NORTHWEST

CHP TECHNICAL ASSISTANCE PARTNERSHIPS

PROJECT PROFILE

Durham Advanced Wastewater Treatment Facility

FOG Collection for Increased Energy Production

1700-kW Reciprocating Engine CHP System

A Unison Solutions gas conditioning system is located outside of the cogeneration building.

Quick Facts

LOCATION: Tigard, Oregon
MARKET SECTOR: Wastewater Treatment
FACILITY SIZE: Average treatment of 26 million gallons per day (MGD) plus collected Fats, Oils, and Grease (FOG)
FACILITY PEAK LOAD: NA
EQUIPMENT: two 848 kW biogas-fueled Jenbacher reciprocating engines
FUEL: Treated biogas
USE OF THERMAL ENERGY: Space and process heating, including anaerobic digesters
CHP Output: 13 million kWh/year
ENVIRONMENTAL BENEFITS: Remove FOG from landfill waste stream
TOTAL PROJECT COST: $16.8 million
TOTAL ANNUAL ENERGY SAVINGS: $800,000
PAYBACK: 9.6 years with incentives and tipping fees included.

Site Description

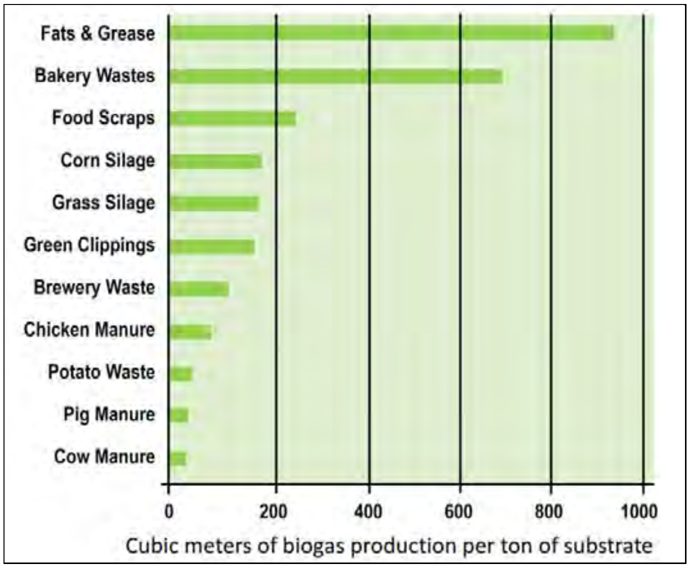
The Durham Advanced Wastewater Treatment Facility (WWTF) treats about 26 million gallons per day (MGD) of wastewater while serving about 250,000 people in the cities of Beaverton, Durham, King City, Sherwood, Tigard, and Tualatin, and some portions of Clackamas and Multnomah Counties, Oregon. The centralized facility began operations in 1973 to replace a scattered system of 14 wastewater treatment plants. The facility includes two 1.3 million gallon anaerobic digesters, and since 1993 has operated a 500 kW biogas-fueled combined heat and power (CHP) system.

Upgrading the CHP System to Take Control of Energy Costs

Durham's legacy 500 kW CHP system was getting old, operated with no biogas pretreatment, and was too small for the expanding WWTF. Due to population growth, the WWTF was producing about 30% more biogas than the engine could combust and the plant was flaring the excess biogas. In addition, the old engine wasn't as efficient or as clean burning as currently available technologies. To deal with these multiple problems, a major upgrade in the plant's digesters and biogas systems was taken on. A $16.8 million facility upgrade consisted of a fats, oils, and grease (FOG) receiving station; FOG storage tanks; a Unison gas treatment system to remove hydrogen sulfide, particulates, siloxanes, and moisture from the raw biogas; two 848 kW Jenbacher biogas-rated engines with generators, and a new waste heat recovery system. These engines were sized to utilize all available biogas from anaerobic digestion of sewage sludge plus biogas produced through co-digestion FOG that could be collected from local food service establishments. The new CHP project was supported through $3.0 million in incentives from the Energy Trust of Oregon and $2.8 million in transferrable tax credits from the Oregon Department of Energy. The CHP project is estimated to save $800,000 per year in energy costs, including $100,000 in heating benefits, while also providing $340,000 in revenues from FOG tipping fees plus O&M cost savings as it eliminates FOG from being entrained in the sewer collection system.

Fats, Oils, and Grease (FOG) storage tanks (70,000 gallons each) at the Durham WWTF (right photos): The Durham facility accepts about 100,000 gallons per week of FOG (about three 5,000 gallon truckloads daily) pumped from food service establishment grease traps. As FOG or brown grease loads are highly variable in volatile solids content and haulers cannot guarantee a specific quantity on a given date, the facility uses their large storage tanks to both store and blend multiple loads of FOGs.

FOG's Energy Potential



FOG is often collected from grease traps and disposed of in landfills. Tests conducted by Clean Water Services (CWS, operators of the Durham WWTF) showed that FOG produces more than twice as much biogas as food waste. CWS then awarded contracts to selected haulers or "Preferred Pumpers" with the goal of maximizing revenue plus maintaining a stable FOG supply. Their FOG co-digestion approach assisted the WWTF to double their biogas production and the new CHP engines triple electrical energy generation due to elimination of flaring. Introduction of FOG to the digester was initially slowly ramped up to avoid digester upsets. Digester conditions must be continuously monitored with adjustments made to the FOG feed rate when appropriate.

FOG and CHP Management Challenges

While the WWTF has a "rock trap", FOG can contain contaminants---such as chunks of concrete, bones, eating utensils, and rags---that can damage pumps and other treatment equipment. CWS has experimented with reduced tipping fees for haulers that provide the expected volume of FOG on the promised day. Scheduling conflicts exist when FOG haulers are unreliable and CWS notes that haulers don't want to deliver on weekends---making it difficult to continuously operate the engines at full capacity. The facility benefits through making use of an extra digester for biogas storage. An unresolved issue is caustic FOG corrosion of the lined concrete storage tanks. It is also difficult to find uses for all recovered waste heat during the summer, when heating requirements are reduced. The new CHP systems are more efficient and emit less pollution, but are more expensive to maintain and are not expected to last as long as older units.

For More Information

U.S. DOE NORTHWEST CHP TECHNICAL ASSISTANCE PARTNERSHIP (CHP TAP)

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"From our perspective, this is another classic example of the evolution of wastewater treatment plants into resource recovery facilities."
- Dave Moldal, Energy Trust of Oregon