PROJECT PROFILE

Burlingame Wastewater Treatment

177 kW Biogas Powered Engine System

PACIFIC U.S. DOE Clean Energy Application Center

Site Description

The Burlingame Wastewater Treatment Plant (WWTP) was commissioned in 1936. Since 1972, it has been operated and maintained by Oveolia Water North America through a public-private partnership that has stood out as a template for such contractual arrangements. The facility recently underwent a $10 million retrofit and refurbishment that was completed in 2006.

With the latest capital improvements, the facility's treatment capacity is 5.5 million gallons per day (MGD) during normal operations and up to 16 MGD during wet weather operations. The facility is currently having a new 1.5 million gallon retention basin installed to facilitate treatment during the wet season. Average flows during dry weather months are approximately 3.4 MGD.

Quick Facts

LOCATION: Burlingame, California
MARKET SECTOR: Government sector
TOTAL PROJECT COST: $1 million
PAYBACK PERIOD: 7.5 to 8.5 years
ENERGY BILL SAVINGS: $8,000-$10,000 per month
EQUIPMENT: 177 kW Caterpillar engine, biogas skid, and control system
FUEL: Biogas and natural gas
USE OF THERMAL ENERGY: Heating the anaerobic digester
FACILITY SIZE: 5 acres
FACILITY PEAK LOAD: 268 kW
FACILITY AVERAGE LOAD: 188 kW
CHP IN OPERATION SINCE: 2006

Project Profile

The Burlingame WWTP facility 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, used onsite to produce power using a 177-kW Caterpillar engine/generator set. Sludge from the digesters is processed, de-watered and collected for collection and land application. The Burlingame WWTP is part of the Bay Area Bio-Solids-to-Energy Alliance that has plans to enter pilot scale studies of the use of digester sludge and gasifiers to extract further energy from WWTP effluent. 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 through land application.

Cogeneration With Digester Gas

Digester gas from the anaerobic digester is fed to the biogas fired cogeneration plant at the Burlingame BWWTP. Before the latest capital improvement project, the facility operated a Waukesha biogas fired generator, but operation and maintenance (O&M) costs were making the generator prohibitive to operate. During the upgrade, the facility installed a new Caterpillar G3412 biogas capable generator, with a rated output of 177 kW- (electric).

This package was chosen over other options due to desires to keep spare parts and O&M procedures consistent with the existing

Burlingame Wastewater Treatment Plant

Caterpillar diesel backup generator. The Waukesha generator is maintained on-site but is not used. In order to be permitted, the new CHP plant was installed with a gas-conditioning unit to remove excess sulfides and siloxanes in order to meet stricter permitting requirements. The generator currently supplies approximately 20% of the WWTP's electrical load, with a high set point of 130 kW. Above the 130-kW set-point, the digester diverts excess biogas to a flare to be burned off. 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 WWTP, such as for maintaining adequate temperatures in the anaerobic digester and activated sludge ponds.

Biogas Fuel Conditioning Skid Example

Generator at the Burlingame WWTP

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 co-generation equipment. To remove the entrained water, it is critical that the dew-point of the gas be lowered significantly prior to the gas 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 gas prior to the gas being sent to the filtration system where the rest of the detrimental constituents be removed.

Other major contaminates include siloxanes that must be removed to low levels prior to being burned in any type of internal combustion engine. Carbon dioxide (CO_2) is also problematic due to the formation of carbonic acid with water vapor in the gas – which is extremely detrimental to most process equipment. There is also hydrogen sulfide (H_2S) that needs to be removed for California Air Resource Board permits and remediated prior to the fuel processing and compression for optimum operation. A biogas fuel conditioning skid removes contaminants via a redwood media bed and activated carbon bed filtration system respectively. The media needs to be changed out approximately every 6-8 months at a cost of ~$5,000 per change-out. The biogas skid systems are designed to comply with all applicable National Fire Protection Agency and other Federal and State codes.

For More Information

Burlingame WWTP:
http://www.burlingame.org/Index.aspx?page=82

Caterpillar (Cat)
http://www.cat.com/cda/layout?m=8703&x=7

Air Resources Board
http://www.arb.ca.gov/homepage.htm

Additional CHP Pacific Projects Profiles:
http://www.pacificcleanenergy.org

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