

City of Sacramento
Budget and Audit Committee Report
915 I Street Sacramento, CA 95814
www.cityofsacramento.org

File ID: 2026-01130

8/11/2026

Audit of the Department of Utilities Energy Use: Power Purchase Agreements

File ID: 2026-01130

Location: Citywide

Recommendation: Pass a **Motion:** 1) accepting the Audit of the Department of Utilities Energy Use: Power Purchase Agreements; and 2) forwarding to the City Council for approval.

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Attachments:

1-Description/Analysis

2-Audit of the Department of Utilities Energy Use: Power Purchase Agreements

3-Presentation

Description/Analysis

Issue Detail: This audit was approved as part of the 2026-27 Work Plan. According to the City Council Rules of Procedures, the Budget and Audit Committee shall receive, review, and forward to the council as appropriate, reports, recommendations, and updates from the City Auditor. This report documents the Audit of the Department of Utilities Energy Use: Power Purchase Agreements.

Policy Considerations: The City Auditor's presentation of the Audit of the Department of Utilities Energy Use: Power Purchase Agreements is consistent with the Mayor and City Council's intent to have an independent audit function for the City of Sacramento.

Economic Impacts: None.

Environmental Considerations: None.

Sustainability: None.

Commission/Committee Action: None.

Rationale for Recommendation: This staff report provides the Budget and Audit Committee with information that may be used to meet its responsibility to provide oversight and supervision of the City Auditor and other City departments.

Financial Considerations: The cost of the Audit of the Department of Utilities Energy Use: Power Purchase Agreements was funded out of the Office of the City Auditor budget.

Local Business Enterprise (LBE): None.

Audit of the Department of Utilities Energy Use: Power Purchase Agreements

Report# 2026/27-02 | August, 2026

Solar power generation through PPAs at EAFWTP and SRWTP helps to reduce energy costs, but DOU must consider its options upon the conclusion of the initial contract term

Although participation has resulted in additional energy costs, the SolarShares program has supported the City's renewable energy goals



City of
SACRAMENTO

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Our Mission

To provide a catalyst for improvements of municipal operations and promote a credible, efficient, effective, equitable, fair, focused, transparent, and fully accountable City government.

Our Vision

To improve City services by providing independent, objective, and reliable information regarding the City's ability to meet its goals and objectives and establish an adequate system of internal controls, root out improper governmental activities (i.e., fraud, waste, or abuse), and address racial, gender, and ethnic inequities.

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The City of Sacramento's Office of the City Auditor can be contacted by phone at 916-808-1166 or at the address below:

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Table of Contents

Audit Fact Sheet.....	3
Glossary of Terms and Abbreviations.....	4
Introduction	5
Background	5
Objective, Scope, and Methodology	13
Finding 1: Solar power generation through PPAs at EAFWTP and SRWTP helps to reduce energy costs, but DOU must consider its options upon the conclusion of the initial contract term.....	14
Finding 2: Although participation has resulted in additional energy costs, the SolarShares program has supported the City’s renewable energy goals.....	29
Department Response.....	35

AUDIT FACT SHEET

Audit of the Department of Utilities Energy Use: Power Purchase Agreements

August 2026

Report #2026/27-02

RECOMMENDATIONS

We made two recommendations regarding the Department of Utilities use of PPAs and participation in the SolarShares program. Our recommendations included:

Power Purchase Agreement Resolution

- Review and assess DOU's options for disposition of the PPAs including exercising the five-year options to extend the current PPAs, purchasing the existing solar arrays, installing new solar arrays, or removing the arrays altogether; and identifying additional costs or opportunities for cost savings for each of the scenarios noted.

Renewable Energy Goals

- Consider opportunities to identify and use renewable energy sources, working with other City departments as necessary, and with SMUD to identify additional opportunities to participate in emission-reducing energy strategies at EAFWTP and SRWTP.

BACKGROUND

The Department of Utilities provides drinking water, stormwater, and wastewater services to residents throughout the city of Sacramento, and is the largest municipal energy user in the City. Two DOU-specific sites rank among the highest City-owned energy users: the Sacramento River Water Treatment Plant (SRWTP), and E.A. Fairbairn Water Treatment Plant (EAFWTP). To help reduce its carbon footprint, the City has entered into Power Purchase Agreements (PPAs) at multiple sites, including at the two water treatment facilities. The City has agreed to purchase solar energy under on-site PPAs, where the solar power generation infrastructure is installed at the City's property. The City also participates in SMUD's Commercial SolarShares program, by which the City receives credit for solar energy produced by SMUD's solar generation facilities. This audit reviews DOU's PPA agreements to identify costs and benefits. We also analyzed DOU's options for the disposition of the PPA solar infrastructure at the end of the contracts. Finally, we reviewed the costs and benefits associated with the DOU sites' participation in the Commercial SolarShares program.

FINDINGS

Finding 1: Solar Power Generation Through PPAs at EAFWTP and SRWTP Helps to Reduce Energy Costs, but DOU Must Consider its Options Upon the Conclusion of the Initial Contract Term.

- From 2021 through 2025, we estimate the City saved more than \$603,000 in energy costs at EAFWTP and SRWTP. These 20-year agreements end in 2031 and 2032, respectively, and DOU must consider its options for disposition of the PPAs: DOU can exercise the five-year option to extend the PPAs, purchase the existing solar arrays, install new solar arrays, or remove the solar arrays from its facilities.

Finding 2: Although Participation has Resulted in Additional Energy Costs, the SolarShares Program has Supported the City's Renewable Energy Goals.

- DOU's Water Treatment Plants make up 28 percent of the City's Commercial SolarShares program yearly allocation, making them two of the largest City participants in the program. Through December 2025, the sites' participation in the SolarShares program has resulted in additional energy costs of more than \$623,000 combined. Through the SolarShares program, the sites have received credit for almost 64 million kWh of solar energy, allowing the City to avoid producing more than 32,000 metric tons of carbon dioxide equivalent and helping to meet the City's renewable energy goals.

Glossary of Terms and Abbreviations

2040 General Plan – Sacramento’s long-term blueprint for development, climate resilience, and equitable growth projected to the year 2040

CAAP – City of Sacramento’s Climate Action and Adaptation Plan; along with the 2040 General Plan, it is the City’s strategic roadmap to reduce greenhouse gas emissions and prepare the community for the impacts of climate change

City – City of Sacramento

DOU – City of Sacramento’s Department of Utilities

DPW – City of Sacramento’s Department of Public Works

EAFWTP – E.A. Fairbairn Water Treatment Plant

GHG – greenhouse gas(es), gases that can trap heat from the sun near the Earth’s surface

kWh – kilowatt-hour, a unit of energy equal to outputting one thousand watts for one hour

MW – megawatt, a unit of power equal to one million watts (or 1000 kilowatts)

MTCO_{2e} – metric tons of carbon dioxide equivalent

PPA – Power Purchase Agreement

PV – photovoltaic cells, semiconductor devices that convert sunlight directly into electricity

SMUD – Sacramento Municipal Utility District

Solar Array – a collection of solar panels at a site

Solar Panel(s) – a collection of interconnected photovoltaic cells

Solar Generation System – the complete set of equipment used to generate electricity from solar energy, including solar panels, inverters, transformers, electrical wiring, and other supporting components

SRWTP – Sacramento River Water Treatment Plant

Introduction

In accordance with the City Auditor’s Fiscal Year 2025/26 Work Plan, we have completed the Audit of the Department of Utilities Energy Use: Power Purchase Agreements. We conducted this performance audit in accordance with Generally Accepted Government Auditing Standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

The City Auditor’s Office would like to thank the Department of Utilities, the Department of Public Works, and Sacramento Municipal Utility District for their collaboration during the audit process.

Background

The impacts of climate change pose an immediate and growing threat to California’s economy, environment, and to public health. The Sacramento region has experienced and is expected to continue experiencing the effects of climate change in various ways, including increased likelihood of droughts, flooding, wildfires, heat waves, and increasingly severe weather patterns.

The Department of Utilities (DOU) provides drinking water, stormwater, and wastewater services to residents throughout the city of Sacramento. As discussed below, DOU is the largest municipal user of energy in the city. Recognizing its responsibility, the City has been intentional about reducing its environmental impact, pursuing cleaner energy as part of a broader commitment to sustainability. DOU has also deployed various energy strategies to minimize the City’s carbon footprint.

Sacramento Municipal Utility District (SMUD) is Sacramento’s community-owned electric utility and has served Sacramento since 1946. SMUD is responsible for the acquisition, generation, transmission and distribution of electricity to customers such as the City of Sacramento. SMUD serves an area of 900 square miles that includes most of Sacramento County. SMUD serves a population of approximately 1.5 million with a total annual retail load of approximately 12.565 million megawatt-hours. SMUD generates 1,771 megawatts (MW) of power and buys 1,483 MW of power to meet the region’s power demands. As such, SMUD and the City are partners in reaching the sustainability goals of each entity.

Relevant Laws and Regulations

The City’s commitment to reducing its carbon footprint reflects not only local values but also a response to a growing body of state environmental requirements that guide how municipalities approach energy procurement and sustainability. Since 2005, the California government has enacted several environmental protection laws aiming to reduce emissions by 2050. The following figure provides an overview of key legislation and executive orders that inform the City and DOU’s current green energy goals, including reduction of greenhouse gases (GHG) emissions.

Figure 1: Summary of Pertinent Environmental Legislation Purpose and Goals

Legislation/Order	Year	Purpose	Goals
Executive Order S-3-05	2005	Set GHG reduction targets	Reduce GHG emissions to 2000 levels by 2010, 1990 levels by 2020, 80 percent below 1990 levels by 2050
Assembly Bill 32	2006	State GHG reduction	Reduce GHG to 1990 levels by 2020, further reductions thereafter
Executive Order B-30-15	2015	Climate adaptation	Factor climate change in planning and investment decisions
Senate Bill 100	2018	100 percent zero-carbon electricity goal	100 percent clean electricity by 2045, Renewables Portfolio Standard ¹ to 50 percent by 2026, 60 percent by 2030

Source: Auditor generated based on relevant laws.

This broader legislation informs guidelines developed by the City and implemented at the department level to support compliance with environmental goals. As described in greater detail below, several City-level efforts have been taken by DOU to implement programs to meet these goals.

City Policies related to Sustainability and Green Efforts

The City, and in particular DOU, plays a key role in mitigating GHG emissions. DOU's green energy strategy is promulgated by the 2040 General Plan² and the Climate Action and Adaptation Plan (CAAP)³. The General Plan aims to encourage the use of renewable energy systems with the goal of converting existing buildings to carbon-free electricity use by 2045, eliminating more than 380,000 metric tons of carbon dioxide equivalent (MTCO_{2e}) in that timeframe. The CAAP further illustrates the goal to reduce MTCO_{2e}, from 7.25 per person in 2016 by half to 3.63 MTCO_{2e} per person in 2030, and finally to zero by 2045, as depicted in the figure below.

¹ Renewables Portfolio Standard is a California regulation requiring electricity providers to obtain a specified percentage of their electricity from eligible renewable energy sources.

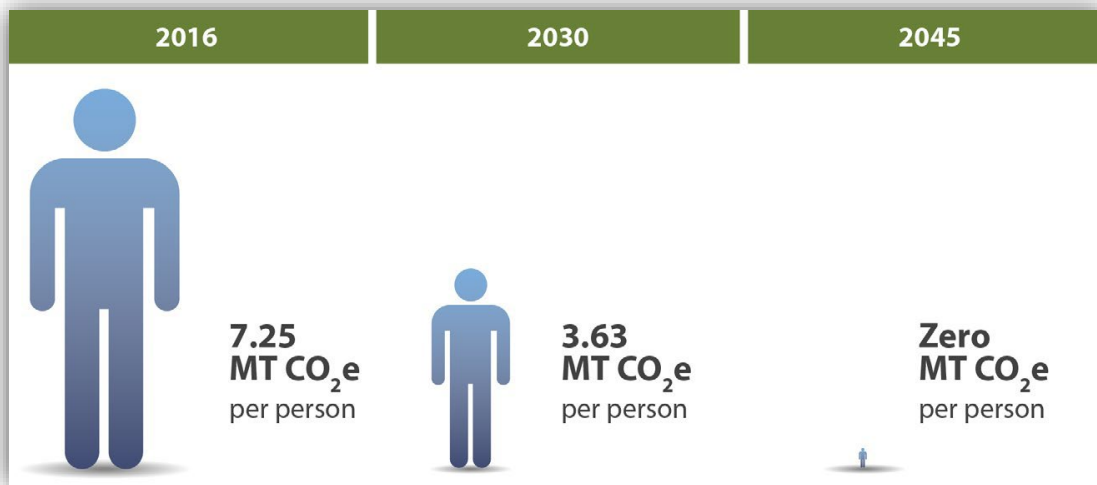
² The City's 2040 General plan can be found here:

https://www.cityofsacramento.gov/content/dam/portal/cdd/Planning/Long-Range/general-plan-2040/Adopted%202040%20General%20Plan_20240227_full_Amended_20251118.pdf

³ The City's Climate Action and Adaptation Plan can be found at this address:

https://www.cityofsacramento.gov/content/dam/portal/cdd/Planning/Long-Range/Climate-Action-Plan/18-06051_Sac%20CAAP_Digital%20-%20Final%20Adopted%20FEB272024.pdf

Figure 2: City's Climate Action Targets Through 2045 (per capita)



Source: City of Sacramento CAAP, page 37.

As part of the action plan, the City considered its strategy to reduce GHG emissions for water and wastewater, which are driven by electricity usage for water conveyance. The City's stated measures are to reduce water utility emissions by 100 percent by 2030 and reduce wastewater emissions by 22 percent by 2030. The City's *2019 Municipal Energy Benchmarking Report* shows that DOU plays a large role in helping the City to meet these goals, as DOU makes up 48 percent of the City's municipal energy use, and 45 percent of the City's energy costs. This indicates that any reductions in GHG emissions made by DOU, especially at the water facilities, will have an outsized impact on the City's GHG reduction goals overall.

Figure 3: Percentage of City's Energy Use and Cost by Department, 2019

Figure 4. 2019 Total Energy Use (MMBtu)

This pie chart represents the portion each City department contributed towards the City's total energy use at City facilities in 2019. This includes SMUD-sourced electricity, PG&E-powered natural gas, and on-site solar electricity

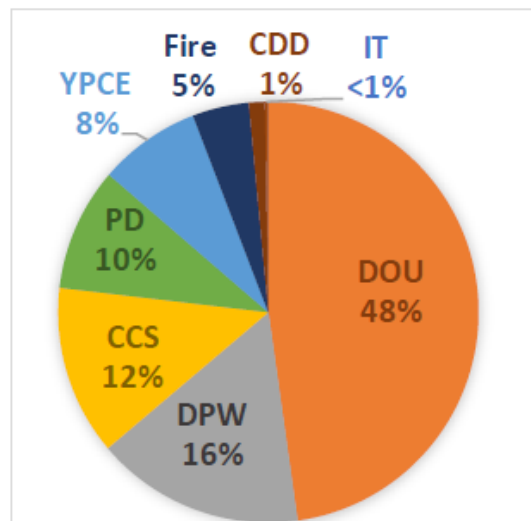
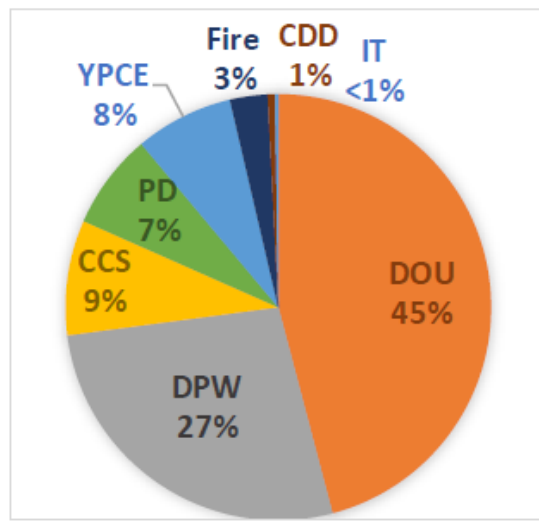


Figure 5. 2019 Total Energy Cost

This pie chart represents the portion each City department contributed towards the City's total cost from energy use at City facilities in 2019. This includes cost incurred from using SMUD-sourced electricity, PG&E natural gas, and on-site solar electricity.



Source: 2019 Municipal Energy Benchmarking Report.

DOU's goals are to safeguard public health, promote environmental conservation, and maintain critical infrastructure through commitment to customer service, employee development, integrity, communication, and innovation. DOU envisions a resilient and sustainable urban utility system that meets current needs, anticipates future demands, and responsibly manages water resources—all while strengthening community trust and advancing Sacramento's long-term environmental and operational goals.

DOU's mission is to provide dependable, high-quality water, wastewater, and storm drainage services in a fiscally and environmentally sustainable manner. In providing these services, DOU works in conjunction with other City departments as well as regional, state, and federal agencies towards the maintenance, development, and rehabilitation of the City's water resources infrastructure. To provide these services, DOU relies on two water treatment plants, numerous wells and sumps, and administrative buildings.

DOU aims to mitigate negative impacts such as GHG emissions, pollution, dependence on non-renewable resources, and over- or excessive use of natural resources. The department participates in and is researching several programs to meet organization-wide GHG goals and DOU wants to

understand the financial sustainability of these programs. This report will focus on the results of a cost analysis of DOU's solar power purchase agreements.

DOU Renewable Energy Programs

DOU participates in several citywide renewable energy programs. They have solar arrays to help meet city-wide environmental preservation goals and are reviewing additional programs to accelerate their adherence to overarching green energy goals. The following are current green energy programs that DOU has been involved in:

- Participation in Power Purchase Agreements whereby the City has contracted to have third-party solar panels installed by SolarCity (the contract is currently held by Tesla) at seven locations, two are on DOU-only facilities. These solar panels are located at the Sacramento River Water Treatment Plant (SRWTP), and the E.A. Fairbairn Water Treatment Plant (EAFWTP).
- Participation in SMUD's Commercial SolarShares program to purchase solar energy from solar fields to lower their carbon footprint.

DOU has Several Partnerships and Contracts to Further Efforts to Reach Green Energy Goals

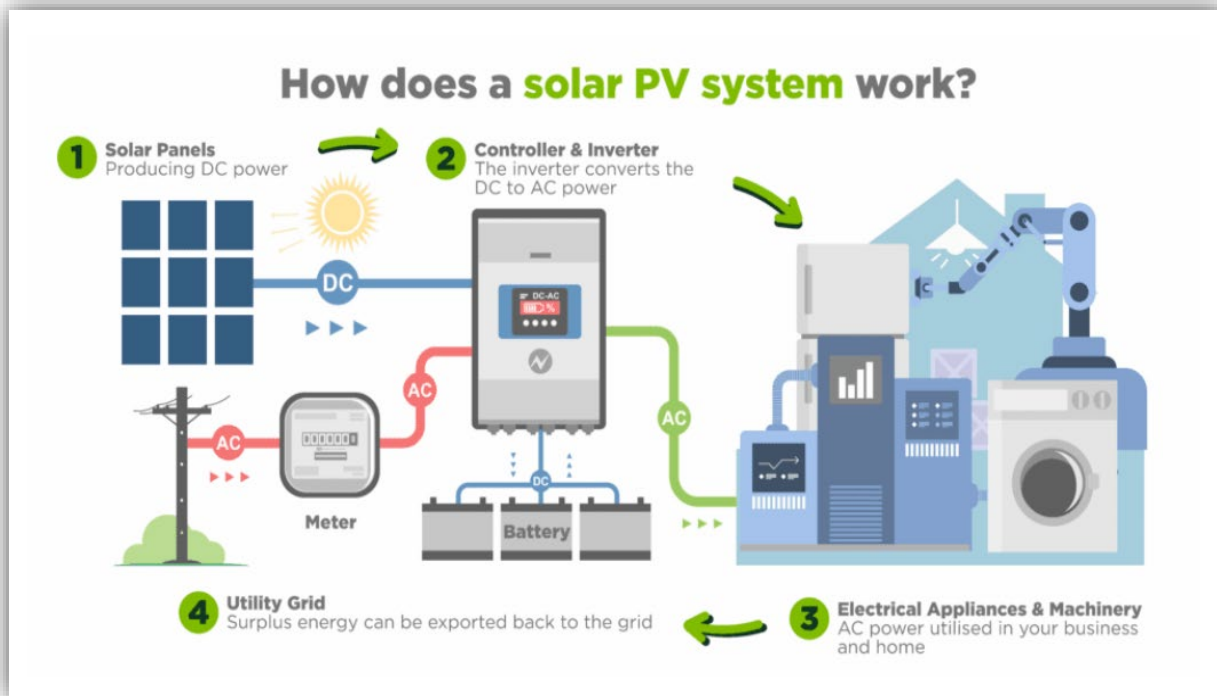
Supporting DOU's green energy progress is a network of partnerships that have helped to expand access to renewable power and reduce DOU's carbon footprint. These partners include the City's Department of Public Works (DPW), SMUD, and the U.S. Department of Energy. The City's green energy goals are informed by legislation such as California Environmental Quality Act, Senate Bill 100, and California Public Utilities Commission guidance.

DOU works internally alongside DPW to research and implement the green energy programs mentioned above. DOU operations are funded using ratepayer fees allocated to the Water Fund, Wastewater Fund, and the Storm Drainage Fund and are subject to expenditure restrictions placed by Proposition 218. DOU reported that their FY25 operating budget included expenditures for the Water, Wastewater and Drainage divisions of around \$215.2 million altogether, excluding multi-year operating projects. Their actual expenditures in FY25 were \$204.5 million, also excluding multi-year operating projects.

Power Purchase Agreements

A Power Purchase Agreement (PPA) is an arrangement in which a vendor installs, owns, and operates a solar energy generation system on a customer's property or off-site. The customer then purchases the system's electric output for a predetermined period and contract price. A PPA allows the customer to receive stable and often low-cost electricity with no upfront cost, while also enabling the owner of the system to take advantage of tax credits and receive income from the sale of electricity. The following diagram illustrates how a solar photovoltaic cell (PV) system works.

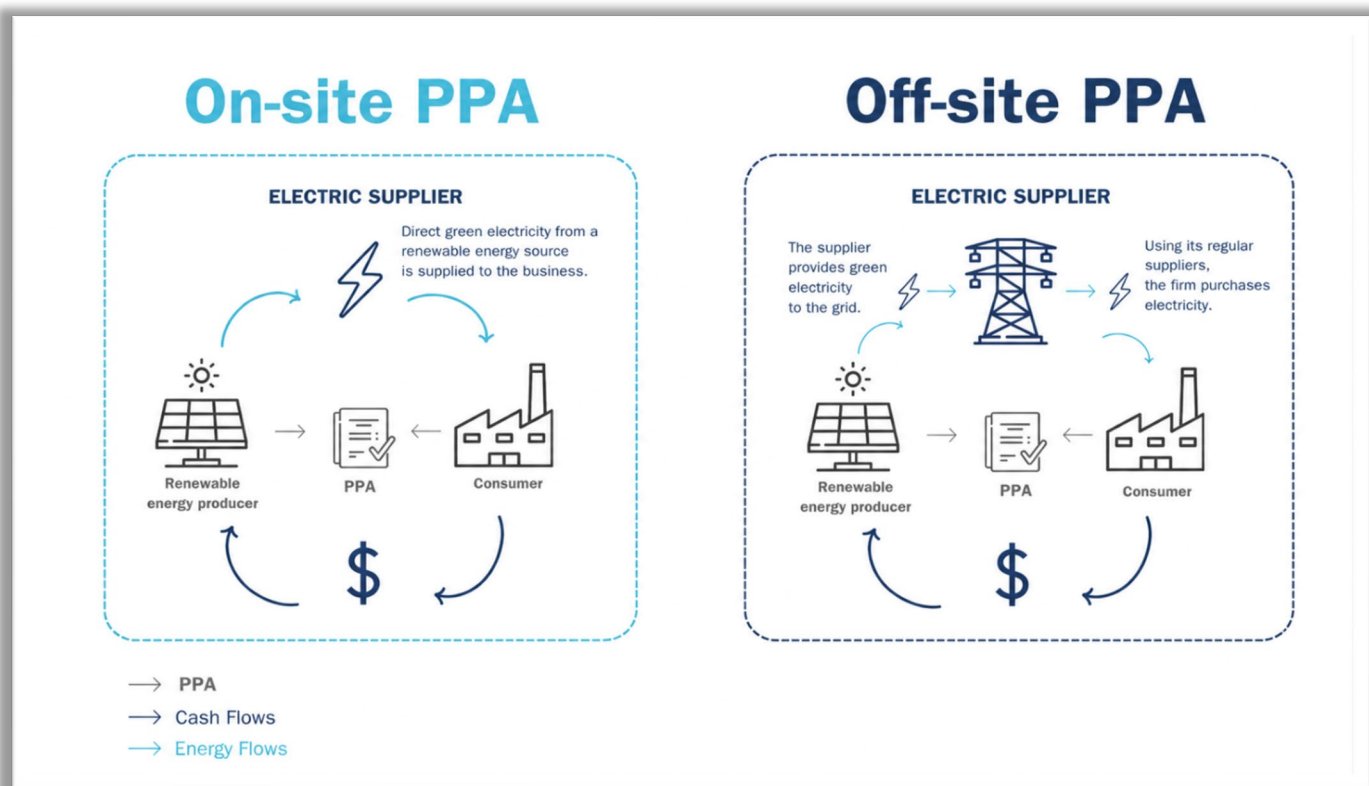
Figure 4: Model of Solar Generation



Source: Model of how solar PVs generate energy from Geo Green Power website.

The more solar energy that is produced, the more electricity the PVs generate up to a maximum per area. That energy then passes through a controller and inverter to be used by the facility or stored using batteries, and the excess returned to the utility grid. Geographic areas like California are ideal for solar panel utilization because they receive a lot of insolation (the amount of solar rays that pass through the atmosphere and reach the earth's surface). PPAs can be on-site or off-site projects. The following figure illustrates the difference between these two configurations.

Figure 5: Typical PPA Configurations (On-site and Off-site)



Source: Auditor generated from Haya Energy Solutions website.

On-site PPAs - SolarCity and Tesla

In 2011, City of Sacramento entered into several 20-year PPAs with SolarCity (now Tesla)⁴. The contracts were executed by the Department of General Services (now defunct) on behalf of various other departments. The contract had provisions for the vendor to build solar panels on several City sites, to produce and sell electricity generated from the solar panels to the City, and to provide upkeep/maintenance of the solar panels. The City agreed to purchase energy generated through these solar panels and the contract specifies a per kilowatt per hour (kWh) cost that increases annually over the life of the agreement. These costs were generally expected to be a discounted kWh rate of electric output when compared to energy purchased from conventional utilities, such as SMUD. As noted in our discussion of the PPAs below, the City has saved as much as 28 cents per kWh during certain periods due to changes in the market cost of energy compared to the PPA cost of energy.

While the City has entered PPAs across multiple sites, two installations were constructed and provide a portion of power to DOU facilities. These facilities fall specifically under the purview of DOU. The two DOU PPAs are for a solar array installed at the Sacramento River Water Treatment Plant (SRWTP) in

⁴ SolarCity Corporation was acquired by Tesla, Inc. in 2016. In this audit, we make reference to SolarCity when discussing contract initiation and to Tesla when discussing more recent billing/maintenance activities.

September 2012, and another solar array installed at the E.A. Fairbairn Water Treatment Plant (EAFWTP) in February 2013.

Under the Agreements, SolarCity retained ownership of the solar generation systems and was responsible for system installation, maintenance, monitoring, and related project development activities, while the City's primary responsibility was to purchase the electricity generated by the systems. The Agreements also included buyout options after Years 6 and 10, as well as a fair market value purchase option after Year 20, along with termination value provisions applicable if the Agreements ended early.

Off-Site PPAs - SolarShares Program

In 2017, the City entered into an agreement with SMUD to participate in their Commercial SolarShares program (an off-site PPA). SMUD is another key partner in DOU's efforts to mitigate GHGs and use clean energy.

SMUD's Commercial SolarShares program allows customers to subscribe to solar energy generated at SMUD-operated solar farms without installing solar panels on their premises. The program offers environmental benefits, including renewable energy credits (RECs), and provides low-maintenance, cost-effective options for accessing clean energy. The service is portable within SMUD's service area – if the customer moves, the service moves with them. At the time the contracts were enacted, the City intended to garner benefits such as savings against future rate increases, renewable energy credits, and the fulfillment of City requirement for clean energy use. The SolarShares contracts allocate a minimum of kWh energy use across 96 City facilities. Of those, 38 are DOU facilities.

Objective, Scope, and Methodology

Our objective of this audit was to review DOU's PPAs to gain an understanding of their associated costs and benefits. DOU has taken a concerted approach to designing and implementing projects and programs to maximize sustainability and green efforts. DOU uses various methods to mitigate the negative impacts of GHG emissions, pollution, dependence on non-renewable resources, and excessive or overuse of non-renewable natural resources at their facilities.

We reviewed DOU's PPA contracts and compared them to contracts executed by other similarly situated cities/municipalities to assess whether the contracts adhered to best practices and contained language to protect the City in the event of damage to or other failure of the solar arrays to produce energy.

We reviewed billing information from SMUD for the period from December 2019 through December 2025 for the SRWTP and EAFWTP water treatment facilities to identify any loss of power generation by comparing solar generation measured by SMUD to amounts reported and billed by the PPA contractor at SRWTP and EAFWTP. We also used the billing information and contracted PPA power rates at the two sites to estimate any costs or savings to DOU based on generation data from January 2021 through December 2025. Finally, we reviewed the billing information to identify additional costs or savings realized at the two plants due to the City's participation in the SolarShares program from enrollment in January 2018 through December 2025.

Using the power generation data we obtained from SMUD, we calculated the amount of solar energy generated and used in kilowatt hours (kWh) at the two facilities. We used those amounts to estimate the equivalent metric tons of carbon (MTCO_{2e}) avoided as a result of the contracts based on the Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator from January 2021 through December 2025.

We analyzed buyout or early termination costs in PPA and SolarShares contracts and any responsibility by the City to bear any costs associated with ending the contracts prior to their expiration or for the City to either remove or maintain control of the solar infrastructure at contract end. We also spoke with DOU staff to identify any likely additional costs and responsibilities related to maintaining the solar infrastructure should the City elect to purchase the solar array upon completion of the original contract term.

Finding 1: Solar power generation through PPAs at EAFWTP and SRWTP helps to reduce energy costs, but DOU must consider its options upon the conclusion of the initial contract term.

The on-site PPAs at the EAFWTP and SRWTP sites helped reduce energy costs and support the City's solar energy generation goals, but they also present important long-term operational and financial considerations as the agreements approach key renewal or buyout decision points. Although the PPAs generated measurable cost savings and contributed to overall site energy demand, differences in solar utilization between sites and the experiences of other California municipalities highlight opportunities to strengthen future contract language related to solar generation system performance, maintenance obligations, accountability measures, and protections for non-performance. As DOU evaluates future contract options, additional consideration is warranted regarding the advantages and tradeoffs associated with the PPA structure, including project costs, energy pricing, maintenance responsibilities, and ownership of the solar arrays.

On-Site PPA Contracts are Approaching Key Renewal or Buyout Decision Points

In 2011, the City entered into agreements with SolarCity to construct solar panels across seven City locations, including the EAFWTP and SRWTP locations. Each agreement established an initial term of 20 years beginning on the Commercial Operation Date, with the option for up to two additional five-year extensions. Under the Agreement for EAFWTP, the solar generation system on site was expected to produce approximately 1.63 million kWh of energy during the first year of operation and included a 1,114.880 DC kW solar array consisting of 4,288 solar modules and two 500 kW inverters. The system at SRWTP was designed to be much smaller than that at EAFWTP. During its first year of operation, SRWTP's 385.320 DC kW solar array, consisting of 1,482 solar modules and one 375 kW inverter, was expected to generate approximately 560,000 kWh of electricity.

The agreements established a fixed energy pricing schedule that increased annually over the contract terms, beginning at \$0.0687 per kWh in Year 1 and increasing to \$0.1001 per kWh by Year 20 at EAFWTP. Similarly, the rates at SRWTP began at \$0.0742 per kWh in Year 1 and will increase to \$0.1081 in Year 20. As of December 2025, the rates were \$0.0871 at EAFWTP and \$0.0960 at SRWTP. Under the agreements, SolarCity retained ownership of the solar generation systems and was responsible for system installation, monitoring, maintenance, and related project development activities, including permitting and rebate processing. The City's primary responsibility under the contracts was to purchase the electricity generated by the system.

The agreements also included buyout provisions allowing the City to purchase the solar generation system after year six for approximately \$2.7 million, after year 10 for approximately \$2.6 million, or at fair market value after Year 20 for EAFWTP. Similarly, the buyouts at SRWTP were about \$977,000 after year six, \$937,000 after year 10, and at fair market value at the conclusion of the agreement. In 2025, the vendor estimated the fair market values of the solar arrays at approximately \$954,000 and \$357,000

at EAFWTP and SRWTP, respectively. Additionally, the contracts established termination values applicable if the contract was terminated before the end of the agreement term.

Based on the agreements' 20-year term and commercial operation dates of September 2012 at SRWTP and February 2013 at EAFWTP, DOU is approaching the end of the contract terms and has already passed the Year 6 and Year 10 buyout option periods. If the Agreement remains in effect through Year 20, DOU may purchase the system at fair market value. As the agreements approach expiration, DOU may need to evaluate whether extending the agreements, purchasing the systems, replacing the infrastructure, or pursuing alternative energy arrangements would provide the greatest long-term benefit.

PPAs Reduced Energy Costs Through On-Site Solar Generation and Utility Credits

Based on billing data obtained from SMUD, we estimated the total savings attributable to solar production generated under the PPAs at EAFWTP and SRWTP from January 2021 through December 2025. As discussed below, we found that PPA contracts for EAFWTP and SRWTP resulted in more than \$603,000 in savings between January 2021 and December 2025.

To calculate estimated cost savings at the two DOU sites, we first calculated the market-rate cost of solar energy used by applying SMUD's average rate per kWh and identified this as "SMUD Market Billing Rates" in Figure 6 and 7 below. Next, we calculated the total costs paid for solar energy produced under the PPA rate and identified as "Total PPA Solar Cost". As shown in Figure 4 in the Background section, during periods of high solar energy production, energy generated in excess of the amount used is returned to the electrical grid, and SMUD provides the City with a credit for that energy, reflected in the "Credits from SMUD" column in Figures 6 and 7. The final column contains the total estimated PPA savings by then adding in SMUD credits for the site by calendar year.

Figure 6: PPA Savings vs SMUD Rates by Calendar Year – EAFWTP (Rounded to Nearest Hundred)

Year	SMUD Market Billing Rates	Total PPA Solar Cost	Credits from SMUD	Total Estimated PPA Savings
2021	\$ 43,000	\$ 58,300	\$ 30,200	\$ 14,800
2022	\$ 153,800	\$ 109,300	\$ 33,300	\$ 77,800
2023	\$ 190,000	\$ 92,900	\$ 14,900	\$ 112,000
2024	\$ 189,900	\$ 80,200	\$ 6,700	\$ 116,400
2025	\$ 232,300	\$ 100,000	\$ 10,900	\$ 143,300
Total	\$ 809,000	\$ 440,700	\$ 96,000	\$ 464,400

Source: Auditor generated based on analysis of SMUD billing data.

Note: Totals are rounded from intermediate calculations and may not be exact sums.

As illustrated above, the PPA generated substantial estimated savings at the EAFWTP site during the review period. As shown in Figure 6 above, the City paid approximately \$440,700 for PPA-generated solar energy compared to an estimated \$809,000 in standard utility costs, resulting in approximately

\$464,400 in estimated net savings after accounting for credits received for excess energy returned to the grid. Estimated annual savings also increased over the review period, from approximately \$14,800 in 2021 to about \$143,300 in 2025.

We found the PPA for the SRWTP site generated an estimated \$138,600 in net savings between January 2021 and December 2025. As shown in Figure 7 below, the City paid approximately \$127,000 for PPA-generated solar energy compared to an estimated \$265,100 in standard utility costs during the same period.

Figure 7: PPA Savings vs SMUD Rates by Calendar Year – SRWTP (Rounded to Nearest Hundred)

Year	SMUD Market Billing Rates	Total PPA Solar Cost	Credits from SMUD	Total Estimated PPA Savings
2021	\$ 100	\$ 100	\$ 0	\$ 0
2022	\$ 1,400	\$ 1,300	\$ 0	\$ 100
2023	\$ 86,600	\$ 43,300	\$ 200	\$ 43,600
2024	\$ 92,200	\$ 42,600	\$ 100	\$ 49,700
2025	\$ 84,800	\$ 39,800	\$ 200	\$ 45,200
Total	\$ 265,100	\$ 127,000	\$ 500	\$ 138,600

Source: Auditor generated based on analysis of SMUD billing data.

Note: Totals are rounded from intermediate calculations and may not be exact sums.

As shown above in Figure 7, savings increased substantially between January 2023 and December 2025 following improved solar production. Savings were comparatively lower than at EAFWTP due to smaller size of solar generation system at SRWTP and periods of non-production during the audit period. As we discuss below, a damaged inverter at the SRWTP solar generation system in 2019 resulted in reduced solar production from October 2019 through December 2022.

Based on our analysis of SMUD billing data, we estimated that solar energy production generated under the PPAs at the EAFWTP and SRWTP sites resulted in more than \$603,000 in total savings between January 2021 and December 2025 compared to market rates.

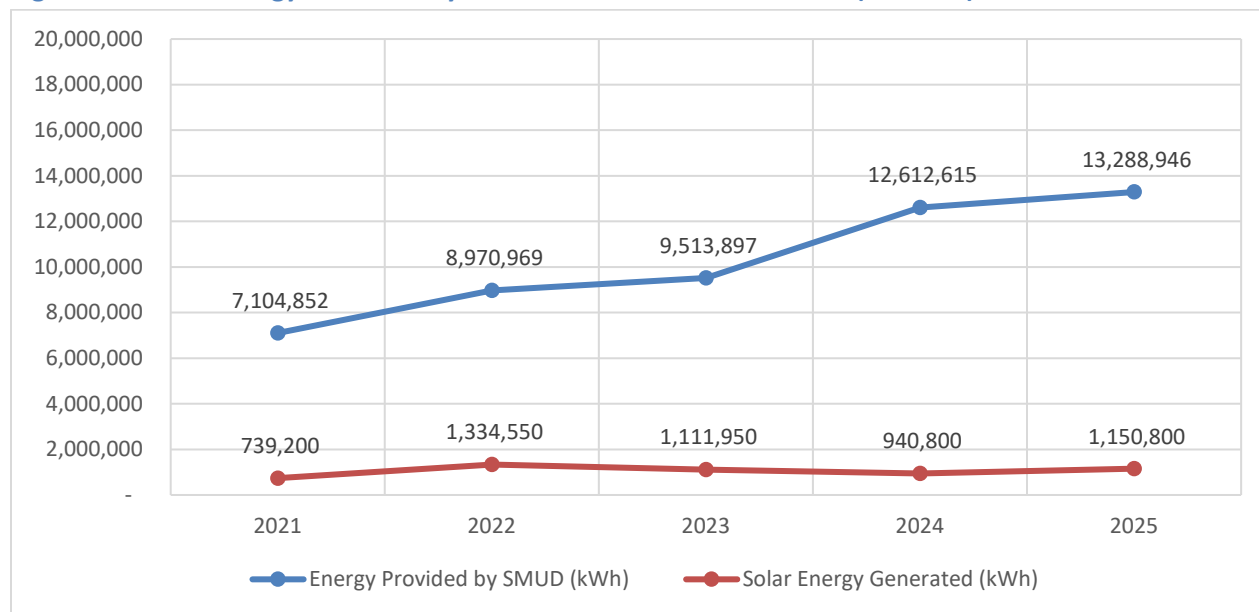
PPA-Generated Solar Energy Represented a Small Share of Total Site Energy Use

While the PPA agreements are yielding savings in energy costs at DOU sites in our review, the power produced by the panels is a small fraction of the aggregated power used at these sites.

We compared the total annual electricity SMUD delivered to EAFWTP and SRWTP to the amount of solar energy produced at the respective site by the panels, based on SMUD solar production data. First, for EAFWTP, we determined that the average amount of overall electricity that SMUD delivers to EAFWTP is 10.3 million kWh annually. The amount of solar energy produced at the site averaged 10.25 percent of the total energy delivered at EAFWTP during the period of review. Figure 8 below shows the total energy

delivered by SMUD and the total solar energy produced by the PPA solar array at EAFWTP from January 2021 through December 2025.

Figure 8: Annual Energy Delivered by SMUD vs. PPA Solar Production (EAFWTP)



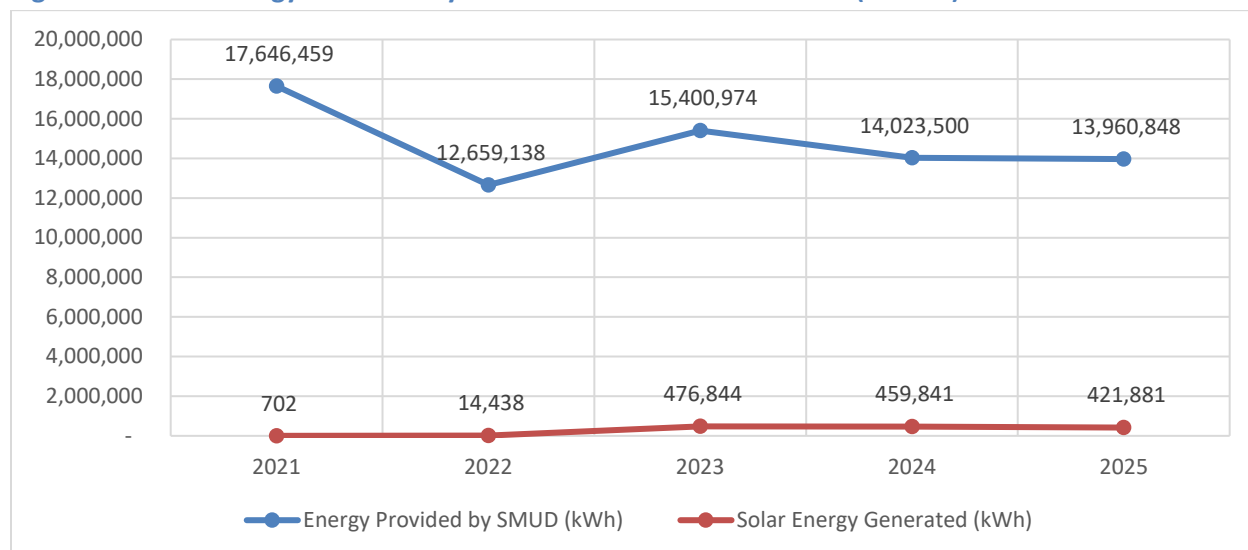
Source: Auditor generated based on SMUD bills and Tesla invoices.

While the Agreements generated energy cost savings at the EAFWTP site, the solar array produced a relatively small share of the site's total electricity demand between January 2021 and December 2025.

Second, for the SRWTP site, we determined that the average amount of overall electricity that SMUD delivers to SRWTP is 14.7 million kWh, annually. The amount of solar energy produced averaged 1.86 percent of the total energy delivered at SRWTP during the period of review. We noted that from January 2023 through December 2025, when SRWTP produced solar energy without interruption⁵, the average solar produced was 3.13 percent of the energy delivered.

⁵ As we discuss later in the report, the solar generation system at SRWTP was damaged resulting in periods of reduced production between 2019 and 2022.

Figure 9: Annual Energy Delivered by SMUD vs. PPA Solar Production (SRWTP)



Source: Auditor generated based on SMUD bills and Tesla invoices.

Similarly, while the agreements generated energy cost savings at the SRWTP site, the solar array produced a relatively small share of the site's total electricity demand between January 2021 and December 2025.

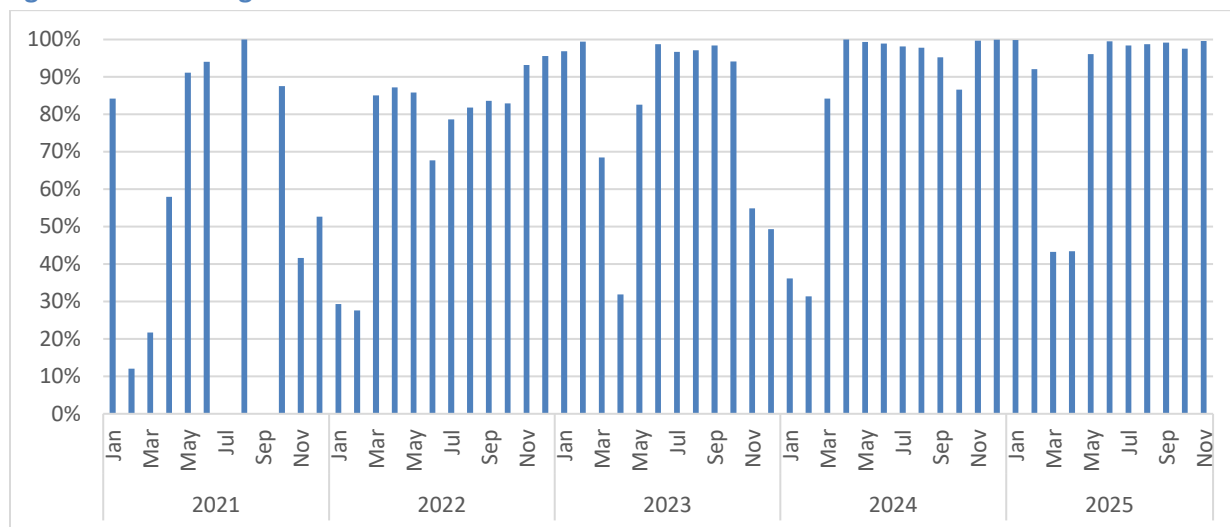
While the PPAs generated energy cost savings at the EAFWTP and SRWTP sites, the solar arrays produced a relatively small share of each site's total electricity demand during the review period. PPA-generated solar energy averaged approximately 10.25 percent of total electricity delivered at EAFWTP and 1.86 percent at SRWTP between January 2021 and December 2025. These results suggest the PPAs provided supplemental energy generation rather than serving as a primary power source at either site.

Solar Energy Utilization Varied Across DOU Sites During the Review Period

To better understand how the Agreements contribute to DOU's energy operations, we analyzed the extent to which solar energy produced at the EAFWTP and SRWTP sites was used on-site versus returned to the electrical grid. Specifically, we compared total solar energy production to overall site energy demand and evaluated monthly usage patterns and utility credits. This analysis provides additional context regarding how effectively the solar arrays align with operational energy needs and whether production capacity appears appropriately sized for each site.

We noted that for about half of the months, EAFWTP uses 90 percent of the solar energy it produces. Figure 10 below shows the percentage of produced solar energy used at EAFWTP.

Figure 10: Percentage of Produced Solar Used at EAFWTP

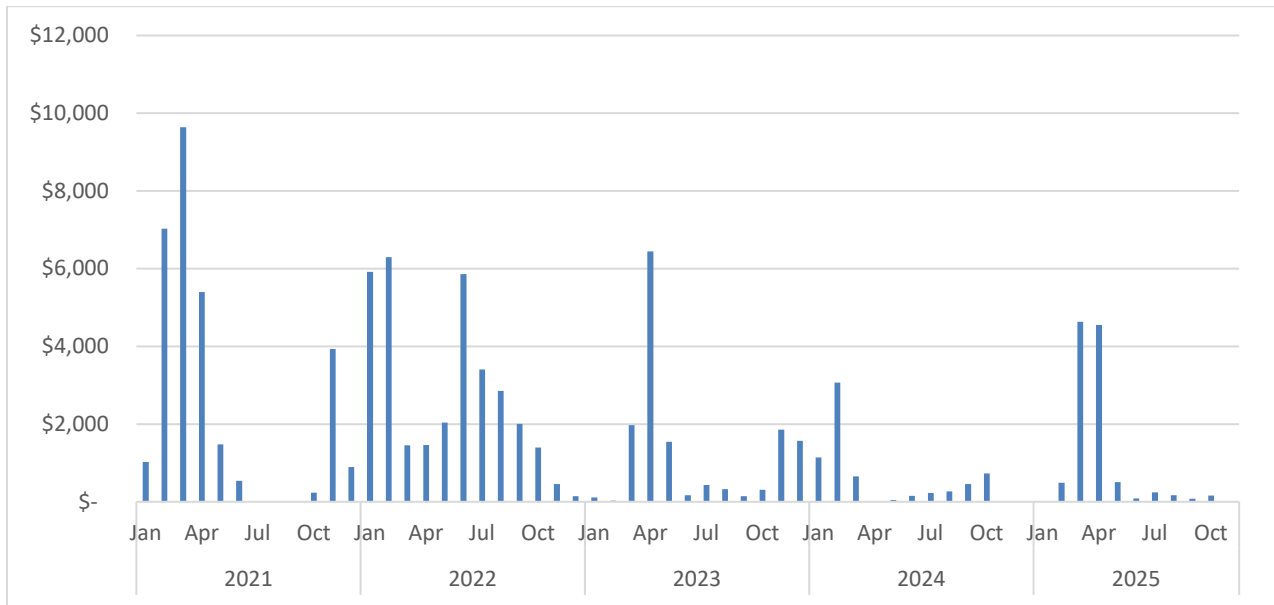


Source: Auditor generated based on SMUD billing data.

However, at other times, depending on energy use and solar generation during a given period, EAFWTP does not use as much of the solar energy it produces, varying between 12 and 88 percent. Because the array does not include battery storage to capture the solar energy for later use, the energy is returned to the grid as depicted in Figure 4 in the background. The excess solar production generated additional utility credits from SMUD. These results suggest the PPA generally aligned with site energy demand while also providing additional savings through excess energy credits.

The overproduction results in additional savings to DOU, as it receives additional credits from SMUD for energy produced and added to the SMUD energy grid during these periods. SMUD credits DOU for the energy returned to the grid at the same billing rate in effect during that time, such as peak or off-peak rates. In 2030, SMUD will pay all renewable energy credits produced by customers, including DOU, at the Solar and Storage Rate, a flat rate that SMUD implemented for all accounts approved to connect after March 1, 2022. DOU will continue to receive the higher reimbursement rate as long as it doesn't significantly modify or move its solar generation systems. The figure below shows the total credits received by month from SMUD for excess solar production.

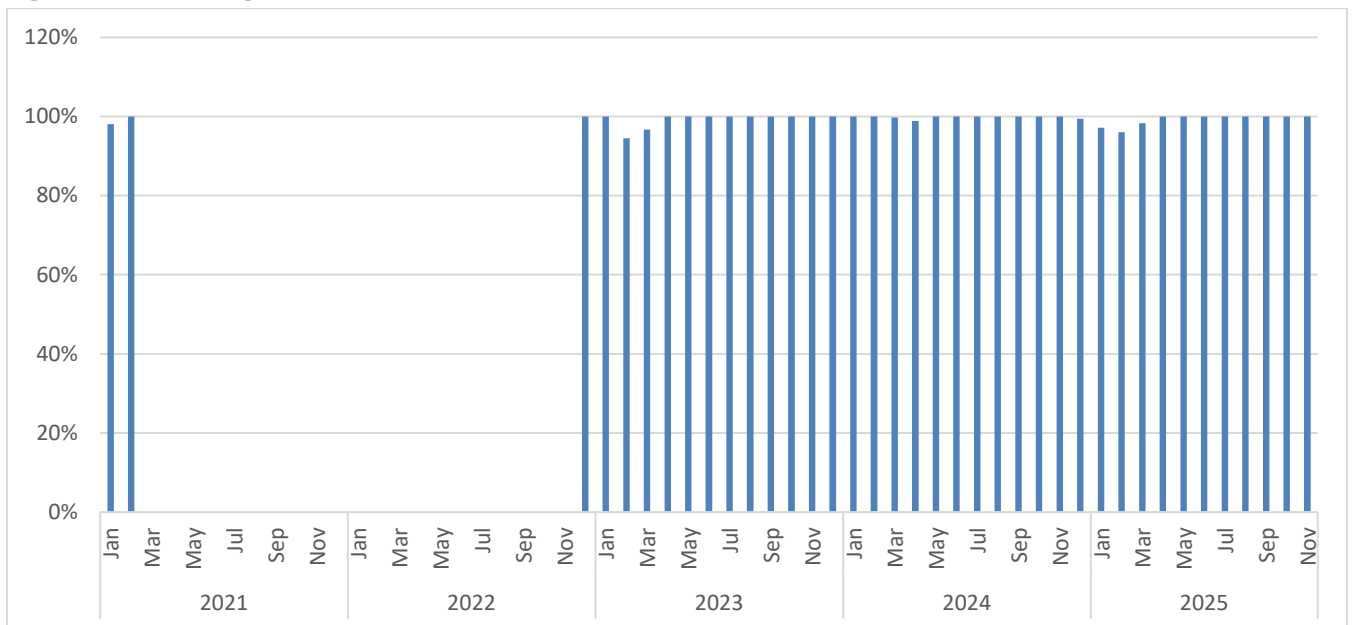
Figure 11: Total Solar Generation Credits Received by Month at EAFWTP



Source: Auditor generated based on SMUD billing data.

We also found that SRWTP generally uses all the solar energy it produces, indicating that increased production capacity may be useful. Figure 12 below shows the amount of solar energy produced and used at SRWTP.

Figure 12: Percentage of Produced Solar Used at SRWTP



Source: Auditor generated based on SMUD billing data.

As shown in Figure 12, monthly solar energy usage consistently approached 100 percent of total production, indicating that the site's energy demand regularly exceeded available solar generation. These results suggest additional solar production capacity at the site may provide further energy cost savings.

We found the EAFWTP and SRWTP sites demonstrated different patterns of solar energy utilization during the review period. EAFWTP generally consumed most of the solar energy it generated at the time it was produced, while periodically generating excess production that resulted in additional utility credits. In contrast, SRWTP consistently used nearly all solar energy generated at the site, indicating the demand for energy at the time the solar energy is produced regularly exceeded available solar production. Together, these results suggest the PPAs generally aligned with operational energy needs and generated cost savings, although opportunities may exist to optimize production capacity or to explore battery storage options based on site-specific usage patterns.

Advantages and Disadvantages of Using PPAs to Support Solar Energy Generation Goals

While the PPAs generated energy cost savings and reduced the City's responsibility for upfront construction, maintenance, and repair costs, they also involve tradeoffs related to long-term pricing, ownership, and operational control. To better understand these considerations, we reviewed several advantages and disadvantages associated with the use of PPAs to support solar energy generation goals, including project financing, energy pricing structures, and responsibilities for system ownership and maintenance.

Project Costs

One advantage of using PPAs to support solar energy generation goals is that PPAs could cover up to 100 percent of project construction costs. At the EAFWTP and SRWTP sites, for example, SolarCity absorbed the upfront capital costs associated with deploying the solar arrays. As a result, the City avoided significant initial capital expenditures and reduced its financial risk associated with constructing and implementing the solar infrastructure.

However, PPAs may also result in higher long-term costs over the life of the agreement. While DOU avoided upfront construction costs, those costs are likely incorporated into the energy rate structure established under the PPA. As a result, DOU may ultimately pay more over the duration of the agreement than it would have paid had it directly financed and owned the solar infrastructure itself.

In contrast, DOU may decide to construct a new solar array at one of their sites. Under this course, DOU would absorb all capital costs for purchase and installation of the facilities. However, DOU would receive all of the solar generated power at the facility without paying a rate and would be the beneficiary of all energy subsidies returned to the energy grid to SMUD.

Energy Pricing

Another advantage of PPAs is that the price of power purchased through the provider is typically lower than the retail electricity rate charged by the utility, which can help protect customers from utility rate fluctuations over time. As discussed above, we found that the PPA contracts for the EAFWTP and the SRWTP resulted in more than \$603,000 in savings between January 2021 and December 2025, suggesting the PPAs reduced overall energy costs during the review period. The following figure shows the average cost per kWh for energy from SMUD, the cost per kWh from the PPAs, and the savings per kWh at EAFWTP for January and July 2021 through January and July 2025. We used January and July to show the difference between average winter and summer rates.

Figure 13: Costs and Savings per Kilowatt-Hour at EAFWTP

EAFWTP			
Month	SMUD Average Rate per kWh*	PPA Solar Rate per kWh	Savings per kWh
January 2021	\$ 0.0944	\$ 0.0789	\$ 0.0155
July 2021	\$ 0.1121	\$ 0.0789	\$ 0.0332
January 2022	\$ 0.0970	\$ 0.0805	\$ 0.0165
July 2022	\$ 0.2533	\$ 0.0821	\$ 0.1712
January 2023	\$ 0.1005	\$ 0.0821	\$ 0.0184
July 2023	\$ 0.3426	\$ 0.0837	\$ 0.2589
January 2024	\$ 0.1021	\$ 0.0837	\$ 0.0184
July 2024	\$ 0.3565	\$ 0.0854	\$ 0.2711
January 2025	\$ 0.1098	\$ 0.0854	\$ 0.0244
July 2025	\$ 0.3719	\$ 0.0871	\$ 0.2848

Source: Auditor analysis of SMUD billing data and PPA contracts

**To calculate the SMUD average rate per kWh, we summed the total energy costs from each of the Time-of-Day rates billed during the period and divided that number by the total number of kWh billed. The average cost does not include any delivery fees, fixed costs, or taxes.*

The PPA cost of energy is also lower than the average costs of energy per kWh from SMUD at SRWTP, though the rates differ slightly. The following figure shows the average cost per kWh for energy from SMUD, the cost per kWh from the PPAs, and the savings per kWh at SRWTP for January and July 2021 through January and July 2025. We used January and July to show the difference between average winter and summer rates.

Figure 14: Costs and Savings per Kilowatt-Hour at SRWTP

SRWTP			
Month	SMUD Average Rate per kWh*	PPA Solar Rate per kWh	Savings per kWh
January 2021	\$ 0.0962	\$ 0.0869	\$ 0.0093
July 2021	\$ 0.1119	\$ 0.0869	\$ 0.0250
January 2022	\$ 0.0963	\$ 0.0886	\$ 0.0077
July 2022	\$ 0.2378	\$ 0.0886	\$ 0.1492
January 2023	\$ 0.1011	\$ 0.0904	\$ 0.0107
July 2023	\$ 0.3124	\$ 0.0904	\$ 0.2220
January 2024	\$ 0.1027	\$ 0.0923	\$ 0.0104
July 2024	\$ 0.3429	\$ 0.0923	\$ 0.2506
January 2025	\$ 0.1117	\$ 0.0941	\$ 0.0176
July 2025	\$ 0.3512	\$ 0.0941	\$ 0.2571

Source: Auditor analysis of SMUD billing data and PPA contracts

**To calculate the SMUD average rate per kWh, we summed the total energy costs from each of the Time-of-Day rates billed during the period and divided that number by the total number of kWh billed. The average cost does not include any delivery fees, fixed costs, or taxes.*

However, PPAs may also present long-term pricing risks. Many PPAs include annual price escalators, typically ranging from 1 to 5 percent, which gradually increase the cost of electricity purchased under the agreement. If retail electricity rates decline or increase more slowly than the escalator rate, the customer could ultimately pay more for electricity under the PPA than under prevailing market rates.

While the Agreements generated substantial savings during the review period, future savings are not guaranteed. As DOU considers whether to extend or renew these PPAs, it should evaluate projected PPA pricing against anticipated utility rates to ensure the arrangements remain cost-effective over the long term. Further, DOU could opt to purchase the solar arrays, which would reduce the kilowatt hour cost for the solar produced to zero, but as we discuss below, DOU would also take on the costs of maintenance, repairs, and training staff for those tasks.

Maintenance and Repair Costs

Under a PPA, a third party installs, owns, and maintains the solar energy system, allowing the customer to avoid the risks and complexity of equipment ownership. For example, in DOU PPAs with SolarCity/Tesla, DOU was only responsible for paying for energy that was produced at the solar arrays at the site.

During the course of the PPA at SRWTP, in October 2019, a fire caused damage to the solar array inverter at the SRWTP facility, resulting in lost energy production and use. Based on solar production data, it appears that the vendor attempted to fix the damage in April 2020, however the array went down again the same month. Additional attempts to fix the array occurred in November and December 2020, which resulted in production in December 2020, but the array again stopped producing energy in January 2021, indicating the repair did not remedy the issue and resulting in another failed repair

attempt in February 2021. Finally, the array was fixed in August 2022 and has consistently produced energy since.

During this period, DOU was not paying for solar energy produced at the site and was purchasing the energy from SMUD at market rate. As noted in our discussion of contract terms below, DOU is not responsible for maintaining or repairing the system and was forced to rely on the vendor to diagnose the issue, and the contract did not include any remedy for DOU for periods of non-production or under performance. Staff at DOU cited a long lead time for parts and apparent lack of urgency to repair the system on behalf of the vendor. It is likely that if DOU had borne the responsibility to keep the array functional, it may have been able to repair the array and return it to service in a shorter time frame leading to additional solar energy production and additional cost savings for DOU.

We noted that the contracts do not require regular maintenance or include a maintenance schedule for the equipment. When the vendor wants to schedule service, they email DOU staff to ensure their ability to enter the premises for their work. We obtained those requests from DOU from November 2023 through August 2025 and found that the vendor visited EAFWTP a total of 12 times for maintenance and visited SRWTP seven times over the approximately two-year period.

If DOU were to service and maintain the solar infrastructure, including dusting the solar panels and landscaping around the array on its own, it would likely have to hire and train staff for the tasks. DOU management stated that existing staff would not be able to absorb the workload associated with maintaining or repairing the solar generation system. According to DOU, it may require an additional 1.5 full-time equivalent electricians, and they believe hiring staff may be cheaper than obtaining a vendor for maintenance. Based on City salary and benefit data, the cost of 1.5 full-time equivalent electrician positions would be between approximately \$103,000 and \$171,000 in salary per year, in addition to any benefits and costs to onboard or train those staff. It may be possible that solar technician training is required for the positions, and we identified a solar technician training program operated by Modesto Junior College, a nearby school, that costs about \$1,400 per student.

Ownership of the Solar Arrays

Under the PPAs the City entered into with SolarCity/Tesla, the company is the owner of the solar array facilities. The contracts also provide that, at the completion of the term of the contract, the company is responsible for the removal of the solar equipment from the site and returning the site to original conditions. DOU is, therefore, not responsible for removal or disposal of the equipment.

This fact is critical for two reasons. First, since the contracts were executed, and solar arrays were constructed in 2012 (SRWTP) and 2013 (EAFWTP), there has been aging, and wear and tear on the solar arrays which could impact their ability to produce power. However, research has shown that the efficiency of the power production of solar array drops less than one percent per year and should still operate at 80 to 85 percent of their original efficiency after 25 years. As such, after more than 13 years

of operation at the EAFWTP and SRWTP sites, the panels may not be producing as much energy as they were after initial construction.

Second, there have been significant technological advances in how much power can be generated by a solar panel. According to one study, a solar panel from 2025 may be up to 40 percent more efficient than those made in 2010. In other words, a standard panel produced in 2010 could turn about 15 percent of energy from sunlight into energy, while most made today may have efficiency ratings between 19 and 22 percent.

We estimated the costs of a new solar array upon removal of the existing equipment. Considering the 260-watt panels, support structure, inverters, installation, permitting, and other normal costs, replacing the current arrays could cost approximately \$1.6 million to \$1.8 million at SRWTP. The cost to replace the infrastructure at EAFWTP with similar hardware could cost approximately \$4.6 million to \$5.3 million.

We also looked at the cost to upgrade the panels from 260 watts to 435 watts. The upgraded panels would increase the system generation capacity by 82 percent at SRWTP and EAFWTP. Upgrading the panels could cost approximately \$2.8 million to \$3.2 million at SRWTP, and from approximately \$8 million to \$9.2 million at EAFWTP. Additional costs, such as upgrades to inverters or other solar generation hardware, may also need to be considered. The increased generation may present the opportunity for the City to consider purchasing storage capacity as well. DOU would also have to work with SMUD to obtain approval for the upgraded system.

DOU could also consider battery storage to capture excess solar energy produced rather than exporting the energy back into the SMUD energy grid. Producers of solar energy can use battery storage to obtain full benefits of the solar energy produced by storing surplus energy for use when grid prices are higher. They can also use battery storage to help reduce costs by using the stored energy when demand is higher, shaving peaks in energy usage and avoiding increased demand rates. Battery storage could help improve energy resilience during power outages by providing backup power. However, as we discussed above, DOU's solar arrays do not generate sufficient electricity to support continued operation of the facilities, limiting the effectiveness of battery storage.

Battery storage costs depend on a number of factors, including the size of the solar generation system, the primary use, and the duration of storage for the energy. DOU stated that they have discussed battery storage concepts with SMUD, who informed DOU that SMUD was not currently in the position to support the size of batteries needed to be useful for operations. DOU further stated that cost estimates for the size of batteries needed to support easing peak hour usage at SRWTP was in the tens of millions. Further, DOU stated that battery storage was likely not feasible because of the battery's large footprint and the space constraints at the facilities.

As the PPAs approach the end of their term, DOU has options to consider. We noted previously that PPAs provide a source of renewable energy, usually at a lower cost than market rates, and include energy costs per kWh for the term of the agreement. This provides certainty in volatile energy markets. Further, PPAs generally require the vendor to install, maintain, and repair the solar generation system in the event of damage or failure. There may also be notable drawbacks to PPAs as discussed in the benchmarking section below, specifically if the contracts do not contain remedies for underperformance of the system. Further, reliance on the vendor to maintain and repair the system could result in delays that cause DOU to purchase energy directly from SMUD at market rates, leading to increased costs and the loss of cost certainty that the PPA was intended to provide.

Benchmarking of PPAs with California Cities Identified Opportunities to Strengthen Contract Language

We reviewed PPA contract terms used by other California municipalities and identified several contract provisions intended to strengthen operational accountability and reduce long-term performance risks. Through discussions with peer agencies, we found that some agreements included stronger protections related to solar panel performance, timely repairs, maintenance obligations, and financial remedies for underproduction or non-production. If utilized by the City, these types of provisions may provide greater assurance that solar energy systems generate anticipated energy savings throughout the life of the agreement.

We conducted benchmarking against five other entities⁶ including Los Angeles Department of Water and Power, Bonita Vista Middle School, City of Long Beach, City of Ventura, and City of Reedley. We compared their contracts with the City's to identify and assess contract terms for items in the PPAs, such as solar production estimates, vendor maintenance responsibilities, and remedies or damages for non-performance of maintenance or production. The figure below summarizes select contract terms for the benchmarked entities.

⁶ We selected cities with publicly available PPA information for benchmarking.

Figure 15: PPA Benchmarking Summary

Contract Terms	City of Sacramento	LA Department of Water and Power	Bonita Vista Middle School	City of Long Beach	City of Ventura	City of Reedley
Year of contract	2011	2014	2012	2017	2023	2020
Energy estimates for first year (kWh)	✓	✓	✓	✓	✓	✓
Energy estimates for all years	✗	✓	✗	✓	✓	✗
Production flat rate	✗	✓	✗	✗	✓	✓
Vendor responsible for maintenance	✓	✓	✓	✓	✓	✓
Contract defines panel inspection frequency	✗	✓	✓	✓	✓	✗
Remedy/damages for non-performance (maintenance)	✗	✓	✓	✓	✓	✗
Rates/production guaranteed	✗	✓	✓	✓	✗	✗
Stated minimum output for panels	✗	✓	✓	✓	✓	✗
Remedy/damages for panel non-performance	✓	✓	✓	✓	✓	✓
Audit clause	✗	✓	✓	✓	✓	✗
Damages for default	✓	✓	✓	✓	✓	✓

Source: Auditor generated based on benchmarking data.

We compared these contract terms with those in DOU’s agreements and found that other entities had more concrete maintenance terms such as time of performance, standards for level of performance (for panel maintenance and production), and audit clauses wherein vendor had to demonstrate how well the panels are producing.

In several instances, the clauses were so specific that they only allow a 1 percent deviation in panel production as well as vendor penalties if the production is off by more than this amount. As an example, contract terms in executed PPAs by the Los Angeles Department of Water and Power places the responsibility on the vendor to “devise and implement a plan of inspection, maintenance, and repair” for the solar panels that adheres to the “Prudent Utility Practices” and keep records of inspections, maintenance, and repairs. All this information must be made available to LADWP with reasonable notice.

We contacted Tesla to obtain their maintenance processes and schedules, but they stated that they perform preventative maintenance on an “as-needed basis” and would provide maintenance logs only when contractually obligated to do so.

Additionally, our review of PPAs used by other California municipalities identified contract provisions that may have provided greater assurance regarding solar panel performance, maintenance, operational accountability, and long-term cost savings for the City of Sacramento.

More specifically, as discussed above, during the course of the PPA at SRWTP, a fire occurred in October 2019 that caused damage to the solar array inverter at the facility resulting in lost energy production and use. The solar array was not fully repaired until August 2022 and has consistently produced energy since. Notably, during the course of the outage, DOU was in contact with Tesla representatives in attempts to have the solar energy system repaired. As noted earlier, the company was unable to repair the system to normal production levels. As a result, the City was forced to purchase power from SMUD at market rates and from January 2021 through August 2022 paid over an estimated \$30,400 more than it could have otherwise, assuming average production during the non-production period.

Through discussions with other California municipalities, we found that some PPAs contain provisions that provide greater assurance regarding timely repairs, panel performance, and long-term cost recovery when solar arrays are not functioning as expected. Examples of these provisions included long-term production estimates covering the full life of the agreement rather than only the first year, minimum power production guarantees with allowable deviation thresholds of approximately one percent, penalties or financial remedies for underproduction or non-production, stronger requirements for scheduled maintenance, and audit clauses allowing review of panel production and maintenance records. Collectively, these provisions may help strengthen operational accountability and better protect public entities from long-term performance risks.

Solar power generation through the PPAs at the EAFWTP and SRWTP sites helped reduce energy costs through on-site solar generation and utility credits, while limiting DOU's upfront capital and maintenance responsibilities. However, the Agreements generated only a small share of overall site energy demand, and solar utilization patterns varied between sites, with some periods of excess production and others where demand exceeded available solar generation. As the Agreements approach key renewal or buyout decision points, DOU will need to evaluate the long-term financial and operational implications of extending the agreements, purchasing the solar arrays, or pursuing alternative energy strategies. Additionally, benchmarking with other California municipalities identified opportunities to strengthen future contract language related to production guarantees, maintenance requirements, and remedies for non-performance to better protect the City's long-term interests.

We RECOMMEND the Department of Utilities

- 1. Review and assess its options for disposition of the PPAs including exercising the five-year extension options in the current PPAs, purchasing the existing solar arrays, installing new solar arrays, or removing the solar arrays altogether; and identifying additional costs or opportunities for cost savings for each of the scenarios noted.**

Finding 2: Although participation has resulted in additional energy costs, the SolarShares program has supported the City's renewable energy goals.

The City's renewable energy strategy extends beyond its physical facilities through its participation in SMUD's Commercial SolarShares program – off-site PPAs that allow the City to purchase a portion of energy generated by remote solar installations. The City entered into an agreement with SMUD to purchase electricity generated from SMUD-operated solar facilities through SMUD's Commercial SolarShares program. The program was intended to advance the City's renewable energy and sustainability goals by allowing the City to participate in utility-scale solar generation without the need to construct or maintain its own solar infrastructure while helping support investment in SMUD's broader solar energy portfolio. However, while the program contributed toward the City's renewable energy goals, our analysis found that participation resulted in more than \$623,000 in net additional energy costs during the review period.

Background of SolarShares and Commercial SolarShares Program

The purpose of SMUD's Commercial SolarShares program is to provide solar power from SMUD solar farms and is considered flexible and easy. SMUD's Commercial SolarShares program is the business-oriented version of its community solar model. Instead of installing and maintaining solar panels on a business property, participating organizations subscribe to a share of SMUD-managed solar generation and receive renewable energy benefits through their utility bill.

A participating business signs an agreement with SMUD for a specified amount of solar capacity, typically measured in kilowatt-hours (kWh). SMUD then allocates output from regional solar facilities to that customer's account. SMUD manages and maintains the solar infrastructure on behalf of participants, allowing the City to receive the benefits of solar energy generation without incurring upfront capital costs for construction or ongoing maintenance responsibilities. Through the program, SMUD develops, owns, and operates the solar arrays while delivering the associated energy to participating customers through their utility service. This structure allows the City to support renewable energy goals and claim solar-related cost and environmental benefits without assuming ownership, operational risk, or long-term system maintenance obligations.

City Agreements with SolarShares

In 2017, the City signed a 20-year Commercial SolarShares contract with SMUD wherein it agreed to purchase the solar energy produced at SMUD's solar farms. This agreement helps accomplish two goals: it helps the City meet its green energy goals while also helping subsidize clean energy initiatives at SMUD's solar farms.

The City has currently enlisted 96 facilities to participate in the SolarShares program, of which 38⁷ are DOU sites. SMUD allocated the City more than 28.7 million kWh per year in the original contract. As of November 2025, the City's contracted total yearly allocation was just over 28.8 million kWh. SMUD distributes the solar energy benefits across the City's utility accounts based on monthly energy production. The EAFWTP and SRWTP facilities received two of the City's largest shares of the program. Under the agreement, SMUD can adjust the amount of solar allocation assigned to an account or move participation between City accounts under certain conditions. The City may also remove a facility from the program with SMUD's agreement. However, if the City chooses to remove a facility on its own or terminate the SolarShares contract completely, SMUD may charge a termination fee based on the remaining SolarShares allocation and duration of the contract.

In addition to the use of the energy produced, the City also receives Renewable Energy Credits (RECs) associated with the production of solar energy and may make all claims to renewable and environmental attributes in the RECs, including that the City uses solar power.

The price of SolarShares allocation is made up of two components, the Energy Cost Component (ECC) and the Delivery Service Charge (DSC). The ECC is fixed and replaces the City's energy-only charges under its applicable SMUD rate. SMUD calculates the credits from this component on a time-of-use basis depending on when the City's kWh usage at its facilities occurs, then applies the generation amount according to the allocation schedule included in the contract. The DSC is variable and based on the delivery costs normally included in the City's standard rates. It represents the cost to recover fixed charges in the System Infrastructure Fixed Charge included in SMUD's Standard Rates. We noted that as of December 2025, the DSC had increased by 32 percent from the original contracted rate.

SolarShares Program Resulted in Additional Energy Costs to the City

To analyze the program, we evaluated how the SolarShares contract affected the City's overall electricity costs. From the SMUD billing data, we sought to determine the costs at the EAFWTP and SRWTP sites over the life of the SolarShares contract, which began with the January 2018 billing period through December 2025. We calculated the yearly total SolarShares Delivery Service Charge, SolarShares Electricity Charge, SolarShares Credits, and Net SolarShares Credits (or Fees) at EAFWTP and SRWTP. Overall, participation in the SolarShares program has resulted in additional energy costs of more than \$623,000, or 2.5 percent of the total energy costs at the two sites from January 2018 through December 2025.

SolarShares Contract Cost – EAFWTP

We found that, as of December 2025, EAFWTP total yearly allocation accounted for 16 percent of the City's total SolarShares allocation. From inception through December 2025, EAFWTP has received almost

⁷ The number of participating facilities fluctuates as electricity demand increases or decreases. If a facility does not produce the threshold contracted kWh, it may be removed from the portfolio of participating facilities and replaced by another facility, or SolarShares credits may be reallocated to facilities with higher energy usage.

100 percent of its total allocated SolarShares credits. Through December 2025, participation in the SolarShares program has resulted in additional energy costs of about \$438,800 at EAFWTP above the market rate cost of energy or 4.1 percent of EAFWTP's total energy costs.

Figure 16: SolarShares Net Fees and Credits – EAFWTP (Rounded to Nearest Hundred)

Year	SolarShares Delivery Service Charge	SolarShares Electricity Charge	SolarShares Credit \$	Net SolarShares Charges/ (Credits)
2018	\$ 71,600	\$ 413,200	\$ (418,000)	\$ 66,800
2019	\$ 72,400	\$ 412,200	\$ (454,200)	\$ 30,400
2020	\$ 75,500	\$ 412,300	\$ (447,400)	\$ 40,500
2021	\$ 80,800	\$ 418,900	\$ (479,500)	\$ 20,100
2022	\$ 81,900	\$ 412,200	\$ (420,800)	\$ 73,300
2023	\$ 84,100	\$ 413,400	\$ (397,700)	\$ 99,800
2024	\$ 87,800	\$ 412,300	\$ (435,300)	\$ 64,800
2025	\$ 92,800	\$ 412,200	\$ (461,900)	\$ 43,200
Grand Total	\$ 646,900	\$ 3,306,700	\$ (3,514,800)	\$ 438,800

Source: Auditor generated based on analysis of SMUD billing data.

Note: Totals are rounded from intermediate calculations and may not be exact sums.

As illustrated in Figure 16, the City's participation in the SolarShares program at the EAFWTP facility resulted in higher energy costs during the review period. Annual net costs fluctuated year to year based on the relationship between SolarShares charges and credits. These results illustrate that, while the program provided access to renewable energy benefits without requiring the City to own or maintain solar infrastructure, participation did not generate net financial savings for the facility during the period reviewed.

SolarShares Contract Cost – SRWTP

As of December 2025, SRWTP's total yearly allocation accounted for 12 percent of the City's total SolarShares allocation. From inception through December 2025, SRWTP has received about 98 percent of its total allocated SolarShares credits. Through December 2025, participation in the SolarShares program has resulted in additional energy costs of roughly \$184,200 at SRWTP above the market rate cost of energy or 1.3 percent of SRWTP's total energy costs.

Figure 17: SolarShares Net Fees and Credits – SRWTP (Rounded to Nearest Hundred)

Year	SolarShares Delivery Service Charge	SolarShares Electricity Charge	SolarShares Credit \$	Net SolarShares Charges/ (Credits)
2018	\$ 52,500	\$ 302,600	\$ (336,100)	\$ 19,000
2019	\$ 53,100	\$ 302,700	\$ (331,800)	\$ 24,000
2020	\$ 57,500	\$ 313,600	\$ (367,100)	\$ 4,000
2021	\$ 60,000	\$ 311,000	\$ (382,800)	\$ (11,800)
2022	\$ 60,100	\$ 302,700	\$ (337,900)	\$ 24,900
2023	\$ 61,600	\$ 302,700	\$ (310,500)	\$ 53,700
2024	\$ 64,400	\$ 302,700	\$ (323,300)	\$ 43,800
2025	\$ 68,400	\$ 303,600	\$ (345,300)	\$ 26,600
Grand Total	\$ 477,500	\$ 2,441,500	\$ (2,734,800)	\$ 184,200

Source: Auditor generated based on analysis of SMUD billing data.

Note: Totals are rounded from intermediate calculations and may not be exact sums.

As illustrated in the figure above, the City’s participation in the SolarShares program at the SRWTP facility resulted in modest additional energy costs over the review period, while still providing the facility with essentially its full allocated share of solar credits over the life of the agreement. Annual net costs varied by year depending on the balance between SolarShares charges and credits, including one year in which credits exceeded program costs. These results demonstrate that, although the program allowed the City to receive renewable energy benefits without owning or maintaining solar infrastructure, participation did not produce overall cost savings for the facility during the period reviewed.

We noted that while the City staff analysis supporting the contract in 2017 indicated an estimated cost savings element over the life of the agreement, the contract is explicit in that SMUD makes no guarantees or warranties with respect to any cost savings. The City anticipates that as energy costs fluctuate over the remaining life of the contract, the fixed energy cost element will help to generate cost certainty and savings.

SolarShares Participation has helped the City to Avoid Thousands of Metric Tons of Carbon Dioxide

As noted above, participating in the SolarShares program allows the City to recognize the benefits of solar energy production, such as cost certainty for a percentage of energy costs, without being responsible for constructing or maintaining the associated solar infrastructure. One of the largest benefits is the City’s ability to claim renewable and environmental attributes from solar production, including that the City uses solar power. As a result, the City may recognize reductions in greenhouse gas emissions related to its participation in the program. Figure 18 below shows the kWh allocated to each EAFWTP and SRWTP by calendar year through December 2025.

Figure 18: SolarShares Kilowatt-Hours (kWh) Credited and Metric Tons of Carbon Dioxide (MTCO_{2e}) Avoided

	EAFWTP	SRWTP		
Year	SolarShares Credits (kWh)	SolarShares Credits (kWh)	Total kWh Credited	Total Metric Tons of Carbon Dioxide Avoided
2018	4,591,088	3,362,686	7,953,774	4,012
2019	4,579,976	3,362,793	7,942,769	4,006
2020	4,581,321	3,484,465	8,065,786	4,068
2021	4,654,294	3,455,901	8,110,195	4,090
2022	4,580,254	3,363,048	7,943,302	4,006
2023	4,593,131	3,363,037	7,956,168	4,013
2024	4,580,918	3,362,857	7,943,775	4,007
2025	4,580,238	3,373,009	7,953,247	4,011
Total	36,741,220	27,127,796	63,869,016	32,213

Source: Auditor analysis of SMUD billing data.

Through December 2025, SMUD has credited DOU sites a total of 63,869,016 kWh of energy from SolarShares resulting in an estimated 32,213 MTCO_{2e} of avoided greenhouse gas emissions. According to the Environmental Protection Agency’s Greenhouse Gas Equivalencies Calculator, this would be the equivalent of CO₂ emissions from consuming over 3.6 million gallons of gasoline, driving more than 82 million miles in a gasoline-powered passenger vehicle, or the electricity use of over 11,100 homes for one year. The City’s continued participation in the SolarShares program, for which the contract will end with the December 2038 billing period, will continue to provide environmental benefits for the duration of the contract, absent a catastrophic event affecting SMUD’s solar arrays.

According to the SMUD website, the Commercial SolarShares program is currently fully subscribed and is not accepting new enrollments as of the date of this report. SMUD may no longer be able to expand their solar panel fields thereby providing capacity for future enrollments. Recent legislation, specifically Public Law 119-21—the One Big Beautiful Bill Act—cuts prior Inflation Reduction Act (Public Law 117-169) provisions aimed at addressing climate risks, including subsidies for solar energy. These changes may make it less cost effective for solar construction as upfront costs will likely be higher than in the recent past.

SMUD’s goal is to reach zero carbon emissions in their power supply by 2030 by focusing on identifying new renewable energy and storage resources, and new technologies like carbon capture and sequestration, green hydrogen, and long-duration energy storage technologies. Additionally, about 40 percent of SMUD’s electricity portfolio is qualified as renewable energy under California’s Renewable Portfolio Standard as of 2024. As a result, there may be diminishing incentives for customers, such as the City, to enroll in new SolarShares contracts if the electricity sold to consumers on the standard market is all renewable energy.

We RECOMMEND the Department of Utilities

- 2. Consider opportunities to identify and use renewable energy sources, working with other City departments as necessary, and with SMUD to identify additional opportunities to participate in emission-reducing energy strategies at EAFWTP and SRWTP.**

MEMO

TO: Farishta Ahrary, City Auditor

FROM: Dalia Fadl, Director

DATE: July 28, 2026

CC: Ryan Moore, Assistant City Manager
Yvette Rincon, Assistant Director

SUBJECT: Audit of the Department of Utilities Energy Use: Power Purchase Agreements

This memorandum is in response to the City Auditor's audit of the Department of Utilities (DOU) Power Purchase Agreement (PPA) contracts currently active in 2026.

The Department of Utilities acknowledges receipt and concurs with the recommendations from the City Auditors written report. DOU will implement the recommendations with all current and future PPA contracts.

I would like to take this opportunity to thank the City Auditor and staff for their effort.

AUDIT RECOMMENDATIONS AND DEPARTMENTAL RESPONSE:

1. **Recommendation:** Review and assess its options for disposition of the PPAs including exercising the five-year options in the current PPAs, purchasing the existing solar arrays, installing new solar arrays, or removing the solar arrays altogether; including identifying additional costs or opportunities for cost savings for each of the scenarios noted.

Response: DOU's energy program manager will implement this recommendation for all current and future PPA contracts, including the current active contracts at SRWTP and EAFWTP.

2. **Recommendation:** Consider opportunities to identify and use renewable energy sources, working with other City departments as necessary, and with SMUD to identify additional opportunities to participate in emission-reducing energy strategies at EAFWTP and SRWTP.

Response: DOU's energy program manager will continue to investigate and evaluate opportunities to reduce energy use and emissions for all DOU assets and facilities, including EAFWRP and SRWTP. DOU will hire an energy consultant to advise on future PPA contracts and also to develop a department-wide Energy Management Plan (EMP). DOU will work with other city departments and SMUD representatives to determine if the SolarShares contract terms can be improved for DOU's benefit.

A dark blue silhouette of the Sacramento skyline, featuring various building shapes and the two towers of the Golden Gate Bridge on the right side.

Audit of the Department of Utilities Energy Use – Power Purchase Agreements

Budget and Audit Committee

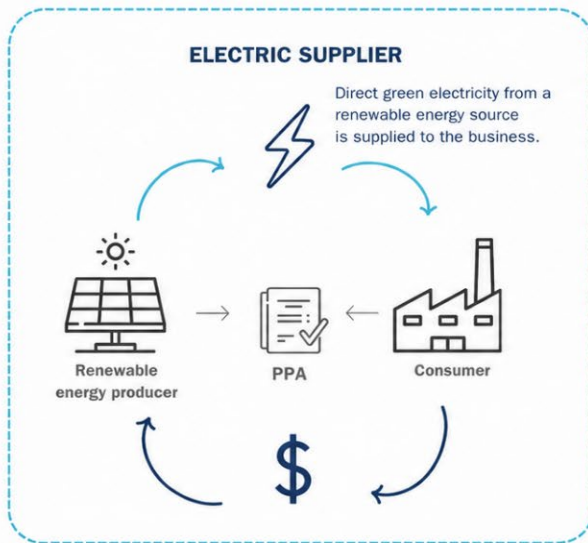
Audit Scope and Methodology

The objective of this audit was to review DOU's Power Purchase Agreements (PPAs) to gain an understanding of their associated costs and benefits.

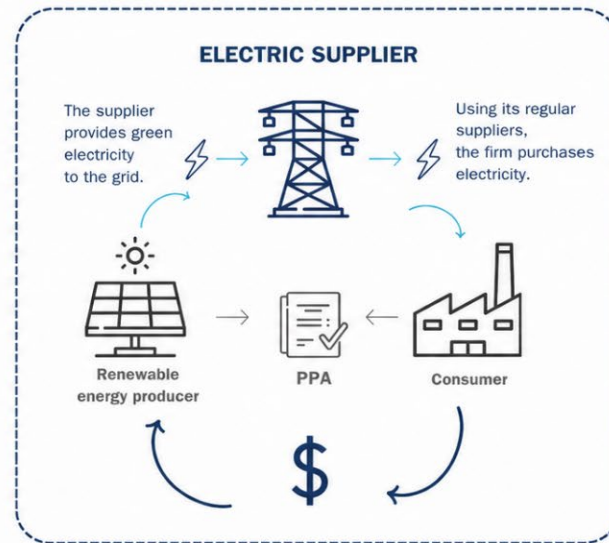
- We reviewed solar billing information from SMUD for the SRWTP and EAFWTP.
- Used power generation data from SMUD to calculate the amount of solar energy generated and used in kilowatt hours (kWh) at the two facilities.
- We benchmarked DOU's PPA contracts to five other municipalities.
- We analyzed buyout or early termination costs in PPA and SolarShares, and alternatives beyond PPA contract horizon.

What is a PPA?

On-site PPA



Off-site PPA



- PPA
- Cash Flows
- Energy Flows

Finding 1: Solar power generation through PPAs at EAFWTP and SRWTP helps to reduce energy costs, but DOU must consider its options upon the conclusion of the initial contract term.



- The on-site PPAs at the EAFWTP and SRWTP sites helped reduce energy costs and support the City's solar energy generation goals.
- Present important long-term operational and financial considerations as the agreements approach key renewal or buyout decision points.
- The agreements end in 2032 (2033 at EAFWTP) so DOU must consider its options at that juncture.

Estimated PPA Savings Across DOU Sites

Year	<u>EAFWTP</u>	<u>SRWTP</u>
	Net PPA Savings (rounded)	Net PPA Savings (rounded)
2021	\$14,800	\$7
2022	\$77,800	\$100
2023	\$112,000	\$43,600
2024	\$116,400	\$49,700
2025	\$143,300	\$45,200
Total	\$464,400	\$138,600
Grand Total	\$603,000	

Benchmarking: contract terms

Most municipalities had contract provisions for:

- production estimates (all years);
- robust maintenance terms;
- remedies/damages for panel non-generation; and
- energy audit clause/damages for contract default.

Contract Terms	City of Sacramento	LA Department of Water and Power	Bonita Vista Middle School	City of Long Beach	City of Ventura	City of Reedley
Year of contract	2011	2014	2012	2017	2023	2020
Energy estimates for first year (kWh)	✓	✓	✓	✓	✓	✓
Energy estimates for all years	✗	✓	✗	✓	✓	✗
Production flat rate	✗	✓	✗	✗	✓	✓
Vendor responsible for maintenance	✓	✓	✓	✓	✓	✓
Contract defines panel inspection frequency	✗	✓	✓	✓	✓	✗
Remedy/damages for non-performance (maintenance)	✗	✓	✓	✓	✓	✗
Rates/production guaranteed	✗	✓	✓	✓	✗	✗
Stated minimum output for panels	✗	✓	✓	✓	✓	✗
Remedy/damages for panel non-performance	✓	✓	✓	✓	✓	✓
Audit clause	✗	✓	✓	✓	✓	✗
Damages for default	✓	✓	✓	✓	✓	✓

Cost Estimates for City Ownership of Solar Panels

- PPA contracts end between 2032 and 2033.
- New solar array using 260-watt panels and equipment could cost up to \$1.9 million at SRWTP.
- At EAFWTP, they could cost up to \$5.3 million.
- New panels at 435 watts could cost approximately \$2.8 million to \$3.2 million at SRWTP, and approximately \$8 million to \$9.2 million at EAFWTP.
- Upgraded panels from 260W to 435W could increase the system generation capacity by 82 percent.

On-Site PPA Contracts are Approaching Key Renewal or Buyout Decision Points. DOU options:

- Extend contracts for five years.
- Purchase the existing solar panels from vendor.
- Remove the existing arrays and install new ones.
- Remove solar panels and use land for other purposes.
- **Recommendation**: Review and assess DOU's options for disposition of the PPAs.



Finding 2: Although participation has resulted in additional energy costs, the SolarShares program has supported the City's renewable energy goals.

- The SolarShares program is a type of off-site PPA and energy is then sold to participants.
- The City enrolled 96 facilities in the SolarShares program, including 38 DOU sites.
- Since the City has been participating in SMUD's Commercial SolarShares program, costs for energy have increased at the SRWTP and EAFWTP sites.
- At the same time, the clean energy produced has offset a great deal of CO₂ emissions.



Metric Tons of CO₂ Emissions Avoided

Year	Total kWh credited	Total Metric Tons of CO ₂ Avoided
2018	7,953,774	4,012
2019	7,942,769	4,006
2020	8,065,786	4,068
2021	8,110,195	4,090
2022	7,943,302	4,006
2023	7,956,168	4,013
2024	7,943,775	4,007
2025	7,953,247	4,011
Total:	63,869,016	32,213

SolarShares resulted in higher energy costs.

- SMUD makes no guarantees with respect to cost savings.
- Uncertain savings in future.
- **Recommendation:**
Consider opportunities to identify and use renewable energy sources, identify additional opportunities to participate in emission-reducing energy programs at SRWTP and EAF.

Net SolarShares Charges/(Credits)		
Year	SRWTP	EAFWTP
2018	\$19,000	\$66,800
2019	\$24,000	\$30,400
2020	\$4,000	\$40,500
2021	(\$11,800)	\$20,100
2022	\$24,900	\$73,300
2023	\$53,700	\$99,800
2024	\$43,800	\$64,800
2025	\$26,600	\$43,200
Total	\$184,200	\$438,800
Grand Total:	\$623,000	

Thank you.

Farishta Ahrary

City Auditor

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City of
SACRAMENTO
Office of the City Auditor

