

Hayward, CA

Green Energy Generation at City of Hayward's Water Pollution Control Facility

The City of Hayward's Water Pollution Control Facility (WPCF) is an award-winning green energy generating site and the first publicly owned treatment works and largest generating account in the California RES-BCT (Renewable Self Generating Bill Credit Transfer) Program. Since the completion of the 1,132 kilowatt (kW) cogeneration facility in 2014, it has been generating an average of 750,000 kilowatt hour (kWh) monthly, allowing virtually all of the solar energy generated on site to be exported to PG&E.

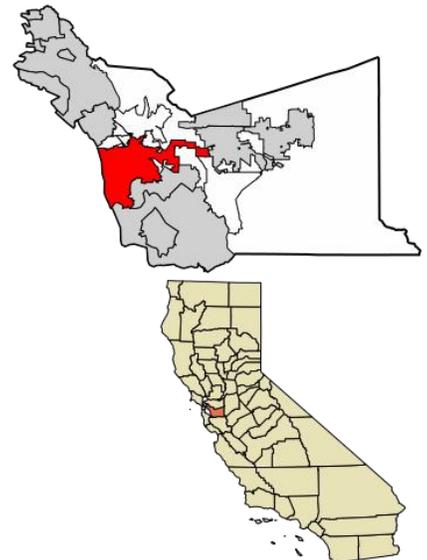
Case study

November 2017

Summary

Located in Alameda County in the San Francisco metropolitan area, the City of Hayward has been leading the way on green power generation for years. In 1981, the city installed its first 700 kW cogeneration facility designed to use biofuel produced in the digestion process to generate energy for use at its WPCF. Decades later, in December 2010, the city added to its on-site green power portfolio with a one-megawatt solar installation. Together the installations met an average of 60 percent of the total electricity demand at the WPCF.

In 2013, the WPCF decided to explore options for increasing its on-site green power production. The facility commissioned a fats, oils, and grease (FOG) receiving station that accepts organic waste directly into the city's digesters, boosting biogas production. In 2014, the city replaced its aging cogeneration system with a new 1.1-megawatt cogeneration facility that uses the methane produced from the digesters as a fuel. Waste heat from the new cogeneration system is captured and used to heat the city's anaerobic digesters, further reducing reliance on natural gas formerly used to heat the sludge during colder months of the year. The cogeneration facility, along with the solar array, produces more green power than the WPCF needs, which means it can export excess electric energy to other city facilities. The city estimates that the WPCF exports 3,292 megawatt-hours of green power annually.



Population/land area

158,937 / 63.82 sq. mi

Cogeneration: Electricity Generation for Wastewater Treatment Facilities

Cogeneration is a common feature of many wastewater treatment plants. Used in the United States for decades, it has proven to be a dependable, efficient, and cost-effective method of power generation. Digester gas, a wastewater treatment byproduct rich in methane content, can be used in internal combustion engines and generators to produce electricity for plant use or for sale, as well as thermal energy for heating work space or digester tanks. The economics of cogeneration are variable, because changes in plant operation will affect energy use over the 20-year life span of a typical cogeneration facility. Many factors influence the cost effectiveness of cogeneration, including anaerobic gas production levels, electricity, or thermal power use, technological advancements, regulatory requirements, and electricity buy-sell arrangements. That's why operators should evaluate their systems every year or two to assess cogeneration's economic benefits and identify new opportunities for additional savings.

City Context

A thriving regional center of commerce, manufacturing activity and trade, the City of Hayward is the sixth-largest city in the San Francisco Bay Area. Hayward was among the first in the Bay Area to ratify its Climate Action Plan in 2009 with goals to reduce baseline emissions by 12.5% by 2020 and 82.5% by 2050. The WPCF provides an opportunity for both water recycling and green energy generation by solar and cogeneration, both important components of the Climate Action Plan.

Project Profile

The City of Hayward's WPCF is a Bay Area leader in using renewable energy including solar power and biogas powered cogeneration facilities. The City's goals in using renewable energy include reducing greenhouse gas (GHG) emissions, improving air quality, reducing energy costs, and improving reliability of energy sources available to power the City's WPCF. In addition, the City has established a goal of achieving zero net energy (ZNE) for its portfolio of facilities by 2025. The City's WPCF is transitioning from a facility that treats and discharges wastewater into the bay to a resource recovery facility.

Resource recovery efforts

include use of renewable energy from solar, green power (by use of digester gas) as fuel for the production of heat and power, or "cogeneration", and use of recycled water for cooling at the adjacent Russell City Energy Center (RCEC).



Cogeneration Engine

The WPCF is the largest energy consumer owned by the City with a total plant demand of approximately 8,300,000 kWh annually. Prior to constructing the solar facility, approximately 40% of the plant's demand was satisfied by the cogeneration system, and the rest came from power purchased from PG&E. In December of 2010, the one megawatt solar facility came on line satisfying an average of 20% of the plant's demand with resulting decreased reliance on PG&E power to 40% of plant demand. During the day, power from solar and cogeneration exceeds plant demand with the resulting excess power exported to the grid through a net energy meter. Prior to the new cogeneration facility coming on line, approximately 70% of the solar energy produced was used at the plant, with the excess power sent to PG&E via the net energy meter.

In November of 2014, the new 1,132 kW cogeneration facility was completed and commissioned replacing the existing cogeneration system which had reached the end of its useful lifetime. The new system produces nearly three times more energy than the old system due to the larger, more powerful engine and improved efficiency. In addition to electric energy (power), the system produces heat which is captured and used in the plant's hot water loop for heating the digesters. At the same time, the City switched to the Renewable Energy Self-Generation Bill Credit Transfer (RES-BCT) tariff. The RES-BCT tariff allows local governments to generate electricity at one account, and based on the value of any exported electricity, transfer bill credits (in dollars) to another account owned by the same local government within the same city or county. Since March 2015, the new combined heat and power system has satisfied all plant demand and has resulted in excess power exported to the grid. In addition, because the new system satisfies plant demand, virtually all of the solar power produced at the plant is also exported to the grid. In 2016, 3,200,000 kWh of excess energy was exported and used at other benefitting accounts within the City under the RES-BCT tariff.

Results

Since coming online in December 2014, the cogeneration power produced at the plant has averaged around 750,000 kWh monthly with an average of 92,000 kWh of excess power exported to the grid. The cogeneration power was sufficient for the site to stop using solar power. Solar power used at the plant decreased from an average of 136,000 kWh per month (70% of total generated) to 17,000 kWh per month (9% of total generated), so nearly all solar energy was exported to PG&E. Solar is used at the plant when the cogeneration is down for maintenance, which can be several days to a week at a time.



“Hayward has a long-standing commitment to sustainability, and investment in renewable energy is reducing our carbon footprint and delivering on that commitment.”

— Hayward Mayor Barbara Halliday

Budget and Finance

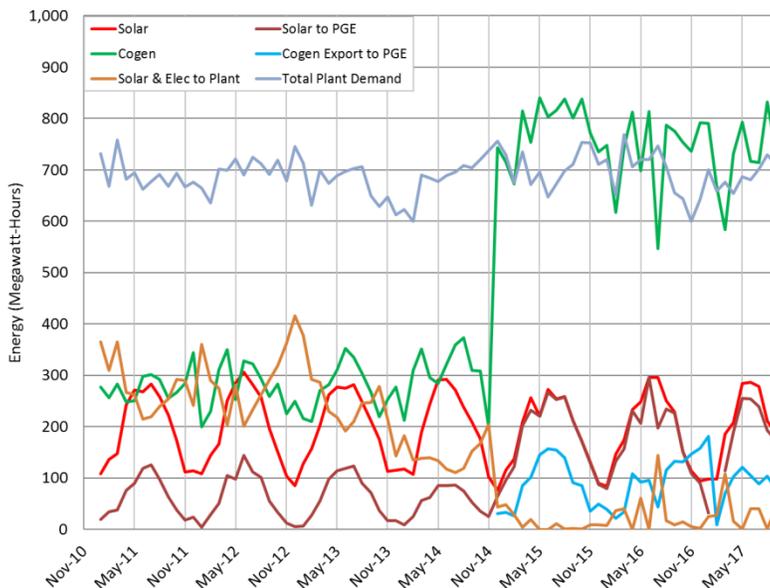
The City of Hayward was the first city in the Pacific Gas and Electric service area to utilize the RES-BCT tariff. The RES-BCT tariff was approved by the CPUC in accordance with Public Utilities Code 2830, which was statute created by AB 2466 in 2008. The RES-BCT tariff allow local governments to generate electricity at one account and based on the value of any exported electricity, transfer bill credits (in dollars) to another account owned by the same local government within the same city or county. The City receives annual savings of about \$193,000 from the new cogeneration facility and solar combined. These savings are to be spread amongst several utilities facilities. As of 2017, PG&E has twenty-seven customers who have implemented RES-BCT.

Recognition

Hayward's WPCF has won several awards for its cogeneration capacity, including the 2016 [Acterra Award for Environmental Leadership](#), the 2016 Engineering Achievement Award from the California Water Environment Association, and the EPA's [2015 Green Power Leadership Award](#). The plant was also named 2015 Plant of the Year by the California Water Environment Association San Francisco Bay Section. In addition, the combined energy savings from the cogeneration and solar facility as well as smaller HVAC upgrades allowed the City of Hayward to win Beacon Awards in 2015 and 2017.

Lessons Learned

- When considering if a cogeneration system is economically viable, an agency must consider other factors such as on-going maintenance costs, fuel clean-up costs, reoccurring costs to replace media in the fuel conditioning system skid, costs of lube oil, and other similar costs associated with operation.
- The cogeneration facility is a complicated engineering project involving heat recovery and complicated electrical equipment. Startup challenges include integrating into a plant's hot water loop (used for heating the digesters) as well as coordination between manufacturers of the



Hayward WPDF Plant Demand and Energy Sources

engine, generator control package, integration into the existing plant switchgear and coordination with the utility (PG&E).

- The internal combustion engine produces a lot of excess heat that is radiated into the room. In addition, the engine cylinders have sensitive electronic equipment for monitoring performance of the engine. Careful consideration must be given to design of ventilation systems to ensure adequate heat removal from the building on hot summer days.

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HAYWARD



Next Steps

Design efforts are currently underway to improve the WPCF's existing digesters. Among those improvements include plans to improve the blending and mixing systems for the digester feed. This will improve digester performance resulting in an increase in the production of biogas and thereby combined heat and power production.

The WPCF has additional out-of-service ponds that are underutilized to the north of the existing solar field. Plans are underway to construct an additional two megawatt solar facility on that site.



One Megawatt Solar Array

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