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A No-Brainer

A CHP MICROTURBINE AT WINONA'S WASTEWATER TREATMENT PLANT WORKED SO WELL THAT THE CITY CHOSE TO ADD ANOTHER AND DOUBLE CAPACITY

By Steve Lund

Two blue mixers protrude from the gas cover on one of the digesters at the Winona Wastewater Treatment Plant.

A skid-mounted gas conditioning system is used to pressurize and dry the biogas and remove siloxanes before the fuel is burned in the microturbines.

Winona is doubling down on combined heat and power.

The Minnesota city on the Mississippi River installed its first CHP microturbine generator at its wastewater treatment plant in 2010. In spring of 2025, it replaced the original one and added a twin, both Capstone C65 models, like the original unit.

The expansion wasn't a hard decision, says Paul Drazkowski, wastewater superintendent. Tax credits and U.S. Department of Energy grants covered about 90% of the $637,000 cost, and the city's digesters were producing more biogas than the plant could use efficiently with only one microturbine.

The biogas cleaning infrastructure also had capacity to support another generator. "We didn't have to invest extra money to upgrade the gas cleaning. All we had to do was add another microturbine and get the plumbing hooked up," Drazkowski says. "It was a no-brainer."

NO MORE FLARING

The wastewater treatment plant (9.6 mgd design, 3.5 mgd average) has two 500,000-gallon digesters. Biosolids are dewatered on a belt press (Komline-Sanderson); the cake at 12% solids is stored on site and twice a year applied on local farms.

The digesters have floating gas covers, but there is no additional gas storage. Before the second turbine was installed, fuel supply in summer sometimes exceeded demand, and the excess was flared. That is no longer the case.

Before the second generator was added, the single turbine operated continuously at full power (65 kW). Excess gas was directed to a secondary boiler to heat the digesters. Now the plant can use all the gas in the generators, which can be modulated to run at 35 to 65 kW. "We can produce up to 130 kW, if we have enough gas," Drazkowski says.

Since the plant always had at least enough gas to run the original generator, the city hadn't considered adding fats, oil and grease to the digesters to boost gas production. Now that has changed.

The Winona plant now has two Capstone C65 microturbines that generate electricity and process heat.

"In the past, a FOG receiving station would never have paid for itself," Drazkowski observes. "Now, we don't have enough gas to run both generators 24/7 at full power. If there's money available through grants or other funding, down the road accepting FOG is a possibility."

BETTER HEAT EXCHANGERS

Capturing heat is a key feature of CHP, and Winona's new microturbines came with more efficient heat exchangers. "Our original microturbine's heat exchanger was stainless steel," Drazkowski says. "The new ones are copper and have twice the heat transfer capacity."

The hot water pumped through the old heat exchanger at 40 gpm had a 10-degree temperature rise. The new ones boost the temperature by 20 degrees. With both microturbines operating, the potential heat output quadruples. That means much less natural gas is needed to keep the digesters at their ideal temperature.

Both digesters are equipped with a pair of mixers (WesTech Engineering), which used to run full speed all the time, 23 hours forward and one hour in reverse. At that rate, the mixers could turn over the entire 500,000 gallons every hour. Installing Allen Bradley variable-speed drives (Rockwell Automation) on all four mixers has saved significant energy.

"It was a huge cost savings," Drazkowski says. "And we didn't see any change in our methane production by slowing the mixers down. We still are digesting fine, with good solids reduction. We didn't see any disadvantage."

TWEAKING THE EQUIPMENT

Winona has also tried to save energy by finding the most efficient way to operate its two boilers, a 2 million Btu/h unit that runs wide open or is off, and a 1.5 Btu/h modulating boiler that maintains a constant 170 degrees F.

Sludge tubes run through the water in the larger boiler to pick up heat for the digesters. Hot water from the heat exchangers at the microturbines and from the modulating boiler all go to the main boiler.

"We favor running the smaller boiler; it's just more efficient," Drazkowski says. "It's a hot water loop, and everything gets fed to the big boiler. Whether the big boiler actually runs or not, it's getting supplemented with the hot water from other sources."

Drazkowski expects his staff to do similar tweaking with the new microturbines. It was simpler when only one microturbine ran at full speed all the time. Now the team needs to experiment to find the most efficient way to operate.

"It has been a learning curve, to say the least," Drazkowski says. "We typically try to run both of them all the time even if at minimum speed. That is still better than just running one. That's how we're playing it right now. If we wanted to run them wide open and make more electricity, it would be for a short duration, just because we'd be burning so much fuel." tpo