



Assessment of Fixed Charge Proposals

June 1, 2023

- I. Introduction.....1
- II. Modeling Inputs and Assumptions.....1
 - A. Home Energy Usage.....1
 - B. Distribution of Energy Use by Building Type3
 - C. Electrification.....6
- III. Discussion and Findings6
 - A. Impacts with Current Consumption Profiles.....6
 - B. Impacts for CARE Customers.....19
 - C. Impacts for Customers Adopting Electrification22
- IV. Redesigning TOU for Electrification25

I. Introduction

This paper assesses proposals on residential fixed charges from CPUC Public Advocates Office (PAO), TURN/NRDC, and the Joint IOUs. We analyzed the impacts on customers with three home sizes. The fixed charge proposals were used according to three income levels: California median income of \$84,000 per household,¹ customers with \$150,000 in household income, and CARE customers with half the California median income. The analysis is done with tools from the U.S. Department of Energy (USDoE) and the National Renewable Energy Laboratory (NREL) that model hourly energy usage profiles from specific appliances in specific climate zones.

The results of this analysis for the mid-size home and the middle-income household are similar to those in the E3 Fixed Charge Design Model that was used by parties in opening testimony. Our assessment diverges significantly from that model for different home sizes and income levels.

We also analyzed the impacts on customers switching home appliances from natural gas to electricity under the fixed charge proposals and an alternative concept to encourage electrification with more highly differentiated time of use (TOU) rates.

II. Modeling Inputs and Assumptions

Costs under current and proposed rates for each utility were analyzed with home load profiles corresponding to following climate zones (CZ): PG&E CZ12 (Sacramento), SCE CZ9 (Los Angeles), and SDG&E CZ7 (San Diego). Three separate households were modeled for each climate to assess the impact of usage and load shape:

- A 1,250 square-foot home with light efficiency upgrades (e.g. lighting + EnergyStar appliances).
- A 2,500 square-foot home built to 2016 Title 24 standards. This aligns with typical home consumption.
- A 3,750 square-foot larger and older home with lower insulation, increased leakage, and heavier appliance use resulting from higher occupancy.

A. Home Energy Usage

EnergyPlus simulation software (from USDoE) was used to model each home in the respective climates using the BEopt front end from the National Renewable Energy Laboratory (NREL). This includes specific appliance specifications for air conditioner, furnace, water heater, cooking, and dryer.

- Baseline homes were modeled with gas appliances typical in California construction.
- EnergyPlus weather files for representative climate zones were used to determine the hourly energy profile of each household.
- Variance against a California Energy Commission (CEC) 2019 residential saturation survey was checked to ensure close alignment.

¹ U.S. Census Bureau, “Quick Facts: California,” available at <https://www.census.gov/quickfacts/CA>.

Table 1. Specifications of Modeled Home Types

	Low Use	Normal Use	High Use
Construction			
Home size (sq ft.)	1250	2500	3750
Bedroom/Bath	2/1.5	3/2	4/3
Wall Insulation	R-13	R-13	R-7
Ceiling Insulation	R-30	R-30	R-13
Window U-Value	0.49	0.49	0.76
Leakage	6 ACH50	6 ACH50	10 ACH50
Ventilation	ASHRAE 2013 Exhaust	ASHRAE 2013 Exhaust	None
Ducts	R-8, 10% Leakage	R-8, 10% Leakage	R-4, 15% Leakage
Appliances/Fixtures			
Air Conditioner	SEER 13	SEER 13	SEER 13
Furnace	80% AFUE	80% AFUE	80% AFUE
Water Heater	0.59 EF Gas	0.59 EF Gas	0.59 EF Gas
Lighting	100% LED	80% LED	
Refrigerator	18 sq. ft. 21.9 EF	18 sq. ft. 17.6 EF	25 sq. ft. 19.6 EF
Washer	EnergyStar (80% usage)	EnergyStar	EnergyStar (120% usage)
Misc loads (kWh/year)	1365	2351	4314

Figure 1. Pre-Electrification Profile of Electricity Usage for 2,500 Square Foot Home in PG&E Territory

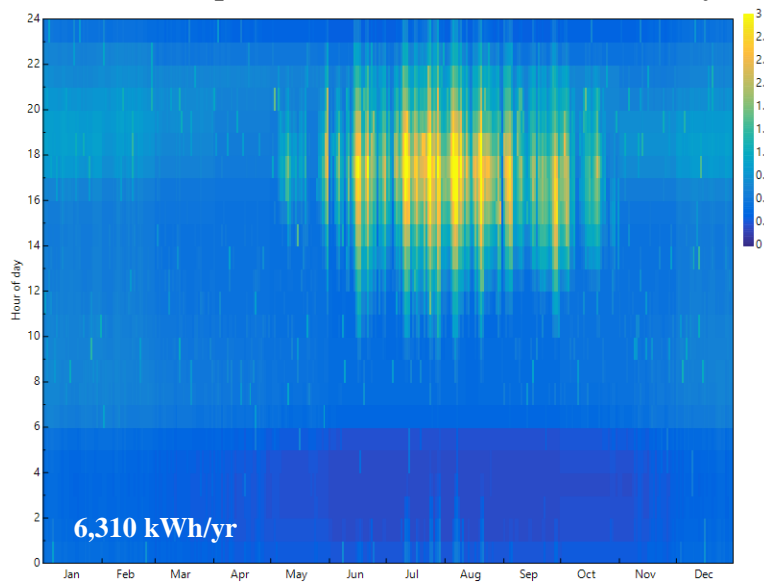


Figure 2. Pre-Electrification Profile of Electricity Usage for 2,500 Square Foot Home in SCE Territory

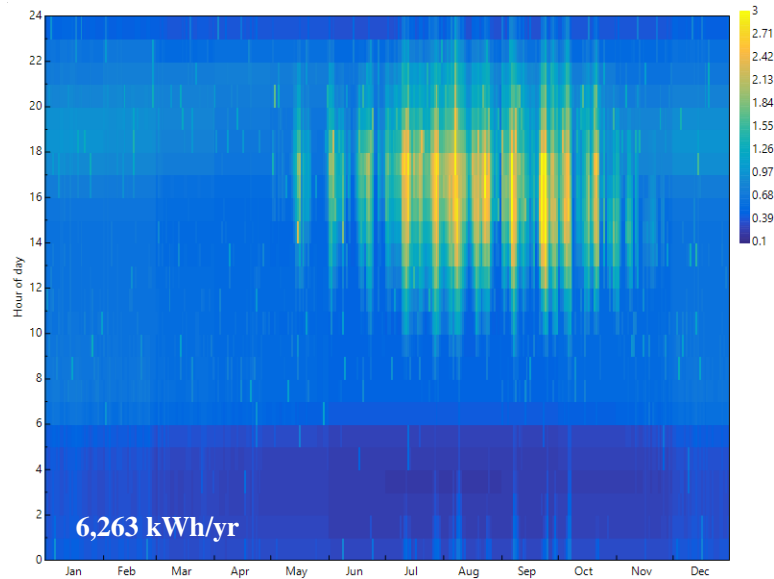
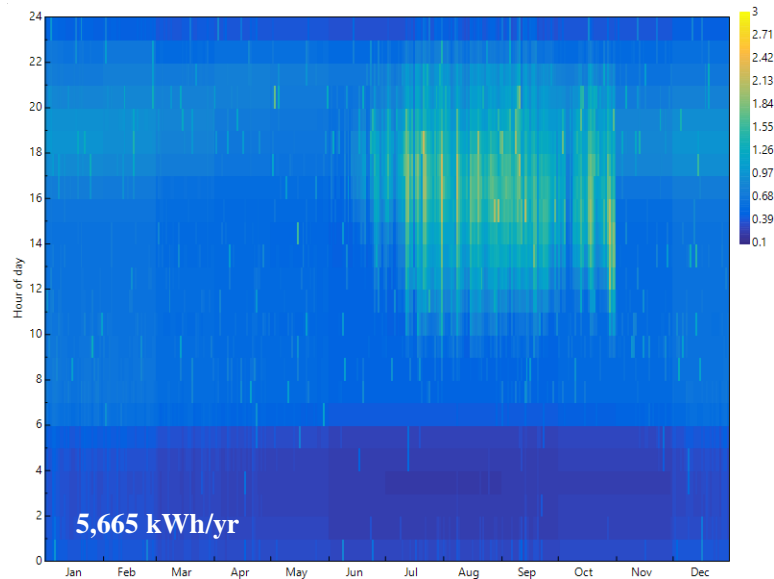


Figure 3. Pre-Electrification Profile of Electricity Usage for 2,500 Square Foot Home in SDG&E Territory



B. Distribution of Energy Use by Building Type

The 2019 CEC survey breaks out three classes of customer usage for single-family and multifamily homes representing low, medium, and high usage. For each classification, the survey presents a representative annual consumption as well as the number of units in each class. This is

shown in the rows labeled “Population Count” and “Population kWh/Yr” in Table 14 from the CEC survey, which is reproduced as Table 2 below.²

Table 2. Energy Consumption in 2019 CEC Survey

Utility	Study Characteristic	Single family Dwelling Low	Single family Dwelling Medium	Single family Dwelling High	All	Net Metered	Multi-family Dwelling Low	Multi-family Dwelling Medium	Multi-family Dwelling High	All	Net Metered	Utility Total
LADWP	Population Count	130,613		42,971	288,699	29,944	482,086		155,624	230,958	1,850	1,362,745
LADWP	Population kWh/Yr	4,726		18,157	9,232	6,696	2,454		7,933	4,677	4,731	5,702
LADWP	Sample Count	276		74	934	111	791		208	400	2	2,796
LADWP	Respondent kWh/Yr	5,345		16,420	8,476	4,625	2,593		6,557	4,356	3,038	5,332
LADWP	StdErr of Respondent kWh/Yr	303		1,160	766	465	114		427	273	1,077	236
PG&E	Population Count	1,418,740	727,135	702,012	134,827	332,802	224,884	431,210	213,042	469,544	13,171	4,667,367
PG&E	Population kWh/Yr	4,747	6,112	13,337	8,300	4,216	1,334	3,009	6,254	4,528	2,638	6,032
PG&E	Sample Count	4,716	2,753	2,143	434	1,671	594	1,074	871	1,647	64	15,967
PG&E	Respondent kWh/Yr	4,878	6,107	12,606	10,157	3,973	1,352	2,904	5,928	4,335	1,990	5,949
PG&E	StdErr of Respondent kWh/Yr	135	129	380	1,437	460	52	64	208	157	343	131
SCE	Population Count	1,199,237	1,003,043	723,300	130,936	248,342	323,941	275,658	196,564	282,133	2,033	4,385,187
SCE	Population kWh/Yr	4,676	6,142	13,391	7,869	8,683	2,397	3,353	6,853	4,746	6,249	6,622
SCE	Sample Count	3,778	2,895	1,718	757	1,370	1,091	564	505	693	10	13,381
SCE	Respondent kWh/Yr	4,633	6,139	12,261	7,849	8,805	2,348	3,328	7,250	4,936	6,251	6,446
SCE	StdErr of Respondent kWh/Yr	127	79	268	497	455	98	83	456	448	1,400	112
SDGE	Population Count	251,239	267,135	174,511		115,752	92,340	174,854	86,284	70,323	6,732	1,239,170
SDGE	Population kWh/Yr	3,160	5,398	11,205		3,039	1,623	3,296	6,291	3,296	2,473	4,891
SDGE	Sample Count	1,250	1,343	743		475	323	548	284	196	10	5,172
SDGE	Respondent kWh/Yr	3,037	5,395	10,166		2,762	1,502	3,372	5,860	3,104	2,958	4,650
SDGE	StdErr of Respondent kWh/Yr	110	82	304		830	74	80	206	368	831	140
SMUD	Population Count	282,190		92,790		16,754				133,073	157	524,964
SMUD	Population kWh/Yr	7,383		18,042		7,389				5,731	7,057	8,848
SMUD	Sample Count	1,518		370		125				352	1	2,366
SMUD	Respondent kWh/Yr	7,177		16,035		7,907				5,610	21,356	8,371
SMUD	StdErr of Respondent kWh/Yr	216		705		1,252				540		306

Source: 2019 California Residential Appliance Saturation Survey;

Plotting the energy use of each dwelling type by its percentage representation within each IOU gives us the plot in Figure 4. Within this plot, the vertical dotted line indicates the average annual energy consumption for all California homes. This has close alignment with the medium usage single family detached homes clustering around this line. However, we see other clusters far from the average.

- A. **Low Use:** This cluster is made of low and medium use multifamily dwellings using roughly half of the statewide average. Approximately 1 in 5 IOU households falls in this category.
- B. **High Use:** This cluster is made of high usage single family detached homes using approximately double the statewide average. Just under 1 in 5 IOU households falls in this category
- C. **Efficient Single Family:** The highest representation is in low usage single family homes making up nearly 1 in 3 households and using 24% less energy than the average home.

² CEC, “2019 California Residential Appliance Saturation Study,” available at <https://www.energy.ca.gov/publications/2021/2019-california-residential-appliance-saturation-study-rass>. The reproduced table is Table 14 in the original.

Figure 4. Energy Consumption in 2019 CEC Survey

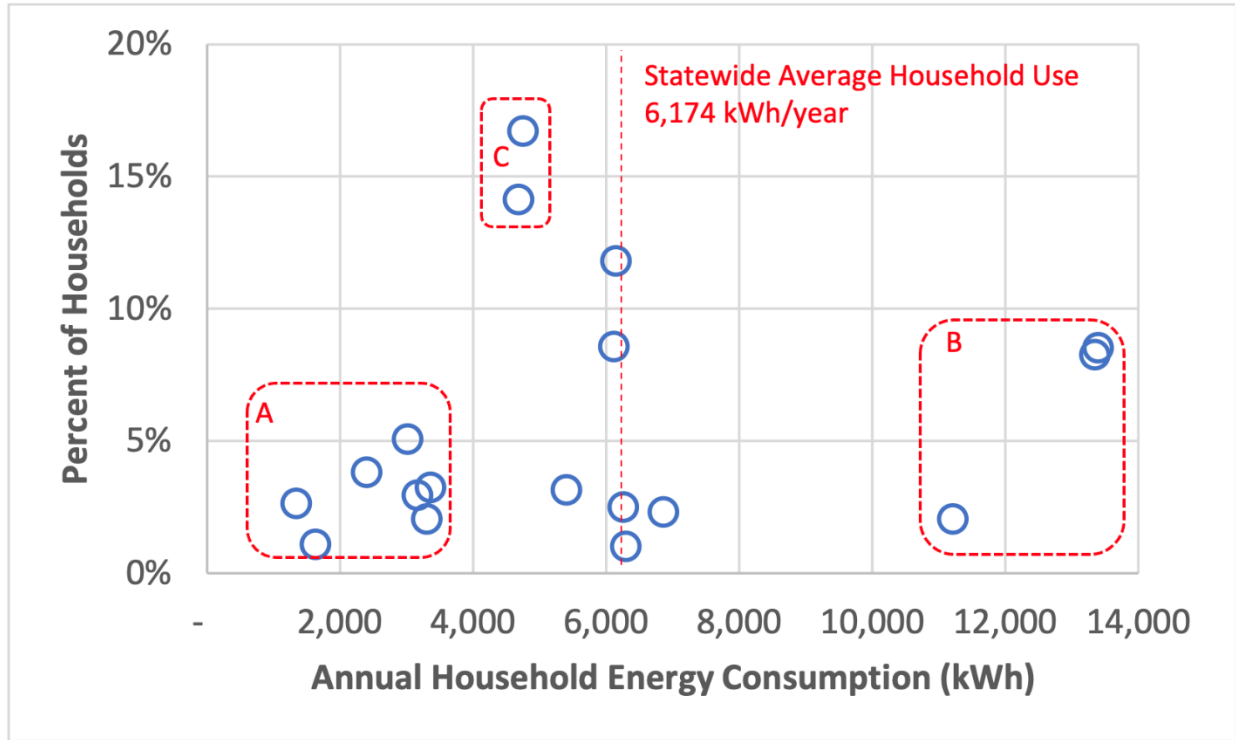


Table 3. Comparison of Modeled Energy Use with CEC Survey

	CEC 2019 Survey (kWh)	BeOpt/EnergyPlus (kWh)	Variance (%)	Gas Usage (Therms)
PG&E (CZ12)	6,266	6,310	+1%	550
SCE (CZ9)	6,424	6,263	-3%	299
SDG&E (CZ7)	5,230	5,665	+8%	281

Customer bills were calculated using hourly (8760) home electricity load profiles using NREL’s System Advisor Model (SAM). This bill modeling used current and proposed tariffs from each proposal under three separate rate types: flat, TOU, and electrification/EV. Standard residential gas tariffs were used with the proper allocation of baseline and excess rates based on modeled home gas consumption. In the analysis of CARE customers, the rates were discounted according to the CARE discounts as shown. Impacts on homeowner annual electric bills as compared to existing rate structures were assessed for each proposal across regions and housing types.

Table 4. Modeled Rate Schedules

	Electricity				Natural Gas	
	Flat	TOU	Electrification	CARE Discount	Gas	CARE Discount
PG&E	E1	E-TOU-C	E-ELEC	35.0%	G-1	20.0%
SCE/SCG	D	TOU-D-4-9	TOU-D-PRIME	32.5%	GR	20.0%
SDG&E	DR	TOU-DR1	TOU-E-ELEC	35.0%	GR	20.0%

C. Electrification

The cost effectiveness of fuel switching from natural gas to high efficiency electric appliances (e.g. heat pumps) was assessed under the new proposed rates, all of which aim to reduce variable energy charges to promote electrification.

In all cases, we presume the customer is moving to the most modern heat pump and induction cooking technologies as represented by the highest efficiency levels in NREL’s BEopt appliance database. However, potential savings are dependent on the efficiency of the gas appliances the customer is converting from. Homes with more efficient gas appliances will have a larger challenge switching to electric appliances because their current gas costs are low. We cover this sensitivity by modeling two boundaries of existing home types, one with legacy low-efficiency technologies (non-condensing) and one with modern high-efficiency (condensing) technology that has become more common in the last decade. Most homes will fall between these two modeled limits.

Gas costs were pulled from residential general service tariff and annual costs were calculated using consumption rates for below and above baseline. SCE was modeled using service from Southern California Gas. All major appliances were moved from gas to high efficiency electric. The resultant home had no natural gas consumption.

Table 5. Appliance Assumptions Before and After Electrification

	Gas – Low Efficiency	Gas – High Efficiency	Electric – High Efficiency
HVAC – Heating	80% AFUE Furnace	98% AFUE Furnace	10 HSPF Heat Pump
HVAC – Cooling	SEER 13 Air Conditioner	SEER 21 Air Conditioner	22 SEER Heat Pump
Water Heating	0.59 EF Gas Storage	0.96 Tankless	3.5 UEF Heat Pump
Cooking	Gas	Gas	Induction Cooktop
Dryer	Gas	Gas	Heat Pump

III. Discussion and Findings

A. Impacts with Current Consumption Profiles

One of the intentions of the proposed fixed charge is to buy down the variable rate (\$/kWh) to make electrification more economic and cost competitive against fossil fuel sources (gasoline, natural gas). Lower variable rates require higher fixed charges to maintain a revenue neutral position on the rate base.

In all proposals, there will be a balance point in home consumption against the current rates where the discounted variable rate offsets the fixed component and the proposal is revenue neutral for the customer. At consumption levels above this level, the proposal will result in annual savings. Below this level the fixed rate becomes more dominant and the customer sees increased utility costs. This balance point in usage can be calculated by dividing the increase in the fixed bill component by the decrease in the blended variable rate used by the home. This varies primarily by the wide range in fixed charges according to income level between the proposals.

Here are two examples for SCE territory:

- **PAO:** Under the median household income on a simple TOU-D-4-9 rate with the consumption profile of the mid-line 2500 square-foot home, there is a \$383 fixed charge with a \$0.059/kWh (\$0.336 -\$0.277) variable rate discount. This results in a balance point consumption of 6,220 kWh/year where the fixed charge proposal matches the existing rate on the annual bill. Homes using less than that amount will see their bills increase under the proposal, and homes using more will see their bill decrease.
- **IOU:** Under the Joint IOU proposal for a household earning \$150,000, the fixed charge increases nearly three-fold to \$1,023/year, but with an increase in the variable rate discount to \$0.104/kWh. The balance point usage for this household income is 9,836 kWh for the proposed rate to break even with the current rate. The net impact is an 18% bill increase for a 2,500 square-foot home with normal consumption.

There are significant impacts for all three proposals across household income levels, the specific proposal, and annual home energy use. Details can be found in Tables 6-14. We call out the following trends:

- **Marginal Impact:** The proposals are reasonably neutral for the median income home with average home energy use (e.g. 2500 square-foot home with typical use). This is the impact presented in most proposals. Across all three proposals, we find representative savings to be 10% for PG&E, no impact for SCE, and 2% for SDG&E.
- **Significant Negative Impact:** We find the most severe bill increases in small efficient homes with household income of \$150k or more. Looking at the TOU-D-4-9 rate structure in SCE territory, we see a 62% rate increase under the IOU proposal. If we specifically look at the fixed charge components, the \$1,023 annual fixed charge (IOU proposal) nearly matches the full annual bill of \$1,105 under the current rate structure without accounting for the additional energy charges of \$765. We see a similar trend across all utility territories with bill increases exceeding 50% across territories under the IOU proposals. The PAO proposal has lower fixed charges partially mitigating this impact, but bill increases of ~10% – 20% are still found under this proposal. In addition to the

small single family detached home that was modeled, this energy usage profile is common for apartments, duplexes, townhomes, and condominiums. Specifically, we see many apartment renters as falling into this impacted customer class.

- **Significant Positive Impact:** Homes with high energy use well above the balance point see significant bill savings. If we look at the large 3750 square-foot home with median household income, bill reductions are in the 15-30% range under the IOU proposals, with annual household savings on the order of \$1,000. This level of savings is achieved without any investment in efficiency or electrification for this customer group. Simply having high existing energy use associated with the typical needs of a larger home leads to material savings under the proposals.

Table 6. PG&E Bill Impacts for 1250 Square-Foot Home

		E1	E-TOU-C	E-ELEC
Current Rates	Blended Variable Charge \$/kWh	\$ 0.341	\$ 0.340	\$ 0.349
	Annual Variable Charge	\$ 1,190	\$ 1,189	\$ 1,219
	Annual Fixed Charge	\$ -		\$ 180
	Annual Electric Bill	\$ 1,190	\$ 1,189	\$ 1,399
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.256	\$ 0.267	\$ 0.287
	NRDC/TURN	\$ 0.240		\$ 0.247
	IOU	\$ 0.203	\$ 0.212	\$ 0.228
	Annual Variable Charge			
	CPUC PAO	\$ 895	\$ 934	\$ 1,003
	NRDC/TURN	\$ 839		\$ 863
	IOU	\$ 709	\$ 740	\$ 796
Bill Impacts	\$84k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 383	\$ 382	\$ 381
	NRDC/TURN	\$ 492		\$ 600
	IOU	\$ 612	\$ 611	\$ 610
	Annual Bill			
	CPUC PAO	\$ 1,278	\$ 1,316	\$ 1,384
	NRDC/TURN	\$ 1,331	\$ -	\$ 1,463
	IOU	\$ 1,321	\$ 1,351	\$ 1,406
	Annual Bill Change			
	CPUC PAO	7%	11%	-1%
	NRDC/TURN	12%		5%
	IOU	11%	14%	1%
	\$150k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 440	\$ 440	\$ 438
NRDC/TURN	\$ 744		\$ 900	
IOU	\$ 1,101	\$ 1,100	\$ 1,098	
Annual Bill				
CPUC PAO	\$ 1,335	\$ 1,374	\$ 1,441	
NRDC/TURN	\$ 1,583	\$ -	\$ 1,763	
IOU	\$ 1,810	\$ 1,840	\$ 1,894	
Annual Bill Change				
CPUC PAO	12%	16%	3%	
NRDC/TURN	33%		26%	
IOU	52%	55%	35%	

Table 7. PG&E Bill Impacts for 2500 Square-Foot Home

		E1	E-TOU-C	E-ELEC
Current Rates	Blended Variable Charge \$/kWh	\$ 0.367	\$ 0.367	\$ 0.350
	Annual Variable Charge	\$ 2,318	\$ 2,318	\$ 2,206
	Annual Fixed Charge	\$ -		\$ 180
	Annual Electric Bill	\$ 2,318	\$ 2,318	\$ 2,386
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.276	\$ 0.288	\$ 0.288
	NRDC/TURN	\$ 0.259		\$ 0.248
	IOU	\$ 0.219	\$ 0.228	\$ 0.228
	Annual Variable Charge			
	CPUC PAO	\$ 1,742	\$ 1,820	\$ 1,815
	NRDC/TURN	\$ 1,635		\$ 1,562
	IOU	\$ 1,379	\$ 1,441	\$ 1,441
Bill Impacts	\$84k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 383	\$ 382	\$ 381
	NRDC/TURN	\$ 492		\$ 600
	IOU	\$ 612	\$ 611	\$ 610
	Annual Bill			
	CPUC PAO	\$ 2,125	\$ 2,202	\$ 2,196
	NRDC/TURN	\$ 2,127	\$ -	\$ 2,162
	IOU	\$ 1,991	\$ 2,052	\$ 2,051
	Annual Bill Change			
	CPUC PAO	-8%	-5%	-8%
	NRDC/TURN	-8%		-9%
	IOU	-14%	-11%	-14%
	\$150k Income Household			
Annual Fixed Charge				
CPUC PAO	\$ 440	\$ 440	\$ 438	
NRDC/TURN	\$ 744		\$ 900	
IOU	\$ 1,101	\$ 1,100	\$ 1,098	
Annual Bill				
CPUC PAO	\$ 2,182	\$ 2,260	\$ 2,253	
NRDC/TURN	\$ 2,379	\$ -	\$ 2,462	
IOU	\$ 2,480	\$ 2,541	\$ 2,539	
Annual Bill Change				
CPUC PAO	-6%	-3%	-6%	
NRDC/TURN	3%		3%	
IOU	7%	10%	6%	

Table 8. PG&E Bill Impacts for 3750 Square-Foot Home

		E1	E-TOU-C	E-ELEC
Current Rates	Blended Variable Charge \$/kWh	\$ 0.393	\$ 0.396	\$ 0.357
	Annual Variable Charge	\$ 4,469	\$ 4,505	\$ 4,056
	Annual Fixed Charge	\$ -		\$ 180
	Annual Electric Bill	\$ 4,469	\$ 4,505	\$ 4,236
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.295	\$ 0.312	\$ 0.295
	NRDC/TURN	\$ 0.277		\$ 0.255
	IOU	\$ 0.233	\$ 0.247	\$ 0.236
	Annual Variable Charge			
	CPUC PAO	\$ 3,356	\$ 3,545	\$ 3,353
	NRDC/TURN	\$ 3,153		\$ 2,895
	IOU	\$ 2,654	\$ 2,813	\$ 2,679
Bill Impacts	\$84k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 383	\$ 382	\$ 381
	NRDC/TURN	\$ 492		\$ 600
	IOU	\$ 612	\$ 611	\$ 610
	Annual Bill			
	CPUC PAO	\$ 3,739	\$ 3,927	\$ 3,734
	NRDC/TURN	\$ 3,645	\$ -	\$ 3,495
	IOU	\$ 3,266	\$ 3,424	\$ 3,289
	Annual Bill Change			
	CPUC PAO	-16%	-13%	-12%
	NRDC/TURN	-18%		-17%
	IOU	-27%	-24%	-22%
	\$150k Income Household			
	Annual Fixed Charge			
CPUC PAO	\$ 440	\$ 440	\$ 438	
NRDC/TURN	\$ 744		\$ 900	
IOU	\$ 1,101	\$ 1,100	\$ 1,098	
Annual Bill				
CPUC PAO	\$ 3,796	\$ 3,985	\$ 3,791	
NRDC/TURN	\$ 3,897	\$ -	\$ 3,795	
IOU	\$ 3,755	\$ 3,913	\$ 3,777	
Annual Bill Change				
CPUC PAO	-15%	-12%	-10%	
NRDC/TURN	-13%		-10%	
IOU	-16%	-13%	-11%	

Table 9. SCE Bill Impacts for 1250 Square-Foot Home

		D	TOU-D-4-9	TOU-D-PRIME
Current Rates	Blended Variable Charge \$/kWh	\$ 0.311	\$ 0.316	\$ 0.339
	Annual Variable Charge	\$ 1,087	\$ 1,105	\$ 1,184
	Annual Fixed Charge	\$ -		\$ 155
	Annual Electric Bill	\$ 1,087	\$ 1,105	\$ 1,339
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.258	\$ 0.260	\$ 0.303
	NRDC/TURN	\$ 0.240		\$ 0.265
	IOU	\$ 0.216	\$ 0.218	\$ 0.255
	Annual Variable Charge			
	CPUC PAO	\$ 905	\$ 912	\$ 1,062
NRDC/TURN	\$ 842		\$ 930	
IOU	\$ 758	\$ 765	\$ 895	
Bill Impacts	\$84k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 367	\$ 367	\$ 368
	NRDC/TURN	\$ 492		\$ 612
	IOU	\$ 612	\$ 612	\$ 612
	Annual Bill			
	CPUC PAO	\$ 1,272	\$ 1,279	\$ 1,430
	NRDC/TURN	\$ 1,334	\$ -	\$ 1,542
	IOU	\$ 1,370	\$ 1,377	\$ 1,507
	Annual Bill Change			
	CPUC PAO	17%	16%	7%
	NRDC/TURN	23%		15%
	IOU	26%	25%	13%
	\$150k Income Household			
	Annual Fixed Charge			
CPUC PAO	\$ 422	\$ 422	\$ 423	
NRDC/TURN	\$ 744		\$ 912	
IOU	\$ 1,022	\$ 1,023	\$ 1,023	
Annual Bill				
CPUC PAO	\$ 1,327	\$ 1,334	\$ 1,485	
NRDC/TURN	\$ 1,586	\$ -	\$ 1,842	
IOU	\$ 1,780	\$ 1,788	\$ 1,918	
Annual Bill Change				
CPUC PAO	22%	21%	11%	
NRDC/TURN	46%		38%	
IOU	64%	62%	43%	

Table 10. SCE Bill Impacts for 2500 Square-Foot Home

		D	TOU-D-4-9	TOU-D-PRIME
Current Rates	Blended Variable Charge \$/kWh	\$ 0.326	\$ 0.333	\$ 0.337
	Annual Variable Charge	\$ 2,058	\$ 2,104	\$ 2,125
	Annual Fixed Charge	\$ -		\$ 155
	Annual Electric Bill	\$ 2,058	\$ 2,104	\$ 2,280
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.274	\$ 0.277	\$ 0.305
	NRDC/TURN	\$ 0.255		\$ 0.267
	IOU	\$ 0.228	\$ 0.232	\$ 0.257
	Annual Variable Charge			
	CPUC PAO	\$ 1,713	\$ 1,737	\$ 1,907
	NRDC/TURN	\$ 1,595		\$ 1,670
	IOU	\$ 1,431	\$ 1,456	\$ 1,609
Bill Impacts	\$84k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 367	\$ 367	\$ 368
	NRDC/TURN	\$ 492	\$ -	\$ 612
	IOU	\$ 612	\$ 612	\$ 612
	Annual Bill			
	CPUC PAO	\$ 2,080	\$ 2,104	\$ 2,275
	NRDC/TURN	\$ 2,087	\$ -	\$ 2,282
	IOU	\$ 2,043	\$ 2,068	\$ 2,221
	Annual Bill Change			
	CPUC PAO	1%	0%	0%
	NRDC/TURN	1%		0%
	IOU	-1%	-2%	-3%
	\$150k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 422	\$ 422	\$ 423
NRDC/TURN	\$ 744	\$ -	\$ 912	
IOU	\$ 1,022	\$ 1,023	\$ 1,023	
Annual Bill				
CPUC PAO	\$ 2,135	\$ 2,159	\$ 2,330	
NRDC/TURN	\$ 2,339	\$ -	\$ 2,582	
IOU	\$ 2,453	\$ 2,479	\$ 2,632	
Annual Bill Change				
CPUC PAO	4%	3%	2%	
NRDC/TURN	14%		13%	
IOU	19%	18%	15%	

Table 11. SCE Bill Impacts for 3750 Square-Foot Home

		D	TOU-D-4-9	TOU-D-PRIME
Current Rates	Blended Variable Charge \$/kWh	\$ 0.346	\$ 0.358	\$ 0.332
	Annual Variable Charge	\$ 3,934	\$ 4,076	\$ 3,774
	Annual Fixed Charge			\$ 155
	Annual Electric Bill	\$ 3,934	\$ 4,076	\$ 3,929
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.298	\$ 0.307	\$ 0.309
	NRDC/TURN	\$ 0.278		\$ 0.271
	IOU	\$ 0.249	\$ 0.257	\$ 0.262
	Annual Variable Charge			
	CPUC PAO	\$ 3,275	\$ 3,370	\$ 3,392
NRDC/TURN	\$ 3,054		\$ 2,977	
IOU	\$ 2,730	\$ 2,825	\$ 2,870	
Bill Impacts	\$84k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 367	\$ 367	\$ 368
	NRDC/TURN	\$ 492	\$ -	\$ 612
	IOU	\$ 612	\$ 612	\$ 612
	Annual Bill			
	CPUC PAO	\$ 3,642	\$ 3,737	\$ 3,760
	NRDC/TURN	\$ 3,546	\$ -	\$ 3,589
	IOU	\$ 3,342	\$ 3,437	\$ 3,482
	Annual Bill Change			
	CPUC PAO	-7%	-8%	-4%
	NRDC/TURN	-10%		-9%
	IOU	-15%	-16%	-11%
	\$150k Income Household			
	Annual Fixed Charge			
CPUC PAO	\$ 422	\$ 422	\$ 423	
NRDC/TURN	\$ 744	\$ -	\$ 912	
IOU	\$ 1,022	\$ 1,023	\$ 1,023	
Annual Bill				
CPUC PAO	\$ 3,697	\$ 3,792	\$ 3,815	
NRDC/TURN	\$ 3,798	\$ -	\$ 3,889	
IOU	\$ 3,752	\$ 3,848	\$ 3,893	
Annual Bill Change				
CPUC PAO	-6%	-7%	-3%	
NRDC/TURN	-3%		-1%	
IOU	-5%	-6%	-1%	

Table 12. SDG&E Bill Impacts for 1250 Square-Foot Home

		DR	TOU-DR1	TOU-E-ELEC
Current Rates	Blended Variable Charge \$/kWh	\$ 0.452	\$ 0.462	\$ 0.429
	Annual Variable Charge	\$ 1,455	\$ 1,486	\$ 1,378
	Annual Fixed Charge			\$ 192
	Annual Electric Bill	\$ 1,455	\$ 1,486	\$ 1,570
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.382	\$ 0.391	\$ 0.408
	NRDC/TURN	\$ 0.370		\$ 0.365
	IOU	\$ 0.271	\$ 0.281	\$ 0.283
	Annual Variable Charge			
	CPUC PAO	\$ 1,228	\$ 1,258	\$ 1,312
	NRDC/TURN	\$ 1,190		\$ 1,175
	IOU	\$ 871	\$ 903	\$ 911
Bill Impacts	\$84k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 445	\$ 444	\$ 443
	NRDC/TURN	\$ 492		\$ 612
	IOU	\$ 860	\$ 857	\$ 855
	Annual Bill			
	CPUC PAO	\$ 1,673	\$ 1,702	\$ 1,755
	NRDC/TURN	\$ 1,682	\$ -	\$ 1,787
	IOU	\$ 1,731	\$ 1,760	\$ 1,766
	Annual Bill Change			
	CPUC PAO	15%	15%	12%
	NRDC/TURN	16%		14%
	IOU	19%	18%	12%
	\$150k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 512	\$ 511	\$ 510
	NRDC/TURN	\$ 744		\$ 912
	IOU	\$ 1,505	\$ 1,500	\$ 1,496
Annual Bill				
CPUC PAO	\$ 1,740	\$ 1,769	\$ 1,822	
NRDC/TURN	\$ 1,934	\$ -	\$ 2,087	
IOU	\$ 2,376	\$ 2,403	\$ 2,407	
Annual Bill Change				
CPUC PAO	20%	19%	16%	
NRDC/TURN	33%		33%	
IOU	63%	62%	53%	

Table 13. SDG&E Bill Impacts for 2500 Square-Foot Home

		DR	TOU-DR1	TOU-E-ELEC
Current Rates	Blended Variable Charge \$/kWh	\$ 0.480	\$ 0.492	\$ 0.430
	Annual Variable Charge	\$ 2,719	\$ 2,789	\$ 2,438
	Annual Fixed Charge			\$ 192
	Annual Electric Bill	\$ 2,719	\$ 2,789	\$ 2,630
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.405	\$ 0.416	\$ 0.410
	NRDC/TURN	\$ 0.393		\$ 0.367
	IOU	\$ 0.287	\$ 0.298	\$ 0.285
	Annual Variable Charge			
	CPUC PAO	\$ 2,296	\$ 2,359	\$ 2,322
	NRDC/TURN	\$ 2,229		\$ 2,080
	IOU	\$ 1,626	\$ 1,689	\$ 1,614
Bill Impacts	\$84k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 445	\$ 444	\$ 443
	NRDC/TURN	\$ 492	\$ -	\$ 612
	IOU	\$ 860	\$ 857	\$ 855
	Annual Bill			
	CPUC PAO	\$ 2,741	\$ 2,803	\$ 2,765
	NRDC/TURN	\$ 2,721	\$ -	\$ 2,692
	IOU	\$ 2,486	\$ 2,546	\$ 2,469
	Annual Bill Change			
	CPUC PAO	1%	1%	5%
	NRDC/TURN	0%		2%
	IOU	-9%	-9%	-6%
	\$150k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 512	\$ 511	\$ 510
	NRDC/TURN	\$ 744	\$ -	\$ 912
	IOU	\$ 1,505	\$ 1,500	\$ 1,496
Annual Bill				
CPUC PAO	\$ 2,808	\$ 2,870	\$ 2,832	
NRDC/TURN	\$ 2,973	\$ -	\$ 2,992	
IOU	\$ 3,131	\$ 3,189	\$ 3,110	
Annual Bill Change				
CPUC PAO	3%	3%	8%	
NRDC/TURN	9%		14%	
IOU	15%	14%	18%	

Table 14. SDG&E Bill Impacts for 3750 Square-Foot Home

		DR	TOU-DR1	TOU-E-ELEC
Current Rates	Blended Variable Charge \$/kWh	\$ 0.517	\$ 0.534	\$ 0.437
	Annual Variable Charge	\$ 4,947	\$ 5,112	\$ 4,180
	Annual Fixed Charge			\$ 192
	Annual Electric Bill	\$ 4,947	\$ 5,112	\$ 4,372
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.436	\$ 0.452	\$ 0.416
	NRDC/TURN	\$ 0.425		\$ 0.373
	IOU	\$ 0.308	\$ 0.323	\$ 0.291
	Annual Variable Charge			
	CPUC PAO	\$ 4,177	\$ 4,325	\$ 3,982
	NRDC/TURN	\$ 4,067		\$ 3,575
	IOU	\$ 2,951	\$ 3,091	\$ 2,788
Bill Impacts	\$84k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 445	\$ 444	\$ 443
	NRDC/TURN	\$ 492	\$ -	\$ 612
	IOU	\$ 860	\$ 857	\$ 855
	Annual Bill			
	CPUC PAO	\$ 4,622	\$ 4,769	\$ 4,425
	NRDC/TURN	\$ 4,559	\$ -	\$ 4,187
	IOU	\$ 3,811	\$ 3,948	\$ 3,643
	Annual Bill Change			
	CPUC PAO	-7%	-7%	1%
	NRDC/TURN	-8%		-4%
	IOU	-23%	-23%	-17%
	\$150k Income Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 512	\$ 511	\$ 510
NRDC/TURN	\$ 744	\$ -	\$ 912	
IOU	\$ 1,505	\$ 1,500	\$ 1,496	
Annual Bill				
CPUC PAO	\$ 4,689	\$ 4,836	\$ 4,492	
NRDC/TURN	\$ 4,811	\$ -	\$ 4,487	
IOU	\$ 4,456	\$ 4,591	\$ 4,284	
Annual Bill Change				
CPUC PAO	-5%	-5%	3%	
NRDC/TURN	-3%		3%	
IOU	-10%	-10%	-2%	

The bubble charts in Figures 5-7 demonstrate the winners and losers under the three modeled proposals. The size of the bubbles represents the number of customers in each of the customer groups from the 2019 CEC study on California residential electricity consumption.

Apartment residents with low electricity usage would face higher bills, as would customers in small single-family homes. Single-family homes with high existing electricity consumption would experience significant decreases in their bills. As a general rule, small efficient homes would subsidize larger, less-efficient homes. Looking back at Figure 4, groups A and C would have bill increases and group B would have a bill reduction.

Figure 5. Impacts by Dwelling Type and Income Under Cal Advocates Proposal

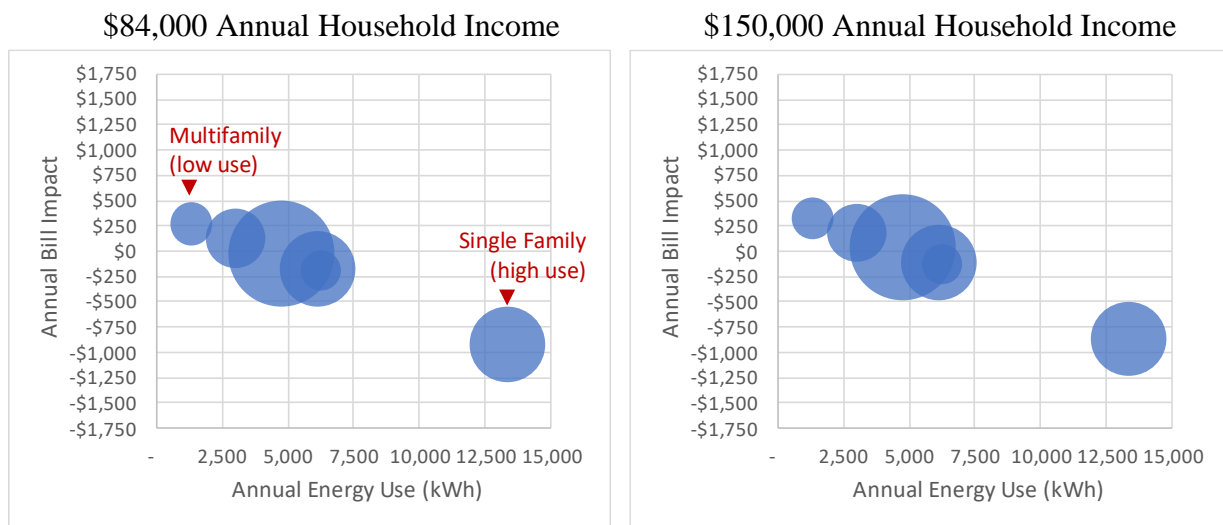


Figure 6. Impacts by Dwelling Type and Income Under NRDC/TURN Proposal

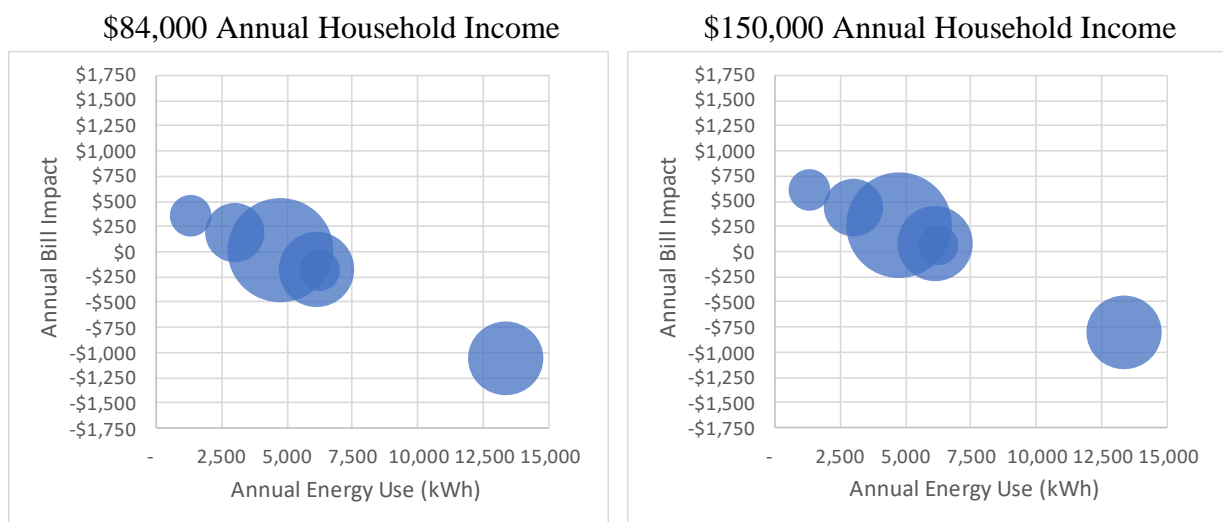
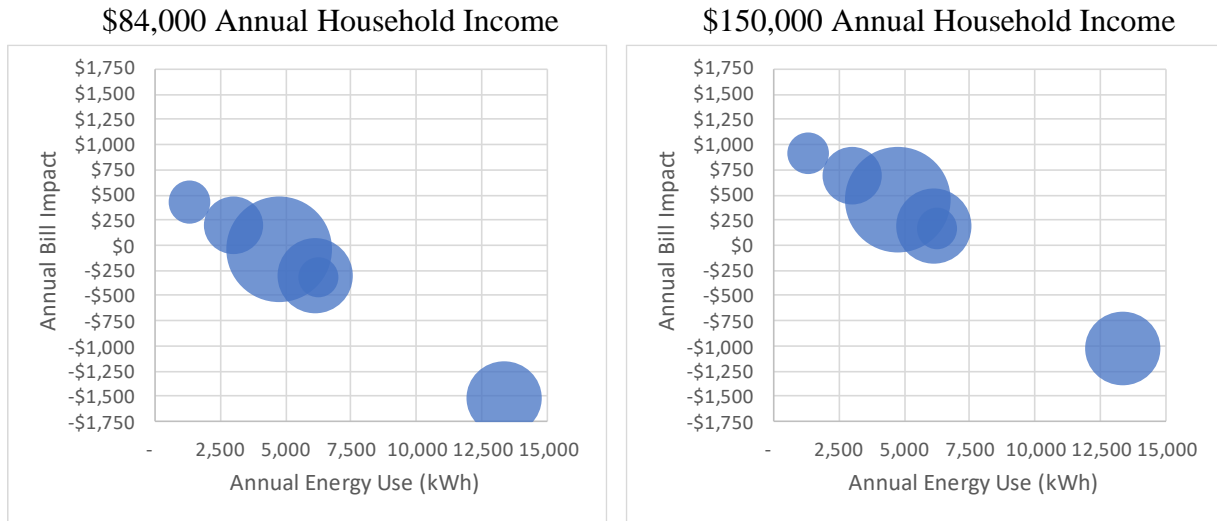


Figure 7. Impacts by Dwelling Type and Income Under Joint IOU Proposal



B. Impacts for CARE Customers

All proposals materially decrease the fixed rate component for CARE customers to a fraction of the non-CARE burden. We limited the CARE modeling to only the non-TOU rate structures after seeing that the savings for TOU and non-TOU rate schedules closely tracked for non-CARE customers. While we modeled all three house profiles, we believe the 1,250-2,500 square-foot homes to be most representative.

Within these home load profiles, we see the new rate proposals as being generally advantageous. The IOU proposal for the smallest home in PG&E territory results in a 4% bill increase, but most customer types see bill decreases.

Table 15. Bill Impacts for 1250 Square-Foot Home on CARE Rates

		PG&E E1	SCE D	SDG&E DR
Existing Rates	Blended Variable Charge \$/kWh	\$ 0.221	\$ 0.210	\$ 0.271
	Annual Variable Charge	\$ 773	\$ 734	\$ 946
	Annual Fixed Charge			
	Annual Electric Bill	\$ 773	\$ 734	\$ 946
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.166	\$ 0.168	\$ 0.233
	NRDC/TURN	\$ 0.150	\$ 0.160	\$ 0.230
	IOU	\$ 0.128	\$ 0.144	\$ 0.161
	Annual Variable Charge			
	CPUC PAO	\$ 580	\$ 588	\$ 814
	NRDC/TURN	\$ 524	\$ 561	\$ 804
IOU	\$ 447	\$ 502	\$ 563	
Bill Impacts	\$44k Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 122	\$ 130	\$ 164
	NRDC/TURN	\$ 60	\$ 60	\$ 60
	IOU	\$ 360	\$ 240	\$ 408
	Annual Bill			
	CPUC PAO	\$ 702	\$ 718	\$ 978
	NRDC/TURN	\$ 584	\$ 621	\$ 864
	IOU	\$ 807	\$ 742	\$ 971
	Annual Bill Change			
CPUC PAO	-9%	-2%	3%	
NRDC/TURN	-24%	-15%	-9%	
IOU	4%	1%	3%	

Table 16. Bill Impacts for 2500 Square-Foot Home on CARE Rates

		PG&E	SCE	SDG&E
		E1	D	DR
Existing Rates	Blended Variable Charge \$/kWh	\$ 0.239	\$ 0.220	\$ 0.280
	Annual Variable Charge	\$ 1,507	\$ 1,389	\$ 1,768
	Annual Fixed Charge			
	Annual Electric Bill	\$ 1,507	\$ 1,389	\$ 1,768
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.179	\$ 0.185	\$ 0.241
	NRDC/TURN	\$ 0.163	\$ 0.171	\$ 0.237
	IOU	\$ 0.138	\$ 0.150	\$ 0.167
	Annual Variable Charge			
	CPUC PAO	\$ 1,130	\$ 1,168	\$ 1,520
	NRDC/TURN	\$ 1,027	\$ 1,068	\$ 1,496
	IOU	\$ 872	\$ 949	\$ 1,051
Bill Impacts	\$44k Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 122	\$ 130	\$ 164
	NRDC/TURN	\$ 60	\$ 60	\$ 60
	IOU	\$ 360	\$ 240	\$ 408
	Annual Bill			
	CPUC PAO	\$ 1,252	\$ 1,298	\$ 1,684
	NRDC/TURN	\$ 1,087	\$ 1,128	\$ 1,556
	IOU	\$ 1,232	\$ 1,189	\$ 1,459
	Annual Bill Change			
CPUC PAO	-17%	-7%	-5%	
NRDC/TURN	-28%	-19%	-12%	
IOU	-18%	-14%	-17%	

Table 17. Bill Impacts for 3750 Square-Foot Home on CARE Rates

		PG&E	SCE	SDG&E
		E1	D	DR
Existing Rates	Blended Variable Charge \$/kWh	\$ 0.255	\$ 0.234	\$ 0.283
	Annual Variable Charge	\$ 2,905	\$ 2,656	\$ 3,215
	Annual Fixed Charge			
	Annual Electric Bill	\$ 2,905	\$ 2,656	\$ 3,215
Proposed Rates	Blended Variable Charge (\$/kWh)			
	CPUC PAO	\$ 0.191	\$ 0.196	\$ 0.243
	NRDC/TURN	\$ 0.175	\$ 0.187	\$ 0.238
	IOU	\$ 0.148	\$ 0.160	\$ 0.168
	Annual Variable Charge			
	CPUC PAO	\$ 2,177	\$ 2,231	\$ 2,763
	NRDC/TURN	\$ 1,988	\$ 2,056	\$ 2,708
	IOU	\$ 1,681	\$ 1,818	\$ 1,911
Bill Impacts	\$44k Household			
	Annual Fixed Charge			
	CPUC PAO	\$ 122	\$ 130	\$ 164
	NRDC/TURN	\$ 60	\$ 60	\$ 60
	IOU	\$ 360	\$ 240	\$ 408
	Annual Bill			
	CPUC PAO	\$ 2,299	\$ 2,361	\$ 2,927
	NRDC/TURN	\$ 2,048	\$ 2,116	\$ 2,768
	IOU	\$ 2,041	\$ 2,058	\$ 2,319
	Annual Bill Change			
CPUC PAO	-21%	-11%	-9%	
NRDC/TURN	-30%	-20%	-14%	
IOU	-30%	-23%	-28%	

C. Impacts for Customers Adopting Electrification

In the previous section, we assessed the annual bill impacts for each of the rate proposals to determine impact by utility, income class, energy use, and other metrics for customers that do not engage in fuel switching. As previously discussed, there are customer types that benefit from the proposals and those that are negatively impacted. The specific impact on each customer is absorbed upon rate implementation before significant levels of electrification occur. Any customer that sees bill savings under the proposals is under no obligation to invest those savings in electrification. The benefits and drawbacks of new fixed charges are fully absorbed in this initial phase.

With the new rates in place that have a lower variable component (subsidized through the fixed charge), we assess if these reduced rates are sufficient to incentivize customers to invest in electrification. The key metric in such an analysis is the annual bill savings in moving appliances from natural gas onto these new reduced electric rates. At a bare minimum, electrification cannot

result in increased utility bills. More practically, there must be sufficient bill savings to justify the equipment upgrades with a reasonable payback period.

To assess changes in consumption, baseline pre-electrification home loads and additional electrification loads were binned by month and TOU period to see usage and cost within the existing rate structure. The most important insight is that winter off-peak is nearly 2/3 of increased usage for electrification. This is driven by winter off-peak being the hours of heaviest heat pump use for both space heating and water heating. Equally interesting, only 5% of the usage in electrification falls in the summer on-peak and mid-peak periods.

Table 18. Pre-Electrification Residential Load by TOU Period

	Summer			Winter			Total
	On-Peak	Mid-Peak	Off-Peak	On-Peak	Mid-Peak	Off-Peak	
Jan				149	91	297	537
Feb				129	81	256	465
Mar				112	89	241	441
Apr				97	82	222	401
May				149	93	211	453
Jun	223	118	212				553
Jul	310	156	257				723
Aug	307	152	243				702
Sep	246	130	219				594
Oct				186	108	219	513
Nov				123	70	223	415
Dec				145	85	283	514
Annual Total	1,086	555	931	1,090	699	1,951	6,311
Annual Pct	17%	9%	15%	17%	11%	31%	

Table 19. Additional Load from Electrification by TOU Period

	Summer			Winter			Total
	On-Peak	Mid-Peak	Off-Peak	On-Peak	Mid-Peak	Off-Peak	
Jan				130	127	605	861
Feb				79	73	410	562
Mar				59	65	344	468
Apr				57	47	242	346
May				40	26	115	181
Jun	43	22	63				127
Jul	25	25	71				121
Aug	21	13	52				87
Sep	19	21	107				147
Oct				57	47	242	346
Nov				54	51	245	349
Dec				91	107	455	653
Annual Total	108	81	294	567	543	2,657	4,249
Annual Pct	3%	2%	7%	13%	13%	63%	

Table 20. Post-Electrification Residential Load by TOU Period

	Summer			Winter			Total
	On-Peak	Mid-Peak	Off-Peak	On-Peak	Mid-Peak	Off-Peak	
Jan				279	218	902	1398
Feb				208	153	666	1028
Mar				171	154	584	909
Apr				154	130	463	747
May				188	119	326	633
Jun	266	140	274				680
Jul	336	180	328				844
Aug	328	165	296				789
Sep	265	151	326				741
Oct				244	156	460	860
Nov				177	120	467	764
Dec				236	193	738	1167
Annual Total	1,194	636	1,224	1,657	1,242	4,608	10,560
Annual Pct	11%	6%	12%	16%	12%	44%	

When converting from modern high efficiency gas appliances, there is no case under any of the evaluated rate proposals where electrification results in annual bill savings for customers. The target electricity rate necessary to break even against modern high efficiency gas appliances is \$0.147/kWh - \$0.176/kWh. This rate is not achieved under any of the evaluated proposals.

With legacy low-efficiency gas appliances there is annual savings in PG&E territory under the IOU and NRDC/TURN proposals, but they are marginal. Assuming a maximum 10-year simple payback for residential consumers to be willing to adopt, the turnkey cost (equipment plus installation) for whole home electrification would need to be less than \$2,170, post all incentives, to break even. For existing homes, actual installed costs for the modeled electric appliances are likely to be in excess of \$20,000.

Table 21. Target Rates for Electrification

	PG&E	SCE/SCG	SDG&E	PG&E	SCE/SCG	SDG&E
Gas Usage & Cost	Low Efficiency Gas Appliances			High Efficiency Gas Appliances		
Space Heating (therms/yr)	334	96	76	256	73	57
Water Heating (therms/yr)	159	146	149	94	85	87
Appliances (therms/yr)	57	57	57	57	57	57
Annual Gas Usage (Therms)	550	299	281	407	214	201
Annual Gas Variable Charges	\$ 941	\$ 388	\$ 549	\$ 663	\$ 279	\$ 392
Annual Gas Fixed Meter Charges		\$ 60			\$ 60	
Annual Gas Total Charges	\$ 941	\$ 448	\$ 549	\$ 663	\$ 339	\$ 392
Electrification Use (kWh)	4,080	2,299	2,224	4,080	2,299	2,224
Breakeven Rate (\$/kWh)	\$ 0.231	\$ 0.195	\$ 0.247	\$ 0.162	\$ 0.147	\$ 0.176
Rate Proposal						
Cal Advocates	\$ 0.237	\$ 0.249	\$ 0.362	\$ 0.237	\$ 0.249	\$ 0.362
TURN	\$ 0.198	\$ 0.211	\$ 0.317	\$ 0.198	\$ 0.211	\$ 0.317
IOU	\$ 0.177	\$ 0.201	\$ 0.236	\$ 0.177	\$ 0.201	\$ 0.236

IV. Redesigning TOU for Electrification

Our analysis indicates that modifying TOU rate structures would be more beneficial to electrification than increased fixed charges. We modeled a TOU structure that is revenue neutral for a typical customer and demonstrate that it would result in energy bill savings, combining gas and electric bills, compared to the existing electrification rate. We recognize that this rate design is not designed to be revenue neutral for the residential class as a whole. This analysis should be replicated with a revenue neutral rate design that is similar in structure.

As stated above, 2/3 of increased usage for electrification is during winter off-peak and only 5% is in summer on-peak and mid-peak periods. For this reason, highly differentiating the rate structure would benefit electrification while avoiding the problems of inequity among households with the more blunt instrument of significant monthly fixed charges that go beyond the cost of customer access.

We created modified TOU pricing, using the PG&E E-ELEC tariff as an example. We reduce the winter off-peak to \$0.08/kWh to enable electrification, with a resulting increase in the summer on-peak rate to \$0.874/kWh. Other winter rates have a moderate discount and other summer rates see a moderate increase to balance revenue for the baseline home at the same \$0.349/kWh blended rate for this typical customer.

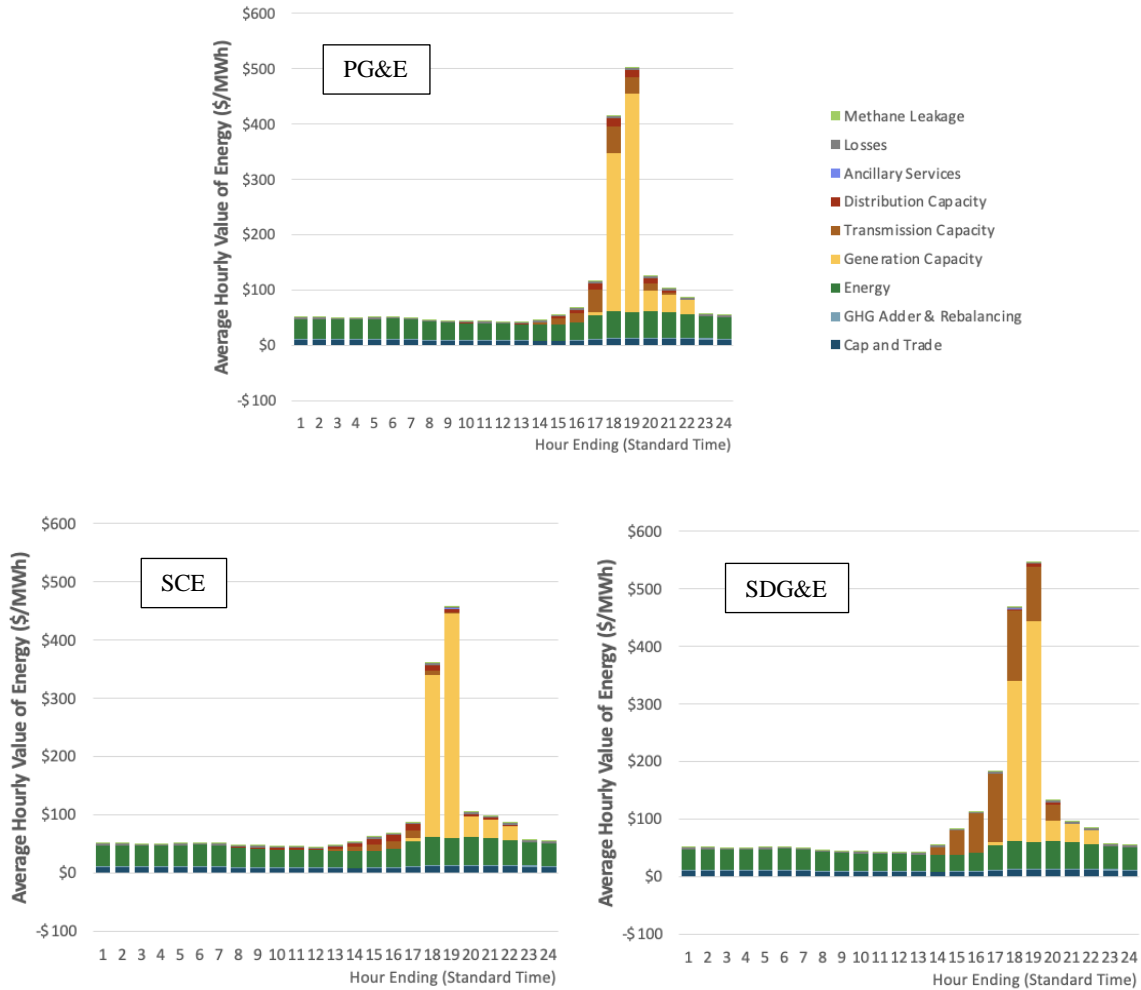
As shown in Table 22, the existing E-ELEC rate structure has a blended rate of \$0.349/kWh for the existing home profile and \$0.298/kWh for the off peak and winter weighted electrification. Because electrification is winter off-peak biased, the proposed rate decreases the blended rate from \$0.298 to \$0.163/kWh for additional electrification load, and from \$0.329/kWh to \$0.273/kWh for the total load after electrification. This would create greater savings than any of the assessed fixed charge proposals for electrification of gas loads. The \$681 additional electricity cost after electrification would be less than the pre-electrification average gas cost of \$802 that represents the mid-point between our low and high efficiency appliance scenarios.

Table 22. Bill Impacts of Electrification Under Modified TOU

Pre-Electrification Baseline						
		Existing		Modified		
		Total	Price	Total	Price	Pct of Usage
Summer	On-Peak	\$ 593	\$ 0.546	\$ 949	\$ 0.874	17%
	Mid-Peak	\$ 214	\$ 0.385	\$ 342	\$ 0.615	9%
	Off-Peak	\$ 305	\$ 0.328	\$ 427	\$ 0.459	15%
Winter	On-Peak	\$ 343	\$ 0.315	\$ 257	\$ 0.236	17%
	Mid-Peak	\$ 205	\$ 0.293	\$ 72	\$ 0.103	11%
	Off-Peak	\$ 544	\$ 0.279	\$ 156	\$ 0.080	31%
Total		\$ 2,204	\$ 0.349	\$ 2,203	\$ 0.349	
Additional Load from Electrification						
		Existing		Modified		
		Total	Price	Total	Price	Pct of Usage
Summer	On-Peak	\$ 59	\$ 0.546	\$ 95	\$ 0.874	3%
	Mid-Peak	\$ 31	\$ 0.385	\$ 50	\$ 0.615	2%
	Off-Peak	\$ 96	\$ 0.328	\$ 135	\$ 0.459	7%
Winter	On-Peak	\$ 178	\$ 0.315	\$ 134	\$ 0.236	13%
	Mid-Peak	\$ 159	\$ 0.293	\$ 56	\$ 0.103	13%
	Off-Peak	\$ 741	\$ 0.279	\$ 213	\$ 0.080	63%
Total		\$ 1,265	\$ 0.298	\$ 681	\$ 0.160	
Total Load with Electrification						
		Existing		Modified		
		Total	Price	Total	Price	Pct of Usage
Summer	On-Peak	\$ 652	\$ 0.546	\$ 1,044	\$ 0.874	11%
	Mid-Peak	\$ 245	\$ 0.385	\$ 391	\$ 0.615	6%
	Off-Peak	\$ 401	\$ 0.328	\$ 562	\$ 0.459	12%
Winter	On-Peak	\$ 522	\$ 0.315	\$ 391	\$ 0.236	16%
	Mid-Peak	\$ 364	\$ 0.293	\$ 127	\$ 0.103	12%
	Off-Peak	\$ 1,286	\$ 0.279	\$ 369	\$ 0.080	44%
Total		\$ 3,469	\$ 0.329	\$ 2,884	\$ 0.273	

Because this is additional load, it results in increased electricity sales. The \$0.08/kWh winter off-peak rate in our modified TOU example is higher than utility avoided costs of energy during off-peak hours. Total avoided costs in the Avoided Cost Calculator for off-peak hours, averaged across all summer and winter months, is approximately \$0.06/kWh, as shown in Figure 8. This rate would not be scaled up to recover legacy costs, but it would recover current avoided costs and would be an effective tool to encourage electrification.

Figure 8. Hourly Avoided Costs in the Avoided Cost Calculator³



Our approach and findings using a highly differentiated TOU structure are in line with those from a January 2023 study by Brattle Group analysts.⁴ This study evaluated the cost effectiveness of electrification of the heating load for 80 homes under an existing flat rate structure as well as a rate structure with a higher fixed charge and another with highly differentiated TOU rates. The study found that the highly differentiated TOU delivered over twice the annual customer savings (\$521 vs \$221), reducing the system payback by over half while remaining revenue neutral for the utility. The preferred TOU structure included a marginal 28% increase in the fixed rate component, as compared to a 250% increase in the less effective fixed charge proposal.

³ Summary tables from the 2022 ACC Electric Model for 2024 start year and a 1 year levelization period. Representative climate zones are CZ 12 for PG&E, CZ 10 for SCE, and CZ 10 for SDG&E.

⁴ Energy Systems Innovation Group, “Heat Pump-Friendly Cost-Based Rate Designs,” January 2023, available at <https://www.esig.energy/wp-content/uploads/2023/01/Heat-Pump%E2%80%93Friendly-Cost-Based-Rate-Designs.pdf>.