Biogas-Fueled Cogeneration Is a Great Energy Saver, Especially When It's Fine-Tuned for Maximum Output

Atlanta’s main clean-water plant gets the most from on-site power generation while looking to Class A biosolids and nutrient recovery for fertilizer.

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Sustainable Operations

Inside the headworks, team members inspect the area where mechanical grit screening equipment (Huber Technology) was installed.

A cogeneration project at Atlanta's R.M. Clayton Water Reclamation Plant didn't work as well as expected — until the operators found a better place to use the electricity.

In 2012, the plant added a 1,600 kW Caterpillar Inc., Electric Power Division, engine-generator to make better use of biogas from the four anaerobic digesters. Previously the methane had been compressed and stored and used to heat the digesters or to fuel the plant's two incinerators, but sometimes surplus gas had to be flared. Heat captured from the generator was looped back to the digesters.

The project was a significant sustainability improvement, but it didn't operate as well as expected. The basic problem: The generator produced electricity faster than the plant could consume it, and the electricity was overwhelming the equipment in the headworks. "It was shutting down switchgears," says Daniel Sabou, plant manager. "We've got a lot of older switchgears that were not designed to receive load on the back side."

The cogeneration system was not designed to send power to the grid; the power has to be used immediately on site. With the frequent equipment failures, the generator could not run at capacity — until the team devised a solution.

"We rerouted the electrical output from the primary side, which was not that much of a load, to the secondary side, where there is higher demand," Sabou says. Changing the point of consumption enabled the plant to make full use of the generator's output.

Solving a grit problem

Meanwhile, there was another problem at the plant: a tertiary facility (100 mgd design, 80 mgd average) discharging to the Chattahoochee River. Grit was affecting all plant operations, including the cogeneration system. "The grit coming from the headworks was taxing on the digesters," Sabou says. "We were filling the digesters with grit. We couldn't mix them properly, the pumps were failing constantly, and we were not producing good-quality biogas.

"The grit was interfering with all the biological processes. It was plugging up pipes, so we couldn't transfer sludge from one tank to another. We couldn't maintain our process in a viable fashion."

Late in 2015, a major headworks upgrade started. A new screening mechanism (HUBER Technology) reduced the screen openings 1 inch to half an inch, and a HeadCell grit removal system (Hydro International) was added. The equipment went online in 2017.

The grit removal system is like a cone-shaped stack of trays. The wastewater slows down in the trays and the grit and other solids settle out. The material that ends up in the bottom of the cone is pumped to a separator, dried and trucked to a landfill.

"It removed all the abrasive components in the wastewater that had been significantly damaging our equipment — pumps, valves, gauges, everything," Sabou says. "We noticed a decrease in the maintenance emergency requests and lower costs for equipment replacement once we started removing the grit continuously."

Toward Class A biosolids

Looking ahead, sustainability improvements are in store for the solids side of the process. Thickened sludges are sent to the digesters, and the digested material goes to a dewatering centrifuge that produces cake at 24 to 25 percent solids. The cake is then fed to two incinerators, built in the 1970s. For every 9 tons of cake, about 1 ton of ash remains.

In the past, the ash was used by a brick manufacturer. When that company went out of business, the ash had to be landfilled. With air pollution regulations becoming stricter and the incinerators nearing end of life, the plant team looked for alternatives.

The solution is a low-temperature dryer (SUEZ), expected to be operating by 2022. The cake will be placed on a long conveyer belt where 170-degree F air will be blown across it. The dried material will then be pushed through a grid to form pellets. The final product is expected to be a Class A biosolids at 65 to 90 percent solids.

Nutrient harvesting

Another improvement, in an early stage of development, is a nutrient harvesting system designed by Ostara Nutrient Recovery Technologies that will capture phosphorus and nitrogen in the centrifuge centrate to create a marketable fertilizer.

"We hope to find a pretty good market for that," Sabou says. "Currently, to meet our phosphorus discharge limits, we have to add chemicals to the wastewater, and that's a cost. By capturing the phosphorus, we get something out of it. It's not just a cost; there's also revenue."

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