California Public
Utilities Commission

UTILITY COSTS AND AFFORDABILITY OF THE GRID OF THE FUTURE

An Overview of White Paper Observations

CPUC En Banc Hearing | February 24, 2021

Primary Narratives to Inform Today's En Banc Hearing

- ❖ Household energy costs and rates are rising and disproportionately impacting affordability for low- to moderate-income Californians in hotter climate zones.
- ❖ Bundled residential rates began outstripping inflation in 2013, and our IOUs are gradually climbing the national rankings relative to other utilities as their average residential bills increase year over year.
- ❖ Transmission and Distribution rate base has accelerated in recent years. The resulting rate impacts are exacerbated by substantial wildfire mitigation plan costs and higher than national average returns on equity (ROE).
- ❖ NEM and DER customers are disproportionately wealthier homeowners that are able to arbitrage rates and reduce bill impacts by investing in solar PV, storage technologies, electric vehicles, and other behind-the-meter (BTM) solutions.
- ❖ Conversely, lower-income customers are less likely to participate in BTM offerings and more likely to pay for incremental costs displaced by BTM customers.
- ❖ Electrification can lead to lower household energy costs, however, the up-front investments in EVs and other DERs for lower-income Californians may be a barrier to participation.

White Paper Summary Highlights

- **The paper describes a 10-year (2021 – 2030) bundled residential rate forecast that demonstrates increasing trends in costs and rates (derived from 2020 rates).**
  - **PG&E**: $0.240 to $0.329, or about an annual average increase of 3.7%
  - **SCE**: $0.217 to $0.293, or about an annual average increase of 3.5%
  - **SDG&E**: $0.302 to $0.443, or about an annual average increase of 4.7%

- **There are several critical areas to actively manage over the next decade to ensure that rates and bills remain affordable for our most vulnerable customers.**
  - Capital additions and rate base (transmission and distribution) are accelerating and need stringent review for reasonableness, prudence, and timelines for recovery.
  - Wildfire Mitigation Planning costs hold a significant rate impact.
  - The Distributed Energy Resources (DER) marketplace is rapidly maturing and can lead to cost shifts that harm non-participants if benefits are not fully realized.
    - More research and examination is needed to understand how DER system efficiencies / revenue savings might be accounted for to offset some of these added costs.

Cost and Rate Tracking Tools and Rates Forecast Modeling

- PG&E's, SCE's, and SDG&E's current **Cost and Rate Tracking Tools (CRTs)** were used as the foundation for this special-purpose bundled residential 10-year rates forecast.
- California Energy Commission (CEC) **IOU service area rates** were used to derive preliminary bundled residential rates that were used as inputs in the rates forecast modeling.
- The bundled residential rates forecast was then used as an input to a consultant-developed **Residential Energy Cost Calculator (RECC)** tool.

CRT Rates Inputs

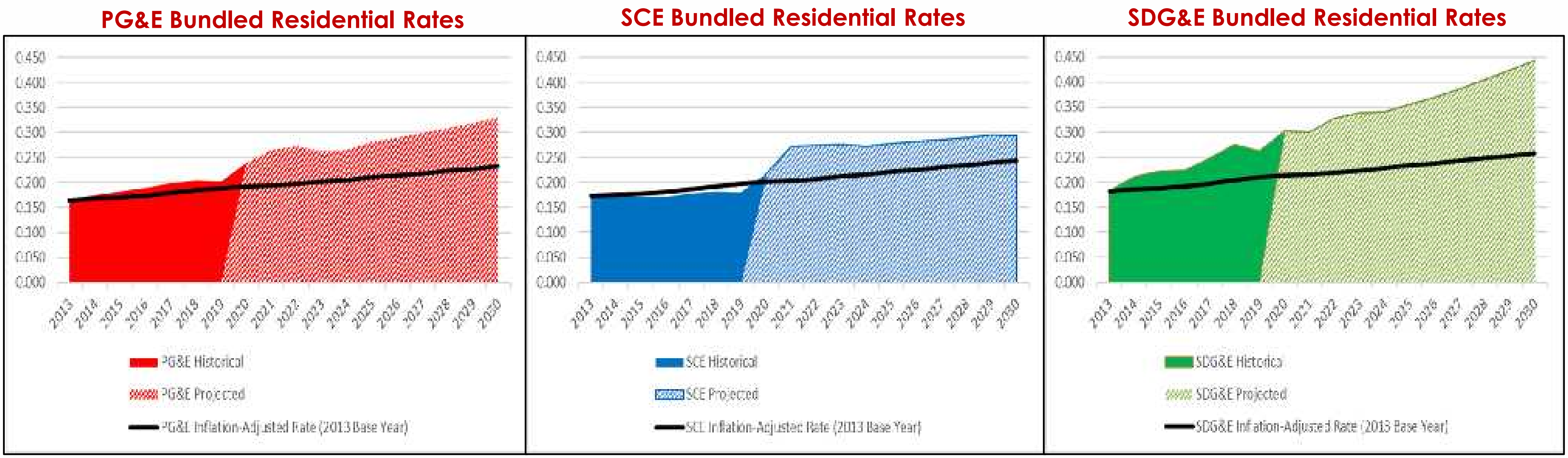
- ➢ The CRT produces rates based on modeled comprehensive forecasted revenue requirement and sales data, as updated quarterly by the electric IOUs.
- ➢ 2021 – 2023 forecasted bundled residential rates are simple volumetric rates from the most recent CRTs, adjusted to remove the California Climate Credit.

CEC Rates Inputs

- ➢ CEC escalation factors used in producing IOU service area residential rates were used to escalate 2025 – 2030 revenue requirements, after 2024 level-setting by selecting the higher of CRT or CEC-derived preliminary revenue requirements.
- ➢ 2030 sales forecasts were set to CEC-derived preliminary bundled residential sales forecasts and then interpolated between 2023 and 2030 sales forecasts.

Historical and Projected Rate Trends Relative to Inflation

- By 2030, bundled residential rates are forecasted to be approximately **40% (PG&E), 20% (SCE), and 70% (SDG&E) higher** than they would have been if 2013 rates for each IOU had grown at the rate of inflation.
- Rates tracked inflation historically, but this changed starting in 2013 as rate increases accelerated for PG&E and SDG&E.



- 2013 – 2019 rates effective January 1 include California Climate Credit
- 2020 actual and 2021 – 2030 projected rates as of yearend and do not include California Climate Credit
- Rates are intended solely to facilitate discussion related to this white paper and are not to be used for any other purpose.

Rate Base and Return on Rate Base

- IOU rate base is the value of the company's undepreciated assets and provides a basis for computing rates of return, calculated as **capital additions (capex) net of accumulated depreciation**.
- Return on rate base, which primarily reflects the opportunity for the IOU to earn a profit, has **been increasing at an annual average rate of about 5% to 7% since 2016**, with larger increases for PG&E and SCE from 2019 to 2020 than seen in previous years.
- The ROR figures below are based on California and FERC jurisdictional rate base.

Return on Rate Base ($ billions)						
	PG&E	**Δ %**	**SCE**	**Δ %**	**SDG&E**	**Δ %**
2016	$1.95	-	$1.85	-	$0.55	-
2017	$2.00	2.6%	$1.99	7.6%	$0.60	9.1%
2018	$2.07	3.5%	$2.03	2.0%	$0.58	-3.3%
2019	$2.07	0.0%	$2.04	0.5%	$0.62	6.9%
2020	$2.37	14.5%	$2.44	19.6%	$0.66	6.5%
Annual Average Δ		**5.1%**	**-**	**7.4%**	**-**	**4.8%**

Current IOU Cost of Capital and Rate of Return

- The CPUC establishes capital structure for each utility by setting the percentages of long-term debt, preferred stock, and common stock to total capital that the utility should hold.
- Establishes the **authorized ROR** based on the authorized capital structure, return to long-term debt, return to preferred stock, and ROE.
- **PG&E**: 0.12% increase in ROR = approximately $46 million in 2020 dollars. 1% increase in ROR = $383 million.

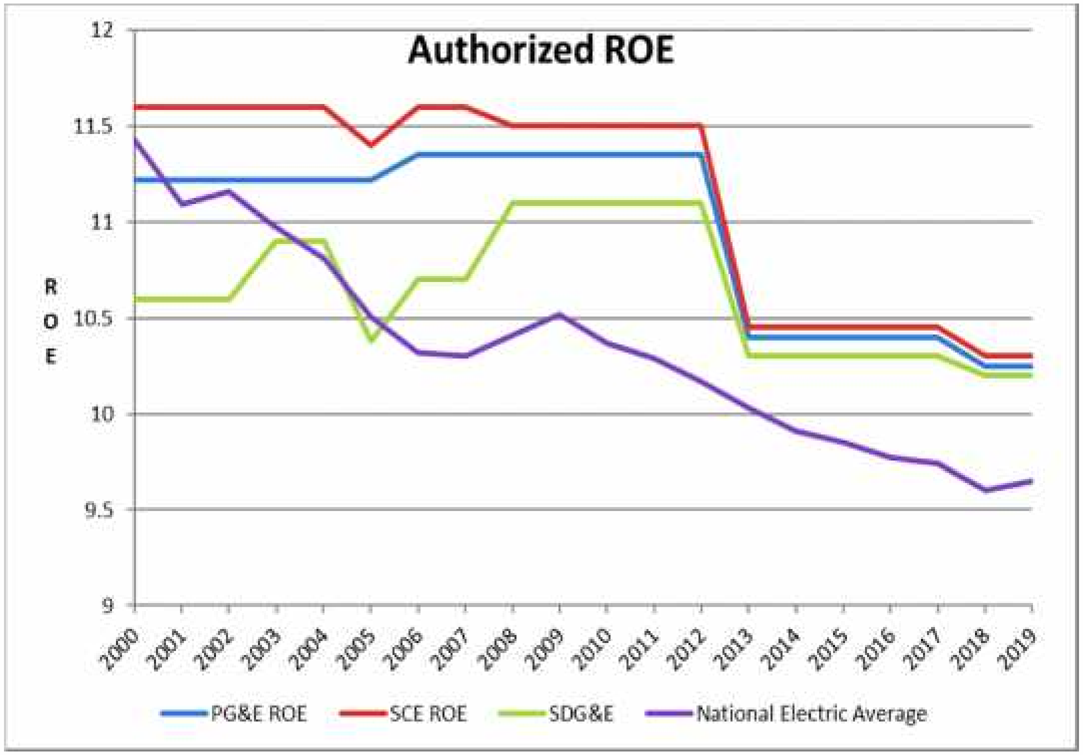
Utility	Cost of Common Stock (ROE)	Cost of Long-term Debt	Cost of Preferred Stock	Overall Cost of Capital (ROR)
SCE	10.30%	4.74%	5.70%	7.68%
PG&E	10.25%	5.16%	5.52%	7.81%
SDG&E	10.20%	4.59%	6.22%	7.55%
SoCalGas	10.05%	4.23%	6.00%	7.30%

California IOUs' Authorized Return on Equity (ROE) Has Been Well Above the National Average

- **The CPUC sets return on equity (ROE)** by estimating expected return on alternative investments of comparable risk in capital markets using financial models.

- IOUs have argued that a higher ROE in California is necessary due to the higher risk of investment and cost recovery. These ROE figures reflect California jurisdictional costs only.

Utility	% Difference in ROE b/w IOUs and Nat'l Average	Impact on Rev Req (million $)
SCE	0.65%	128.85
SDG&E	0.55%	22.49
PG&E	0.60%	125.22

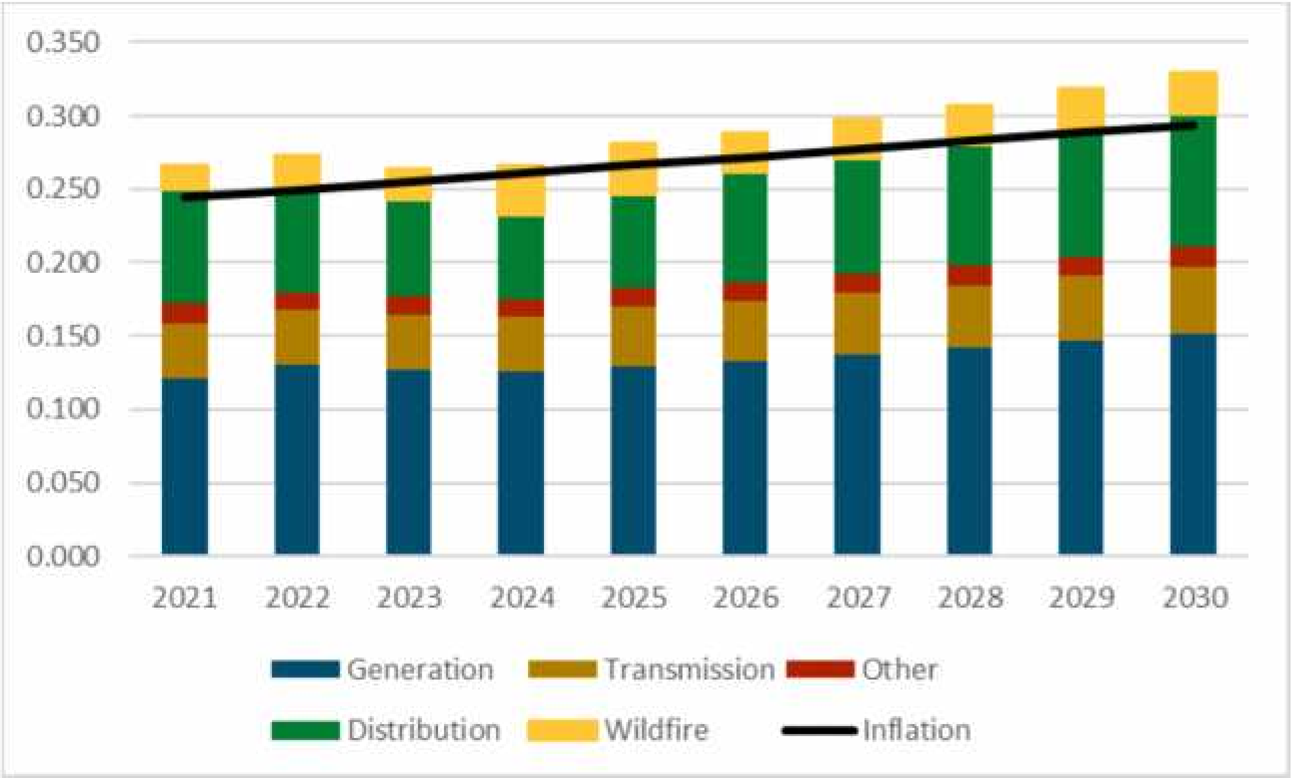


Wildfire Mitigation Scenario: Revenue and Rate Impacts

- We estimated total incremental revenue requirement for a high-cost wildfire scenario (starting in 2023), between 2021 and 2030:
  - **PG&E**: $23.7 billion
  - **SCE:** $17.2 billion
  - **SDG&E**: $ 4.6 billion

- 2021 WMPs were received first week of February. Costs and corresponding revenue requirements are under review.

PG&E Baseline Forecasted Bundled Residential Rates ($ nominal/kWh) Including Wildfire Rate Component



Net Energy Metering and DER Cost Implications

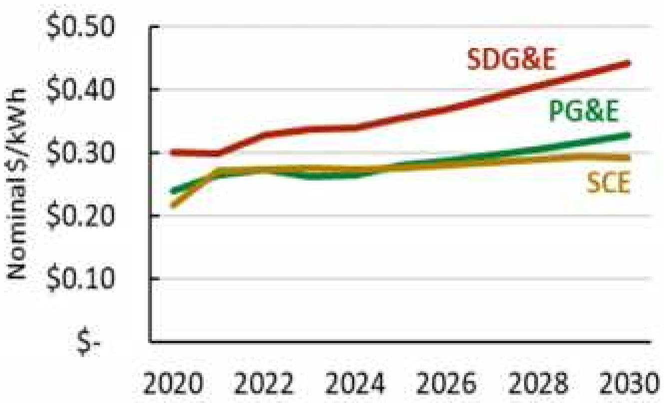
NEM Contributes to Rate Increases

- NEM allows customers with renewable electrical generation facilities to serve onsite energy needs and receive bill credits for surplus energy sent to the electric grid.
- IOUs pay more in NEM bill credits than they would pay elsewhere for the same amount of electricity and other electric grid benefits.
  - **Total Resource Cost (TRC)** test compares benefits and costs to participants and utilities. The statewide weighted average TRC ratio of the NEM 2.0 is **0.84.**
  - **Ratepayer Impact Measure (RIM)** test calculates a resource's impact to ratepayers. The statewide average RIM benefit-cost ratio of the NEM 2.0 population was estimated at **0.37 (increases rates).**

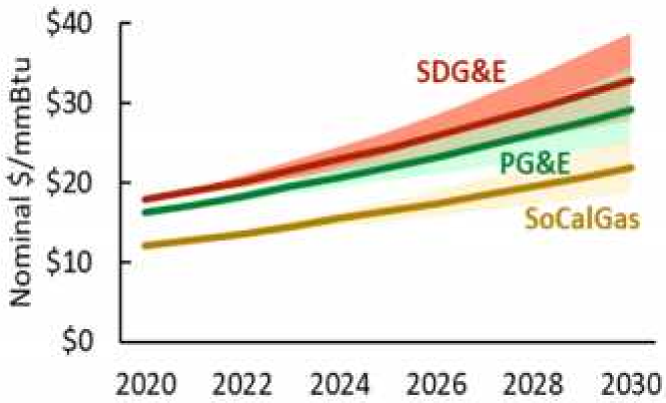
NEM / DER Impacts to Low-income Californians

- NEM and DER customers allow them to arbitrage rate and technology offerings to shift load and avoid higher costs and rates to varying degrees.
- Behind the meter (BTM) investments are made disproportionately by older, located in high-income areas, and likely to own their home.
  - Also increases rates for low-income customers who qualify for California Alternate Rates for Energy (CARE).
- However, long term system benefits of a more robust DER marketplace in incremental decreases in IOU revenue needs need closer study.
  - **Up front DER investments represents a barrier to participation for some lower-income ratepayers.**

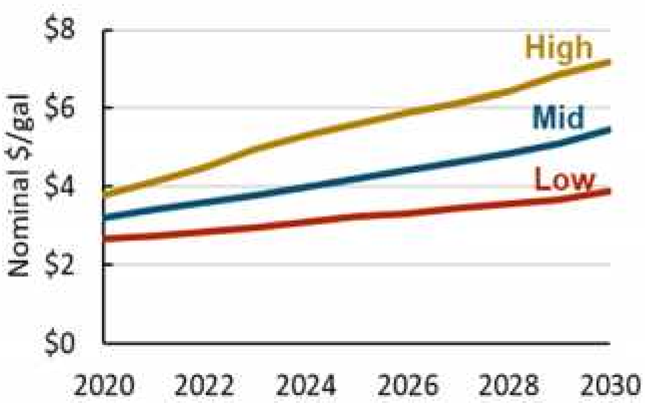
Electric and Gas Rates and Gasoline Prices



IOU Bundled Residential Average Electric Rate Forecast



Residential Natural Gas Rate Forecast

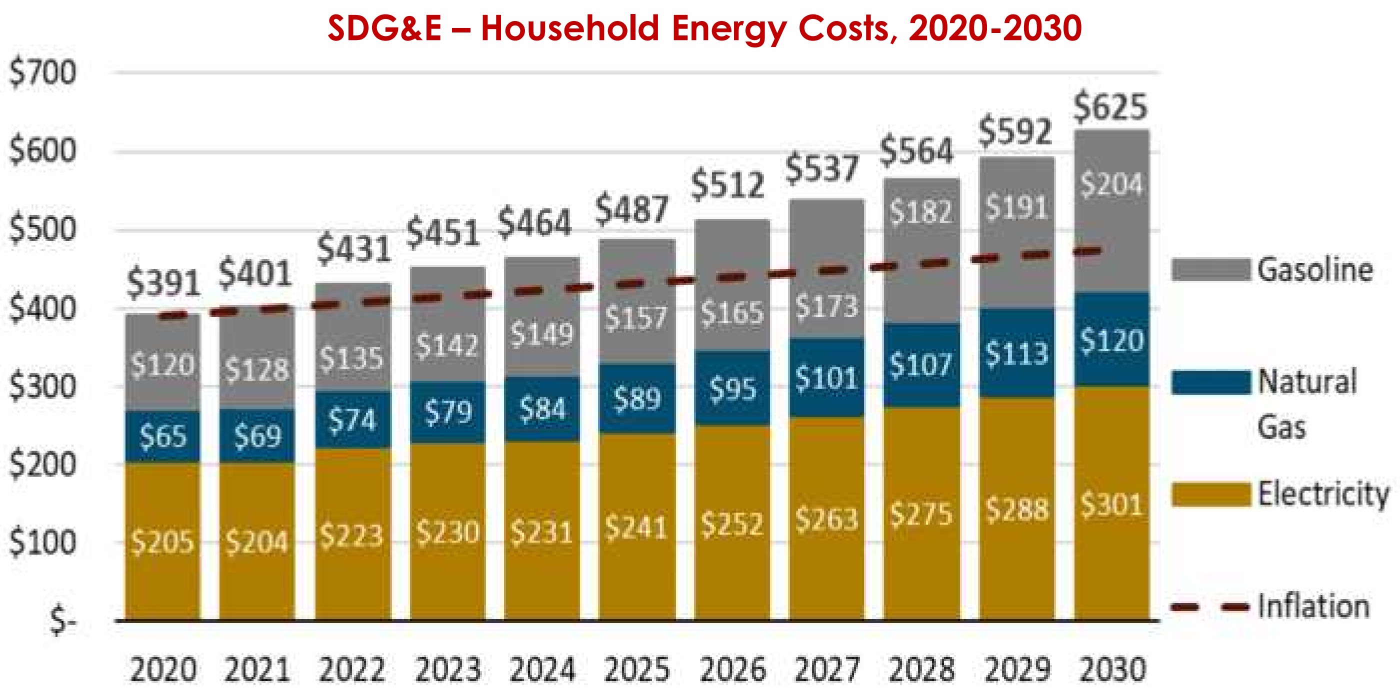


Gasoline Price Forecast

- An accelerating bundled residential electric rate forecast trend for for all three IOUs.
- Gas rate forecasts composed of two components: the commodity rate, and the delivery rate.
- Gasoline price forecast composed of three components: a base price, an adder for California's Cap-and-Trade program, and an adder for the state's Low Carbon Fuel Standard (LCFS).

Household Energy Costs Are Projected to Increasingly Exceed Inflation Over the Next Decade

- An accelerating trend for all three major IOUs.
- SDG&E bundled residential rates and bills are expected to rise more quickly than PG&E and SCE.
- **Main drivers:**
  - kWh sales decline.
  - Load departure.
  - Rate sensitivity to large capital investments due to smaller customer base and lower economies of scale.



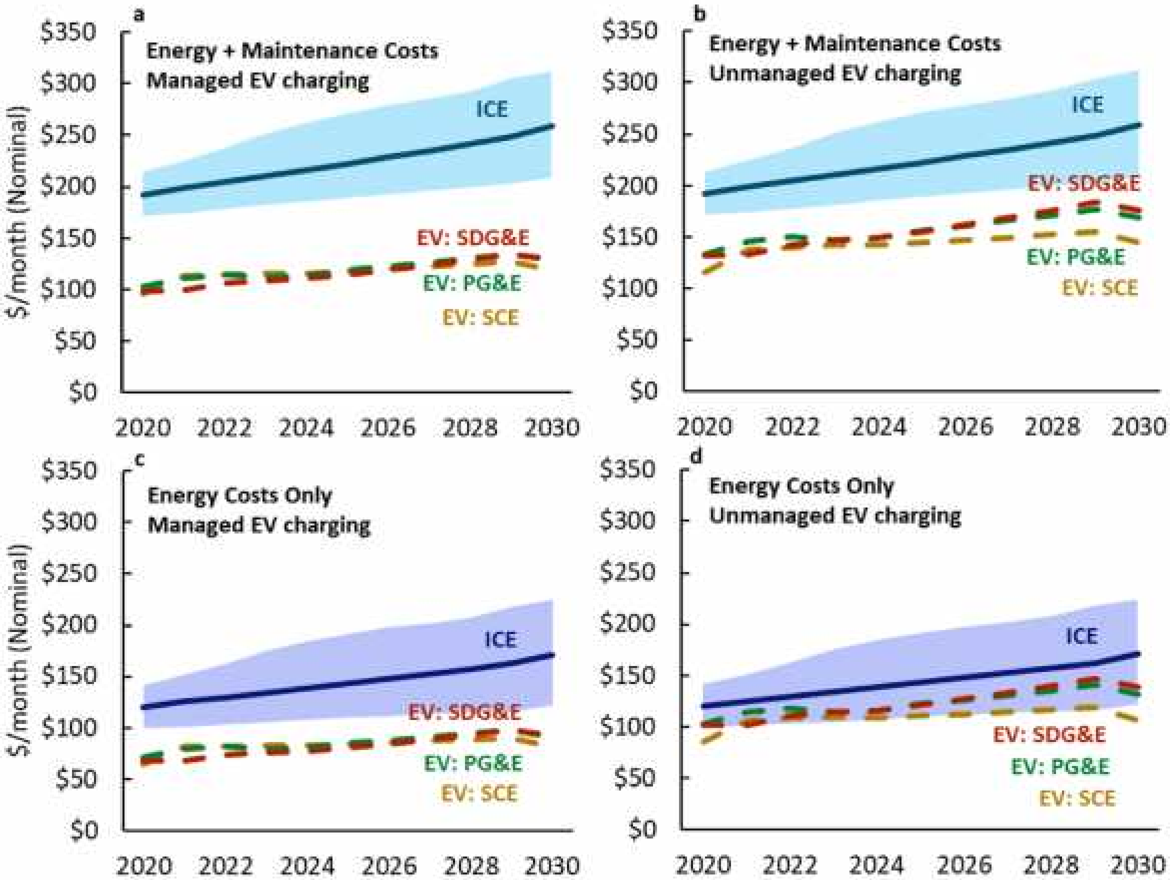
Household Energy Bill Impact Associated With Higher GHG Target

- In the current Integrated Resource Planning (IRP) cycle, CPUC is considering resource plans for two different 2030 electric sector emissions targets: 46 MMT and 38 MMT.
- **A 2030 rate impact of +0.6-0.8 c/kWh** as a result of the stricter GHG target.
  - As a result, a relatively small bill impact associated with the stricter GHG target for all three major IOUs.
- While the impact is larger for the electrified customers, their overall energy costs are considerably lower.

2030 Monthly Energy Costs for a Representative Household With Above Average Energy Use in a Hot Climate Zone on PG&E rates, Comparing 46 MMT and 38 MMT Electric Sector Emissions Targets and With Different Levels of Electrification

Customer Cost-Effectiveness of Vehicle Electrification

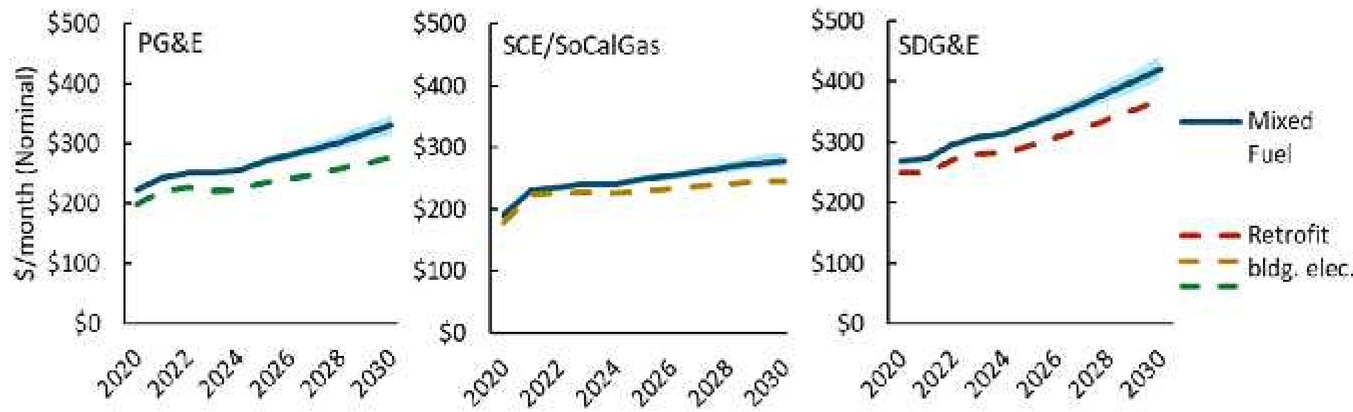
- EV owners see cost savings throughout the decade in all four frameworks under a mid gasoline price forecast.
- Managed charging would enable EV owners to see the highest amount of cost savings.
- In 2030 and compared to an ICE owner (mid gasoline price forecast):
  - EV owners who manage charging are forecast to save $130-$140/month in operating costs (energy plus maintenance costs).
  - Energy cost savings alone:
    - $80-$90/month for EV owners using managed charging.
    - $35-65/month for EV owners using unmanaged charging.



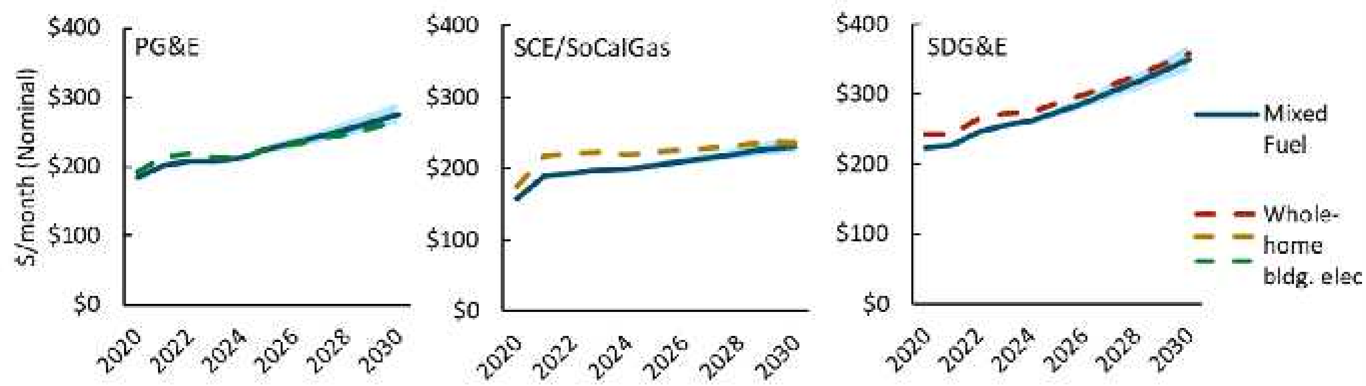
Operating Costs for an ICE Under a Range of Gasoline Price Forecasts and for EVs Assuming Managed and Unmanaged Charging

Customer Cost-Effectiveness of Home Electrification

- Retrofit electrification provides substantial energy cost savings under all three IOU electric and gas rates.
- Energy cost savings will be greater for homes with larger demands for space and water heating.
- Energy costs for mixed-fuel and all-electric homes are likely to be similar over the decade.
    - New homes being more energy-efficient than existing ones.



Monthly Home Energy Bills (Electricity Plus Natural Gas) for a Representative Above Average Energy Usage Home in a Hot Climate Zone Considering Retrofit Electrification of Space and Water Heating



Monthly Energy Bills (Electricity Plus Natural Gas) for a New Mixed-Fuel Home and a New All-Electric Home in a Hot Climate Zone

Impact of High Electrification Scenario on Electric Rates

- The high electrification scenario adds 4.7-5.8 percent to the 2030 revenue requirement (relative to the Reference scenario based on the IEPR Mid Demand case).
- The system average rates would fall by 0.6-0.9c/kWh.
  - 18 TWh of increased retail sales in 2030, corresponding to an 8.5 percent increase in sales.
  - Larger increase in retail sales compared to the increase in costs.
- Residential rates for the three IOUs would fall by 1.4-2.1c/kWh under the *High Electrification* scenario.

Cost component	Unitized cost	Source	2030 Mid cost *(Low-High)*	% of 2030 Rev Req *(Low-High)*
Resource procurement	NA	RESOLVE model	$1.96B	3.8%
Electrification programs	$30/MWh (annual rev req impact)	IOU baseline forecast	$540M *($360M-$720M)*	1.1% *(0.7%-1.4%)*
T&D infrastructure	$60/kW-yr	CA Avoided Cost Calculator, BLS	$110M *($55M-$340M)*	0.2% *(0.1%-0.7%)*
Total	--	--	$2.61B *($2.38B-$2.96B)*	5.1% *(4.7%-5.8%)*

Incremental Costs Associated with High Electrification Scenario

Historical Transmission Cost Trends

- Transmission portion of retail customer's cost (per kWh): PG&E - 16.6%, SCE - 9.1%, SDG&E - 15.1% (percentage of residential rate)
- Increasing Transmission Revenue Requirements (TRR) and Transmission Rate Base.
- TRR driven by increasing Capital Additions, Operations & Maintenance and Administrative & General Expenses for key projects.
  - For instance: increased capacity on certain lines, substation upgrades, renewable transmission, insurance expenses, and IT costs.
- Over the past decade, transmission costs have increased while energy demand decreased.

Transmission Revenue Requirements & Rate Base

- Total TRR increased by 38% from 2016 to 2021.
- Total rate base increased by 38.3%.
- Depending on the rate of depreciation, on average, every dollar put into rate base costs ratepayers at least $3.50 over the life of a transmission asset (as ratepayers finance/amortize these assets over time).

Transmission Revenue Requirements in Settled TO Rate Cases at FERC

Utility	2016	2021	Percentage Change
SDG&E	$ 716 million	$ 1.036 billion	44.7%
SCE	$ 1.092 billion	$ 1.087 billion	-0.5%
PG&E	$ 1.331 billion	$ 2.214 billion	66.3%
Total	**$ 3.139 billion**	**$ 4.336 billion**	**38.1%**

Transmission Rate Base

Utility	2016	2021	Percentage Change
SDG&E	$ 2.896 billion	$ 4.342 billion	49.9%
SCE	$ 5.171 billion	$ 6.428 billion	24.3%
PG&E	$ 5.846 billion	$ 8.476 billion	45.0%
Total	**$ 13.914 billion**	**$ 19.246 billion**	**38.3%**

Increasing Capital Investments

- $2.14 billion in capital additions in 2016; forecasted to be $2.59 billion in 2021 – an approximately 21% increase.
- **FERC incentives add tens of millions of dollars to rates annually.**
- Spending on self-approved projects not (part of the CAISO Transmission Planning Process) accounted for 41% of the $20 billion in capital additions in 2010-2019.
- In 2020 and 2021 capital additions are expected to total $5.3 billion, with approximately 60% being self-approved across all three IOUs.

Transmission Projects in Excess of $500 Million

Project	Original Est. Cost	Actual or Projected Cost	In Service Date	IOU Territory
Sunrise Powerlink	$1.9 billion	$1.9 billion	2012	SDG&E
Devers-Colorado River	$545 million	$775 million	2013	SCE
Tehachapi Renewable Transmission Project	$1.7 billion	$3.062 billion	2016	SCE
West of Devers Conductor Upgrade	$955 million	$799 million	2021	SCE
Ivanpah-Control Transmission Line Rating Remediation	Not available	$703 million	2026	SCE
Riverside Transmission Reliability Project	$48 million	$584 million	2026	SCE

CAISO-approved and Utility Self-approved Projects 2010-2019

Utility	Self-approved Projects	CAISO-approved Projects	Total Capital Additions	Percentage Self-approved	Percentage CAISO-approved
SDG&E	$ 0.81 billion	$ 3.99 billion	$ 4.80 billion	16.9%	83.1%
SCE	$ 1.18 billion	$ 5.08 billion	$ 6.26 billion	18.9%	81.1%
PG&E	$ 6.16 billion	$ 2.77 billion	$ 8.93 billion	69.0%	31.0%
Total	**$ 8.15 billion**	**$11.84 billion**	**$19.99 billion**	**40.8%**	**59.2%**

O&M and A&G Expenses

- Operations & Maintenance Expenses increased by almost 80% between 2016 and 2021.
  - operational expense related to the transmission system that is not a capital expense, depreciation, or taxes
- Administrative & General Expenses, which tend to be the most variable cost category, have increased by 29%.
  - For example, wages/salaries of employees providing accounting, Human Resources, and legal services; IT and insurance

Operations & Maintenance Expenses

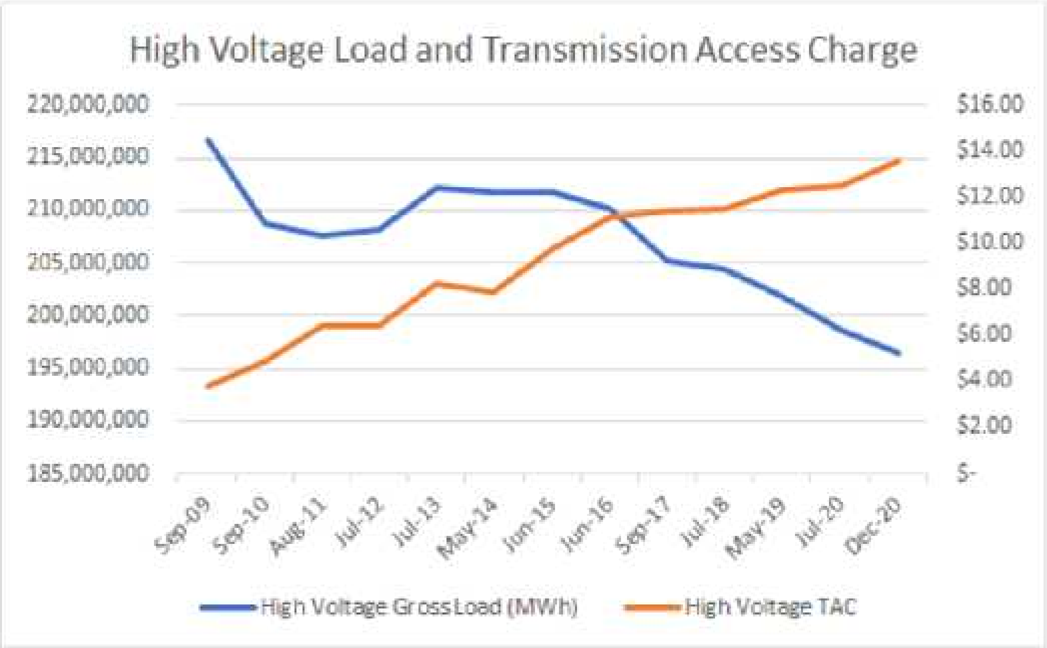
Utility	2016	2021	Percentage Change
SDG&E	$ 62.5 million	$ 85.6 million	37.0%
SCE	$ 93.5 million	$ 110.9 million	18.6%
PG&E	$ 219.5 million	$ 478.1 million	117.8%
Total	**$ 375.5 million**	**$ 674.6 million**	**79.7%**

Administrative & General Expenses

Utility	2016	2021	Percentage Change
SDG&E	$ 79.9 million	$ 70.0 million	-12.4%
SCE	$ 49.7 million	$ 81.8 million	64.5%
PG&E	$ 73.6 million	$ 111.1 million	50.9%
Total	**$ 203.2 million**	**$ 262.8 million**	**29.3%**

Increasing TAC and Decreasing Load

- The CAISO's uniform TAC Rate ($/MWH) is calculated by dividing the sum of all Participating Transmission Owners' (PTO) annual TRRs by the sum of all PTOs' annual gross load.
- For each utility, the total amount of TAC to be collected is a utility's gross load multiplied by the uniform TAC rate.
- **A clear trend of increasing amounts of revenue being collected through the TAC and spread across fewer and fewer MWh (demand).**



Year	2009	2020	Percentage Change
Transmission Access Charge (per MWh)	$3.83	$13.60	255%
Transmission Load (MWh)	216.7 million	196.5 million	-9.3%