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Wires and fire: Wildfire investment and network cost differences across California's power providers

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ABSTRACT

Electricity affordability is a salient policy concern in California. We compare drivers of increasing utility costs for three types of power providers in California: investor-owned utilities (IOUs), publicly owned utilities (POUs), and community choice aggregators (CCAs). Since 2019, the IOU and CCA residential baseline electricity rates have increased by 44–80 % after accounting for inflation, making them some of the most expensive power providers in the United States. POU prices, however, remained nearly unchanged. We compare long-term trends in capital assets, returns, and operation and maintenance expenses to identify sources of increasing utility costs, one of the factors contributing to rising electricity prices in the state. Across IOUs, generation capital assets have declined. Fuel and power purchase expenses have increased, although these increases remain within their historical ranges. Transmission and distribution (T&D) expenses have increased significantly and are the majority of overall costs. T&D operations and maintenance spiked following major wildfires after years of remaining constant despite an aging and expanding electricity grid. CCAs reach price parity with IOUs due to the high costs of T&D infrastructure and exit fees levied on them. POUs, which service smaller territories with low wildfire risks, also expanded their T&D capital assets, operations, and maintenance expenses, but the increase is modest. We foresee continued price divergence among power providers due to wildfire mitigation costs, which will have important affordability consequences.

1. Introduction

Affordable and reliable access to electricity is vital to decarbonizing our energy systems and adapting to climate change. Expensive electricity can reduce the adoption of clean electric technologies, and consumers may forgo cooling and heating in extreme weather (Cong et al., 2022; "2021 and 2022 Annual Affordability Report.", 2024; California Public Utilities Commission, 2024a). California lies at the center of this challenge: the state has ambitious electrification and climate goals but some of the country's most expensive power providers.

California has three main types of power providers: investor-owned utilities (IOUs), publicly owned utilities (POUs), and community choice aggregators (CCAs). IOUs are privately-owned firms participating in the generation, transmission, and distribution of electricity. Owing to the capital-intensive nature of distribution and transmission assets used in electricity supply, these firms enjoy a monopoly in their territory: it is more efficient for a single firm to serve an area with its network than for multiple firms to build redundant infrastructure. In exchange for a service territory monopoly, IOUs accept the obligation to serve all customers and regulatory oversight of their electricity rates, investment returns, and overall costs by the state Public Utilities Commission (PUC) and Federal Energy Regulatory Commission (FERC) (California State Senate Energy, 2024; Sabin, 2023). In 2022, IOUs supplied electricity for about 40 % of California's retail demand[1] (U.S. Energy Information Administration, 2023).

POUs and CCAs, the other two key power providers, operate on a non-profit basis. POUs are owned and operated by cities, counties, and irrigation districts. They are governed by local laws and are not subject to PUC regulations. CCAs are relatively new players in the state's electricity sector and operate within IOU territories. CCAs procure their own

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[1] IOUs have "bundled" customers, for whom they provide both energy and delivery. These customers represent about 40 % of the retail demand in California. IOUs also have "delivery-only" customers, which are primarily CCA and Direct Access customers.

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power but use IOU distribution and transmission networks to deliver it. In 2022, POUs and CCAs served 25 % and 23 % of California's total electricity demand respectively (U.S. Energy Information Administration, 2023). Direct Access providers, "behind-the-meter" rooftop solar providers, one federal utility, and four small rural electric cooperatives meet the residual 14 % of state electricity demand (U.S. Energy Information Administration, 2023) and are not the focus of this paper. Fig. 1 shows the service territories of IOUs, POUs, and CCAs active in northern and southern California.

2018 was a pivotal year for California's utilities. More than a decade after power lines caused wildfires in southern California, a transmission tower owned by PG&E, the largest IOU in northern California, started the Camp Fire in 2018. As of 2024, the Camp Fire remains the deadliest wildfire in California's history, killing eighty-five people and destroying the town of Paradise. Shortly after, PG&E filed for bankruptcy due to financial liabilities (Daniels, 2024) and promised to overhaul wildfire mitigation across its 125,000 circuit miles of power lines (Pacific Gas & Electric Company, 2024a). Wildfire mitigation expenses were quickly reflected in electricity prices, and as of early 2024, PG&E charged its residential customers a baseline[2] rate of 42 cents per kWh, up 20 cents since 2016 after accounting for inflation.

Prices are high and increasing in California's other IOUs and CCAs as well. By early 2024, the IOUs and CCAs charged their residential customers between 37 and 42 cents/kWh, a 30–60 % increase in real terms since 2018. Notably, POU prices have remained low and relatively stable. SMUD and LADWP, two of the largest POUs in California, which together serve roughly the same demand as PG&E, provide affordable electricity at 12 and 20 cents per kWh respectively. We show trends in the residential baseline rates ($/kWh, in 2022$) in Fig. 2, but note that POUs have fixed charges ($/month) as part of their monthly bill, not shown in the figure. In addition to the baseline residential electricity rate, we show the evolution of illustrative monthly bills in Appendix Section 7, along with baseline rates for commercial customers in Appendix Sections 1 and 2. Detailed information on the selected rates and their components are available in the accompanying supplementary data (Singh et al., 2025a).

California IOU prices are high in comparison to other IOUs in western US states. In 2024, baseline electricity rates in other western US states were almost 60–80 % lower compared to PG&E's 42 cents per kWh, with Idaho Power Company charging its residential customers 8.9 cents per kWh, Portland General Electric 17.3, Nevada Power Company 15.1, and Arizona Public Service 12.9 cents per kWh. California's price trends have also diverged from rest of the region: between 2016 and 2024, average residential prices in real dollars – calculated as real revenue earned from residential customers divided by sales to those customers – declined by 6 % and 9 % for Arizona Public Service and Idaho Power Company, while Nevada Power Company and Portland General Electric saw modest increases of 18 % and 7 %. Meanwhile, real average residential prices of California's IOUs saw substantially higher increases in the same time period: 37 % for PG&E, 64 % for SCE, and 76 % for SDG&E (Southern California Edison, 2023; Arizona Public Service, 2025; Clean Power Alliance, 2024a; Idaho Power, 2025; Los Angeles Department of Water and Power, 2024a; NV Energy, 2024; Pacific Gas & Electric Company, 2024b; Pacific Power, 2025; Portland General Electric, 2025; Sacramento Municipal Utility District, 2024a; San Diego Gas & Electric, 2024a; U.S. Energy Information Administration, 2023). While many structural differences between states contribute to power prices and their differences, California's IOUs stand out from major utilities in the western US with their high electricity prices and their trends of sharp recent price increases.

In this study, we analyze the utility costs of seven power providers in California. These include the three major IOUs -PG&E, Southern California Edison (SCE) and San Diego Gas and Electric (SDG&E), two large CCAs - MCE Clean Energy and Clean Power Alliance (CPA), and the two largest POUs - Los Angeles Department of Water and Power (LADWP) and Sacramento Municipal Utility District (SMUD). Together, these providers supply about 60 % of California's total electricity demand and 65 % of all customers. We highlight their 2022 electricity demand and approximate service areas in Table 1. We use historical regulatory, financial, and rate data to contextualize California's key power providers and their growing costs. By analyzing long-term trends in capital, returns, and operations and maintenance (O&M) expenses, we identify the drivers of utility cost increase for IOUs and CCAs and provide comparable data for POUs. Increasing utility costs and the growing price divergence between POU and non-POU prices have important affordability implications across California.

While overall utility cost increases and divergent price trends have been noted in California agency reports and expert commentary, much of the detail—which components of costs are rising most severely, how these trends have evolved over time, and how they affect various types of power providers—remains understudied. To our knowledge, this paper is novel in its breadth of utilities studied and data collection approach. We aggregate price and cost data from utilities' historical price archives, financial reports, regulatory filings, and financial market data to provide a more comprehensive picture of evolving utility costs. Additionally, California PUC reports are necessarily limited to IOUs and CCAs, as they do not regulate the POUs. In contrast, our study compares all three major types of power providers—IOUs, POUs, and CCAs. Fowlie and Calloway (2023) does consider POU prices relative to IOUs, but it does not discuss CCAs). Compared to previous studies, this paper's novel contributions are the combination of a time series analysis, a breakdown of the components of rising costs, and coverage across all three power provider types.

The rest of the paper is organized as follows. Sections 1 and 2 provide historical cost trends for IOUs and POUs. Section 3 decomposes CCA electricity rates to identify sources of price increases, and Section 4 concludes. Throughout this paper, we report electricity rates, costs values, and their increases in real terms (in 2022$), adjusted using the core Consumer Price Index for All Urban Consumers: All Items Less Food and Energy in U.S City Average (U.S. Bureau of Labor Statistics, 2024), and cost trends are normalized to the reference year 2010. The Appendix provides nominal values for key trends discussed in the paper.

Although our focus is on California's largest power providers, the lessons and insights extend to other utilities in the state and beyond. Nationwide, utilities have experienced varying cost pressures, with average real electricity prices increasing by 3.4 % between 2010 and 2022. This increase has not been uniform: electricity became substantially more expensive in California, New England, West Virginia, and Indiana, while prices in Delaware, Maryland, Texas, and New Jersey declined after adjusting for inflation (Singh et al., 2025b). These regional differences will likely become more pronounced, driven by growing electricity demand, grid reliability challenges, costs related to climate risks, as well as utility ownership and governance structures (Bender and Harriman-Pote, 2024; Borenstein, 2017; Borenstein et al. 2021). Our work is also relevant for other wildfire-prone states like Oregon and Hawaii, where electric utilities have proposed rate increases to fund extensive grid hardening and vegetation management programs (Bender and Harriman-Pote, 2024; Sherwood, 2024).

2. Trends in returns and costs for California's Investor-Owned Utilities (IOUs)

IOUs are for-profit entities with geographic monopolies in their territories. The PUC and FERC regulate their costs in a periodic, multi-party, formal regulatory process called the 'rate case.' The rate case determines the revenue requirement, which is the total cost of owning, operating, and maintaining the electricity grid, along with reasonable returns on assets and investments called the 'authorized returns.' Prices

[2] In this paper, baseline rates refer to the marginal bundled rate for the lowest usage tier of a rate schedule.

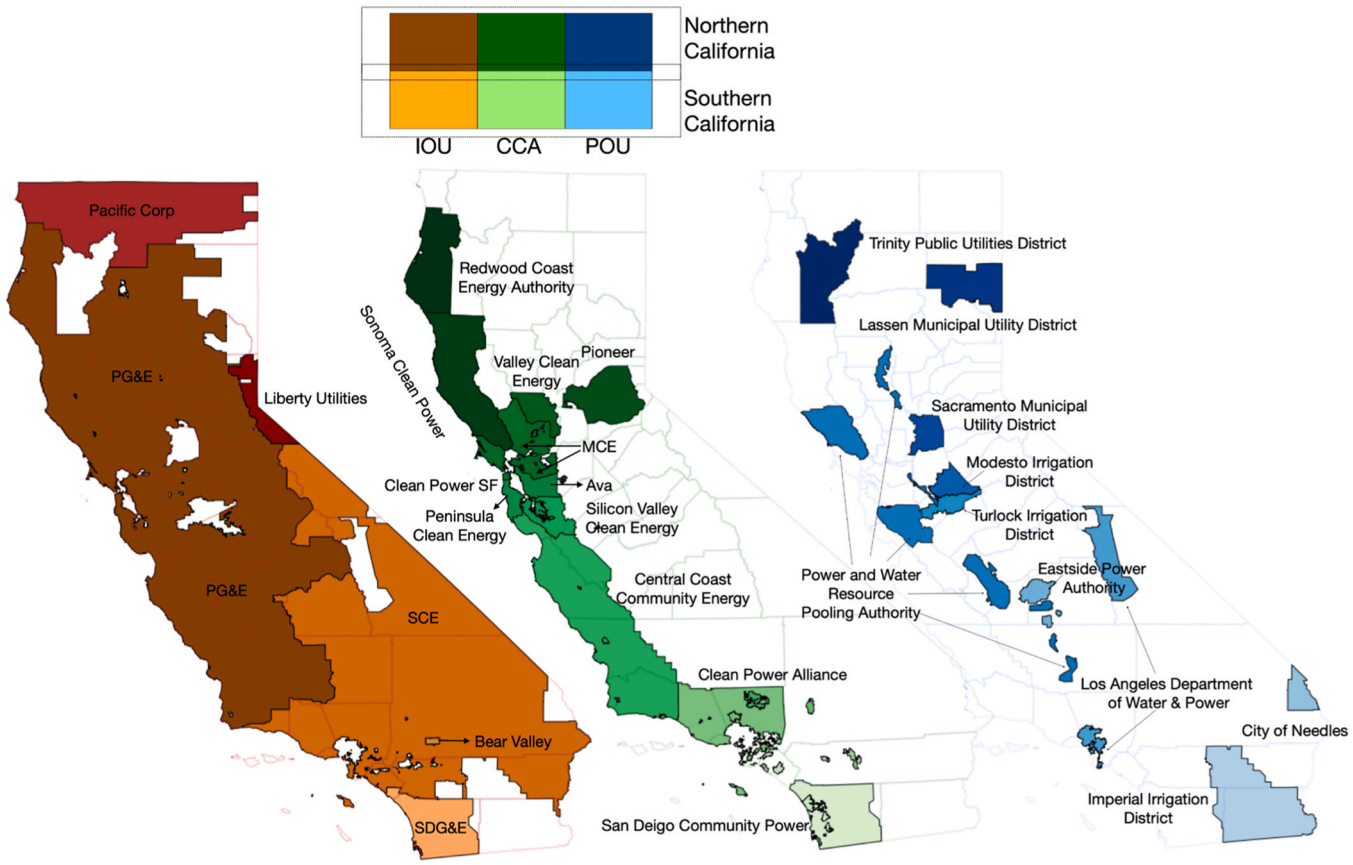

Fig. 1. The geographic territories of select IOUs (brown), CCAs (green), and POUs (blue) in California. Darker colors denote power providers active in northern California, while lighter colors denote those in southern California. CCAs are formed inside IOU territories. Source: California Energy Commission GIS open data (California Energy Commission, 2024a), CalCCA (CalCCA, 2024).

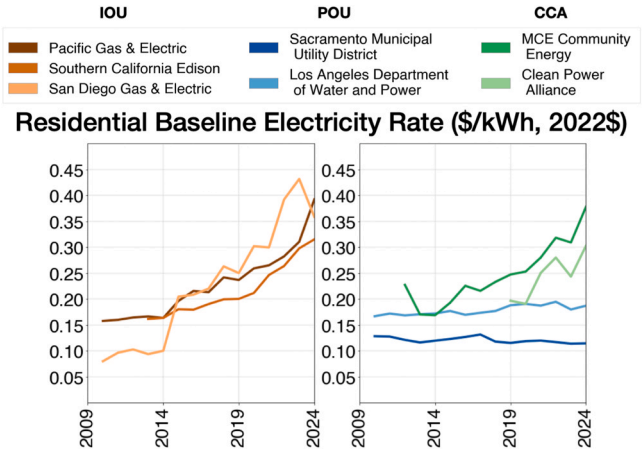

Fig. 2. Residential baseline electricity rate ($/kWh) for California IOUs, POUs, and CCAs (in 2022$). In addition to electricity rates, bills include fixed charges ($/month) not shown in the figure. Rates for SCE and MCE are not available before 2013 and 2012 respectively because of data unavailability. CPA rates begin in 2019 when retail service launched. Source: Historical tariff books and data requests (Clean Power Alliance, 2024a; Los Angeles Department of Water and Power, 2024a; Pacific Gas & Electric Company, 2024b; Sacramento Municipal Utility District, 2024a; Southern California Edison, 2023; San Diego Gas & Electric, 2024a).

Table 1
Residential, industrial, and commercial sales (in TWh) of power providers analyzed in this study.

Power provider	Type	Residential sales (TWh)	Industrial sales (TWh)	Commercial sales (TWh)	Approx. area served in square miles
PG&E	IOU	12.0	11.8	7.4	70,000
SCE	IOU	22.5	4.0	28.4	50,000
SDG&E	IOU	3.9	1.2	2.6	4100
SMUD	POU	4.8	2.1	3.7	900
LADWP	POU	8.5	1.2	12.1	465
MCE	CCA	2.8	0.0	2.6	2700
CPA	CCA	5.3	1.5	4.1	4700

Source: Electricity sales data from EIA Form 861 2022 (U.S. Energy Information Administration, 2023). Service area for POUs and IOUs is taken from power providers' web pages (Pacific Gas & Electric Company, 2024a; Southern California Edison, 2024a; San Diego Gas & Electric, 2024b; Sacramento Municipal Utility District, 2024b; Los Angeles Department of Water and Power, 2024b). The service area for CCAs is calculated by summing the area of included cities and counties listed on CCA websites (MCE Clean Energy, 2024; Clean Power Alliance, 2024b) using the 2020 US Census land area (U.S. Census Bureau,; U.S. Census Bureau, 2020). IOU customers receive all services (energy, transmission, distribution) from IOUs, while CCA customers receive energy services from CCAs using the IOU T&D network.

are then set to ensure IOUs recover their revenue requirement given total electricity sales, and prices may rise due to growing utility expenses and/or declining electricity sales. While our paper primarily examines the trends and drivers of rising utility costs, it is important to note that declining electricity sales resulting from customer generation also plays a significant role in increasing electricity prices in California (California Public Utilities Commission, 2023; Borenstein, 2017; Borenstein et al., 2021; Borenstein et al., 2022; California Public Advocates Office, 2024;

California Public Utilities Commission, 2023a; Fowlie et al., 2024). We provide trends in electricity sales for power providers in Appendix Section 3.

A utility's revenue requirement that it recoups through prices primarily consists of operations and maintenance (O&M) expenses, depreciation, taxes, and returns on capital investments. In 2023, O&M represented 46 % of the revenue requirement for PG&E and SDG&E and 34 % for SCE. Depreciation and return on rate base each accounted for 20–30 %, and taxes made up less than 10 % (California Public Utilities Commission, 2023b). In the next section, we examine trends in rate base, rate of return, and O&M costs to identify drivers of rising utility costs in California. Together, these components reflect nearly 70 % of revenues recouped from ratepayers.

2.1. Rate base

The rate base is the value of a utility's capital and assets minus depreciation. IOUs earn a regulated rate of return on their rate base, discussed in more detail in the next section. An increasing rate base—expansion of IOU capital and assets—raises the revenue requirement even if returns remain constant or decline marginally. In Fig. 3, we show the ratio of real generation, distribution, and transmission rate base in a year to that of a reference year (2010), with corresponding values in Table 2 for 2010, 2018 (the year of the Camp Fire), and 2022 (all in 2022 $). These values are taken from California PUC's historical electric cost data and annual electric and gas utility cost reports (California Public Utilities Commission, 2020, 2021, 2024, 2024b).

Since 2010, the total rate base has increased by an annual average of 4.6 % (PG&E), 6.5 % (SCE), and 9.1 % (SDG&E). Distribution is the largest share of the overall rate base, followed by transmission and generation. Across the three IOUs, the generation rate base declined substantially since 2018, falling by 7–23 %, as utilities shifted away from investing in their own power plants in favor of procuring power through wholesale energy markets. The transmission and distribution rate base has increased by 20–32 % after 2018, largely due to capital investments in wires, poles, transformers, and fixtures. For example, PG&E's authorized distribution capital expenses grew from under $90 million in 2018 to nearly $600 million in 2020 (Batjer et al., 2020) on account of new investments. Similarly, SCE, the largest utility in electricity sales, has doubled its transmission and almost tripled its distribution rate base since 2010. SDG&E, the smallest of the three IOUs, tripled its transmission rate base in less than five years due to updates to their cost methodology, new and planned transmission lines, and recouping under-collected revenues from previous years (San Diego Gas and Electric, 2014).

2.2. Rate of Return (ROR)

In this section, we discuss the authorized and actual rate of return of California IOUs. Authorized ROR is the regulated return earned on the rate base by an IOU. It is the weighted average cost of debt and equity issued by a utility to finance its capital investments and decided during the rate case (California Public Utilities Commission, 2024c). Actual ROR, based on the profits or losses recorded in a year, may diverge both in the positive and negative direction from the authorized ROR. The divergence can be due to the utility's operational efficiency, cost management, weather changes, and unexpected events such as wildfires (Rode and Fischbeck, 2019).

Fig. 4 shows the authorized and actual ROR earned by the California IOUs since 2006.

The authorized ROR for California IOUs declined from 8.77-8.4% in 2006 to 7.68-7.5% by 2022. . In 2023, the authorized ROR was further reduced to 7.44 % (PG&E), 7.27 % (SCE), and 7.15 % (SDG&E). The actual ROR for PG&E and SCE declined sharply in 2018—with negative values for two years for PG&E—due to the damages of the Camp and Woolsey fires. SDG&E shows the opposite trend of actual ROR exceeding its authorized value: for 12 out of the last 15 years, SDG&E has earned more than its authorized ROR. While actual ROR can exceed authorized values, a persistently higher-than-authorized ROR may indicate that utilities tend to overstate expenses or do not pass on improved cost management and operational efficiency gains to ratepayers, preferring to increase returns instead (Grant, 2024).

Return on equity is a subcomponent of ROR and is a measure of the share of revenues collected from ratepayers to compensate the shareholders. In Appendix Section 4, we present trends and discuss authorized and actual return on equity (ROE) of regulated IOUs as well as their parent company that owns them.

2.3. Operations and Maintenance

Operations and maintenance (O&M) expenses are the largest component of IOUs' revenue requirement (California Public Utilities Commission, 2023b). Notably, utilities don't earn a rate of return on O&M expenses. These costs include fuel, purchased power, labor, rent, and capital maintenance, along with wildfire mitigation expenses like vegetation management, network inspection, and repairs. In Fig. 5, we show O&M expenses normalized to the reference year (2010) for California IOUs, with corresponding values for 2010, 2018 (pre-Camp Fire), and 2022 in Table 3. O&M data are taken from FERC Form 1, which documents utilities' expenses as reflected in the financial statements.[3]

Across the three IOUs, generation is the largest share of overall O&M expenses by a factor of four to six. Generation O&M costs include purchased power and fuel, rent, and maintenance expenses for utility-owned generators. Between 2018 and 2022, real generation O&M costs increased for all three IOUs, mirroring a trend seen across IOUs in the western US (Appendix Section 8, Figure A15). While the generation O&M increase for SCE and SDG&E are within historical ranges, expenses peaked for PG&E in 2022. All three IOUs source over 75 % of their power from external purchases, and the increase in expenses is due to rising natural gas and wholesale power prices (California Public Utilities Commission, 2024; Selvans et al., 2024).

T&D O&M costs, though much smaller in magnitude compared to generation O&M, have risen dramatically since 2019. The increase is due to increased vegetation management, liability insurance, and catastrophic event expenses post-wildfire (California Public Utilities Commission, 2024) (Fig. 5). Between 2007 and 2018, T&D O&M expenses are relatively steady for all IOUs despite the growth in network investments, as seen in the rate base trends, and the continued aging of California's century-old electricity grid (California Council on Science and Technology, 2025). However, immediately after the Camp Fire, PG&E increased its T&D O&M expenses by factors of four and five and doubled its expenses on overhead line maintenance expenses (Selvans et al., 2024). Part of this was in response to the California PUC's Safety and Enforcement Division report which noted inadequate inspection and maintenance of PG&E's transmission facilities in their reports following the Camp Fire (Brekke, 2024, California Public Utilities Commission, 2019). Increased T&D O&M during wildfires were previously seen in Southern California between 2003 and 2007 (Keeley et al., 2013). In 2003, SDG&E transmission O&M increased 80 % compared to 2002 levels, climbing further to 3 times their 2002 levels in 2006 before declining to historical ranges by 2007, and have since remained relatively constant. We present a longer time series of SDG&E T&D O&M

[3] FERC Form 1 is a financial and operating report where major IOUs of the United States report their costs, sales, demand, and customer counts annually for market oversight, financial audits, and electric rate regulation (Federal Energy Regulatory Commission, 2024). We use FERC Form 1 data collected by the Catalyst Cooperative as part of the Public Utilities Data Liberation (PUDL) project (Catalyst Cooperative, 2024; Selvans et al., 2024). In this paper, we use Schedule 320 of Form 1 corresponding to operation and maintenance costs of IOUs.

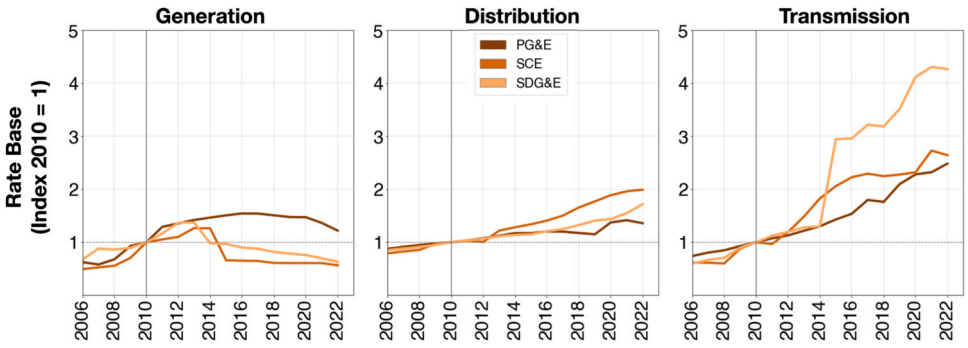

Fig. 3. Ratio of rate base (in 2022$) for the three IOUs in generation, distribution, and transmission of a year to rate base (in 2022$) of the reference year (2010). *Source: California Public Utilities Commission Historical Electric Cost Data (*California Public Utilities Commission, 2024b*).*

Table 2
Generation, Distribution, and Transmission rate base (in billions, $2022).

Utility	Year	Generation	Distribution	Transmission	Sum
PGE	2010	4.0	13.5	4.5	22.0
	2018	6.1	15.8	8.0	29.8
	2022	4.9	18.3	11.2	34.4
SCE	2010	4.2	13.8	2.8	20.8
	2018	2.6	22.9	6.2	31.7
	2022	2.4	27.6	7.3	37.2
SDG&E	2010	0.9	3.4	1.2	5.4
	2018	0.7	4.5	3.7	8.9
	2022	0.6	5.8	5.0	11.3

Source: California Public Utilities Commission Historical Electric Cost Data (California Public Utilities Commission, 2024b)

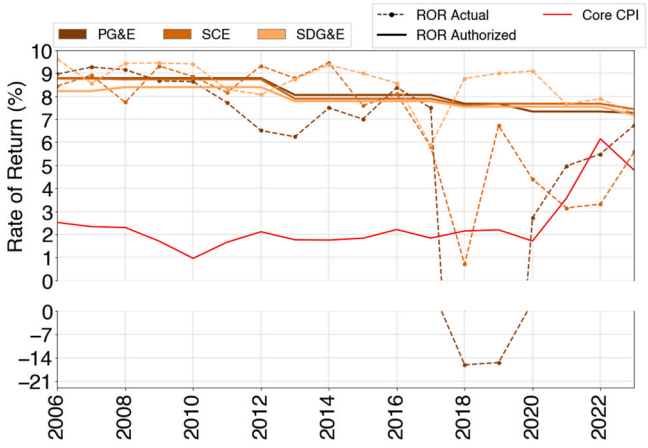

Fig. 4. Authorized and actual rate of return for three California IOUs - PG&E, SCE, and SDG&E and Core Consumer Price Index. Source: CPUC Historical Electric Cost Data and Core CPI from US Bureau of Labor Statistics (U.S. Bureau of Labor Statistics, 2024; California Public Utilities Commission, 2024c).

expenses in the Appendix Section 10, Figure A18.

To contextualize these sharp O&M expenses in California's IOUs, we also analyzed other IOUs active in the western US: Arizona Public Service, Portland General Electric Company, Nevada Power Company, and Idaho Power Company, which serve neighboring states (Appendix Section 8, Figure A14). All utilities except Portland General Electric show relatively stable distribution O&M compared to their 2010 values. Portland General Electric, which also faces high wildfire threats, has consistently increased its distribution O&M expenses since 2010, more than doubling them by 2023. For transmission O&M, the Nevada Power Company is an exception, having increased its expenses after 2012,[4] while all other IOUs have shown transmission O&M trends similar to SCE and SDG&E since 2006.

The sharp spikes followed by steady expenses in California IOUs' T&D O&M—in 2019 for PG&E and between 2003 and 2007 for SDG&E—suggest that O&M expenses for the network infrastructure often respond to heightened wildfire activity or regulatory enforcements, rather than representing a continued effort to maintain a growing and aging grid. As shown in Fig. 6, areas most susceptible to wildfires almost entirely lie in IOU territories,[5] making their wildfire mitigation practices and operations and maintenance of the network infrastructure crucial from both resilience and affordability perspectives.

Depreciation and taxes are the two remaining components of the IOU revenue requirement. IOUs initially finance capital investments but spread out the impact to ratepayers over their useful lifetime through the annual recovery of depreciation costs. Between 2012 and 2022, combined generation and distribution depreciation increased by 26 % in real terms to almost $5 billion on generation and distribution depreciation in 2023 (PG&E $2.4 billion, SCE $2.1 billion, and SDG&E $0.4 billion) (California Public Utilities Commission, 2024). This is similar in magnitude to the returns earned on the rate base of roughly $4.5 billion (PG&E $1.7 billion, SCE $2.3 billion, and SDG&E $0.4 billion) (California Public Utilities Commission, 2023b). As network capital expenses rise, depreciation will continue to grow. The revenue requirement also includes various taxes, such as property and income taxes.[6] Taxes on generation and distribution have declined by 38 % in real terms since 2012 and are the smallest component of revenue requirement (California Public Utilities Commission, 2024). In 2023, the

[4] Nevada Power Company's transmission operation expenses on rent jumped from $3.4 million to $80.8 million (in real 2022$) between 2013 and 2014, accounting for the spike observed. While determining the cause of this spike is beyond the scope of this paper, an increase in rent seems highly unlikely to be wildfire related (Selvans et al., 2024).

[5] Although Trinity Public Utilities District (TPUD) and Lassen Municipal Utility District (LMUD) are POUs located in Tier 2 fire threat areas, together they serve under 20,000 customers, or just about 0.1 % of California's total load. We therefore consider them minor with respect to the broader statewide challenges of rising expenses and affordability (California Energy Commission, 2024b; Lassen Municipal Utility District, 2024)

[6] Certain taxes, such as property and income taxes payable by utilities, are included in the revenue requirement, and are not explicit line items on customer bills. Certain other taxes, namely utility users taxes set by local governments and the California Energy Commission Tax, are payable by customers, and are shown explicitly on customer bills (Pacific Gas & Electric Company, 2024c).

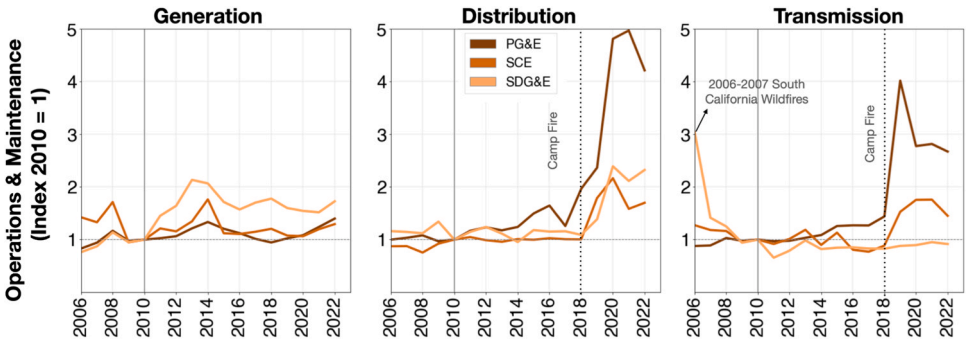

Fig. 5. California IOUs' generation, distribution, and transmission operation and maintenance costs. The figure shows the ratio of a year's real costs (in 2022$) to that of a reference year (2010). Source: FERC Form 1 data via PUDL (Selvans et al, 2024).

Table 3
Generation, Distribution, and Transmission Operations and Maintenance costs (billions of $2022).

Utility	Year	Generation	Distribution	Transmission	Sum
PGE	2010	5.78	0.28	0.67	6.73
	2018	5.47	0.40	1.32	7.19
	2022	8.10	0.74	2.84	11.68
SCE	2010	5.17	0.34	0.61	6.11
	2018	6.23	0.30	0.61	7.13
	2022	6.69	0.49	1.03	8.21
SDG&E	2010	1.31	0.12	0.15	1.58
	2018	2.34	0.10	0.16	2.60
	2022	2.27	0.11	0.34	2.72

Source: FERC Form 1 data via PUDL (Selvans et al., 2024)

IOUs recovered roughly $1.5 billion on taxes as part of the revenue requirement (PG&E $0.6 billion, SCE $0.8 billion, and SDG&E $0.2 billion) (California Public Utilities Commission, 2023b).

3. Trends in Costs for California's Publicly Owned Utilities

POUs are non-profit entities owned and operated by cities, municipalities, and irrigation districts.[7] Their expenses and electricity rates are decided considering each territory's strategic priorities after public feedback and are outside the regulatory purview of the PUC. While POUs do not use precise revenue requirement formulations as used for IOUs, they must still adhere to their internal governance rules when setting their electricity rates.

This section analyzes the two largest POUs in the state, the Sacramento Municipal Utility District (SMUD) and the Los Angeles Department of Water and Power (LADWP). In 2022, SMUD served approximately 650,000 customers throughout the Sacramento area, while LADWP served approximately 1.4 million customers in the greater Los Angeles region and Owens Valley (Los Angeles Department of Water and Power, 2024b; Sacramento Municipal Utility District, 2024c). The combined load of SMUD (10 terawatt-hours) and LADWP (22 terawatt-hours) is approximately equal to half of the entire POU load served in California and slightly larger than PG&E's bundled service load, although SMUD and LADWP service far smaller territories in comparison (U.S. Energy Information Administration, 2023). We present capital, operations, and maintenance expenses for SMUD and LADWP to understand their cost drivers and possible sources of rate divergence relative to IOUs. We also present 2018 and 2023 depreciable utility plant and operation and maintenance expenses data for two smaller, non-urban POUs, facing different challenges than SMUD and LADWP: Lassen Municipal Utility District, which lies in Tier 2 wildfire threat areas, and Imperial Irrigation District (IID), servicing the water and power needs of the Imperial and Coachella Valleys (Appendix Section 9).

3.1. Depreciable utility plant

The depreciable utility plant is the total property, plant, and equipment assets a POU owns to service its generation, distribution, and transmission needs. It serves as an indicator of POU capital costs and does not include accumulated depreciation. Fig. 7 and Table 4 provide trends and values of generation, distribution, and transmission utility plant in service (in real terms).

While the magnitude of the three POUs' depreciable utility plant differs from that of IOUs' rate base, the trends are directionally similar: POU generation assets have declined or remained relatively constant, and their network infrastructure investments have grown. The total depreciable utility plant for the two POUs has grown by 37 % in real terms since 2010, primarily driven by a 47 % increase in the distribution rate base, the largest component across all POUs. Since 2010, distribution assets have increased roughly 50 % for LADWP and 20 % for SMUD, and transmission assets have almost doubled for both the POUs.

3.2. Operations and Maintenance

POUs incur operational and maintenance costs for their infrastructure. Expenses to purchase and produce power are the largest component of LADWP and SMUD O&M costs, accounting for approximately 45 % of the total (Audited Financial Statements and Los Angeles Department of Water and Power, 2024; Sacramento Municipal Utility District, 2024). Fig. 8 and Table 5 show O&M trends and values for LADWP and SMUD. We present a combined O&M expense value due to a lack of disaggregation by generation, distribution, and transmission in their financial statements. POU O&M costs have increased modestly between 2010 and 2023, with an increase of 9 % for LADWP and under 10 % for SMUD. For SMUD, the 2008 spike was due to high wholesale prices and increased electricity consumption (Sacramento Municipal Utility District, 2008), and the recent 2022 increase was due to an unplanned outage of SMUD's Cosumnes Power Plant, which temporarily forced it to rely on more expensive purchased power (Sacramento Municipal Utility District, 2024d). In contrast, in the same period, IOU's overall O&M expenses have increased by ~35 % (SCE) and more than 70 % (SDG&E and PG&E). POU O&M expenses may remain relatively constant due to limited exposure to high-fire threat districts: SMUD does not serve any high-fire threat areas, but LADWP has some Tier 2 territory in the Los Angeles hills and Owens Valley (Fig. 7).

[7] POUs are "non-profit" in contrast to IOUs, which earn returns for their shareholders. It is important to note, however, that some POUs can and do transfer money to the local governments that own them. For example, LADWP transferred approximately $230 million to the reserve fund of the City of Los Angeles in 2023 ("Audited Financial Statements and Los Angeles Department of Water and Power.", 2024).

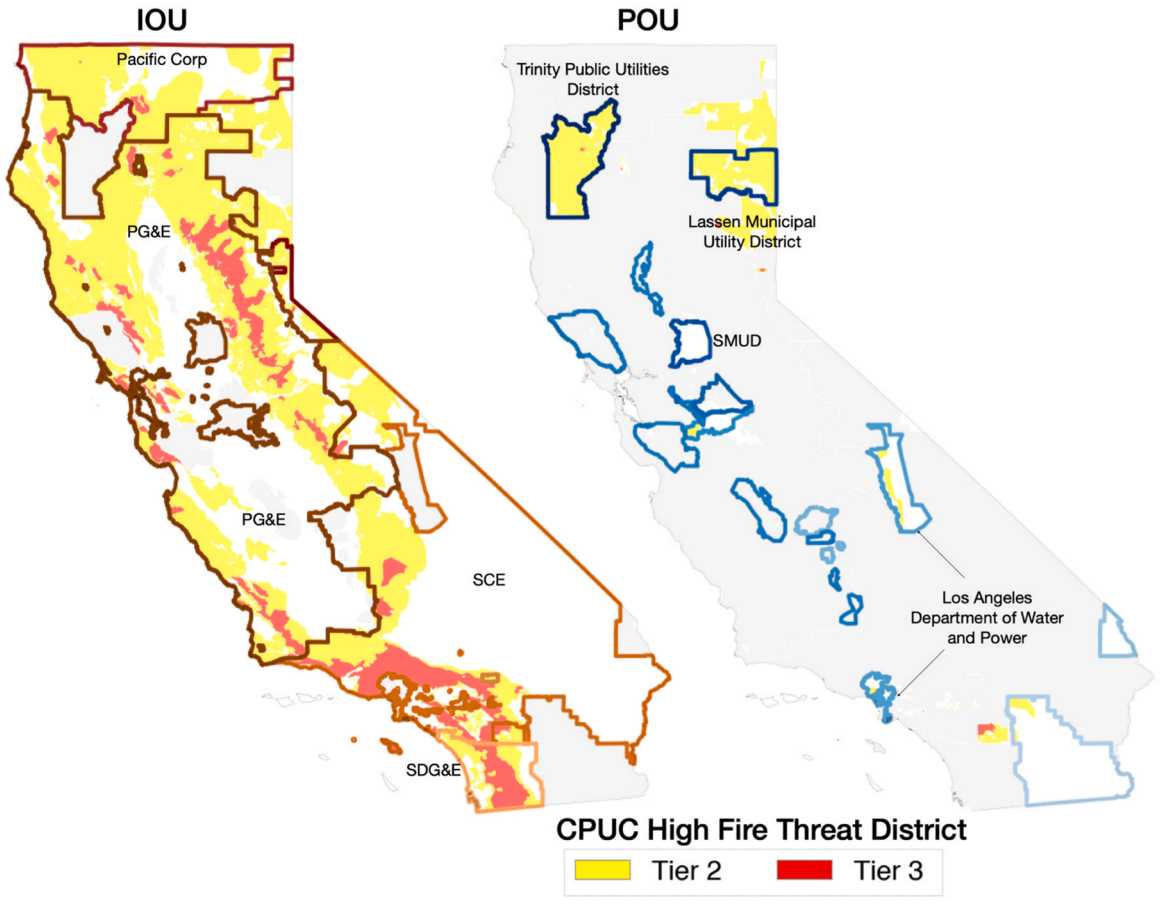

Fig. 6. High fire threat districts in IOU and POU territories. Fire threat districts are outlined based on the "likelihood and potential impacts on people and property from utility-related wildfires." Tier 2 denotes higher risk, while Tier 3 denotes extreme risk. Source: CPUC Fire Threat Maps (California Public Utilities Commission, 2024d) and California Energy Commission GIS open data (California Energy Commission, 2024a).

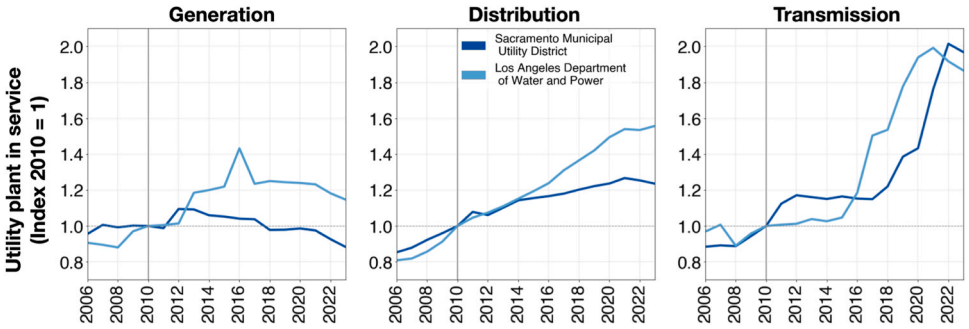

Fig. 7. Generation, distribution, and transmission depreciable utility plant assets of LADWP and SMUD. The figure shows the ratio of a year's real costs (in 2022$) to the real costs of the reference year (2010). Source: Annual financial statements of SMUD and LADWP (Audited Financial Statements and Los Angeles Department of Water and Power, 2024; Sacramento Municipal Utility District, 2024).

4. Relationship between IOU and CCA Rate Increases

The third type of power provider of interest are community choice aggregators (CCAs). CCAs procure power through wholesale markets and independent power providers but use IOU distribution and transmission infrastructure to deliver electricity to consumers (Desert Community Energy, 2024). While many CCAs positioned themselves as an alternative to the IOUs, their ability to offer customers substantial bill savings is limited. A CCA can set its generation charges but is assessed the same transmission and distribution charges as its parent IOU. As Fig. 9 shows, network costs form a large portion of the overall rate charged to the customer, so the T&D drivers of price increases discussed in the previous sections equally apply to IOU and CCA customers (Pacific Gas & Electric Company, 2024; San Diego Gas & Electric, 2024c; Southern California Edison, 2024b). CCAs will only be insulated from overall price increases if their generation cost savings—the only thing they control—are large enough to offset T&D hikes.

However, CCA rates also diverge from IOU rates with respect to a surcharge they must pay through a mechanism known as the Power Charge Indifference Adjustment (PCIA). When large swaths of residential load departed IOUs for CCA service, IOUs had already procured generation resources to serve those customers, and losing those customers' generation revenue would subsequently cause a cost shift onto the remaining IOU customers. The PCIA is determined by the CPUC

Table 4
Generation, Distribution, and Transmission depreciable utility plant assets of SMUD and LADWP (billions of $2022).

Utility	Year	Generation	Distribution	Transmission	Sum
SMUD	2010	1.91	2.22	0.32	4.44
	2018	1.86	2.67	0.38	4.92
	2022	1.77	2.79	0.63	5.19
LADWP	2010	5.41	7.51	1.22	14.14
	2018	6.76	10.25	1.88	18.89
	2022	6.39	11.52	2.35	20.25

Source: Annual financial statements of SMUD and LADWP (Audited Financial Statements | Los Angeles Department of Water and Power, 2024; Sacramento Municipal Utility District, 2024d)

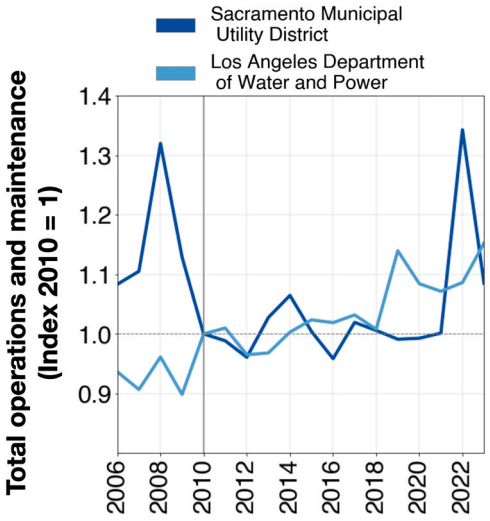

Fig. 8. Total operations and maintenance costs for LADWP and SMUD. The figure shows the ratio of a year's real costs (in 2022$) to the real costs of the reference year (2010)—source: Annual financial statements of SMUD and LADWP.

Table 5
Total operations & maintenance costs of selected POUs (billions of $2022).

Utility	Year	Total O&M
SMUD	2010	1.54
	2018	1.55
	2022	2.07
LADWP	2010	3.49
	2018	3.52
	2022	3.79

Source: Annual financial statements of SMUD and LADWP (Audited Financial Statements and Los Angeles Department of Water and Power, 2024; Sacramento Municipal Utility District, 2024)

through a dedicated regulatory proceeding and is meant to be set at such a level as to offset this adverse effect (California Public Utilities Commission, 2024e). Then, a CCA's net savings will be the generation procurement savings minus the PCIA charge. A relatively high PCIA and/or small-generation procurement savings may even result in a CCA customer paying more than an IOU customer.

For California's two largest CCAs, MCE and CPA, Fig. 9 contextualizes the magnitude of network charges, generation charges, and PCIA fees using data from Joint Rate Comparison mailers produced by IOUs and CCAs. While these CCAs consistently offer lower generation rates than their parent IOUs, the PCIA often ends up being approximately equal to the difference in generation costs between the IOU and CCA, rendering total rates very similar. As IOU rates continue to rise, driven by T&D costs, CCA rates will likely follow a similar trend.

5. Conclusion

Rising electricity prices have become a high-priority concern for policymakers and consumers alike in California. While prices are high and rapidly increasing in IOU and CCA territories, they remain low in POU territories. Our study identifies drivers of rising utility costs in a system simultaneously facing the triple challenges of affordability, decarbonization, and resilience. The state has ambitious renewable energy integration and electrification goals and faces mounting pressure to harden the grid against wildfires.

Across all power providers, trends for capital investments are directionally similar: a flattening or reduction in generation assets and an increase in T&D assets. Since 2018, the IOU generation rate base has declined by 7–23 %, and the POU generation utility plant in service declined by 8–9 %, as most utilities moved to procure power from the wholesale markets instead of self-generation. Utilities' expenses on generation—largely driven by purchased power—show mixed trends. While generation O&M increased for PG&E by 48 %, it remained relatively flat for SCE (7 % increase) and SDG&E (3 % decrease) compared to their 2018 expenses.

Network costs, on the other hand, have been the important drivers of overall utility costs. In real terms, T&D capital assets have increased for all utilities since 2018 (PG&E 24 %, SCE 20 %, SDG&E 32 %, SMUD 12 %, and LADWP 14 %). However, expenses related to operations and maintenance have diverged sharply, particularly in the years following wildfires. Between 2018 and 2022, PG&E's total O&M expenses increased by more than 100 %, with a five-fold increase in O&M expenses for distribution and a four-fold increase in transmission. For SCE and SDG&E, T&D O&M costs increased by 67 % and 73 % in the same time frame. In contrast, overall O&M expenses of POUs have increased by less than 15 % since 2018. We also show that in some cases, IOU network O&M expenses increased significantly during wildfires or due to regulatory enforcements but have remained relatively stable in other years. Expenses for network infrastructure and wildfire mitigation—capital investments in grid hardening, maintenance costs of overhead lines, and vegetation management—will continue to be a source of increasing costs for a growing and aging grid and a possible source of divergence between POU and non-POU costs.

Despite this increase in IOU T&D expenses, the trend for IOU profits in the aftermath of wildfires is somewhat more complex. The ROR has trended downward over time, and PG&E even reported a negative ROR in the years following the Camp Fire. Historical evidence from SDG&E suggests that one possible outcome is the strong recovery of returns and a temporary spike in O&M expenditures. Indeed, PG&E's returns appear to have already returned to previous ranges; more time is needed to determine whether PG&E's O&M expenses will remain high.

Finally, though our work confirms that POUs have tended to be insulated from such severe cost increases, our findings should not be taken to imply that municipalization itself will necessarily relieve bill pressure. POU territories have historically experienced fewer wildfires. However, as demonstrated by the January 2025 wildfires in Los Angeles, this pattern may be shifting—potentially leading to increased upward pressure on LADWP rates. The case of CCAs shows that even under a (partial) public nonprofit structure, exposure to wildfire hardening costs will result in upward pressure on bills. CCAs also reach price parity with IOUs due to the PCIA exit fees levied on them.

A useful direction for future study would be to formally quantify the impact of a public vs. private governance model alongside the importance of many other factors, such as vertical integration, a more concentrated service territory, and a lack of HFTDs (as shown in Fig. 7).

Research data

Data referenced in this paper are available in an online repository (Singh et al., 2025a).

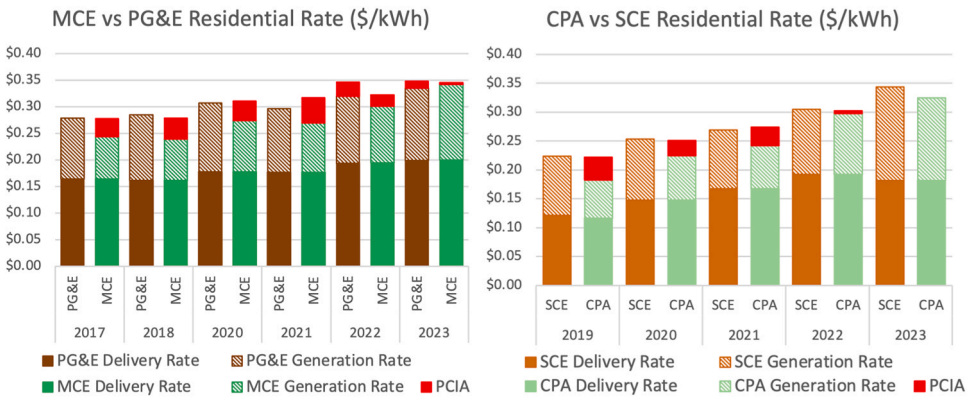

Fig. 9. Comparison of the average residential rate, by component, faced by CCA customers versus the rate charged to IOU customers in the same geographic service territory.[8] The left panel compares MCE with PG&E, while the right panel compares CPA with SCE. Values are shown in real 2022 dollars. Source: Joint Rate Comparisons prepared by CCAs and IOUs (Pacific Gas & Electric Company, 2024; San Diego Gas & Electric, 2024c; Southern California Edison, 2024b).

[8] As of 2022, PG&E has started separately reporting the PCIA charged to their bundled customers. This charge was previously part of their generation component of rates. The PCIA charged to PG&E customers in 2022 and 2023 was larger than the PCIA charged to the CCA customers.

CRediT authorship contribution statement

Singh Madalsa: Writing – review & editing, Writing – original draft, Formal analysis, Data curation, Conceptualization. **Sud Rayan:** Writing – review & editing, Data curation, Conceptualization. **Ong Alison:** Writing – review & editing, Writing – original draft, Formal analysis, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.tej.2025.107475.

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