

York Wastewater Treatment Plant

When energy bills at York Wastewater Treatment Plant in Pennsylvania topped US\$63,000 per month and service of the plant's four internal combustion engines required a hefty 110 gallons (416 liters) of oil every 700 hours of operating time, York officials knew it was time to update the plant's 23-year-old cogeneration system.

The plant, which serves 170,000 residents of York and six surrounding communities, treats 26-million-gallons (98-million-liters) of sewage each day.

To handle the load and implement a new cogeneration system that lowers total lifecycle costs, requires less maintenance, and emits fewer emissions, the York City Sewer Authority selected a highly efficient Capstone CR600 Power Package® for the 600kW combined heat and power (CHP) system. Separately, the Authority purchased a C1000 Power Package® to produce 1MW of additional electricity based on the facility's fluctuating demands.

Today, York officials estimate the Capstone cogeneration system generates more than 2.5-million-kW of electricity annually, reduces energy costs approximately US\$278,000 per year, and lowers carbon dioxide emissions by more than 1.5-million-pounds (680-metric-tonnes) annually.

The CR600 is a Capstone Renewable (CR) microturbine, designed to operate on methane gas and other waste gas fuels created from the treatment of domestic wastewater. At the York facility the CR600 is fueled by methane produced by the plant's two anaerobic digesters that breakdown the waste into biogas. The C1000 is a low pressure dual-mode unit fueled by utility-supplied natural gas.

J.T. Hand, Chairman of York City Sewer Authority explained, "We were looking for an opportunity to invest in future infrastructure



At a glance

Location

York, Pennsylvania, USA

Commissioned

September 2011

Fuel

Methane gas from an anaerobic digester.

Technologies

- One methane-gas fueled Capstone CR600 Capstone Power Package.
- One low pressure natural gas-fueled Capstone C1000 Power Package.
- Two anaerobic digesters with a total capacity for 2.66 million gallons of sludge (1.33 million gallons each).
- One Capstone integrated Heat Recovery Module captures the CR600's exhaust heat, and is reused to maintain the digester's 98°F (37°C) temperature.

Customer

- York City Sewer Authority's wastewater treatment plant, serving 170,000 residents of York and surrounding communities in Pennsylvania.

Results

- Generates more than 2.5-million-kW of electricity annually.
- Reduces energy costs approximately US\$278,000 per year.
- Lowers CO₂ emissions by more than 1.5-million-pounds (680-metric-tonnes) annually.
- Natural gas-fueled C1000 generates 40% more power than the previous internal combustion engine system.
- Provides 1.6MW of backup power.
- Efficiently generates 24/7 baseload electricity.



A natural gas and methane gas fueled Capstone C1000 and CR600 at York's wastewater treatment plant save energy, cut operational costs and protect the environment by generating clean-and-green electricity.

development, not look to the past. That's why we went with the Capstone microturbines."

The plant's environmental engineering firm, Buchart Horn Inc., helped assess the investment. "Through the evaluation it was determined that the capital costs, the upfront costs, were not that much different between the engines versus the microturbines," said Larry Luther, Associate Vice President for Buchart Horn Inc. "But, when we looked at the overall picture – the lifecycle costs – the microturbine technology came out better because it has higher efficiency."

The side-by-side Power Packages produce 40 percent more power than the former internal combustion engines. The custom configuration allows the plant to operate in multiple modes – a digester/natural gas base mode or natural gas peak shaving mode – and, provide 1.6MW of backup power.

For years, the plant simply flared waste methane gas into the air. Because methane has a greenhouse-gas impact on the atmosphere 21 times that of carbon dioxide, it was important to York officials that the plant's upgraded system use the digester-produced methane for fuel.

"We needed redundancy," Hand said. "Methane recovery is absolutely paramount to us. We have a renewable source of energy right here in the digestion process." The CR600 allows the plant to use the recovered methane to produce electricity to help power its onsite electrical grid.

In addition to producing electricity, the CR600's exhaust heat is recovered and used onsite in several ways. Heat from the Power Package is used to maintain the two digesters' constant 98°F (37°C) temperature needed to break down the waste, as well as provide building heat during the region's frigid winter months.

The C1000 generates more power when the plant's demand for electricity rises and for peak shaving several hours each day. "Peak shaving allows the facility to lower electricity costs by producing power onsite when utility rates rise during each 24-hour period," said Jeff Beiter, Managing Partner at E-Finity Distributed Generation, Capstone's Mid-Atlantic and Southeastern Distributor that secured the order.

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*— J. T. Hand, Chairman
York City Sewer Authority*

Both the air-cooled, lubricant-free CR600 and C1000 power systems relieve the plant from power interruptions and staff from burdensome maintenance needs. Steven Douglas, the treatment plant's general manager, explained, "The Capstone turbine had some advantages over other manufacturer's turbines – one being that there was no liquid lubricant in the system at all. It was all air-cooled, air lubricated, very low maintenance costs. The only thing we routinely need to check is an air filter, and that's it."

"The other thing that people don't think about with a wastewater treatment plant is we also have the air to deal with," added Douglas. "These microturbines emit so much less air pollution than the engines that we currently run." Another bonus – the plant may no longer be required to report emission levels to Pennsylvania's Department of Environmental Protection since the microturbines generate a negligible amount of pollutants. ■