

The 'grid battery' in your basement

Minnkota's demand response program aligns with community storage initiative

The most economical battery to store energy and help utilities optimize the electric grid may be hiding in your basement.

A 2016 study from the Brattle Group, an international economic consulting firm, finds that the nation's 50 million residential electric water heaters collectively represent a significant – and underutilized – energy storage resource capable of producing direct benefits to utilities and consumers.

Minnkota Power Cooperative and its members are well-positioned to advance this national effort, referred to as "community

storage," through the use of their demand response program.

For decades, Minnkota and its members have partnered with their consumers on demand response, which allows the consumer to use lower-cost, off-peak electricity to "charge" large capacity electric resistance water heaters during overnight hours. Minnkota benefits from temporarily turning water heaters off because it reduces how much power needs to be generated or purchased during peak demand periods.

"Controlling loads during peak periods protects consumers from the volatility of purchasing surplus energy from the market and prevents the need to build new power plants just to serve peak loads," said Todd Sailer, Minnkota senior manager of energy supply. "The savings by doing this are passed on to members through a lower off-peak electric rate or bill credit."

The consumer does not have to sacrifice comfort during the times when the water heater is being controlled because the water is stored inside a specially insulated tank, which allows almost no heat loss over a 24-hour period.

“Demand response is a vital tool for Minnkota and the member systems to use to keep wholesale power prices competitive. As the grid evolves and more intermittent resources are integrated, the value of the program will continue to grow.”

– TODD SAILER, *senior manager of energy supply*

Currently, Minnkota has approximately 41,500 electric water heaters operating across its system. About 8,500 are large capacity electric resistance water heaters tied into the demand response program.

Broad support

The community storage initiative focuses on a range of programs, such as Minnkota’s demand response program, that aggregate electric storage resources available throughout the community to improve the efficiency of electric energy services for consumers.

Besides water heating, other storage technologies include electric vehicle charging and electric thermal storage space heating. These programs offer the industry practical steps to increase the amount of energy storage available, and also better manage the intermittent nature of renewable resources like wind and solar. That potential has drawn support from America’s electric cooperatives and several environmental groups, including the National Resources Defense Council.

For Minnkota, managing renewable resources is important because in 2017 the cooperative will purchase energy from wind facilities with the capacity to produce 457 megawatts (MW). Wind farms are typically most active during overnight hours when extra electricity isn’t always needed.

The community storage initiative suggests that by shifting a water heater’s primary heating period to these off-peak hours, utilities are able to derive more value from the excess wind generation.

Minnkota members offer rebates

The participating Minnkota member cooperatives and the Northern Municipal Power Agency (NMPA) municipals have partnered to offer a broad array of rebates for consumers who want to install an electric water heater and participate in the off-peak program. Rebates are also available for consumers who install off-peak heating systems.

Minnkota provides the financial incentives to the member and municipal systems, and each system determines how to implement it with their own retail consumers. The program has been popular with homes, farms and businesses benefiting from the post-installation rebates.

Minnkota was one of the early adopters of demand response, launching its program in the mid-1970s. Today, about 50,000 consumers participate in some form. Loads most commonly involved in the program range from heating systems and water heaters to grain dryers and commercial loads with backup generators. When necessary, nearly 80 MW in the summer and 350 MW in the winter can be

interrupted from Minnkota’s control center in Grand Forks.

Loads are interrupted through the ripple control system, which includes computers that can transmit tens of thousands of electronic signals to substations that inject these signals into the power transmission and distribution lines.

Receivers wired into household current at consumer homes and businesses can read the signals, and when the appropriate message is sent, the receiver interrupts the electric power flowing to a water heater, electric heating system or other controllable loads.

Based on metering and market conditions, system operators and energy marketers know when a peak load period is approaching. Depending on the amount by which Minnkota needs to reduce the peak, the operators choose various groups of controlled load and temporarily turn them off using the ripple control system.

Millions of dollars have been saved due to the successful operation of Minnkota’s demand response program over the past 40 years.

“Demand response is a vital tool for Minnkota and the member systems to use to keep wholesale power prices competitive,” Sailer said. “As the grid evolves and more intermittent resources are integrated, the value of the program will continue to grow.” □