Front exterior view of the cogeneration building with rooftop cooling towers

An energy study performed in 2005 determined it would be more beneficial to the BCUA, its municipalities and other sewer service rate payers to derive the required electricity and hot water from a combined heat and power (CHP) cogeneration facility. Subsequently, the BCUA retained the services of Metro Energy Solutions to undertake a competitive procurement process to solicit qualifications from companies that specialize in the design, construction, operation, and maintenance of CHP cogeneration facilities. This resulted in the BCUA entering into an agreement with DCO Bergen Energy LLC in 2006 to complete the CHP cogeneration facility by May 2008. The project was completed on time in June 2008 and under the total project budget of $12 million.

Description of CHP Cogeneration Facilities

DCO designed, built, commissioned, and operates and maintains a CHP plant for the BCUA Water Pollution Control Facility (WPCF) located at the Foot of Mehrhof Road in Little Ferry, New Jersey. Located next to the BCUA's existing blower building, this facility provides reliable, efficient, and economical thermal and electric energy. The energy produced by the CHP plant is consumed entirely by the BCUA WPCF. The CHP plant reduces the BCUA's amount of purchased electric energy and reduces the cost of operating hot water boilers. Effective June 1, 2010, the CHP plant is operated and maintained by BCUA.

The CHP plant uses two General Electric Jenbacher JMS 420 GS-L.L model biogas fueled reciprocating engine generator sets with emission control and heat recovery equipment. Natural gas is used as a backup source of fuel. The engine waste heat is used to produce high temperature and low temperature water loops at the CHP plant. These loops are connected to heat exchangers where heat is transferred for building and sludge digester heating purposes at the BCUA.

The CHP generator is operated in parallel with the Public Service Electric and Gas Co. (PSE&G) electrical distribution system. The generators supply approximately 90% of the electric energy to the BCUA facility. The generators are capable of adjusting to the instantaneous electrical load of the BCUA facility.

The engine exhaust emissions meet the BCUA's Title V air quality permitting requirements for each engine through the use of low emissions engine technology and an oxidation catalyst.

Two 1406 kW engine/generator sets

Digester Biogas Moisture Control System

The BCUA's cogeneration facility is designed with gas scrubbers, which remove as much moisture as possible to protect downstream equipment. As an extra measure, a coalescing filter is provided after the biogas pressure boosting compressors. Cooling water from rooftop refrigeration systems passes through the filter to further improve condensation in the biogas and the removal of moisture.

Digester Gas Siloxane Removal System

Siloxanes are silicone-based compounds, typically found in shampoo and other personal care products, that when discharged into municipal sanitary sewers, glassify when subjected to high combustion engine temperatures. The glassified materials prematurely wear out engine parts. Siloxanes were also found to adversely affect the life and effectiveness of catalytic converters.

The BCUA's cogeneration facility benefited by a variety of lessons learned from the BCUA's digester biogas engine powered aeration blower systems designed and constructed under PSE&G's Standard Offer Energy Conservation Method Rebate Program in 1996. In particular, the issue of siloxanes was addressed. To remove the siloxanes from the digester gas the cogeneration system uses a carbon filtration system.

Aerial view of engine/generator set

Reduction in Emissions Compared to Flaring Excess Biogas

By choosing to capture and use the biogas developed by the anaerobic digestion process to generate power rather than flaring it off, BCUA realizes a significant reduction in air emissions that contribute to both greenhouse gas (GHG) and ground level ozone formation.

Energy Savings

The BCUA consumes approximately 29 million kWh of electricity per year and more than 1,370,000 therms of natural gas per year. Electricity is the largest operating cost for the BCUA WPCF, at almost $2.75 million annually with natural gas second at almost $1.5 million annually.

Since the inception of the project, the engines have generated 29,963,000 kWh of power while using 284.2 mm cu.ft. of biogas, with natural gas as a backup fuel. This equates to an energy cost savings of $3,462,289 to date. The BCUA has also received $22,100 from renewable energy credits (RECs) and has entered into a contract to sell 20,000 more RECs for $200,000 in the next year. To date, this project has exceeded the initial energy saving projection by $1,556,289. Based on current savings, this project will pay for itself in less than 6.35 years.

Additional Revenue from PJM Interconnection Demand Response Program

By participating in the Demand Response Program offered by PJM (the state's regional transmission organization), who is ultimately responsible for maintaining the integrity and reliability of the grid, the BCUA has already received $43,787 for the reduction of kWhs.

Potential for Additional Revenue for Carbon Credits

With the reduction in GHG emissions, BCUA is working to track the opportunities to trade the credits created by those reductions on a future open market designed to help reduce GHG all over the country. BCUA expects to be in an excellent position to comply with the anticipated New Jersey and federal regulations on GHG, as well as generate additional revenue by trading these credits on the open market.

Additional Energy Conservation Projects being Undertaken by BCUA under the Sustainable Energy Master Plan

The Sustainable Energy Master Plan (SEMP) demonstrates the BCUA's progress toward achieving overall sustainability goals of reduced energy consumption, reduced energy costs, reduced green-house gas emissions and minimized environmental impact. BCUA has developed a SEMP and has identified the following energy strategies for further study and development:

- Increased biogas production
- Biogas storage
- Standby power (demand management)
- Changeover of existing fuel oil tank system to natural gas/biogas
- Grease recovery to produce bio-diesel
- PV solar
- Water source heat pump system using lagoon water
- Wind turbine
- Hybrid fleet
- Energy efficiency

Consulting Engineers
Alaimo Group, Metro Energy Solutions,
Birdsall/PMK Group

Other Special Features of BCUA CHP Cogeneration Facilities:

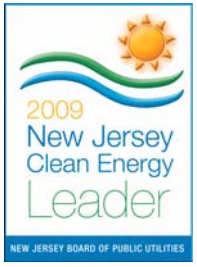
- Special architectural design was incorporated to include face brick and stucco finish to match existing adjacent buildings.
- Finished floor elevation established at least 10 ft. above the mean high tide for flood protection.
- Gas booster compressors are fitted with energy efficient variable frequency drive motors.
- Existing evergreen trees on the site were salvaged and relocated to landscape the side of the roadway between the WPCF process tanks and storm water retention lagoon.
- Spill containment is provided for exterior power transformer.
- Key card type security system for doors is coordinated to work with BCUA's new security enhancement project.
- Special safety systems in place for methane detection, ventilation system activation, and equipment shutdown, if necessary
- Fire and smoke alarm systems are included in building.
- Building and cooling tower lightning protection is provided.
- Generated power is line-synchronized with grid-supplied power to maintain power quality.
- Updated the BCUA's Supervising Control and Data Acquisition (SCADA) system with new screen views and monitoring capabilities.
- Engine and building systems are designed to reduce exterior noise levels because of nearby residences and parks.
- Two monorail-type hoist systems are available to be used for maintenance and/or removal of equipment within the facility.
- Integrated an upgrade of adjacent roadway alignments and intersections including the use of reflector posts, signage, and pavement marking for both vehicle and pedestrian safety.
- Use of existing carbon filter media tanker, truck delivery driveway and storm water retention lagoon saved significant time and money.

Project Manager
DCO Energy

BERGEN COUNTY UTILITIES AUTHORITY

COMBINED HEAT AND POWER COGENERATION FACILITIES

Little Ferry, NJ



Winner of 2009 New Jersey Governor's Environmental Excellence Award