PROJECT PROFILE

PACIFIC

U.S. DOE

CHP Technical Assistance Partnerships

Burlingame Wastewater Treatment Plant

177 kW Biogas CHP System

Quick Facts

LOCATION: Burlingame, CA
MARKET SECTOR: WWTF
FACILITY SIZE: 5.5 million gallons per day
FACILITY PEAK LOAD: 650 kW
EQUIPMENT: 177 kW Caterpillar engine; biogas cleanup skid; and control panel
FUEL: Digester Gas
USE OF THERMAL ENERGY: Digester Heating
CHP TOTAL EFFICIENCY: 85%
ENVIRONMENTAL BENEFITS: Renewable energy and NOx reduced 42% below limits
TOTAL PROJECT COST: $912,000
ANNUAL ENERGY SAVINGS: ~$92,000
SGIP INCENTIVE: $160,000
PAYBACK: 8 years
CHP IN OPERATION SINCE: 2006

Site Description

The Burlingame Wastewater Treatment Facility (WWTF) was commissioned in 1936. Since 1972, it has been operated and maintained by Veolia Water North America through a public-private partnership that has stood out as a template for such contractual arrangements. The facility underwent a $10 million retrofit and refurbishment that was completed in 2006. The facility's treatment capacity peak flow is 5.5 million gallons per day (MGD) during normal operations and up to 16 MGD during wet weather operations. Average flows during dry weather months are approximately 3.0 MGD.

Reasons for CHP

The Burlingame WWTF has primary and secondary treatment of wastewater, with plans in the future to implement tertiary treatment for production of reclaimed water to be distributed locally. Currently, primary sedimentation and activated residual sludge are fed to anaerobic digesters for production of biogas and used onsite to produce power using a 177-kW Caterpillar engine/generator set. Sludge from the digesters is processed, de-watered and collected for land application. The Burlingame WWTF is part of the Bay Area Bio-Solids-to-Energy Coalition that has plans to enter pilot scale studies of the use of digester sludge and gasifiers to extract further energy from WWTF biosolids. However, processing and hauling costs proved cost prohibitive and plans have been scaled back until such time that hauling sludge to gasifiers becomes cost competitive with current contracts for disposal of sludge that currently use land application.

CHP Equipment & Configuration

Digester gas from the anaerobic digester is fed to the biogas fired CHP plant at the Burlingame WWTF. As part of a 2006 capital improvement project, the facility installed a new Caterpillar G3412 biogas capable engine, with a rated electric output of 177 kW. This package was chosen over other options due to the desire to keep spare parts and O&M procedures consistent with the existing Caterpillar diesel backup generator.

The CHP was installed with a gas-conditioning system to remove excess sulfides and siloxanes in order to meet stricter permitting requirements, and to protect the CHP's engine. The biogas conditioning skid, designed to comply with all applicable National Fire Protection Agency and other Federal and State codes, removes contaminants via a sequential redwood media bed and activated carbon bed filtration system with the media needing to be changed out every 8 months at a cost of $5,000 per change-out.

The generator currently supplies approximately 20% of the WWTP's electrical load. If a lack of production of biogas causes the generator to throttle below 85 kW, the generator is programmed to enter a controlled shut down to minimize noise and vibration caused by operating at low output. Waste heat is used as process heat in the WWTF, primarily to maintain adequate temperature in the anaerobic digester. Overall CHP system efficiency is 85%.

Lessons to Share (Digester Gas Conditioning System)

Digester gas contains many contaminants, with the largest being a significant amount of entrained water in the gas. This water must be removed prior to compression and supply of the gas to the CHP equipment. To remove the entrained water, it is critical that the dew-point of the gas be lowered significantly prior to the biogas entering the gas compression cycle and then ensuring that the dew-point is not approached until after the compression cycle is complete. Once the compression cycle is complete, it is important that the dew-point be further lowered to ensure all of the water is out of the biogas prior to it being sent to the filtration system where the rest of the detrimental constituents are removed.

"The Burlingame WWTF has been a pioneer in the effective way to run a public-private partnership for wastewater treatment operations since 1972. We view our commitment to CHP and innovative biosolids management as an extension of that work."

-William Toci, Plant Manager

Other major biogas contaminates include siloxanes that must be reduced to low levels prior to being burned in any type of internal combustion engine. There is also hydrogen sulfide (H_2S) that needs to be removed prior to biogas compression for optimum operation and to meet California Air Resource Board permits.

For More Information

U.S. DOE PACIFIC CHP TECHNICAL ASSISTANCE PARTNERSHIP (CHP TAP)
Gene Kogan
858-633-8561
Gene.Kogan@energycenter.org

Burlingame Wastewater Treatment Plant
William Toci, Plant Manager
Veolia Water NA
650-342-3727
William.toci@veolia.com

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