The Hartley Nature Center in Duluth renovated its solar energy system and added battery backup.

Storage gives boost to solar in Minnesota

Hartley Nature Center retrofits its solar array, adds battery backup

When tornadoes ripped through Deerwood and Crosby this summer in northern Minnesota, they left a trail of downed trees and powerlines. Virtually everyone in the area was without power for three days—everyone except Karen Wilson and her spouse Ellie Slette.

Thanks to their 3-kW solar photovoltaic array with battery backup, Karen and Ellie maintained power for most of their household needs.

“Our grid-connected electricity went out Sunday evening and was out until Wednesday night,” said Wilson, whose 2,500-square-foot home is on 10 acres of wooded land just north of Crosby. “We had hot water, some lights, a few outlets; we were able to use our computers to track the outages and catch up on emails; and the refrigerator was functional and cool. I even made morning coffee on my electric coffee pot. The phone was out but we could use our cell phones on Wi-Fi.”

“It was so sunny the days after the storm that the battery recharged as quickly as we used electricity,” she said. “The battery was fully charged and ready for the next storm, which occurred just one week later and caused more power outages.”

Karen and Ellie were pioneers when they built their retirement home in 2002. They insisted on a super-insulated, passive solar home, and they invested in a battery backup to their rooftop solar PV system. “We just wanted to be as self-sufficient as possible, without it being too expensive,” Karen said.

Their lead-acid battery backup was uncommon at the time for a grid-tied PV system. But in the last year, solar plus storage is becoming more common among homeowners and businesses who want to maintain power for critical electric loads during outages.

Until about a decade ago, the solar market was almost exclusively off-grid systems paired with energy storage. Then the market swung so that most solar was grid-tied, and very few systems had storage components. Today, more solar consumers are beginning to explore battery backup for their PV systems again. The opportunity for demand charge savings has sparked interest among commercial solar customers—a market end use that is expected to increase in the coming years.

Hartley Nature Center serves as battery backup demonstration project

The Hartley Nature Center in Duluth, Minn. is one shining example that solar plus storage is gaining momentum in Minnesota. On Aug. 26, the Nature Center celebrated the retrofitting and commissioning of its Sunverge Solar Integration System, which includes a new lithium-ion battery to store energy.

The "Hartley Nature Center Solar Plus Storage Upgrade" was made possible through a grant from the U.S. Department of Energy's SunShot Initiative. Bret Pence, a project specialist for Ecolibrium3 in Duluth, and Alison Hoxie, a mechanical and industrial engineer from the University of Minnesota, Duluth, are the project co-leaders. Pence coordinated the system installation portion of the project.

"This is one of the first retrofits with battery storage in the Midwest," said Pence. "Battery backups to grid-tied solar systems are already popular on the coasts and in Germany and other European countries, but they're just catching on in Minnesota."

The Hartley Nature Center presented a great opportunity to renovate its existing solar array and add energy storage. The nonprofit's 13.1 kW solar system, installed in 2003, was in need of repair but the Nature Center couldn't afford the upgrades.

"The system had old technology with six inverters that needed repair," said Pence. "So it presented a great opportunity to upgrade the system and add energy storage."

The system went from six to three inverters, with 6 kW going to the battery. The system can store 14.2 kWh.

The lithium-ion battery backup system will provide reliable backup electric power for the Hartley Nature Center in Duluth. (Photo courtesy of the Nature Center)

Pence said it's ironic that a big storm hit Duluth on July 21 and caused the first extended power outage at the center in years. The Nature Center, out of power for six days, had to cancel one week of its environmental camp for kids and refund about $14,000. "If the battery storage had been in place before the storm, they could have held the camp and not lost revenue," Pence said. The cost of the battery system is $19,000, so the battery would've nearly paid for itself in that week alone.

Education and training components

The Nature Center demonstration project, with multiple partners, provides value to the client in the form of insurance against future grid outages. It also educates consumers, businesses, technicians, and power com-

panies about the potential of solar plus storage as a mechanism for providing backup power for emergency services, peak load management, and expanded use of solar power throughout a 24-hour cycle.

A Solar + Storage Retrofit Seminar was held Aug. 18-19 and Aug. 25-26 to educate participants on the potential of solar plus storage systems and train them to deploy new systems. The Nature Center will serve as a case study for ongoing training. Performance data on the Nature Center's system will be collected and analyzed by the University of Minnesota, Duluth, and educational materials will be developed to document the value of solar plus storage.
The Hartley Nature Center solar project is the result of a broad set of partnerships and community support. Funding was provided by the U.S. Department of Energy's SunShot program, the Clean Energy Group, the University of Minnesota-Duluth, and the City of Duluth. Other partners include renewable energy nonprofit group Ecolibrium3, as well as the University of Minnesota Extension Service, Lake Superior College, the Minnesota Power Foundation, Werner Electric, Sunverge, Innovative Solar Inc., Solar Market Pathways. and the International Brotherhood of Electrical Workers (Chapter 242). The system was installed by Great Northern Solar.

The energy storage market is surging in the United States. With the increased incidence of severe storms and the declining cost of lithium-ion batteries, interest in solar coupled with storage will continue to increase as a resiliency strategy nationally. Further, an IRS ruling (Public Letter Ruling 201308005) found that batteries used to store solar electricity qualify for the 30% energy tax credit. There are limitations in cases where the batteries draw electricity from the grid as well as solar, so consumers are advised to consult with their tax advisor for more information.

For more on the Hartley Nature Center Solar Plus Storage Upgrade, contact Pence at bret@equilibrium3.org.

Duluth Mayor Emily Larson presented at the Hartley Nature Center celebration on Aug. 26 and declared the day Solar Energy Storage Day in Duluth.