



CHP
TECHNICAL ASSISTANCE
PARTNERSHIPS

McAlpine Creek Wastewater Management Facility

1MW Biogas CHP System

Project Overview

Charlotte Water (formally Charlotte-Mecklenburg Utilities) operates seven wastewater treatment plants, including their largest, McAlpine Creek Wastewater Management Facility (WWMF). Located in Pineville, near Charlotte, N.C., this facility has a daily treatment capacity of 64 million gallons per day. In March of 2017, McAlpine Creek became the first wastewater treatment plant in North Carolina to utilize anaerobic digester gas to power a Combined Heat and Power (CHP) system. The CHP system generates electricity while also providing process heat to the vital process of anaerobic digestion. The project was supported by a 20-year zero-interest loan from North Carolina's Clean Water Revolving Fund program. In addition, the Southeast Combined Heat and Power Technical Assistance Partnership provided technical support to the utility during the planning phases of the project by conducting a CHP Qualification Screening and a Feasibility Analysis. The facility is now considering the addition of a second CHP system with plans to increase CHP capacity to 2 MW.

Quick Facts

LOCATION: Pineville, NC

MARKET SECTOR: Wastewater Treatment

FUEL: Biogas / Methane

GENERATING CAPACITY: 1MW; approximately 7.9 MWh annually

IN OPERATION SINCE: 2017

EQUIPMENT: GE Jenbacher J320

USE OF ELECTRIC ENERGY: Exported to grid

USE OF THERMAL ENERGY: Digester hot water heating

INSTALLED COSTS: \$4.6 million

ANNUAL SAVINGS: \$300,000

ENVIRONMENTAL BENEFITS: Avoids flaring of up to 900 pounds per day of methane gas

EMISSIONS CONTROLS: Lean oxidation catalysts, scrubbed fuel gas.

EFFICIENCY: 80%

AWARDS: The project was awarded the 2018 Henry A. Stikes Grand Conceptor Award by the American Council of Engineering Companies of North Carolina for having the best engineering project in the state.



McAlpine WWMF CHP System, Pineville, NC

Reasons for Installing CHP

Charlotte Water recognized the energy potential and greenhouse gas emissions associated with the 900 pounds per day of methane gas produced and flared at the McAlpine WWMF. Additionally, the utility was interested in increasing the overall efficiency of their wastewater treatment operations. Prior to installing the CHP system, their anaerobic digesters were heated using 20-year old boilers. By installing CHP, the previously-flared methane fuels a system that provides heat for the digesters and generates electricity that is sold to Duke Energy under a Power Purchase Agreement, the revenue from which offsets a significant portion of the cost to operate the plant.

Equipment Configuration and System Financing

The primary components of the McAlpine WWMF CHP system include the anaerobic digester and gas piping infrastructure, a gas conditioning system, the CHP prime mover and the hot water system. This project also includes interconnect upgrades to Duke Energy's grid. The prime mover is a GE Jenbacher J320 reciprocating engine, which is a container unit that includes pre-installation of all components and equipment. Charlotte Water also opted to integrate the central engine control panel with a single tie-in to their existing SCADA system, simplifying the instrumentation and control process.

An important aspect of this project was the availability of financing through the Clean Water State Revolving Fund (CWSRF). The CWSRF Program was created by the 1987 amendments to the Federal Clean Water Act and is intended to provide various funding options for wastewater treatment facilities and projects associated with estuary and nonpoint source programs. One provision of the program includes an appropriation reserve to provide 20-year 0% interest loans for Green Projects and for rehabilitation projects for certain local government units. Green Projects include those that reduce energy use by at least 20 percent or that produce energy. In North Carolina, the CWSRF is administered by the Department of Environmental Quality.

Charlotte Water applied for and was awarded a \$3.2 million, 20-year 0% interest loan under the Green Project provisions of the CWSRF to support development of the McAlpine WWMF CHP plant. This loan covered approximately 70 percent of the \$4.6 million total project installed cost resulting in a payback of less than 13 years.

Lessons Learned

Will Rice suggests doing an ample amount of research including visiting facilities that have CHP applications and asking questions of the facility managers. By gaining an understanding of the operations and maintenance, as well as the capital expenses, the team was able to successfully manage expectations of leadership and stakeholders alike. Facility leaders are expecting the system to payback in about 13 years. McAlpine Creek's utility provider, Duke Energy, requires them to operate under a 'buy all, sell all' arrangement which is expected to create about \$300,000 annually.

Testimonial

"This CHP facility is science fiction turned into reality. We take dirty water, the things people put down their drains and in their toilet, and in the process of cleaning that water, we generate power."

Will Rice, Project Manager, Charlotte Water



For More Information

U.S. DOE SOUTHEAST COMBINED HEAT AND POWER TECHNICAL ASSISTANCE PARTNERSHIP

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