energy storage deployments can help solve our customer’s financial and operational needs.”*

*–Michael Hastings, CEO, Half Moon Ventures*

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*Half Moon Ventures and Minster will benefit from three revenue streams that will offset the cost of grid improvements and increase their rate of return.*



S&C configured the energy storage system control platform to interface with PJM market interfacing software to enable the system to follow a signal from PJM, which is a regional transmission operator that coordinates the movement of wholesale electricity in 13 states and the District of Columbia. Based on grid conditions and market pricing, the system will generate revenue from either absorbing or dispatching energy.

As a secondary but congruent service to frequency regulation, S&C designed the system to provide var support to combat an occasional low power factor on the system. Initially, the Minster Electrical Department contemplated installing capacitor banks to rectify the issue. However, the energy storage system was instead used to provide power-factor correction concurrent with frequency regulation services. Simultaneously with a full charge or discharge, the system will provide 5.25 Mvar of power factor, both capacitive and inductive. This eliminated the need to install approximately \$350,000 of var-compensation equipment.

The third service S&C built into the design was demand response for peak-load contribution charge reduction. At the end of each year, PJM looks at the five highest two-hour peak load periods across its entire territory. PJM then assesses a peak-load contribution charge to connected utility entities for the load drawn during this time. To reduce this charge, the energy storage system software was designed to predict when these peaks would occur. During these periods, approximately 10 times per year, the system will switch from providing frequency-regulation services to demand response services to consequently help reduce the charge.

After S&C fully designed and integrated the system, S&C performed comprehensive Factory Acceptance Testing at its facility in Franklin, Wisconsin. S&C engineers performed tests and simulated real-world scenarios to ensure critical system-control components integrated together correctly. This proactive testing helped to reduce commissioning time in the field and, more importantly, ensured the seamless integration of complex system components.

The modular, containerized system design allowed for an easy installation. The power conversion system and battery system arrived preassembled with the necessary control and support systems installed. S&C used medium-voltage transformers, three 12.47 kV

S&C PMH Pad-Mounted Switchgear units, and an S&C IntelliRupter® PulseCloser® Fault Interrupter to connect the energy storage system to the grid. This cohesive solution drastically simplified the project for partners Half Moon Ventures and the Minster Electrical Department.

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*“The energy storage system implemented in Minster exemplifies the future of the energy industry. From the start of the project to the commissioning, S&C partnered with the village and the investor to make this project a reality. S&C exceeded our expectations and we believe that working with an experienced partner like S&C made a difference.”*

*–Donald Harrod, Minster Village Administrator*

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## Results

S&C was able to deliver an energy storage system capable of stacking revenues to ensure a strong return on investment. S&C accomplished this by designing and fully integrating a system capable of three revenue streams: frequency-regulation services, transmission and distribution deferral, and demand-response services. Although inherently complex, S&C’s strategic positioning and skills as an experienced energy storage integrator helped to deliver a cohesive solution.

At the time of commissioning, the system was one of the largest energy storage installations in Ohio. The Minster Electrical Department and Half Moon Ventures have aspirations to eventually perform islanding with the system to provide greater reliability to nearby industrial customers.

Since the commissioning, the project has won several notable industry awards including the SEPA Project of the Year Award, Renewable Energy World’s Renewable Energy Project of the Year, the Energy Storage North America Centralized Storage Project Innovation Award, and the American Innovation Project of the Year.