SOUTHWEST

U.S. DOE

CHP Technical Assistance Partnerships

PROJECT PROFILE

Village Creek Water Reclamation Facility

5.2-MW CHP System

Site Description

The City of Fort Worth owns and operates the Village Creek Water Reclamation Facility. The site is permitted to process 166 million gallons of wastewater each day. The average electricity load at the site is 8 MW, occasionally reaching peaks of 12.5 MW during high rain fall events. Since start-up, the system has operated greater than 99% of the time.

Village Creek WRF is dedicated to using its resources efficiently, including recycling energy, as well as biosolids. Approximately 60% to 75% of current plant energy requirements are produced by on-site power. The turbine engines can be run on digester gas, natural gas or landfill gas.

Reasons for CHP

The City of Forth Worth was looking to reduce costs and improve operations. It found a great opportunity at its Village Creek Water Reclamation Facility where it would be able to reduce energy, as well as operation and maintenance costs through an energy performance contract that would not only save money, but guarantee the savings. The City is considering selling power back to the grid for additional revenue. A study is underway to determine the feasibility.

Quick Facts

LOCATION: Fort Worth, TX
MARKET SECTOR: Wastewater Treatment
FACILITY SIZE: 166 Million gallons per day (MGD) design
FACILITY PEAK LOAD: 12.5 MW
FACILITY AVERAGE LOAD: 8 MW
EQUIPMENT: Two Solar Taurus 60 Gas Turbine Driven Generator (one on standby), Heat Recovery Steam Generator
FUEL: Digester Gas, Landfill Gas and Natural Gas
OPERATION: 60-75 % of the electric load is covered by CHP
USE OF THERMAL ENERGY: Steam turbines to drive centrifugal blower, Digester heat
CHP IN OPERATION SINCE: 2012

Village Creek Water Reclamation Facility, Fort Worth Water Department

Bio-gas Turbine (Left) and Heat Recovery Steam Generator & Duct Burner (Right)

CHP Equipment & Configuration

The site has two Solar Taurus 60 Gas Turbines with capacity of 5.2 MW each. Presently, one of the turbine runs full-time, while the other remains in standby. The City is assessing whether to bring the second turbine online. The fuel for the turbine includes digester gas (600 Btu/SCF and 65% CH4, 35% CO2) or landfill gas from Arlington Landfill through Renovar Energy Corp. (500 Btu/SCF and 55% CH4, 40% CO2). Landfill gas is supplied at a steady rate throughout the day and does not vary with season. The gas is supplied at 65 psi and ~1300 SCFM. Prior to entering the turbine, the digester gas passes through a dehydrator to remove residual water and a scrubber to remove any non-condensable gas. Natural gas from ATMOS Energy (919 Btu/SCF) is also available when needed.

The digester gas is produced in 14 concrete tanks, each with a capacity of 1.29 million gallons, with six of the tanks having linear mixers from Ovivo. These digesters were part of the initial plant in 1956, with last upgrade in 1987. The digester gas does vary throughout the day and seasonally, mainly caused by the amount of "high strength waste" deliveries received throughout the week. Six of the fourteen digesters have co-digestion capabilities to boost the gas production. Depending on conditions, the total digester gas production ranges from 800 SCFM to 2000 SCFM.

The heat recovery steam generator (HRSG) is heated by 950 Fahrenheit exhaust gas off of the turbines which is further heated to 1350 degrees Fahrenheit with a biogas fired duct burner. The HRSG produces 50,000 lbs/hr of steam which is fed into two steam turbines each driving their own 30,000 SCFM centrifugal blower. These blowers have reduced the need to use two electricity powered blowers, thereby reducing power import from the grid. The heat from the steam during condensation is then used indirectly to maintain the digesters at 98 degrees Fahrenheit during the fall and winter months.

CHP Development and Operation

The total cost for the project was about $35 million. The utility received $1.3 million from ONCOR as a "Demand Reduction Incentive" back in 2013. The annual saving is ~$2.8 million, coupled with the incentives, gives results in an estimated payback period of 12 years. Johnson Controls (JCI) was the prime for the project and responsible for leading the assessment, design and implementation of the CHP system. The City staff operates the facility and is responsible for preventative maintenance for the steam turbines and surface condensers. The maintenance on the gas turbines, HRSG and water softeners is conducted by Renda Environmental.

Lessons to Share

- End user should get involved from the beginning with the design of the project to ensure the design meets operating conditions. In this case, when the system was first designed, it did not reflect the operational conditions of the facility resulting in slight issues with system performance.
- Involve the O&M staff early so they understand the design and become familiar with the system from the beginning.
- Be conservative in your energy savings and anticipate maintenance issues that may impact your forecast.

"I highly recommend this type of project. Not only do you save money but you reduce your footprint and utilize resources that were once wasted." -Ana Julia Peña-Tijerina, Sr. Professional Engineer

For More Information

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