

## **Cogeneration at West Point Treatment Plant**

The West Point Treatment Plant captures renewable energy to maximize value from a green energy resource – biogas from the wastewater treatment process. Biogas from the plant’s digesters contains about 60 percent methane (the combustible component of natural gas). The cogeneration system creates electricity from this gas and captures the heat generated from the engines. The system reduces West Point’s demand for electricity supplied from the grid, and will provide a significant portion of West Point’s heat demand for most of the year.

West Point’s cogeneration facility is the latest upgrade in a long history of energy recovery from biogas at West Point. West Point has been using digester gas in the treatment process since it opened in 1966 to run raw sewage pump engines and generate heat, and it first began creating electricity from biogas in 1983. This new cogeneration system is the largest combined heat and power facility in the State of Washington that uses biogas from digesters.

### **Internal Combustion Engines**

The cogeneration of power and heat at West Point uses internal combustion engines. Internal combustion cogeneration systems use an engine similar to an automobile engine. In this case, renewable digester gas is used as the energy source instead of gasoline, and the output of the engine drives a generator. At West Point, two internal combustion engines fueled by digester gas provide power to generators that produce electricity for the plant. The heat from several parts of the engines including the jacket water, lube oil, after cooler, and exhaust, is used to heat water which is then sent to heat digesters, and occupied spaces.



### **Engine Generator Design**

- Caterpillar Model G3612 engines, 12-cylinders, 3221 HP
- Kato generators, 2.3 MW, 13.8 kV, 137 A, 0.7 pf, 60 Hz
- Two units: 1 duty and 1 standby
- 750 scfm digester gas for each engine generator at full load
- The engine generator systems were pre-purchased from **NC Power Systems of Tukwila, WA**, and packaged with heat recovery and wasting equipment, switchgear and engine generator controls.
- There is no standby power capability and the utility requires that loss of utility power results in tripping of the generators.
- The engine generators were installed in a retrofitted existing building.

### **Engineering Consultants**

- Brown and Caldwell, Seattle, WA

### **General Contractor**

- Stellar J Corporation, Woodland, WA

### **Financial support**

- \$8.2 million in Coastal Cities grant funding from US EPA
- A strong partnership with Seattle City Light and is allowing WTD to contribute to King County's facilities accountability goals.
- Seattle City Light will purchase power produced by the engines, including Renewable Energy Credits. This will generate \$1.4 million (gross) per year.

### **Other Major Process Systems**

- Mayekawa 200 HP rotary screw digester gas compressors
- Gas conditioning system packaged by Environmental Water Solutions
- Maxim exhaust heat recovery silencers
- Heat exchangers and radiators
- Switchgear and controls

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### **Engine Generators Performance**

- Performing at full rated capacity of 2300 KW
- Meets air emissions limits set by Puget Sound Clean Air Agency
  - specified at 50%, 75% and 100% of engine capacity
- Achieves fuel efficiency that is guaranteed and factory tested on natural gas:
  - 7432 btu/bhp-hr @50%
  - 6886 btu/bhp-hr @75%
  - 6648 btu/bhp-hr @100%

### **Heat Rejection and Recovery Design Data**

- Engine heat is transferred to 30% ethylene glycol circulation loops and then to plant hot water circulation loops.
- Jacket water and lube oil: 3.7 MMBtu/hr
- Engine exhaust: 5.3 MMBtu/hr
- After cooler: 1.4 MMBtu/hr
- Engine heat rejection to surrounding room: 0.8 MMBtu/hr
- Two radiators per engine emit unrecoverable heat

### **Energy Ordinances**

King County has enacted ordinances to reduce carbon emissions and energy consumption, and to increase reliance on renewable energy. WTD's facilities account for about 58% of all King County government's facility energy usage. Wastewater Treatment Division's daily average electricity demand is more than 17 megawatts (MW), and is nearly 70 percent of WTD's total energy use.

### **Outlook**

West Point's cogeneration system will produce about 18,000 MWh (Mega Watt hours) of "green" electricity each year. This partnership will help Seattle City Light achieve its 15 percent renewable energy goal by 2020 in accordance with Washington Initiative 937. The facility is expected to generate \$1.4 million in annual revenue to WTD from the sale of "green" electricity. Revenue is anticipated to exceed operating and maintenance costs.