A Discussion of the Absence of the Societal Cost Test Analysis and Lack of Income-Based, Time of Use Analysis in the NEM 3.0 Proceeding Submittals, and the Necessity of Further Analysis

November 21, 2022

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Honorable Public Utilities Commissioners, Staff, and Interested Parties:

At Redwood Energy we model and monitor low-income tenant utility bills in affordable housing--more than 350 developments to date--which provides us with a granular understanding of how CPUC decisions affect low-income households' bills. We have also provided technical support on home electrification construction costs to the NRDC, Sierra Club and Environmental Defence Fund in the San Joaquin Valley and Three Prong Analysis CPUC proceedings. This letter is to advise you to reject the currently proposed NEM 3.0 decision and return it to Staff and Proponents for reanalysis due to its unmitigated and unconsidered impacts on low-income households. Specifically:

1. Excluding the Societal Cost Test analytic tools formalized in January of 2022, which contain new metrics for determining the Societal Cost of CPUC actions. Air Quality impacts on human health have been thoroughly documented as the largest single "cost shift" in current CPUC rates, but the SCT's Air Quality costs are absent from the various submittals.
2. Increased reliance on Time of Use rates, which LADWP has documented regressively impacts the limited load flexibility in low-income households.

1. The Societal Cost Test:

In the January 2022 publication of the Societal Cost Test, the E3/CPUC Report states:

"An SCT is one of the five cost tests envisioned in the California Standard Practice Manual used for evaluating demand side resources, but it has never been consistently implemented into decision making in California."'

"Under a sensitivity scenario in which 95th percentile estimates for the social cost of carbon and methane are used, an SCT does show increased clean energy resource procurement as cost effective. This scenario, the "High Social Cost of Carbon (SCC)" scenario, shows as cost effective additional clean energy resource procurement that would reduce electric sector emissions from 38 MMT to 19MMT by 2030, at an added annual cost of $1 billion. **This scenario would also increase DER avoided costs by about 35 percent in most hours except the mid-day hours when solar generation is highest." (emphasis added)**

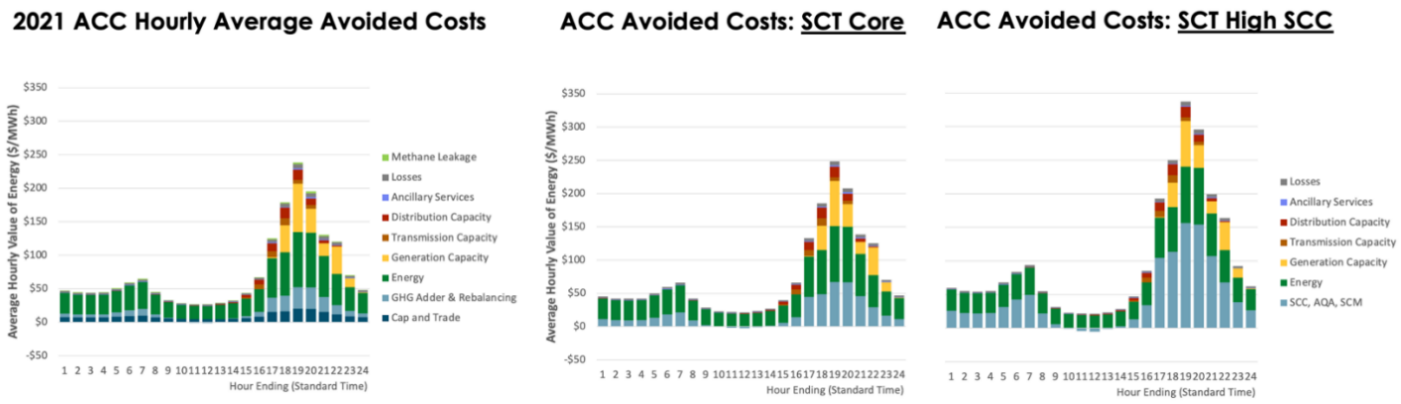


Figure 30. ACC hourly average avoided costs for reference 2021 ACC (left), and 2021 ACC under SCT Core and High SCC scenarios (right).

The SCT analysis of Distributed Energy Resource avoided costs is absent from the NEM 3.0 proceedings, which leads to an inaccurate reduction of the evaluated benefits of rooftop solar, the primary Distributed Energy Resource in the California grid. Functionally, it devalues human life and health--the Societal Cost Test analysis

is the only CPUC Test designed to measure the impact of CPUC decisions on the mortality and morbidity of Californians. It cannot be legally or ethically avoided.

Time of Use Rates with NEM 3.0

To support our recommendation to reject the proposed NEM 3.0 decision and require further analysis and protections on low-income households, and inform future rates with a Time of Use function, this letter re-analyzes the published research on Time of Use (TOU) impacts on low-income households that CPUC and SMUD relied upon when creating TOU rates, and provides new data on 55,000 Redwood Coast Energy Authority customers' electric bills under Tiered and two TOU rates. Our findings are consistent with those of LADWP as David Jacot, Director of Efficiency Services at LADWP, who wrote to the Building Decarbonization Listserve on November 8th, 2022.

"This was also LADWP's finding on residential TOU rates. ***Not only is TOU regressive for low income households, it's proportionally regressive.*** *Meaning, the less a household earns the more TOU hurts them. As Sean points out, they don't have the discretionary loads they can shift. This applies to many small businesses as well (mom and pop restaurants for example). Now, could a more equitable TOU structure [be developed] which is only applied to customers who can actually respond to it? Surely, but at what level of complexity, and how to fairly set the cutoff points etc. But on the balance, count me among the skeptics of a broad-based TOU scheme applied to all residential."* ***(emphasis added)***

Additionally we provide evidence of 60%-100% bill increases on low-income customers in the IOU territories between 2019 and 2022, far above the publicly noticed rate hikes. Again demonstrating **the CPUC Staff and Consultants are insufficiently analyzing the impact of new rates and tariffs decisions on low-income households**, likely due to not analyzing the impacts on low energy users.

A Review of Published Science on Time of Use Rates

As part of writing this comment letter, we consulted CPUC staff, SMUD staff and NRDC staff to identify the TOU studies used by the CPUC to date, we have identified no papers or evidence of energy savings or utility bill savings in Low Income Households. Instead, the evidence is Low Income households pay more for their utilities under TOU, without producing societal or personal benefits, resulting in a Cost Shift from high-consuming households, which are predominantly higher income households, to low-consuming households which are predominantly low-income households.

Studies on time-varying rate structures began in the 1970s when 12 pricing experiments were carried out in the U.S. "The argument was made that if customers had an incentive to reduce usage during costly peak periods, demand and supply would come into balance automatically and avert the need for administrative solutions to avert a crisis".[1]

Testing this simplified economics model was a moot issue in the absence of smart meters in the 1970s, but California's "Energy Crisis"/"Enron Scam" of 2000-2001 triggered the recall and replacement of Governor Davis with Governor Schwarzaneggar, who had a mandate to reform the energy system with Administration and prevent future black-outs. California Energy Commission implemented a new "Time Dependent Valuation" metric for the 2003 Title 24 Energy Code, and in 2005 PG&E proposed that their ratepayers be switched to TOU rates that could be implemented with the Smart Meters. PG&E purported that these new Smart Meters

[1] Faruqui, A., Sergici, S. and Warner, C., 2017. Arcturus 2.0 : A meta-analysis of time-varying rates for electricity. *The Electricity Journal*, 30(10), pp.64-72.

would modify consumer behavior with higher rates during peak usage hours, thus avoiding brownouts and blackouts.[2]

2005: "Household Electricity Demand, Revisited"

In "Household Electricity Demand, Revisited," by Reiss and White in 2005, the authors responded to the TOU proposal by demonstrating that the 1993 and 1997 RECS datasets showed Time of Use rates would be only mildly effective, and that Low-Income households would be enthusiastic but limited in their ability to save energy. In the study the authors concluded:

1. Only approximately 1 in 8 households were strongly sensitive to electricity price changes, and these were most likely to be lower-income households.
2. The other 7 in 8 households were less persuaded by price changes, and 4 of those 7 were completely "price-insensitive," such that changes in price would make no difference to their behavior. These price-insensitive people were more likely to be high-income.[3]

With this information in hand, the CPUC approved PG&E's request to charge ratepayers $2.2B[4] and install Smart Meters to enable TOU residential rates, followed by SMUD, SCE and SDG&E, and others. At the time CPUC President Richard Peevey stated: "[Smart Meters] will empower customers to make informed, intelligent choices about their electrical usage. Through price signals built into time-varying rates, customers will know when to turn up the thermostat on their air conditioner, or not run large appliances"[5] This statement was not supported by the evidence available to President Peevey at the time.

Since 2005, as TOU rate pilots have expanded and evolved they have incorporated designs that have gone beyond the traditional time-of-use structure. This includes rate increases called critical-peak pricing (CPP), peak-time rebate (PTR), and variable-peak pricing (VPP), all of which function to raise rates on those who can't significantly reduce their already low energy consumption.

The proposal for even more convoluted Time of Use rates within the NEM 3.0 proposal requires reconsideration to ensure California ratepayers are being billed Equitably, without a furtherance of a Cost Shift from high-income to low-income households by raising bills on those lower income, low consumption households who cannot shift their consumption. This analysis is necessary in light of facts, not the hypotheticals of TOU boosters who don't read their own research.

The 2009 California Residential Appliance Saturation Study (RASS)

The 2009 California Residential Appliance Saturation Study (RASS) demonstrated that income and energy consumption are tightly correlated (see graphs below). There is a strong, positive relationship between income and energy use, with households making more than $75,000 having both the highest energy use and the most rapid growth rate of energy consumption as their income increases.[6]

The 2009 RASS also documented that 47% of Low Income (<$25,000/year) households are Low Energy Users, while only 11% of High Income (>$75,000) households are Low Energy Users. Conversely, only 8% of

[2] 2000-2001 California Energy Crisis. Wikipedia. Accessed October 22, 2021. https://en.wikipedia.org/wiki/2000%E2%80%9301_California_electricity_crisis

[3] Reiss. P.C., and M. W. White, 2005. "Household electricity demand revisited." Review of Economic Studies 72, 853-858.

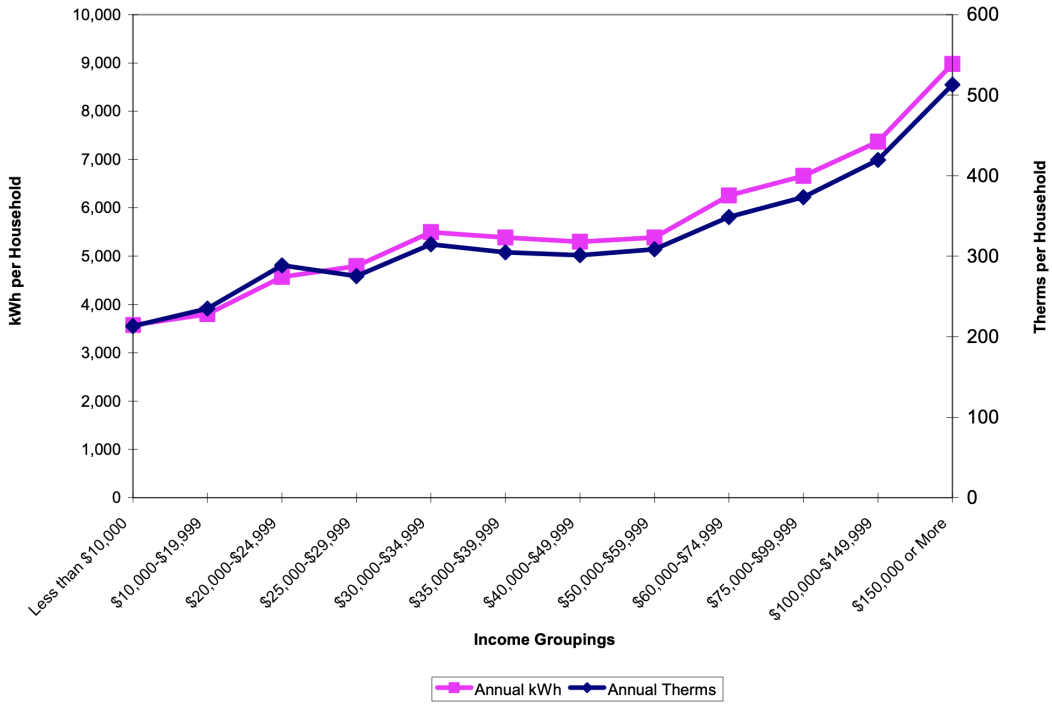
[4] Woodall, Bernie. "PG&E Gets California Approval to Fund Smart Meters." March 12, 2009. Reuters. https://www.reuters.com/article/pge-smartgrid/pge-gets-california-approval-to-fund-smart-meters-idUSN1238251120090313

[5] Press Release. "CPUC Approves Smart Meters for PG&E Customers." July 20, 2006. https://docs.cpuc.ca.gov/PUBLISHED/NEWS_RELEASE/58233.htm

[6] Atamturk, Nilgun. "Electricity Use and Income: A Review." June 21, 2012. California Public Utilities Commission. https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/Pre_2013_PPD_Work/PPDElectricityUseIncome.pdf

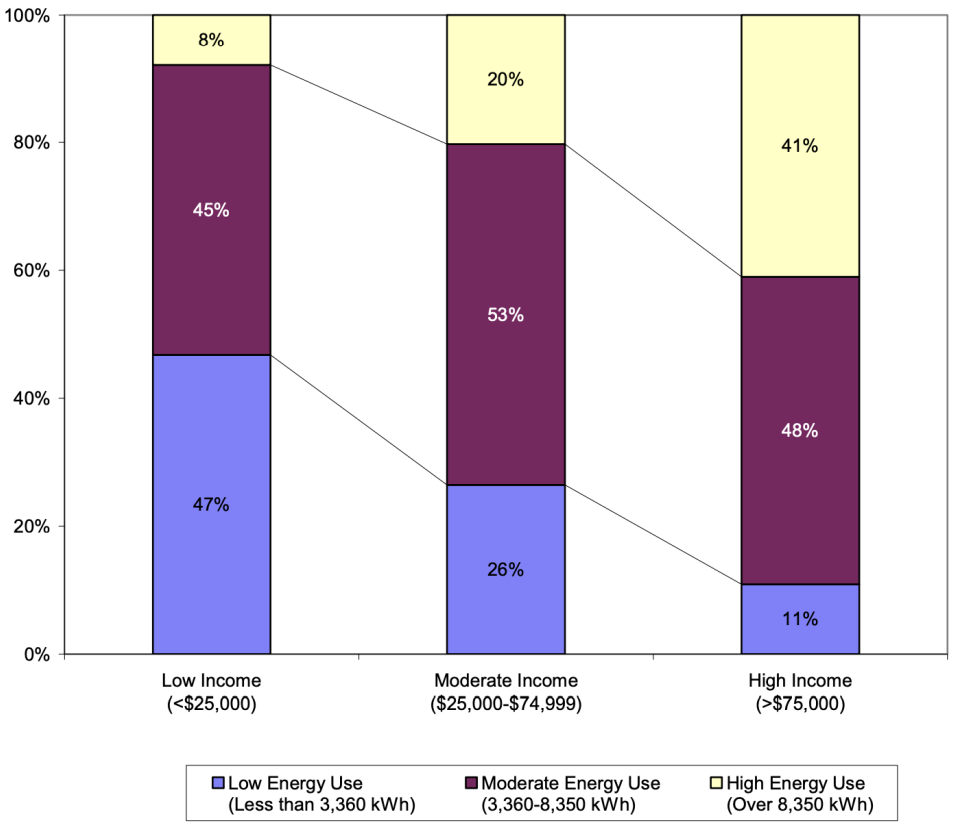
Low-Income households are High Energy Users, compared to 41% of High-Income households that are High Energy Users. Compared to Low-Income households, High-Income households are 5 times more likely to be High Energy Users and roughly 5 times less likely to be Low Energy Users.

Figure ES-34: Average Electricity and Natural Gas Consumption by Income



Source: *2010 California Residential Appliance Saturation Survey*

Figure ES-35: Electricity Consumption Compared With Income



Source: *2010 California Residential Appliance Saturation Survey*

In 2014 the Sacramento Municipal Utility District (SMUD)[7] published results from a two-year study of customers in various Time of Use rates. The analysis showed that Low-Income customers (EAPR) paid 20% to 360% more during the peak than the off-peak price but with little (4.8% reduction) to no (-1.7% reduction) savings impact on reduced kW during TOU peak hours, or during Conservation Day events.

SMUD additionally studied the impact of a pilot effort to provide In-Home Devices (IHD) to inform Low Income (EAPR) and Moderate/High-Income participants of TOU hours and Conservation Day events (CPP). In the second row of Tables, 4-4 and 5-5 one can see Low Income (EAPR) customers benefit from In-Home Devices, as do Moderate/High Income (Non-EAPR) customers, but SMUD did not deploy In-Home Devices, nor did any IOU, but proceeded to device has ever been deployed to enable savings

Low-income participants showed an 8.2% impact for TOU and a 13.7% impact for CPP. Moderate/High-Income participants showed a 13.2% impact for TOU and a 28.6% impact for CPP. While Low-Income participants were more affected by the IHDs during CPP events, overall the energy reduction from the Higher-Income participants was more significant due to the larger amount of energy and reference loads.

[7] Potter, J. M., George, S. S., & Jimenez, L. R. (n.d.). Review of *Smart Pricing Options Final Evaluation*:*The final report on pilot design, implementation, and evaluation of the Sacramento Municipal Utility District's Consumer Behavior Study.* 2014. smud.org/-/media/Documents/Corporate/About-Us/Energy-Research-and-Development/research-SmartPricing-options-final-evaluation.ashx

For example, in Table 4-4 Low-Income participants using an IHD reduced their energy usage by 0.06 kW resulting in a 3.4% impact. Where Moderate/High-Income participants had an impact of 0.04 kW & 1.9%. While these are relatively proportional decreases, the Higher-Income overall impacts were much larger. These are 0.20 kW-11.3% without an IHD and 0.24 kW-13.2% with an IHD. Whereas the Low-Income participants had 0.08 kW-4.8% without an IHD and 0.14 kW-8.2% with an IHD.

From this, we can conclude that In-Home Devices, such as Smart Meters, have a similar effect on Low-Income and Moderate/High-Income participants. However, the Moderate/High-Income participants were more affected by the switch to a TOU rate schedule compared to the Low-Income participants. Even with a 15.4% reduction impact for Low-Income users during CPP events when utilizing an IHD, Higher-Income participants still had a larger impact overall. They only saw a 1% difference during CPP events when utilizing and not utilizing an IHD, but had 2-17 times more impact compared to Low-Income participants. Aligning with the 1993 and 1997 RECS datasets that showed Time of Use rates would only be mildly effective for Low-Income households due to their limited ability to save energy.

Table 4-4: 2012/2013 Average Load Impacts by EAPR Status

Group	EAPR					Non-EAPR				
	Impact	95% CI Lower	95% CI Upper	Reference Load	% Impact	Impact	95% CI Lower	95% CI Upper	Reference Load	% Impact
Opt-in TOU, No IHD Offer	0.08	0.00	0.16	1.65	4.8%	0.20	0.15	0.25	1.76	11.3%
Opt-in TOU, IHD Offer	0.14	0.08	0.20	1.70	8.2%	0.24	0.20	0.29	1.84	13.2%

Table 5-5: 2012/2013 Average Load Impacts by EAPR Status for CPP Pricing Plans

Group	EAPR					Non-EAPR				
	Impact	95% CI Lower	95% CI Upper	Reference Load	% Impact	Impact	95% CI Lower	95% CI Upper	Reference Load	% Impact
Opt in CPP, No IHD	-0.03	-0.38	0.32	1.84	-1.7%	0.69	0.38	1.00	2.51	27.6%
Opt in CPP, IHD Offer	0.30	0.16	0.44	2.18	13.7%	0.76	0.63	0.88	2.65	28.6%

SMUD's summary analysis included:

1. Low Income (EAPR) customers are 10% more likely to opt into a Time Of Use rate than Moderate/High-Income customers.
2. Yet despite their greater enthusiasm, "EAPR [Low Income Discount] customers are generally less responsive to price than non-EAPR customers (about 50% less responsive)."
3. "...Any opt-in program will likely be much more cost-effective if it focuses its marketing resources primarily on large users."

If we can conclude that High Energy Users are generally of a higher income bracket, based on these findings we can advise that TOU & other pricing plans that are used to incentivize peak load reduction behaviors should be targeted at High-Income customers. Low-Income customers may have an enthusiasm to reduce their energy load during expensive times, but High-Income customers have a larger reference load to reduce from. Which results in a greater impact on the grid during those peak times.

2020: A New Study of the Utility Bill Impact of TOU vs. Standard Tiered Rates of Low, Medium, and High Electricity Customers of the Redwood Coast Energy Authority, Humboldt County, CA.

Summary of Findings:

The data in this study are the daily load profiles of all residential customers of the Redwood Coast Energy Authority in 2020 (n=55,000) without electrical vehicles (EVs), i.e., customers currently on an E-1 rate schedule. Profiles selected were those in the 25th, 50th, and 75th percentile of electricity usage. As we learned from the ES-25 graphic 2009 RASS discussed above, a very small amount (e.g. 8%) of low-income households would be found at the 75th percentile of annual electricity consumption, and a very small amount of high-income households would be 25th percentile users (e.g. 11%) of electricity.

What one sees below in Figure 1, is that the largest financial risk of transferring from Tiered to TOU was borne by those in the 25th percentile of consumption – $84 more/year if they transferred from E-1 Tiered to E-TOU-D. The potential savings between E-1 and TOU-C were just $15 annually for those same households. Transferring to TOU is a high-risk, low-reward choice for a 25th percentile household.

Conversely, a 75th percentile consuming household could save $46 annually transferring from E-1 Tiered to E-TOU-D, but only risk $4 of annual bill increase transferring to E-TOU-C. Transferring to TOU is a low-risk, low/modest-reward choice for a 75th percentile consuming household, which we learned from the 2009 RASS is 92% Moderate and High-Income households.

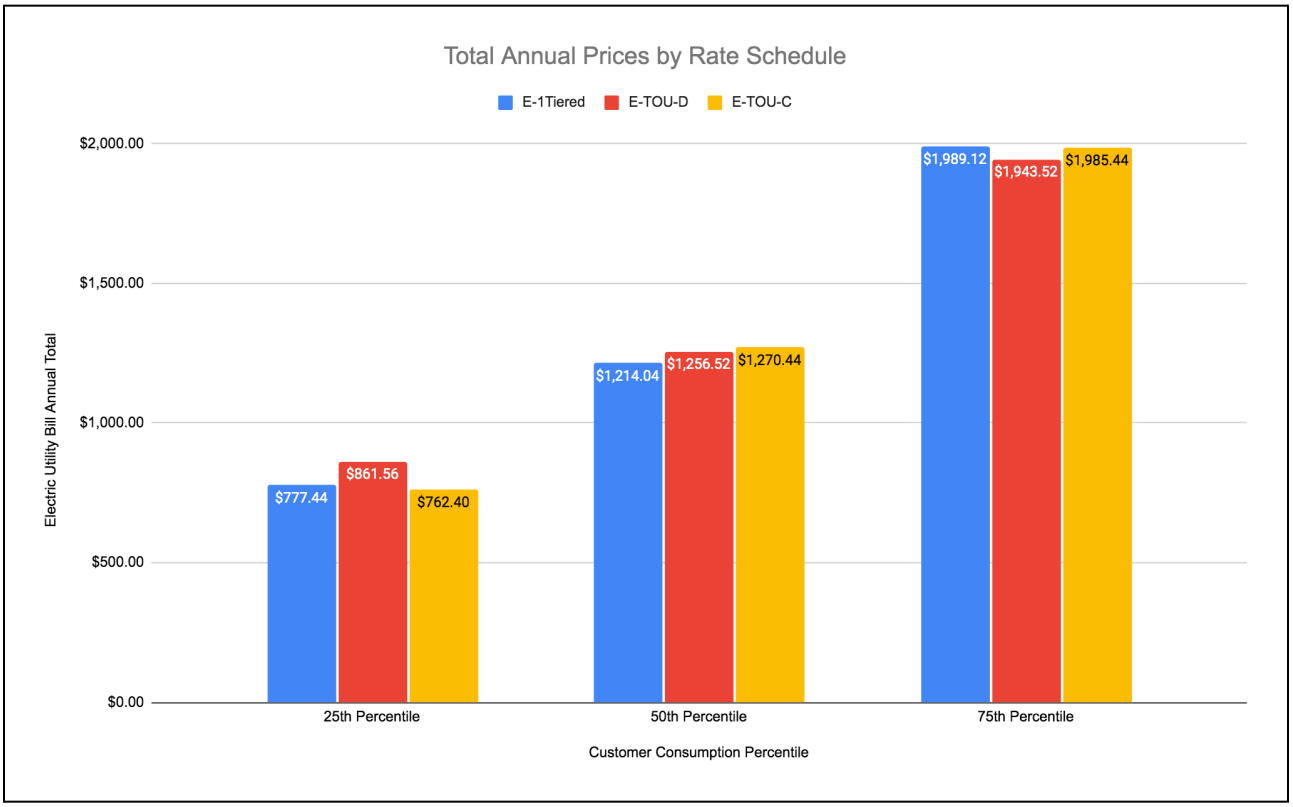


Figure 1

Methodology:

An average of all households in each of the corresponding percentiles was taken and organized on an hourly basis to gain a precise read of customers' energy use throughout the day. The same data was used for each rate schedule to provide an accurate comparison for 30 days of summer and winter prices. The graphs differ by season due to the individual pricing for the summer (June-September) and winter (October-May) seasons. Each daily load profile calculated was adjusted to showcase a 30-day price for a more digestible comparison. Rather simplified versions to easily compare the price structure of the different rate schedules.

For the comparison, three different rate schedules were selected, E-1, E-TOU-D, and E-TOU-C. The traditional E-1 schedule is a tiered structure, meaning customers are charged the same price for each hour of the day which increases with energy use. Once a customer's energy use exceeds their baseline level the prices will increase but remains the same price no matter what time of day. This means that those with lower energy use inherently have a lower energy bill. The other two schedules are Time-of-Use (TOU) rate schedules, where instead the price fluctuates depending on the time of day, i.e., peak pricing. This pricing structure is not necessarily dependent on how much energy a customer uses, but rather when they use it. For E-TOU-D peak pricing is weekdays from 5-8 pm and E-TOU-C has peak pricing from 4-9 pm every day. These are the two schedules PG&E has listed on their site for TOU schedules available. It is worth noting that on the E-TOU-C schedule customers receive credit for usage under their baseline allowance, this was accounted for in the calculations.

Since the data received from RCEA was organized on an hourly basis, the usage for each hour was calculated based on the peak price for the corresponding time for each individual rate. This was done to maintain the organization of the on/off-peak pricing. Each day was then totaled and multiplied by the number of days in the month corresponding to that rate schedule. Keep in mind the E-TOU-D schedule that does not charge peak pricing on weekends. These days were calculated using the same hourly data but were calculated using off-peak pricing and multiplied by the average amount of weekend days in a month of the particular season being analyzed (i.e. E-TOU-C was multiplied by 30 to account for an average month since its structure has peak pricing each day of the week. For E-TOU-D two different types of days were calculated: weekdays that have peak pricing and weekends that are all off-peak. Each was multiplied by the average number of days for a winter/summer month. 22 days for peak price weekdays and 8 days for weekends.).

Due to the tiered pricing having a different structure, it required a different method of calculation. The different tiers are all structured off a baseline energy usage amount that is set for different territories. For the location of this report, western Humboldt County, this is territory V. Baseline amount is a set energy allowance for the month that the utility company determines where the customer will be charged the lowest price. After surpassing baseline energy allowance the customer is then moved into the 2nd tier, where they will be charged a higher price for their usage after that. The 2nd tier is 101-400% over the baseline allowance and the 3rd tier is greater than 400%. Using the total energy usage per day, the amount within baseline was calculated at baseline pricing, then usage over was calculated at corresponding tier pricing. It is important to note that in neither season did either of the percentile groups surpass into the 3rd tier (>400%). The 25th percentile group only breached the baseline in the summer, with a small charge of $7.54 for the usage under the 2nd tier.

It is important to take account of that the same data was used for each rate structure without modification, so behavioral/seasonal change from the energy consumer cannot be accounted for in the numbers presented in the graphs. The calculated data is only to show the differences between the rate schedules on their own without intended behavioral changes. This is to get a true objective sense of the rate structures affect on customers' bills without the influence of human reaction to prices fluctuations.

Summer vs. Winter Months Analysis of Financial Cost of TOU Rates on 25th and 50th Percentile Electricity Consumers, Financial Benefit to 75th Percentile Electricity Users in RCEA Territory

The following graphs below show the monthly, not annual, relative bills of customers in the 25th, 50th, and 75th percentile. During the summer season (June to September), all TOU rates caused in an increase in utility bills for the month. Except for E-TOU-D for the 75th percentile where we saw a decrease of about $5. During the winter season (October to May) that same TOU rate (E-TOU-D) resulted in an increase, again except for the 75th percentile where we saw a decrease about $3/month. From these graphs we can conclude that if customers were to be put on an E-TOU-D rate structure, low and moderate energy users would see an increase in their bills strictly from the change in their rates. This caused an almost $100 increase annually, while high energy users would experience a decrease all year long. This supports the notion that TOU rates put low-income customers at high risk for bill increases. While high income consumers are likely to see in a decrease in the energy bills. With low income customers generally being low energy consumers, being put on a rate structure that increases their bills is dispropriate to the impact they have on the grid compared to high-income/energy customers. It is unfair to offset costs onto those who are already utilizing energy quite minimally when the greatest impact to the grid is in the hands of customers using the highest amount of energy. If a new rate structure is to be implemented to levelize energy use over the course of the day, then it should be targeting high-energy users. Low-energy users have a limited capacity in how much energy they are able to reduce before encroaching on their basic needs, and while generally willing to do so, the reality is that high energy consumers have the most capacity to reduce their energy consumption - resulting in the largest impact on the grid.

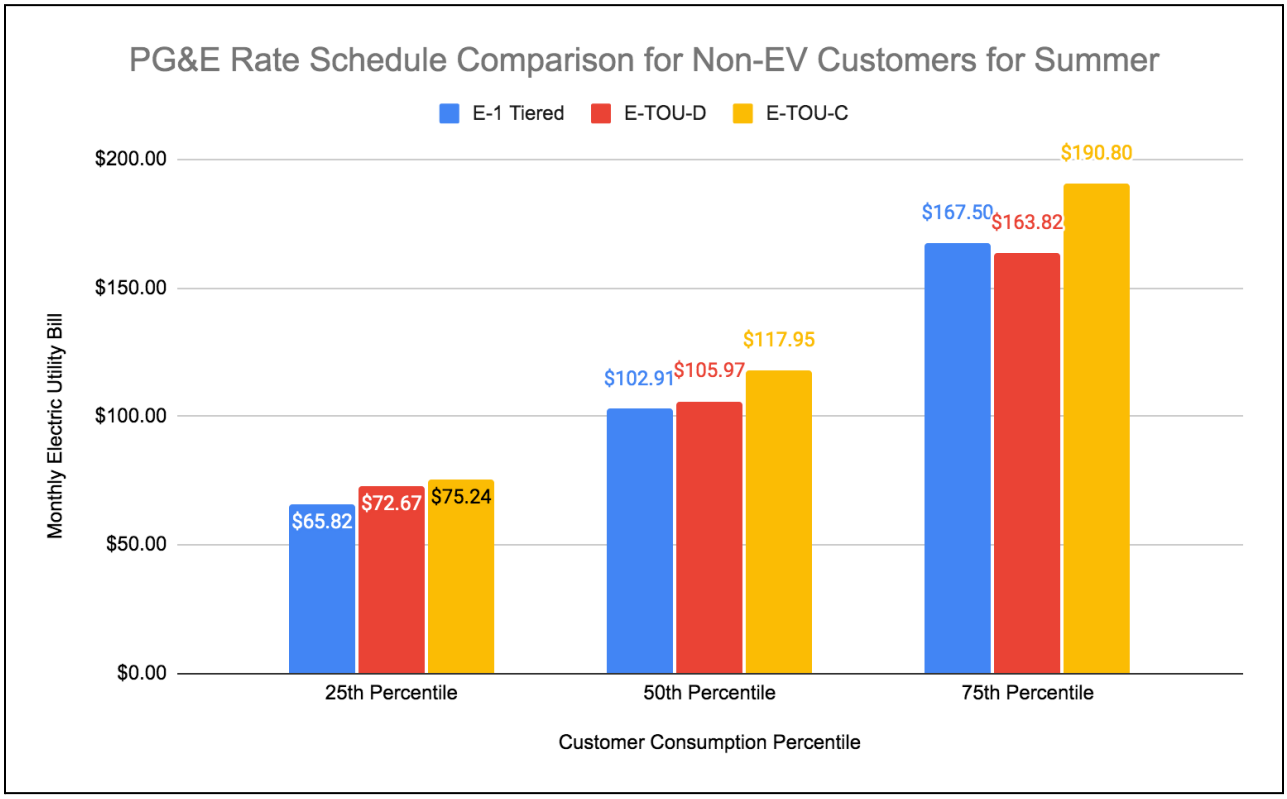


Figure 2

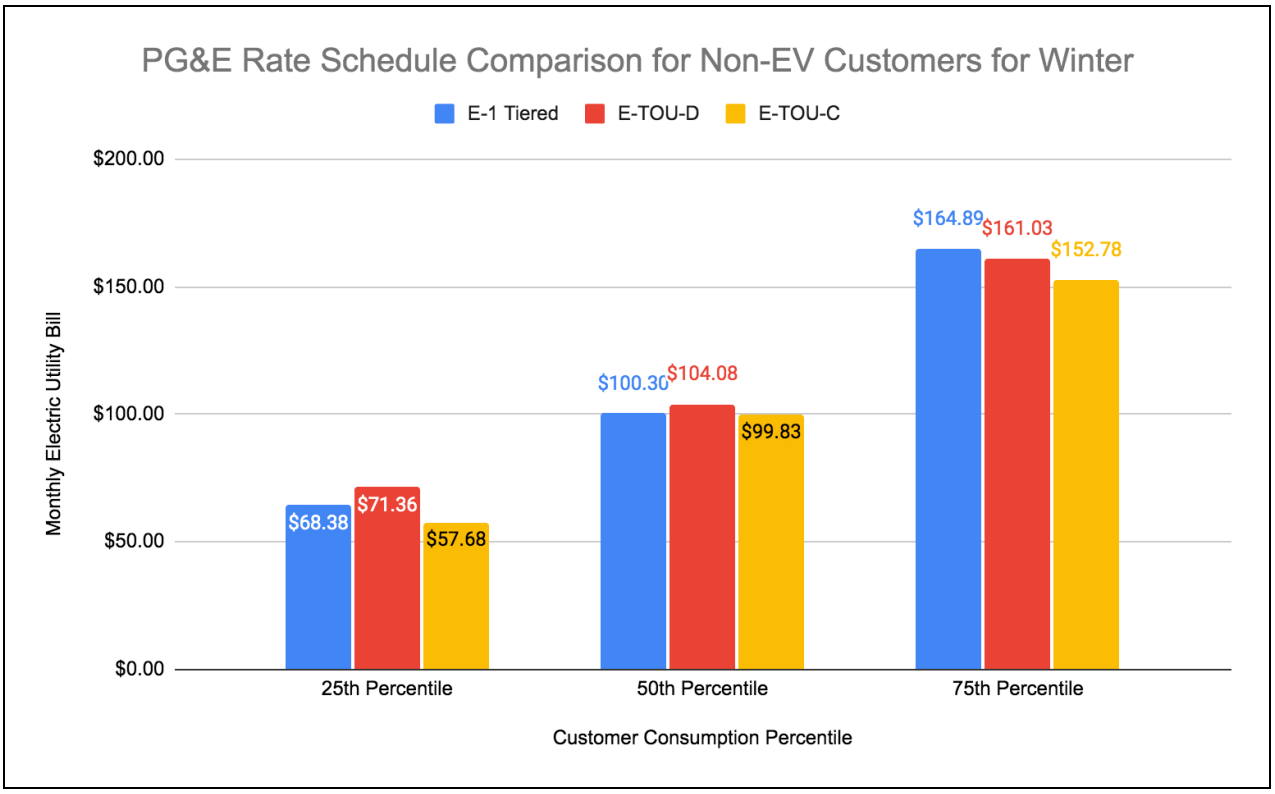


Figure 3

Conclusion

Please incorporate Societal costs and benefits into a new analysis of NEM 3.0, and please reconsider Time of Use rates within NEM 3.0. The evidence supports these requests.

Sincerely,

Sean Armstrong, Managing Principal
Kelsey Martin, Senior Researcher


Redwood Energy