

Value Stacking in Minster

**A RURAL VILLAGE LEVERAGES
SOLAR, STORAGE AND
4 REVENUE STREAMS**

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A RURAL VILLAGE LEVERAGES SOLAR, STORAGE AND 4 REVENUE STREAMS

It is a crisp autumn morning in northwest Ohio, and Don Harrod, Administrator of the Village of Minster, is standing in the middle of the town's 4.2-megawatt (MW) solar field, talking about why plans to expand the project don't include community solar—at least not yet.

The village of just under 3,000 residents—located an hour north of Dayton—had always envisioned a series of phased additions to the project,

which also has 7 MW of battery storage. Since the batteries went online in April of 2016, the combined revenue streams from the installation have saved the town's municipal utility about half a million dollars. Community solar seemed a logical next step, Harrod said, to allow individual residents and small businesses to buy into the benefits of solar without having to put panels on their roofs.



The Village of Minster will be adding another 4.2 MW of solar and 7 MW of storage to its existing installation, located on a former farm that is now the town's well field.

Source: Midnet Media

That is, it seemed logical until Dannon, Minster's top employer and electricity user, added a 280,000-square-foot distribution center to its already-huge factory—the company's largest yogurt-making plant in North America. What's more, Dannon wanted to power the new facility with clean energy. At that point, the community solar project—aka Phase 2—with another 4.2 MW of solar and 7 MW of storage, became a de facto commercial installation.

"We were talking 4.2 MW of additional solar, and that was about what it would take to operate the distribution center," Harrod said. The entire installation will be tied into Minster's distribution system, but Dannon will be buying all the power, he said.

As utilities large and small integrate solar and storage into their systems, the Village of Minster stands out as a practical case study in the innovation that can occur in a small, rural community with a savvy approach to business development and a surprisingly robust industrial sector. For example, in addition to Dannon, the town is also home to Nidec (pronounced nee-deck) Minster, which, Harrod said, produces machine presses that stamp out about 95 percent of the



Don Harrod, Village Administrator of Minster, speaks about the town's solar and storage projects at energy conferences across the country and around the world.

Source: Midnet Media

pop tops on soda and other beverage cans in the United States.

The overwhelming success of the town's **first solar-plus-storage project**—earning Minster national attention and a raft of awards—was

rooted in its market-based design, private financing and four distinct revenue streams. The concept of storage providing multiple energy services and, in turn, multiple lines of revenue—called "value stacking"—has been much discussed in the energy sector. But few have made it work as effectively as Minster.

The town's combination of solar plus storage has improved overall power quality, helped it shave peak demand and associated critical peak pricing, and defer expensive grid upgrades. Meanwhile, Half Moon Ventures, the Chicago-based solar developer that owns the project, is also tapping the storage to sell grid support services into PJM Interconnection's frequency response market. PJM is the grid operator for 13 Midwest and Mid-Atlantic states, including Ohio.

"I am not familiar with any other case study that's so sophisticated in being able to take (advantage of) four revenue streams," said Kelly Speakes-Backman, CEO of the Energy Storage Association (ESA), an industry trade group. "That's exactly what storage is about—the reliability and resilience and ability to be flexible, especially in rural areas where you are at the end of (transmission) lines."

"Minster was the first small public utility to pair solar and storage, and the town has become a model for the kind of public-private partnerships that will advance the combination of these technologies," added Nick Esch, Senior Research Associate at the Smart Electric Power Alliance (SEPA). "The plans for expanding the project underline a trend we have seen in a number of small, rural communities—the use of solar and storage as a catalyst for economic development."

An additional 19 MW of storage—Phase 3—is also being developed, and will be built concurrently

"Sometimes, designing a successful community solar program means knowing when to put a project on hold and wait."

with the commercial project. Besides taking advantage of economies of scale, Harrod said, the goal here is to create a local microgrid that can be used to ensure power—and improved reliability—for critical facilities and local businesses in the event of an outage.

It will also be one of the first storage facilities selling energy directly into PJM’s wholesale power markets, said Michael Hastings, CEO of Half Moon, which is again partnering with Minster on the project expansions. Groundbreaking for the two projects is tentatively scheduled for the second quarter of 2018, he said.

At the same time, Minster has not given up on community solar. In 2017, the town partnered with SEPA on an initial customer survey that revealed strong interest in a shared solar project, but also a need for more information and public outreach.

“Sometimes, designing a successful community solar program means knowing when to put a

project on hold and wait,” said Dan Chwastyk, SEPA’s Utility Strategy Manager, who worked on the survey. “Our original idea was that Dannon would be an ‘anchor’ or early subscriber—to draw in other customers and make financing the project easier. But the company’s expansion—and its interest in procuring clean energy—changed the dynamics.”

Harrod is now talking with the town’s school district, which is in the midst of renovation plans for its combined middle and high school. Superintendent Brenda Boeke sees a lot of possibilities, either to include solar in the renovation or sign on as a new anchor subscriber for a future community solar project.

“If there was a way to tie solar into that (renovation) project, we would be very interested,” she said. “The potential is huge to include the kids. It’s critically important that we start educating them young on the need for renewable energy, and by experiencing a solar field, I think we have an absolutely great opportunity.”

SMALL TOWN, BIG BUSINESS

In many ways, Minster is typical of many small municipal utilities, said Michael Hyland, Senior Vice President for Engineering Services at the American Public Power Association (APPA).

About half of the association’s members are municipal utilities serving less than 2,000 meters, he said.

“They are nimble; they are small; they listen to their customers,” he said.

But, he cautioned, even with rapidly falling storage costs, the technology has not yet reached the point where solar plus storage will be the right option for every small-town utility. It’s not “the holy grail,” he said, “but a step closer to a solution” for the challenges these small municipals now face.

Why it worked in Minster is a combination of the town’s conservative, but can-do ethos, and a fortuitous change in state policy, which forced village leadership to do some outside-the-box thinking.

“I’ve managed several facilities over 20 some odd years, and the electrical infrastructure and processes that exist in Minster are the most consistent,” Box said. “I think a lot of it is due to the fact that we have storage capacity here as the result of the solar field.”

The Village of Minster was founded in 1832 by a group of German Catholic immigrants with a fierce work ethic and staunch community spirit, both of which remain cornerstones of the local culture. This heritage is also at least part of the reason Minster—which is still surrounded by flat fields of corn, soy and wheat—has been able

to avoid the loss of population and industry often associated with small rural towns.

The unemployment rate here is about 3.3 percent. Kids leave for college and first jobs in nearby cities—Dayton, Cincinnati or Indianapolis—Harrod said. But a good number of them return once they get



Dannon's yogurt manufacturing plant in Minster covers 58 acres, runs 24-7 and produces 260 different types and varieties of yogurt.

Source: Midnet Media

married and start families of their own, and in some cases, they start new businesses that create more jobs as well.

Harrod, who at 51 has been village administrator for 24 years, said the town has thrived based on the ongoing expansion of its home-grown businesses, some of which have then been bought by national or international companies. Dannon is marking its 50th year in the village, said Joe Box, Plant Director at the Minster facility. Still, driving up to the 58-acre plant, you can see the small building that housed the local dairy, which eventually grew into the business Dannon acquired. Similarly, Nidec Minster was originally the Minster Machine Company.

The town recently broke ground on a new industrial park, planned specifically to give local businesses more room to grow. New residential development is also underway.

Maintaining this strong economy means Minster must provide its commercial customers abundant,

reliable, high-quality power—with minimal fluctuations in voltage and frequency—at a price its small municipal utility can afford, while still keeping residential rates low.

Dannon alone uses about 58 million kilowatt-hours of electricity per year, Box said, and the 24-7 operations at the plant can drive substantial

HOW MANY KWH?

A kilowatt-hour (kWh) is a measure of energy usage—the equivalent of using 1,000 watts, or 10 100-watt light bulbs, for an hour. According to the U.S. Energy Information Administration, the average home in the U.S. uses about 10,770 kWh of electricity per year. Thus, the 58 million kWh the Dannon factory uses annually could power an estimated 5,385 homes—more than four times the 1,257 homes that are actually in Minster.

peaks and power fluctuations. For example, the factory pasteurizes millions of gallons of milk a year, and the pasteurization equipment has to be completely shut down and cleaned every one to three days.

The result, Box said, is that a lot of machinery may be turned off and later come back on all at the same time. The factory is working to stagger the process,

but he gives Minster and its solar plus storage a high rating for providing reliable, steady power.

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STRICTLY MARKET-BASED

Minster started considering solar about five years ago as a pragmatic solution to its power needs, Harrod recalled. After partnering with American Municipal Power—the town’s electricity provider—on other generation projects, “we were looking to find another cost-effective (resource) that would enable us to diversify our portfolio . . . shave our peak demand, and reduce our costs,” he said.

The site for the project was farmland originally owned by one of the town’s founding families and now used as the municipal well field, providing much of the town’s drinking water, Harrod said. That use, as a well field, preempted most other development, opening the way for solar.

“We’re able to offer solar to them cheaper than (power from) coal, and still make money on the deal,” said Hastings.

In 2014, the village had signed a power purchase agreement for a 4.2-MW solar project—without storage—when the state legislature put Ohio’s

renewable portfolio standard on hold for two years. The freeze effectively killed the value of the solar renewable energy certificates that were critical to finance the project, and potential investors backed off.

The city put the project on hold, recalibrated its bottom line and

searched for new investors. Project economics had to be strictly market-based, and adding storage made the installation pencil out. Half Moon came on board at this point, bringing with it private financing and project development experience.

“We’re able to offer solar to them cheaper than (power from) coal, and still make money on the deal,” said Hastings.

As he tells it, Hastings started Half Moon in 2005, after spending a decade in investment banking in Hong Kong, watching as pollution turned the skies from blue to smog-choked gray.

He now sees solar plus storage as “a pretty simple and elegant solution to a lot of municipal needs.”

Minster’s first power purchase agreement (PPA) with Half Moon—for its original solar field—was for about 7 cents per kilowatt-hour, Harrod said. With solar and storage prices falling, the PPA for Phase 2 came in at around 5 cents per kilowatt-hour.

On the savings side, the village has cut its peak capacity and demand charges by about \$150,000,



Lining up for the 2016 ribbon cutting at the Village of Minster storage project are (left to right) Michael Edmonds of S&C Electric, Minster Mayor Dennis Kitzmiller, Village Administrator Don Harrod, Michael Hastings of Half Moon Ventures and Yu Weizhou, CEO of Concord New Energy, a project investor.

Photo by K Kaufmann

Harrod said. The town was also able to avoid spending \$350,000 on capacitors, a type of battery used to improve power quality. Those savings are passed on to customers through the town's power

adjustment factor—an adjustment to customers' bills based on the price Minister has pay to buy power on spot markets to meet its peak demand.

CHANGING RULES, CHANGING TECHNOLOGY

Locating a solar project on former farmland does have its challenges. During the summer months, the grass on the site started to grow, creating a potential hazard for the project—a common problem at solar plants on former agricultural land. The town's solution, Harrod said, was bringing in a flock of sheep for onsite landscape management.

The positive economics of Minster's solar plus storage were also briefly upended early in 2017, when PJM tightened the requirements for storage batteries participating in its frequency response market. Among other changes, batteries that provided fast response had to be able to maintain that level of power for up to half an hour, versus the previous requirement of 15 minutes.

With 3 1/2 megawatt-hours (MWh) of power, Minster's first 7 MW of storage were designed to provide fast response over a shorter duration, and had to be adjusted to meet the new requirements without overheating. The Phase 2 project will be specifically designed to meet the PJM requirements with 7 MW and 7 MWh of power, enough to provide both fast response and longer duration.

In addition, both the 4.2 MW of solar and 7 MW of storage will be located on the well field, and installed to allow Half Moon to take advantage of the federal investment tax credit for both.

The first project was split—solar panels at the well field, storage a mile away at one of the town's substations.

The additional 19 MW of storage is also aimed at a critical problem for the village. When a major wind storm barreled through Minster a few years ago, the town experienced a significant outage—more than six hours—due to problems with one



The Village of Minster keeps the grass short at its 4.2-MW solar project by bringing in a herd of sheep in the summer.

Photo by K Kaufmann

of the two outside transmission lines the town depends on for its power. Both lines are owned by another utility. Backed up by the town's solar and possibly a new substation, this new bank of storage batteries could allow the village to disconnect, or "island," itself from the grid in such circumstances.

"From the business standpoint, it helps us," said Dennis Kitzmiller, a lifelong resident who has

been Minster's mayor for the past 22 years. "Any business that would want to come into town knows that a half-hour power outage is not going to affect them. That's a big thing."

ESA's Speakes-Backman sees a growing opportunity for storage linked to clean energy as more businesses locate data centers or other

"Any business that would want to come into town knows that a half-hour power outage is not going to affect them. That's a big thing."

facilities in small or rural communities—and, like Dannon, need 24-7 power.

“I think storage is a great play there,” she said. “If you look at the economy and where

people are moving to more rural areas, it’s an interesting trend. I’m excited to see more of that (development) happen.”

THE COMMUNITY SOLAR CHALLENGE

Ask anyone in Minster about the town’s solar and storage, and they will talk about the recognition, pride and competitive edge the project has brought the community. The display case that greets visitors to Minster’s Village Administration Building is packed with the awards the town has received in the past two years, including a SEPA Power Player Award as 2016 Public Power Utility of the Year.

Another point of pride—Harrod has become a sought-after speaker at utility industry events both in the U.S. and as far away as the Middle Eastern Emirate of Dubai.

“A lot of places have some solar, but not a lot of people are into the battery the way we are,” Kitzmiller said. “We’re kind of on the cutting edge.”

Bringing community solar to Minster could present a different kind of challenge. Funded by the Department of Energy’s Solar Electric Technologies Office, the SEPA survey found overwhelming interest in the general concept of community solar, Chwastyk said. But on questions aimed at probing local priorities, 20 percent or more of those surveyed said they needed more information or did not understand how the program would work.

Kitzmiller is typical of some of Minster’s older residents. He supports the idea of community solar, but for himself, he said, “It would depend how much you have to lay out, the term of the contract. I don’t know that for an older person that might be a good thing.”

“Getting this kind of feedback from the community is the foundation for any successful community solar program,” Chwastyk said. “One of the strengths of these projects is they can be sized and customized based on what customers want—for example, by offering shorter-term contracts or different financing options.”

While still taking a cautious approach to the technology, APPA’s Mike Hyland sees the potential for more storage, paired with community and other solar projects, “where and when it makes sense.” Another key driver will be the entrepreneurial spirit of small town leaders like Kitzmiller and Harrod, who often provide the vision and momentum for adopting and fully leveraging new technologies, he said.

This is grid-edge innovation of another order. While larger cities—and their utilities—tend to get attention for pilot programs testing out new technologies and business models, Minster is navigating the energy transition—and staying ahead of the pack—by sticking with the basics. Engage with customers to understand their needs, alter plans when market conditions change, and stay focused on the bottom line.



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