DATE: September 14, 2020

TO: Council Sustainability Committee

FROM: Director of Public Works

SUBJECT: Review and Comment on the Five-Year Performance of Cogeneration Engine at the Water Pollution Control Facility

RECOMMENDATION

That the Council Sustainability Committee (CSC) receives this informational report.

SUMMARY

The Water Pollution Control Facility (WPCF), the City's single-largest energy user, has been producing renewable electricity for decades via a cogeneration system (combined heat and power) using biofuel produced as part of the treatment process. The original cogeneration system was in operation between 1982 and 2014 and had reached the end of its useful life. In December 2014, a new cogeneration facility was commissioned that included a 1,137-kW cogeneration engine capable of producing more energy than is needed at the WPCF. This report presents an update on the five-year performance of the cogeneration system. In addition, an update is provided on the WPCF Solar Phase 1 and Phase 2A projects.

BACKGROUND

The City's General Plan includes the following goals related to the generation of renewable energy at City facilities:

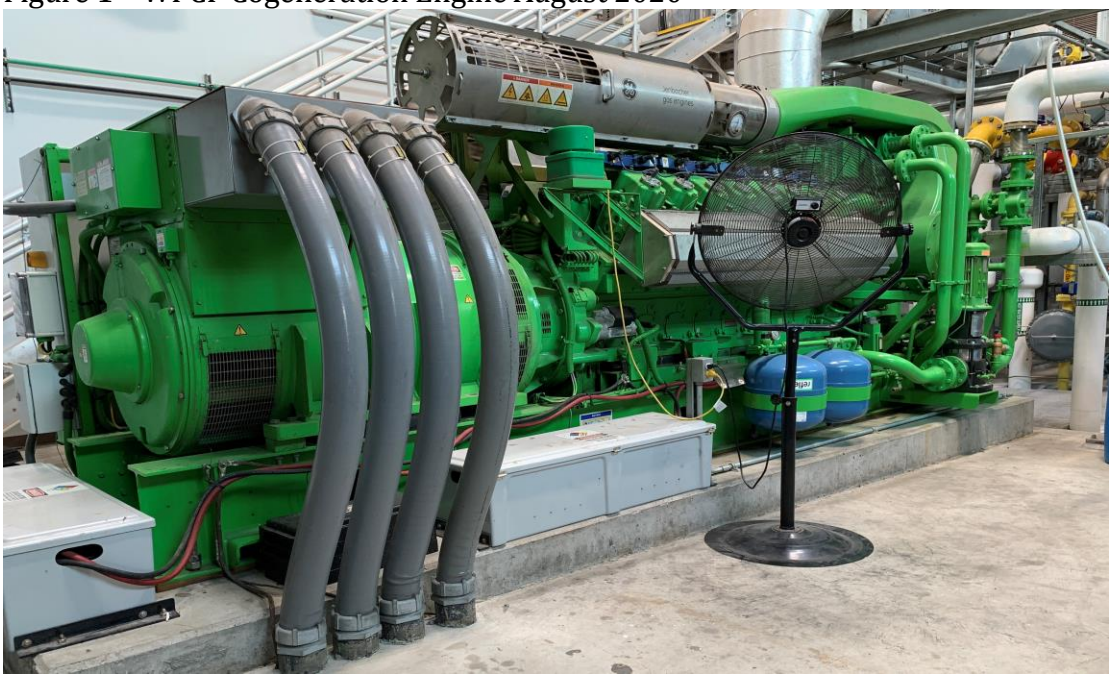
> *NR-2.5 Municipal Greenhouse Gas Reduction* - The City shall reduce municipal greenhouse gas emissions by 20 percent below 2005 baseline level by 2020, 30% below 2005 levels by 2025, 55% below 2005 levels by 2030. In addition, the City shall work with the community to develop a plan that may result in the reduction of community based GHG emissions to achieve carbon neutrality by 2045.
>
> *NR-4.10 Public Renewable Energy Generation* - The City shall ensure that all new City-owned facilities are built with renewable energy, as appropriate to their functions, and shall install renewable energy systems at existing City facilities where feasible.

In addition to the above General Plan goals, on December 6, 2016, Council adopted Resolution 16-219 establishing the goal achieving Zero Net Energy (ZNE) for electricity and natural gas use for the City's portfolio of facilities by 2025.

The WPCF is the largest energy consumer owned by the City with an average annual demand of 8,263,000 kWh over the past five years. In 1981, the City installed its first 700 kW cogeneration facility consisting of two-350 kW cogeneration engines designed to use biofuel produced in the digestion process to generate energy for use at the WPCF. After 30 years in service, the cogeneration system combined energy output had declined to approximately 390 kW on average supplying 41 percent of the total electricity demand at the WPCF. In December 2010, the City added a one-megawatt solar facility (Phase 1 project) to its on-site green power portfolio supplying 20 percent of the total electricity demand at the WPCF. Together the cogeneration and solar installations met an average of 63 percent of the total electricity demand at the WPCF.

In 2013, to increase on-site green power production, the WPCF commissioned a fats, oils, and grease (FOG) receiving station that accepts organic waste directly into the city's digesters, boosting biogas production. With more available biogas, the WPCF evaluated options for increasing its green power production and selected a new, larger cogeneration system to replace the existing aged system. In 2014, the City commissioned a new 1,137 kW cogeneration facility nearly tripling its power production capability. A recent photograph of the cogeneration engine is shown in Figure 1.

Figure 1 – WPCF Cogeneration Engine August 2020



DISCUSSION

Self-Generation Incentive Program

At the end of 2019, the WPCF achieved a five-year operational milestone for the cogeneration facility. Construction of the cogeneration facility was partially funded by the California Public Utilities Commission's (CPUC) Self-Generation Incentive Program (SGIP). The City applied for and was awarded a grant totaling up to $2.665 million for the project. The City was eligible for disbursement of half of the grant money (or $1,332,500) upon project completion and the other half payable under a five-year performance-based incentive. Under the performance-based incentive, the City was required to monitor and report net energy output, fuel consumption (both natural gas and digester gas), and useful thermal energy delivered. To receive the maximum performance-based incentive, the following performance metrics were required:

- Biogas satisfying a minimum of 75% of the total energy input required each year.
- Engine operation able to produce a minimum of 80% of the rated output each year including down-time.

Plant operations and maintenance staff have exceeded the minimum performance metrics consistently over the past five years to achieve the maximum grant reimbursement of $1,332,500 under the performance-based incentive.

Plant Demand and Summary of Green Power Energy Imports and Exports

Over the past five years, the cogeneration facility has supplied on average 107% of plant demand. At the same time, in light of the additional energy produced by the new cogeneration system, the one-megawatt solar facility went from supplying 20% of plant demand to 3% of plant demand, resulting in solar exports to the grid increasing by 274% to 2,010,000 kWh annually. Between 2015 and 2019, the WPCF exported 15.5 megawatt-hours of excess green energy (combined solar and cogeneration energy) to the grid for use at other City facilities under PG&E's Renewable Energy Self-Generation Bill Credit Transfer (RES-BCT) tariff. These facilities include various water and sewer pump stations, reservoirs, City Hall, and the police station (newly added as a benefitting account with the new Solar Phase 2A project). An update on the RES-BCT arrangement is presented below. A summary of plant demand and energy sources is presented in Table 1 for the years following commissioning of the one-megawatt solar facility (2011 – 2014) and for the years following commissioning of the 1,137 kW cogeneration facility (2015 – 2019).

Table 1. WPCF Energy Demand vs. Generation (kWh)

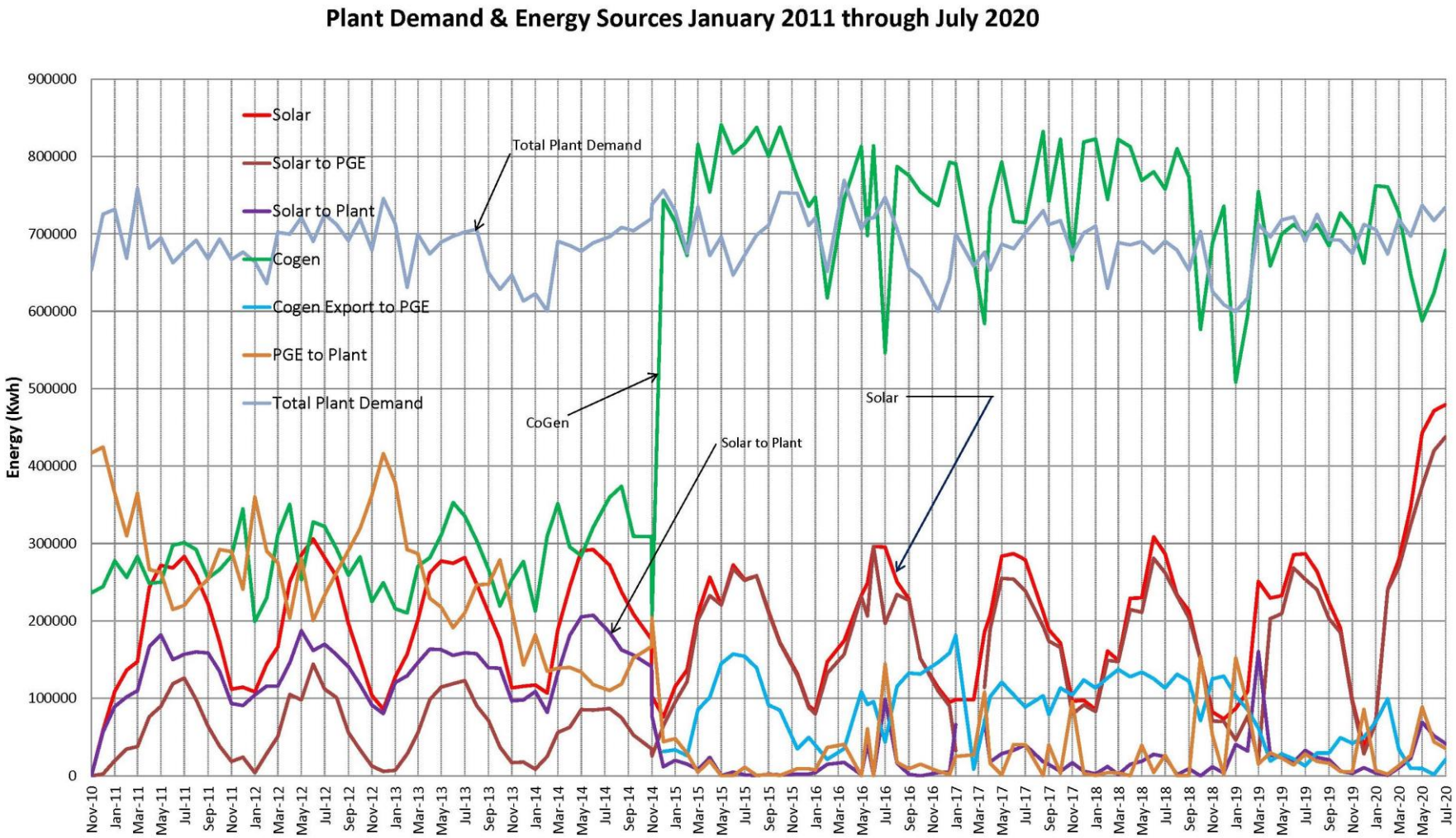
Plant Demand & Energy Sources	**Average 2011 - 2014**	**Average 2015 - 2019**
WPCF Total Plant Demand (kWh/year)	8,248,000	8,263,000
WPCF Solar Phase 1 Production (kWh/year)	2,359,000	2,270,000
WPCF Solar Phase 1 Export to Grid (kWh/year)	734,000	2,010,000
WPCF Solar Phase 1 to WPCF (kWh/year)	1,625,000	226,000
% Plant Demand Met by Solar (1)	20%	3%
WPCF Cogeneration Energy (kWh/year)	3,413,000	8,863,000
WPCF Cogeneration Energy Export to Grid (kWh/year)	0	1,082,000
WPCF Cogeneration Energy to WPCF (kWh/year)	0	7,781,000
% WPCF Plant Demand Satisfied by Cogen (1)	41%	94%
PG&E Import to WPCF (kWh/year)	2,849,000	328,000
% Plant Demand Met by PG&E(1)	35%	4%
Excess Energy Exported to Grid (kWh/year)	734,000	3,092,000
% WPCF Plant Demand Met by Cogen & Solar(1)	61%	97%
% Green Power in Excess of Plant Demand	0%	137%
	Total 2011-2014	**Total 2015-2019**
Total Green Power Exported to Grid (kWh)	2,937,000	15,460,000

Notes:

(1) Percentages for solar, PG&E, and cogeneration contributions to total plant demand do not add up to 100% due to inaccuracies derived from gathering data from multiple sources (REC solar, PG&E, and plant supervisory control and data acquisition (SCADA) system.

A graph showing plant energy demands and power sources including exports to PG&E is shown in Figure 2.

Figure 2 – Plant Demand and Energy Sources / Exports



Solar Phase 2A Update

In February 2020, the City commissioned a new solar facility, Phase 2A, which added 0.6-megawatts of solar energy production to the WPCF's green power portfolio. The new facility is anticipated to produce an additional 1.4 megawatt-hours of energy that will be available for use at other City facilities under the Renewable Energy Self-Generation Bill Credit Transfer (RES-BCT) tariff. Addition of this solar array boosts the facility's green power exports by 45% to 4.5 megawatt-hours annually. Figure 2 shows the increase in both solar production and solar export upon commissioning of the solar Phase 2A project beginning in February of this year. An aerial view of the WPCF Solar Facilities - Phase 1 and Phase 2A is shown in Figure 3.

Figure 3 – Expanded Solar Field Phase 1 and Phase 2A

RES-BCT Tariff Update

At the time the cogeneration system was commissioned, the WPCF was the first publicly owned treatment works (POTW) and largest generating account in the California RES-BCT program. 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. In 2019, the City

received annual bill credits totaling $346,000. With the added 0.6-megawatt solar array commissioned in February 2020 the annual bill credits are projected to save the City up to $550,000 in 2020 from the cogeneration facility and solar combined. With the additional energy exports to the grid, additional accounts including the police station were added to the RES-BCT arrangement and are now receiving bill credits.

EPA Green Power Partnership – On-Site Generation

The City has been a member of the U.S. Environmental Protection Agency (EPA)'s Green Power Partnership Program since 2015 after the cogeneration facility was fully operational. The Green Power Partnership encourages the voluntary use of green power to reduce the risk of climate change. To be considered a green power partner for organizations the size of the City (organizations that use between 10 and 1,000 megawatt-hours of electricity a year), a minimum of 10% of the total electricity used must be from green power sources. In 2019, the City's total energy demand was 20.6 megawatt-hours (including total plant demand at the WPCF), with 62% of that demand satisfied by green power sources. Green power sources included cogeneration, solar at the WPCF, and a portion of the power purchased from EBCE that was eligible under the States renewable portfolio standard. As part of the green power partnership, EPA also tracks the top on-site generators. Since 2015, the City's WPCF has been included in the Top 30 On-Site Generators. As of January 27, 2020, the City ranked 28 in comparison to other on-site green power generators that include Apple, Walmart, the City of Portland, and General Motors among others.

ECONOMIC IMPACT

The City's investments in renewable energy have little impact on the local economy, however the most recent solar Phase 2A project included the community workforce agreement requirements that required outreach to hire local Hayward residents and Hayward Unified School District graduates.

FISCAL IMPACT

Renewable energy generation at the WPCF saved the City $346,000 in bill credits in 2019. The savings are anticipated to increase to $550,000 in bill credits in 2020 due to the recently commissioned Solar Phase 2A project.

STRATEGIC ROADMAP

This agenda item relates to the Strategic Priority of Combat Climate Change. Specifically, this agenda item relates to the implementation of the following project:

Project 3: Transition electricity use in city operations to 100% renewable energy (beginning in FY22)

SUSTAINABILITY FEATURES

Renewable energy generation at the WPCF is helping the City achieve municipal zero net energy (ZNE) by 2025 and supports the City's sustainability and long-term GHG reduction goals. It is consistent with General Plan Policies NR-4.4 (Energy Resource Conservation in Public Buildings) and NR-4.10 (Public Renewable Energy Generation). Additionally, if the goal is achieved, the City and the community will benefit from the following sustainability features:

> *Energy*: Achieving municipal ZNE will reduce the City's reliance on fossil fuels and provide energy from clean and renewable sources.
>
> *Air*: Achieving municipal ZNE will reduce pollutants and make significant progress toward meeting the City's municipal greenhouse gas emissions reduction goals.

NEXT STEPS

Engie was awarded a 2.0 megawatt solar project with the first phase (Phase 2A - 600 kW) to be added to the WPCF power grid for export to other City facilities under the RES-BCT tariff, and the second phase (Phase 2B – 1,400 kW) to be interconnected to EBCE. Staff were unable to negotiate an agreement with EBCE to buy the power, and subsequently awarded only the first phase to Engie for construction. Staff continue to explore opportunities to use the additional 1,400 kW of power including potentially off-setting additional power demands at the WPCF upon completion of the facility upgrades required to meet upcoming regulatory requirements to reduce nutrient loading to the bay.

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