



GREEN PURCHASING CASE STUDIES: TURNING BIOGAS INTO POWER

CITY OF PORTLAND, BUREAU OF PURCHASES

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Microturbines at the Columbia Boulevard Wastewater Treatment Plant use biogas to generate electricity.

PURCHASING GREEN

The Columbia Boulevard Wastewater Treatment Plant (CBWTP) produces about one million cubic feet of anaerobic digester gas (comprised of 55 to 60 percent methane) every day as a by-product of the sewage treatment process. The plant has

implemented several technologies over the years to reclaim this "biogas" for electrical power generation. In addition, CBWTP recovers heat from these on-site power generation facilities to heat its boilers and digesters. The plant also sells excess biogas to Malarkey Roofing Company, a nearby shingle manufacturer.

In 1999, CBWTP constructed a 200 kilowatt (kW) fuel cell, the first fuel cell in the Western U.S. to run on wastewater biogas. However, the fuel cell proved costly to maintain and was decommissioned in 2005. To augment the electricity generated by the fuel cell, the plant added four 30 kW Capstone microturbines in 2003.

In June 2008 CBWTP introduced two 850 kW reciprocating engine generators to produce a total of 1.7 megawatts of power that offsets approximately half of the treatment plants daily power demands. The generators use about 70 percent of the biogas produced by the plant and the remaining biogas is used to operate its microturbines and surplus will continue to be sold to Malarkey Roofing Company.

BENEFITS

Treatment plants like the CBWTP typically flare, or burn, excess biogas. Redirecting this biogas to generate power provides the facility with a free, renewable energy source, displacing electricity generation at power plants that use fossil fuels. The microturbines

AT A GLANCE

WHO

Columbia Boulevard Wastewater Treatment Plant

WHAT

Fuel cell, microturbines, and engine generators

COST

- 💰 Fuel cell: \$1.3 mil; microturbines: \$346,000; reciprocating engines: \$8 mil
- 💰 Generates electricity savings
- 💰 Surplus biogas provides revenue

BENEFITS

- ✓ Uses waste biogas as energy source
- ✓ Reduces use of fossil fuels
- ✓ Offsets energy use

alone generate enough electricity to power 60 to 75 homes. The facility's on-site electricity generation also serves as a back-up system during power outages, allowing the CBWTP to maintain control of the plant and the pump stations located throughout the city.

Cost

The total cost for the city's biogas fuel cell was \$1.3 million. However, the city was able to obtain outside grants and funding that cut the cost to the city in about half. The CBWTP received \$200,000 from the U.S. Department of Defense and \$14,000 from the Oregon Department of Energy. The facility also received a \$247,000 green power credit from Portland General Electric and a \$194,000 credit from the Oregon Business Energy Tax Credit program. Although the project saved about \$60,000 in electricity per year, maintenance costs were prohibitive and ultimately led the plant to shut down the fuel cell.

The microturbines cost \$300,000, plus \$46,000 for installation. After the Oregon Business Energy Tax Credit, the city's total cost for the project was \$309,000. The microturbines save the CBWTP about \$61,000 a year in electricity costs. In addition to the electricity savings from the generation of on-site power, the CBWTP currently receives more than \$120,000 a year from sales of excess biogas to Malarkey Roofing.

The new reciprocating engine-generators cost the City \$8 million, but the City will receive a \$362,000 cash incentive from the Energy Trust of Oregon. In addition, the City will use the Oregon Department of Energy Business Tax Credit program to offset 25% to 30% of the project cost, and with an approximate 40% energy savings rate, should recover its investment within 12 to 15 years.

Performance

The microturbine system experienced problems early on that resulted in the microturbines being shut down for 18 months. For example, biogas fuel needs to be adequately treated to remove problem pollutants. Moisture, hydrogen sulfides, and siloxanes in the biogas stream impair performance of the equipment. Gas treatment and the addition of a gas dryer proved necessary to make the equipment operate reliably and successfully.

Since these and other adjustments were made, three of the four microturbines have been operating more dependably. The fourth microturbine was rebuilt by the manufacturer and is experiencing some problems with its gas flow meter. However, the microturbines are an emerging technology, and the

“The Columbia Boulevard Wastewater Treatment Plant is at the forefront of testing emerging technologies, exploring opportunities to partner with both public and private entities. This has led to a greener Portland and sewer rate cost containment.”

Garry Ott
Project Engineer,
Bureau of Environmental Services



The City should recover the investment cost of the new reciprocating engine-generators within 12 to 15 years.

CBWTP hopes that sharing their experiences will lead to technical improvements.

The CBWTP was able to take the lessons learned from the previous fuel cell and microturbine projects and apply them to the installation of the new reciprocating engine-generators and biogas treatment system. Hopefully, this will minimize problems that may occur.

LESSONS LEARNED

The CBWTP's ability to pioneer these promising technologies for reclaiming biogas from the wastewater treatment process was possible in large part due to financial partnerships. By pursuing grants, credits, and rebates from federal, state, and local sources, the CBWTP was able to partially offset initial installation costs. Exploring opportunities to partner with both public and private entities has been instrumental in the CBWTP's success.

ABOUT THE COLUMBIA BOULEVARD WASTEWATER TREATMENT PLANT

Operated by the Portland Bureau of Environmental Services (BES), the Columbia Boulevard Wastewater Treatment Plant (CBWTP) is the largest wastewater treatment plant in Oregon. CBWTP serves over 550,000 people and is the collection point for approximately 1,800 miles of wastewater sewer pipes throughout the city, including about 92 pumping stations. The facility processes 80-90 million gallons of wastewater each day.

FOR MORE INFORMATION

Garry Ott, Project Engineer, Bureau of Environmental Services
503-823-2498