APPENDIX C: SYNAPSE WHITEPAPER

Establishing Income Based Fixed Charges in California

A review of economic theory, policy tradeoffs, and practical considerations for fixed charge reform

Prepared for The Utility Reform Network and Natural Resources Defense Council

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AUTHORS

Eric Borden
Ben Havumaki
Alex Lawton
Melissa Whited

Synapse Energy Economics, Inc.

485 Massachusetts Avenue, Suite 3
Cambridge, Massachusetts 02139

617.661.3248 | www.synapse-energy.com

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1. INTRODUCTION AND OVERVIEW

The purpose of this white paper is to provide an overview of the theoretical underpinnings of rate design that should be considered when establishing how, and to what extent, a fixed charge is appropriate for inclusion in residential rate design. This was developed to inform the current proceeding in California that was established pursuant to recent legislation, and to aid The Utility Reform Network (TURN) and Natural Resources Defense Council (NRDC) with development of their fixed charge proposal. The content of this white paper is the work of Synapse Energy Economics and does not necessarily reflect the views or opinions of TURN and NRDC.

We discuss the interaction of sometimes conflicting theoretical economic frameworks with diverse policy goals and considerations. We acknowledge that rate design is both a science and an art to provide a framework for the CPUC to consider how best to implement progressive fixed charges with existing tools and information.

This is spurred by legislative action allowing for higher residential fixed charges in California, subject to a number of provisions and considerations. Namely, in 2022, the California legislature passed Assembly Bill (AB) 205, which among other provisions states,

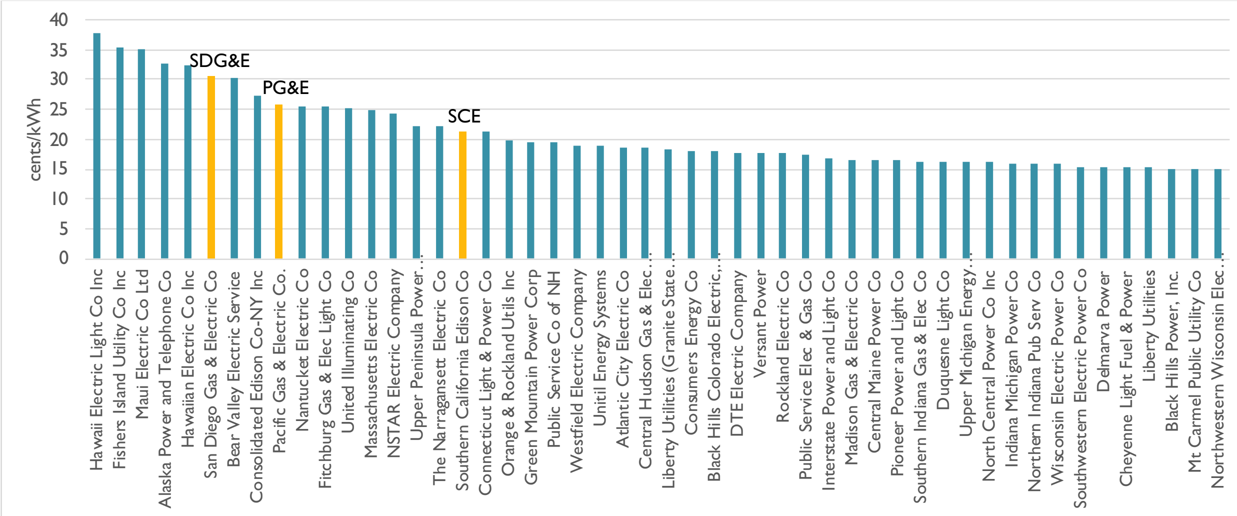
> the commission may authorize fixed charges for any rate schedule applicable to a residential customer account. The fixed charge shall be established on an income-graduated basis with no fewer than three income thresholds so that a low-income ratepayer in each baseline territory would realize a lower average monthly bill without making any changes in usage. The commission shall, no later than July 1, 2024, authorize a fixed charge for default residential rates.[1]

The law is clear that fixed charges are meant to be charged on a relatively progressive basis – e.g. higher-income households should generally be charged higher fixed charges, and vice-versa. The exact implementation and rate schedules are subject to California Public Utilities Commission (CPUC) approval.

At present, California IOU electric rates are among the highest in the country, and set to go higher. With virtually no fixed charge established to-date,[2] revenue requirements are collected almost entirely through volumetric charges.

[1] AB 205, Section 10(e)(1).
[2] IOUs in the state do have fairly low "minimum bills" of around $10, which act differently than fixed charges.

Figure 1. Investor Owned Utility Average Residential Rates in the United States, Top 50 Utilities, 2021[3]



Note that the rates shown above are expected to be significantly higher in 2023 – over 30 cents for PG&E and SCE and over 45 cents for SDG&E.[4] This would make them among the highest in the country unless rates in other jurisdictions grow at the same astonishing pace.

We wish to note upfront the limitations of any rate design to solve or manage the affordability predicament California IOU ratepayers currently find themselves. As stated in a recent CPUC report to the legislature,

> Cost reduction strategies result in a direct impact on electric IOU revenue requirement savings because they reduce the size of the overall "pie" of costs that utilities are authorized to recover through rates, and this benefits all customers. Cost allocation and rate design strategies redistribute costs and have an indirect impact, because they reduce system costs only to the extent that they can alter customer incentives to achieve greater alignment between energy usage and grid conditions over time.[5]

Still, the influence of rate design on customer behavior and its impact on an array of policy goals is significant and must be carefully considered. We provide an overview of these considerations in this paper.

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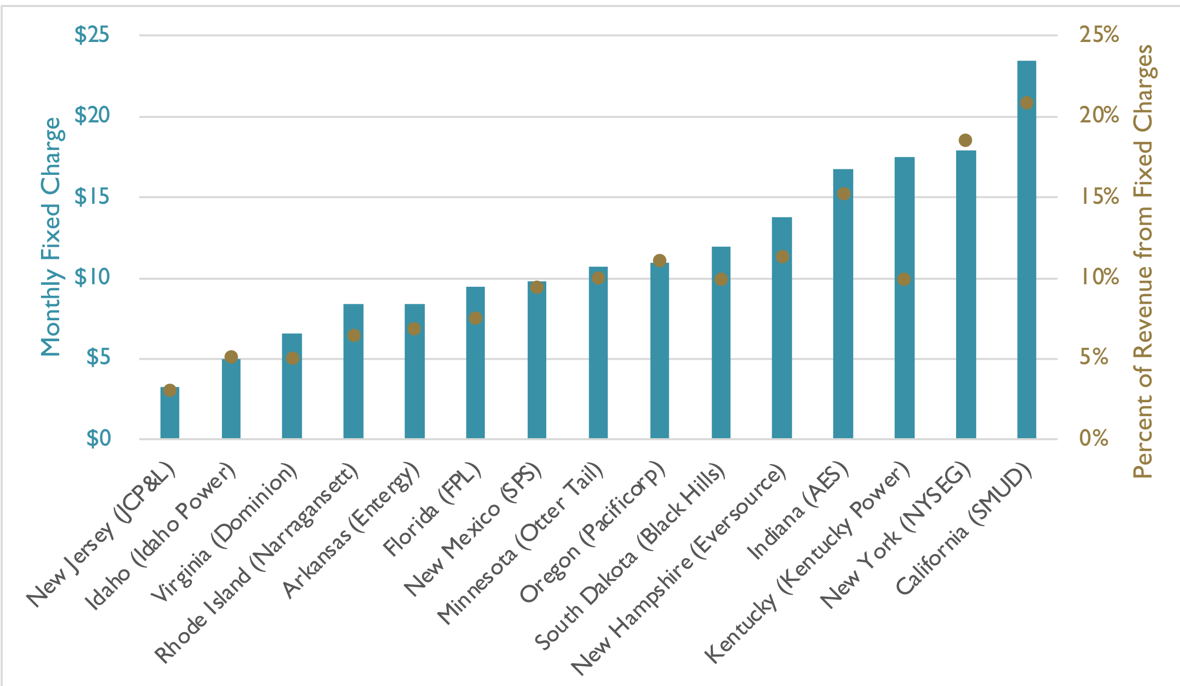
[3] Energy Information Administration (EIA), https://www.eia.gov/electricity/sales_revenue_price/, Table 6.
[4] Calculated from the E3 Tool's total revenue requirements for default rates divided by total 2023 load.
[5] CPUC 2022 Senate Bill 695 Report, May 2022, p. 48, https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/office-of-governmental-affairs-division/reports/2022/2022-sb-695-report.pdf.

2. Fixed charges in the United States and California

Residential customer charges (also called “fixed charges”) vary significantly across the country. Synapse analyzed a sample of utilities’ residential customer charges contained in the National Renewable Energy Laboratory’s OpenEI utility rates database. These were selected to provide a recent, diverse sample of electric fixed charges across the country, but are not meant to be representative of the entire country.[6]

Figure 2. Electric Bill Fixed Charge Levels and Percentage of Residential Revenue across the United States



In general, the level of fixed charge scaled linearly with the percentage of revenue collected. As a percentage of revenue, customer charges collect 9 percent of the residential revenue requirement on average, but range significantly from nearly 0 percent to greater than 20 percent. We are not aware of any fixed charge that has been assessed on a progressive basis, by either income or usage, for the residential class.

[6] The OpenEI database was cross referenced with actual current utility tariff data to ensure accuracy. Customer counts and residential revenues from EIA-861 – schedules 4A&4D and EIA-861S, downloaded from the Energy Information Administration’s (EIA’s) website.

3. Economic Theory and Fixed Charges

3.1. Varying conceptions of the fixed charge

Fixed charges are common in utility rate design, yet there isn't a consensus on how they should be implemented or calculated. Discussion of fixed charges in utility regulatory proceedings is frequently attended by both theoretical disagreements and more pragmatic, policy-related ones. On one hand are variations on the plain argument that fixed charges should recover the share of the utility bill that represents fixed costs. On the other are what is "fixed," policy aims of rate design, the time horizon across which rates are set, and other considerations. Since rate design provides price signals to customers regarding their consumption, the effect of design on customer behavior – consumption patterns and investment incentives - is a key consideration.

Fixed charges are most commonly applied in the residential sector to recover customer-related costs. These are the costs of physically connecting customers to the grid that do not vary with the amount of customer usage – in other words, these costs do not change - relative to energy consumption. There is little debate that meters, service drops, and some amount of billing and services may be categorized as customer-related fixed costs.[7] Yet even within this simple-sounding parameter, there are differing theoretical perspectives and differences in methodologies to calculate these costs. These different perspectives are frequently on display in California regulatory proceedings.[8]

There is also a recurring debate over whether additional facets of the distribution system ought to be categorized as customer-related.[9] Utilities may argue that there is an overarching customer-related function that characterizes the entire distribution grid, including those parts of the distribution grid that do not vary with the number of customers or other marginal elements.[10] The implication of this argument is that a portion of the costs of distribution grid facilities not proximate to individual customers or explicitly deployed to provide grid connection to these customers should nonetheless be conceptualized as customer-related or fixed – with potentially large consequences for both cost allocation and rate design.

What about other purportedly "fixed" costs? Utilities may seek to use fixed charges to recover non-customer related costs that do not obviously vary with energy or peak demand.[11] Examples

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[7] National Association of Regulatory Utility Commissioners (NARUC). 1992. Electric Utility Cost Allocation Manual, pp. 87-88 and 102-104.

[8] See Regulatory Assistance Project (RAP), *Electric Cost Allocation for a New Era. 2020, pp. 207-208.*

[9] Weston, Frederick, et al. 2000. Charging for Distribution Utility Services: Issues in Rate Design. Regulatory Assistance Project (RAP), pp 29-30.

[10] See, for example, Direct Testimony of Larry T. Legg on behalf of Georgia Power Company. Docket No. 42516. June 28, 2019, p. 7.

[11] Faruqui, Ahmad and Kirby Leyshon. 2016. Methodologies for Establishing Fixed Charges in Residential Tariffs: A Survey. Prepared for Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company, p. 4.

of such costs include administrative costs and the costs of public policy compliance. We discuss the economic basis of considering these questions in the following section.

3.2. Principles of rate design and fixed charges

The claim that fixed charges should recover fixed costs may be an allusion to foundational rate design goals. First is the objective of fairness. The second goal connecting fixed charges and fixed costs is economic efficiency. While both of these aims appear clear in the abstract, there may be considerable dispute over how they should best be balanced, especially given the utility imperative to recover the costs of past investments, which comprises the vast majority of revenue requirement.

The fairness objective is often related to the principle of "cost causation," which requires that customers pay according to the costs that they impose on the system. For example, in the case of customer connection costs that can be attributed to a single class of customers, these costs are *caused* by the customer connection to the grid, so they should be allocated accordingly. This may be extended to rate design with the conclusion that customers should pay for the costs they are responsible for, in the manner the costs were imposed.[12] This often has implications for future costs that are incurred in the same way, which may be avoided through accurate price signals and consumer understanding of those price signals.

The objective of economic efficiency supports some degree of fixed charge cost recovery. Economic theory holds that efficiency is maximized by setting price equal to short run social marginal cost, which is the cost borne by society to producing an additional unit of a good or service. By invoking "efficiency," economics is ultimately talking about maximizing wellbeing by appropriating limited resources according to societal need; by maximizing efficiency, the competitive market with marginal cost pricing is predicted to maximize combined consumer and producer wellbeing to an optimal level. When price is not equal to marginal costs, the level of production and consumption is deemed inefficient because total wellbeing generated is less than the theoretical maximum. This inefficiency is measured by "deadweight loss," which directly relates to the over- or under-consumption of a given good relative to efficient levels.

The cost causation and efficiency principles are related but may not always lead to the same result. To the extent that the cost causation principle is applied retrospectively to utility recovery of past investments, it may be in tension with the efficiency objective. Maximizing economic efficiency requires looking ahead, assessing the future cost implications of consumption decisions. Other principles and policy considerations may add further complication such that a narrow fidelity to efficiency or fairness criteria is usually unworkable. However, these principles provide guidance for how to think about and ultimately apply economically defensible fixed charges.

[12] Similarly, costs caused by peak demand, or consumption at certain times, should be allocated to those times and charged accordingly. This can be accomplished with a variety of price mechanisms including time of use (TOU) rates, critical peak pricing (CPP), demand charges, and others.

Rate Design Principles

The authoritative source on rate design principles is James Bonbright's 1961 "Principles of Public Utilities." This work sets out eight core rate design principles, which address fairness and economic efficiency among other considerations:

1. The related, "practical" attributes of simplicity, understandability, public acceptability, and feasibility of application.
2. Freedom from controversies as to proper interpretation.
3. Effectiveness in yielding total revenue requirements under the fair-return standard.
4. Revenue stability from year to year.
5. Stability of the rates themselves, with a minimum of unexpected changes seriously adverse to existing customers. (Compare "The best tax is an old tax.")
6. Fairness of the specific rates in the apportionment of total costs of service among the different consumers.
7. Avoidance of "undue discrimination" in rate relationships.
8. Efficiency of the rate classes and rate blocks in discouraging wasteful use of service while promoting all justified types and amounts of use:
    - in the control of the total amounts of service supplied by the company:
    - in the control of the relative uses of alternative types of service (on-peak versus off-peak electricity, Pullman travel versus coach travel, single-party telephone service versus service from a multi-party line, etc.).[13]

Bonbright addresses fairness in his sixth principle, while economic efficiency is addressed through the eighth principle. Under Bonbright's framing, it is easy to see how these principles could be in conflict, as explained in the previous section. Achieving "fairness" (with respect to historical costs) could require increasing class rates to the extent that some (future) "justified" use of service is stifled.

The CPUC's rate design principles build on this theoretical framework, and reflect some additional policy priorities of the state. The current CPUC proposal for these principles, which have been modified over time, is shown here.

[13] James Bonbright. 1961. Principles of Public Utility Rates, p. 155.

1. All residential customers (including low-income customers and those who receive a medical baseline or discount) should have access to enough electricity to ensure that their essential needs are met at an affordable cost.
2. Rates should be based on marginal cost.
3. Rates should be based on cost causation.
4. Rates should encourage economically efficient (i) use of energy, (ii) reduction of greenhouse gas emissions, and (iii) electrification.
5. Rates should encourage customer behaviors that improve electric system reliability in an economically efficient manner.
6. Rates should encourage customer behaviors that optimize the use of existing grid infrastructure to reduce long-term electric system costs.
7. Customers should be able to understand their rates and rate incentives and should have options to manage their bills.
8. Rates should avoid cross-subsidies that do not transparently and appropriately support explicit state policy goals.
9. Rate design should not be technology-specific and should avoid creating unintended cost-shifts.
10. Transitions to new rate structures should (i) include customer education and outreach that enhances customer understanding and acceptance of new rates, and (ii) minimize or appropriately consider the bill impacts associated with such transitions.[14]

3.3. Identifying customer-related costs for fixed charges

As discussed above, recovery of marginal customer costs through a fixed charge is consistent with theoretical efficiency-maximizing criteria. The marginal costs to be included in the monthly fixed charge are those principally driven by the number of customers connected to the grid, and not by customer demand or energy consumption. This approach turns out to be commonplace across many jurisdictions. Meanwhile, inclusion of non-marginal customer-related costs, or other costs that are otherwise fixed relative to the standard determinants is more contentious.

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[14] Many of these principles were set forth in R.12-06-013 and incorporated into D.15-07-001, D.17-01-006, and D.17-08-030. CPUC, *Basics of Rate Design* Presentation, 2018, https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/r/6442457672-ratedesign101-for-evs-june-7-2018-june-6-final.pdf. The currently proposed revisions reflected here are from R.22-07-005, *Proposed Decision of ALJ Wang Adopting Electric Rate Design Principles and Demand Flexibility Design Principles,* March 17, 2023, https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M503/K824/503824406.PDF.

Distribution plant costs are contained in the FERC distribution account numbers 360 to 374. While certain costs in this category are clearly customer-related (e.g., meters and services), other accounts are sometimes classified as customer-related, sometimes as demand-related, and sometimes as a combination of the two. According to the 1992 NARUC Electric Utility Cost Allocation Manual,[15] the distribution plant accounts that may be classified as some combination of demand and customer include:

360 Land and land rights
361 Structures and improvements
364 Poles, towers and fixtures
365 Overhead conductors and devices
366 Underground conduit
367 Underground conductors and devices
368 Line transformers

Distribution expenses are contained in FERC account numbers 580 through 598. These are also sometimes classified as demand-related and sometimes classified as customer-related. In particular, the following costs may be classified as either demand-related, customer-related, or some combination thereof:

Operation
580 Operation supervision and engineering
583 Overhead line expenses (Major only)
584 Underground line expenses (Major only)
588 Miscellaneous distribution expenses
589 Rents

Maintenance
590 Maintenance supervision and engineering (Major only)
591 Maintenance of structures (Major only)
593 Maintenance of overhead lines (Major only)
594 Maintenance of underground lines (Major only)
595 Maintenance of line transformers
598 Maintenance of miscellaneous distribution plant

Where costs are thought to be jointly related to demand and the number of customers, there are several methods for splitting the costs into their respective demand and customer components. The “minimum system” or “minimum size” method is a common method for apportioning these costs. Under the minimum system method, the analyst estimates the cost of building a hypothetical system from scratch employing the smallest size components typically installed, and then deems those costs customer-related.[16] While this method has some intuitive

[15] NARUC. 1992.
[16] *Ibid*, p. 95.

appeal, it is also widely critiqued on a number of methodological grounds beyond the scope of this report.[17]

4. Fixed charges and Interaction with Equity, Energy Efficiency, and Decarbonization Goals

The inverse relationship between fixed charges and volumetric charges – higher fixed charges means lower volumetric charges, and vice-versa - means that when fixed charges are raised, customers have less control over managing their bills, though this depends on the level of fixed charge established. On the other hand, customers are not penalized for using more electricity, which is desirable when the short-run social marginal cost is low. As discussed further below, low-usage customers experience a larger percentage increase in their bills as a result and are disproportionately impacted by higher fixed charges. While this is generally seen as regressive due to the correlation of income and usage discussed herein, this is also distorted by high levels of DG in California.

AB 205 presents a paradigm shift in these traditional concerns by allowing for a progressive fixed charge, but it is likely impossible to completely alleviate these issues due to practical and data limitations. California has recognized in AB 205 that rates must be set to not only satisfy traditional rate design principles, but also must promote equity and protect incentives for policies encouraging energy efficiency, energy conservation, beneficial electrification, and GHG emission reductions. These goals can help provide positive distributional impacts and contribute to decarbonization efforts. This law comes at a time of increasing fixed charges nationally.[18] This section explores some of these interacting policy issues to explain why they should be considered in setting a fixed charge. Better understanding the interplay between policy considerations and fixed charges helps to lay a foundation for setting reasonable, progressively increasing fixed charges, as outlined in AB 205.

4.1. Equity and Fairness Considerations

Fixed charges must be carefully considered due to their disproportionate impact on equity and fairness. As we show in this section, when fixed charges are increased, low-usage customers – who are more likely to be low income - will experience a significantly greater percentage bill

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[17]Weston, Frederick, et al. 2000, p. 34.

[18] *A Troubling Trend in Rate Design: Proposed Rate Design Alternatives to Harmful Fixed Charges*, Southern Environmental Law Center (Dec 2015). Available at: https://legacy.uploads.southernenvironment.org/news-feed/A_Troubling_Trend_in_Rate_Design.pdf; Trabish, H. *Are regulators starting to rethink fixed charges,* UtilityDive (Aug 2018). Available at: https://www.utilitydive.com/news/are-regulators-starting-to-rethink-fixed-charges/530417/

increase than high-usage, higher income customers. This means a fixed charge can compound the already regressive nature of utility bills.

National data reveals that income is correlated with energy usage, and that low-income customers tend to be lower-usage customers.[19] The Department of Energy's Lead Tool also demonstrates the correlation between energy usage and income in California when electricity spending is used as a proxy for usage.[20]

Table 1. Average site electricity consumption (kWh per household using the end use).[21]

2015 annual household income	Total (kWh) usage
Less than $20,000	11,819
$20,000 to $39,999	12,321
$40,000 to $59,999	13,477
$60,000 to $79,999	13,843
$80,000 to $99,999	13,932
$100,000 to $119,999	14,825
$120,000 to $139,999	14,683
$140,000 or more	15,693

Similarly, TURN has analyzed the relationship between income and usage by climate zone for California customers and determined they are correlated at all levels.[22] Under California's steeply inclining block rate structure in 2012, the average rate paid corresponded directly to a customer's kWh usage levels (i.e. there were higher marginal rates at higher usage levels), so overall rates and usage were directly correlated. This was matched with income data by climate zone, whereby significant correlations between usage and income were found.

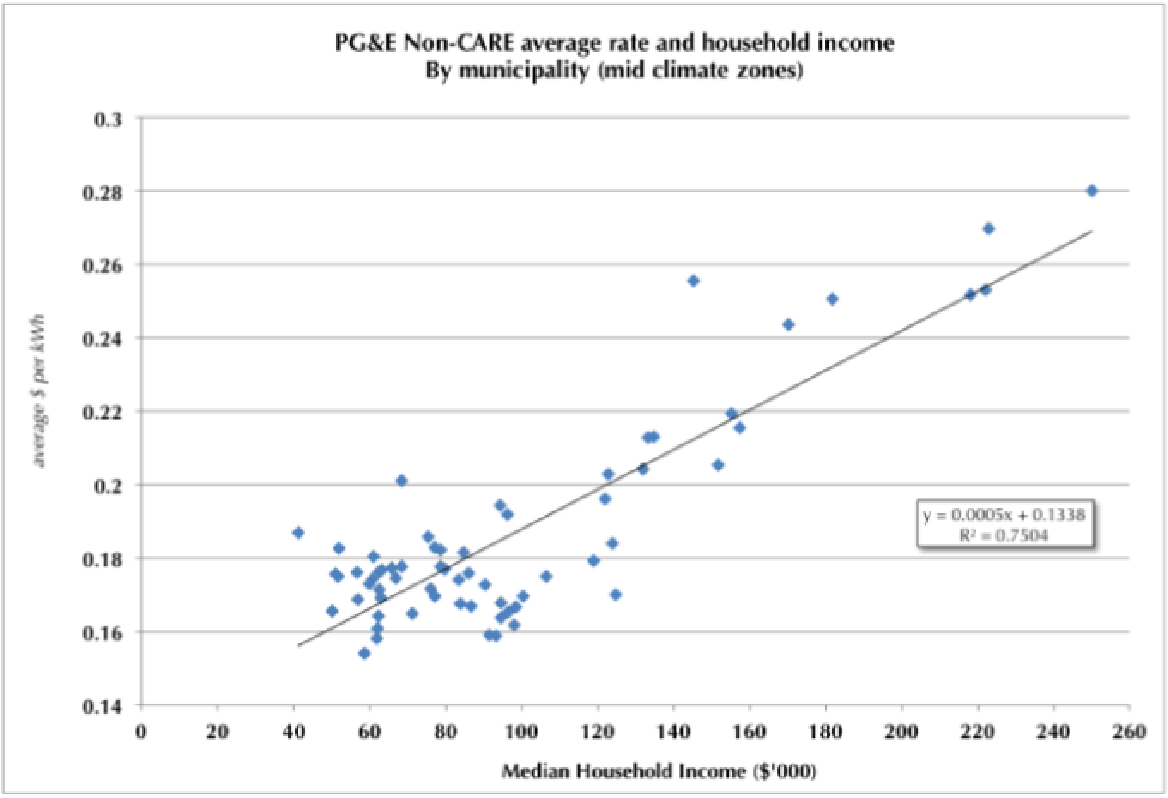
[19] U.S. Energy Information Administration, *Table CE5.3a Detailed household site electricity end-use consumption, part 1—averages.*, EIA (2015). Available at: https://www.eia.gov/consumption/residential/data/2015/c&e/ce5.3a.xlsx;

[20] U.S. Department of Energy, *Low-Income Energy Affordability Data (LEAD) Tool: Avg. Annual Energy Cost for Census Tracts in California*, Office of State and Community Energy Programs (2018). Available at: https://www.energy.gov/scep/slsc/lead-tool

[21] U.S. Energy Information Administration, *Table CE5.3a Detailed household site electricity end-use consumption, part 1—averages.*, EIA (2015). Available at: https://www.eia.gov/consumption/residential/data/2015/c&e/ce5.3a.xlsx

[22] Analysis by the Residential Appliance Saturation Study also confirms the positive correlation between income and usage; KEMA, Inc., 2009 California Residential Appliance Saturation Study, October 2010, CEC-200-2010-004-ES (hereinafter KEMA RASS Report).

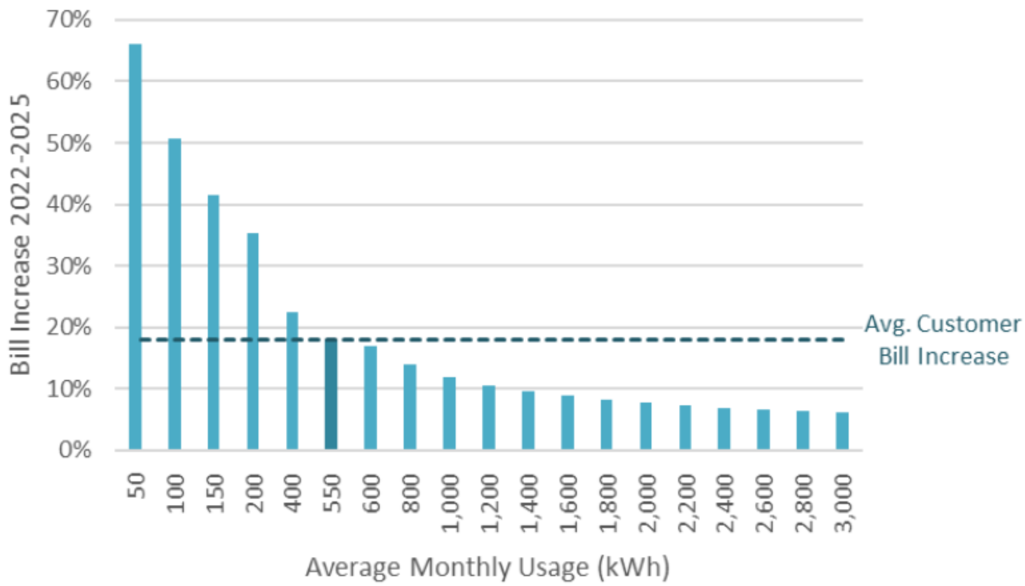
Figure 3. Relationship between income and usage in California.[23]



The correlation between income and usage relate directly to implications of establishing a fixed charge. The figure below, from an analysis Synapse conducted in Maine,[24] illustrates a typical distributional result of the impact of a fixed charge. For higher-usage customers, there is essentially a negligible bill increase or bill decrease, while lower-usage customers see significant bill increases.

[23] *Reply Comments of The Utility Reform Network on Rate Proposals*, Rulemaking 12-06-013, Public Utilities Commission of the State of California (June 2012), 23.
[24] Direct Testimony of Melissa Whited and Eric Borden, On Behalf of Maine Office of the Public Advocate, December 2, 2022.

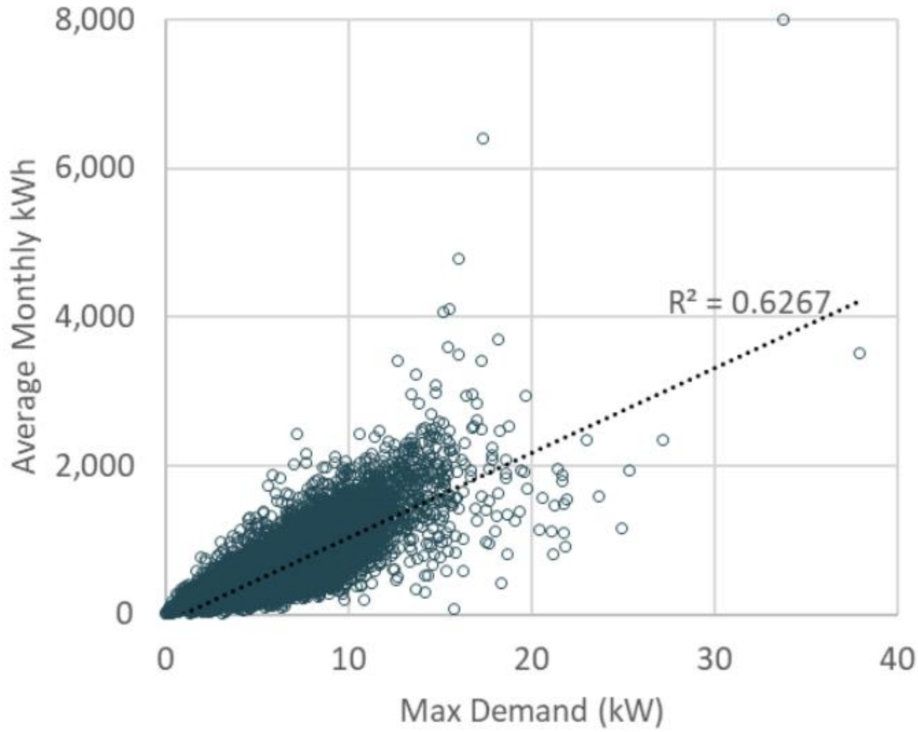
Figure 4. Percentage change in average monthly bill



We have also found that there is a strong correlation between electricity consumption (kWh) and electricity demand (kW).[25]

[25] Larry Blank and Doug Gegax, "Residential Winners and Losers behind the Energy versus Customer Charge Debate," The Electricity Journal, 27, no. 4 (May 2014)

Figure 5. Correlation between residential energy consumption and non-coincident peak demand.[26]



If demand-related costs are recovered through fixed charges, this raises equity considerations, since these may unfairly burden low-usage, low-income customers.

While reconfiguring prices to minimize fixed charges on low-income customers can have positive distributional impacts to reduce inequities, needs-based programs can also help reduce adverse impacts to lower-income customers, though they cannot be considered a panacea. As recognized in AB 205, income-based fixed charges can ameliorate the inequitable impacts that a flat increase in a fixed charge would produce while still leaving sufficient financial incentives for these customers to further lower energy use through conservation or distributed generation technology. This introduces parallel issues regarding how fixed charges interact with policies concerning energy efficiency, decarbonization, and distributed generation, discussed in the next section.

4.2. Energy efficiency, Distributed Generation, and Decarbonization Policy Impacts of Fixed Charges

Energy and climate policies like promoting energy efficiency, energy conservation, distributed generation, GHG emission reductions, electrification, and overall decarbonization are key state policies that are affected by rate design, including the level of fixed charges. These policies are promoted because they have garnered broad consensus as a means to keep energy costs low,

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[26] Analysis of Massachusetts D.P.U. Docket 15-155, response to data request DPU-1-12-1.

achieve state climate goals, bolster the local economy, and improve overall economic competitiveness. This is evidenced by the proliferation of ratepayer funded energy efficiency programs throughout the US, which are in effect in all 50 states and the District of Columbia.[27] Governments have also advanced these policies through building codes, appliance standards, federal weatherization assistance, and tax incentives. Establishing and modernizing net metering programs and tax incentives to promote distributed generation policies also highlights efforts to advance these policies.

Layered into all of this, including the equity discussion, is how technological advances enable greater customer control over energy usage monitoring and management than ever before. Utilities often tout how smart meters, online information portals, and other programs can empower customers to better manage bills. Time of use (TOU) rates are predicated on customers ability to react to changing grid dynamics. Yet raising fixed charges for customers can reduce customer control and ability to reduce their bill, decreasing the incentive to respond to price signals. The relationship between the magnitude of a fixed charge and the customer's level of control over their energy costs therefore has implications for energy and climate policies, and should be considered in setting the level of any fixed charge.

Energy Efficiency and Energy Conservation

Energy efficiency denotes installation of a measure (such as installing an appliance or insulation) that maintains the same level of performance while using less energy. All else equal, the more that costs are embedded in volumetric charges, the greater the incentive is for customers to upgrade to energy efficient appliances and to implement weatherization measures since lowering their usage saves more, relative to higher fixed charges. Lower fixed charges may also encourage energy conservation, which is similar yet distinct from efficiency. Energy conservation is defined as instances where customers avoid consumption altogether, such as by turning off lights, unplugging appliances, and lowering their thermostats. When more costs are placed in volumetric charges, customer have greater ability to save through lowering usage.

Distributed Generation

In the same way as energy efficiency, the economics of distributed generation (DG) are affected by a fixed charge. In general, net metering compensation schemes offset the variable portion of the electric bill, so a higher fixed charge necessarily decreases this offset. At the same time, it is possible that higher fixed charges for net metering participants will alleviate cost shifts between DG customers and customers who do not have access to DG.[28] These cost shifts depend on the design of net metering tariffs – in general, since DG production offsets a portion or all of the volumetric charges that would have been paid by those utility customers, the utility must collect more revenue from customers without access to DG technology. The presence of this cost shift means that these customers do not adequately contribute to the fixed costs of the

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[27] American Council for an Energy Efficient Economy, *The 2022 State Energy Efficiency Scorecard* (2022). Available at: [The State Energy Efficiency Scorecard | ACEEE]

[28] This principle also applies to customers who have invested in energy efficiency or conservation measures.

grid. At the same time, cost shifts among these customers are mitigated by avoided costs due to DG production, including generation, transmission, and distribution costs. In a state like California, where fixed charges (not fixed costs) are very low and volumetric charges among the highest in the country, cost shifts from DG are likely exacerbated by the lack of a significant fixed charge.

Electrification

As increased electrification penetration becomes a priority under California's commitments to electrify transport and buildings as part of its larger decarbonization efforts,[29] electricity consumption will rise. Decrease in overall consumption through continued energy efficiency and conservation efforts will likely be partially or completely offset in coming years as the state promotes beneficial electrification throughout its economy as a strategy to meet GHG emission reduction targets.[30] Higher fixed charges generally benefit the economics of electrification since, as explained above, higher usage customers benefit from fixed charges through lower volumetric rates. This should also be considered as California addresses its rate design objectives. However, there are differences between a customer who buys an electric vehicle and seldomly drives and one who buys an electric heat pump. Furthermore, electrification will occur heterogeneously across different types of consumers, and over a long time period.

Balancing Rate Design Objectives

Compliance with AB 205 will require fixed charges to be designed in a manner that preserves incentives to advance state policy. At the same time, rates must be designed to fulfill other rate design principles such as fairness, cost-causation, and preventing inequitable intra-class cost-shifting.[31] Varying levels of fixed charges could be a step in the right direction if it can be designed in such a way that protects the incentives for energy efficiency, conservation, and decarbonization while satisfying broader objectives. Admittedly, this is no simple task. Such a design should balance the interests of (1) protecting low-income customers from the disproportionate impacts of high fixed costs; (2) appropriate incentives for energy and climate policies; (3) recovering more utility costs through fixed charges without unduly burdening customers, and (4) addressing cost-shifting concerns appropriately.

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[29] Governor Newsom, *Letter to Chair Randolph*, Office of the Governor (July 22, 2022). Available at: https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf?emrc=1054d6. California Releases World's First Plan to Achieve Net Zero Carbon Pollution, Office of the Governor (November 2022). Available at: https://www.gov.ca.gov/2022/11/16/california-releases-worlds-first-plan-to-achieve-net-zero-carbon-pollution/.

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5. COMMON APPROACHES TO SETTING FIXED CHARGES

There are a range of policy options that Commission considers what level of fixed charge to implement across income tiers. We seek here to outline the bookends of what prevalent rate design theory supports in terms of the level of fixed charge that can appropriately be levied on ratepayers. Our discussion and calculations presented below focuses on an average fixed charge across all residential ratepayers, with an understanding that the charge would be lower for low-income customers and higher for high-income customers.

5.1. Low Case: Fixed Charge Based on the Marginal Customer Access Cost

As detailed above, one approach to fixed charges considers only those costs which can be attributed to an individual customer's connection to the grid as "fixed." This is because these costs do not vary with the level of demand (or energy) of an individual customer. Put another way, *when, how, and to what degree* a customer consumes energy will not increase or decrease these costs, which is why including them in a fixed charge is seen as appropriate based on economic principles.

As stated in the NARUC manual "most analysts agree that distribution equipment that is uniquely dedicated to individual customers or specific customer classes can be classified as customer rather than demand related." These costs include the service drop and meter, which are costs incurred due to an individual customer, and a customer's portion of billing, customer service, and O&M costs for customer equipment.[32]

These costs have been estimated in California using the "new customer only" (NCO) and "rental" methods, as part of California's rate design and cost allocation proceedings which estimate marginal costs, which are scaled up to on an equal percentage basis to recover embedded costs. The public tool for this proceeding estimates these costs directly, based on each utility's calculation methodology.

5.2. High Case: Fixed Charge Based on Short Run Social Marginal Costs

At the high end of the spectrum, a fixed charge could include all costs *other than* short run social marginal costs, which would remain variable and collected on an energy (per kWh) or power (per kW) basis. Social marginal costs are defined as marginal costs - the cost of producing or consuming the next unit of electricity (e.g. kilowatt or kilowatt hour) - *plus* the marginal cost of environmental externalities. A classic example of the latter is pollution, which can be directly linked to consumption of energy at certain times, but it also includes the societal cost of carbon to reflect the marginal impact on climate change. Without a price signal that incorporates this

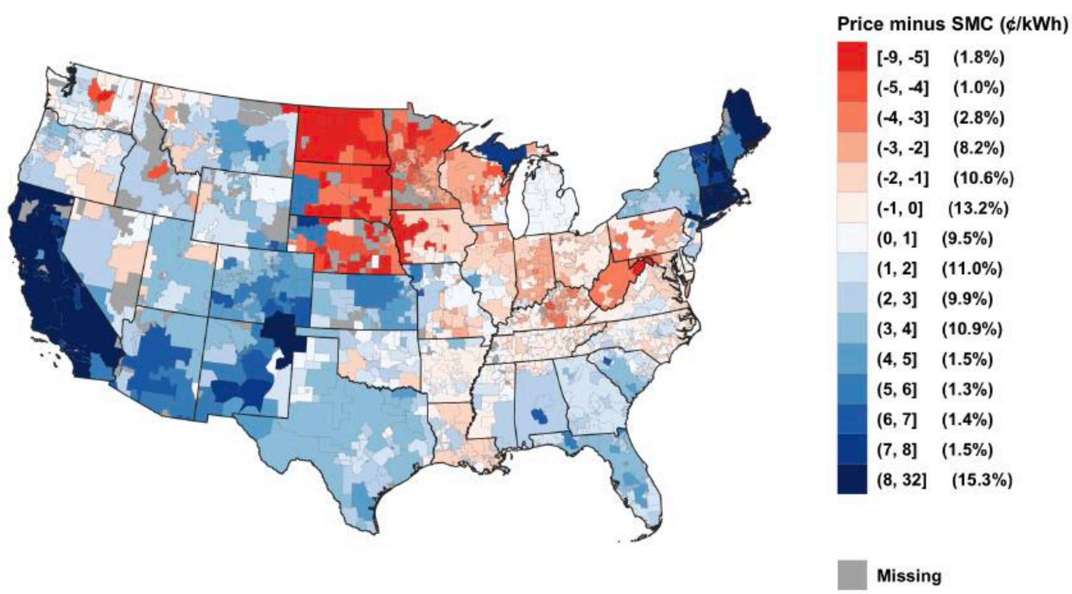
[32] RAP Cost Allocation Manual, pp. 207-211.

externality, a consumer has no financial incentive or dis-incentive to consume electricity in a way that minimizes environmental harm or maximizes private gain from the use of electricity.

The economic theory behind this option is that in order to minimize “deadweight loss” (DWL), the cost incurred by society due to market inefficiency, prices to which the consumer can respond should reflect the social marginal cost. Deadweight loss is incurred from over or under-consumption of electricity relative to the societal optimum. While a fixed charge does not vary, and thus cannot be affected by consumption patterns, variable charges on a per kWh or per kW basis do, by definition, vary over time or by time period, and can therefore provide price signals that effect customer behavior.

In their paper quantifying the difference between social marginal cost and retail prices seen by residential customers across the U.S., Borenstein and Bushnell found that variable retail prices in California significantly exceed social marginal costs, rivaled only by utilities in the Northeast – this is indicated by the dark blue areas of the map shown below.

Figure 6. Difference Between Price and Social Marginal Cost in the U.S.



Calculating Fixed Charges Based on Marginal Customer Access Costs and Social Marginal Cost

Synapse used the public spreadsheet tool created for the fixed charge Rulemaking (“E3 Tool”) to calculate fixed charges based on the marginal customer access costs and social marginal cost theories described above. We show fixed charges for all customers below; these can be considered to be an "average" fixed charge across multiple income tiers (and CARE) in the context of AB 205.

Marginal customer access costs were estimated directly by each utility and incorporated into the E3 tool. The figure shows the average fixed charge across all residential customers.

Figure 7. Monthly Fixed Charges Based on Marginal Customer Access Cost

Calculating social marginal costs required the summation of multiple cost categories, as well as a separate estimation of externality costs by utility, which were not incorporated into the E3 tool.

Short-run social marginal costs (SRSMCs) are comprised of three primary components – 1. Marginal energy costs (plus losses); 2. Societal externality costs of pollution; 3. Societal externality costs of carbon.[33]

Marginal energy costs and losses have been estimated for each IOU in the CPUC's avoided cost calculator (ACC).[34] Further, the CPUC has directly estimated the cost of pollution due to marginal gas generation in California in a recent study, which we adopt here.[35]

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[33] Additional societal externalities, if quantifiable, may also be included in this calculation.
[34] See E3, https://www.ethree.com/public_proceedings/energy-efficiency-calculator/.
[35] We adopt the statewide average value of $14/MWh. See CPUC, *Societal Cost Test Impact Evaluation,* January 2022, p. 14.

For the social cost of carbon we adopt the latest estimate from the White House Interagency Working Group of $76 per tonne in 2020, based on a 2.5 percent discount rate.[36] To calculate what this signifies in the California context, we derive a weighted average marginal emission rate in the avoided cost calculator,[37] which allows for a calculation of marginal CO_2 emissions in tonnes per MWh across the year (2023). We multiply this factor by the social cost of carbon ($76 per tonne) to calculate the marginal social cost of carbon in dollars per MWh, which is multiplied by each IOU's total annual load to derive an annual cost of carbon impacts.

Incorporating all costs into a fixed charge *other than* the social marginal cost results in the following fixed charges for each IOU. The figure shows the average fixed charge across all residential customers.

Figure 8. Monthly Fixed Charges Based on Social Marginal Cost Approach to Fixed Charges

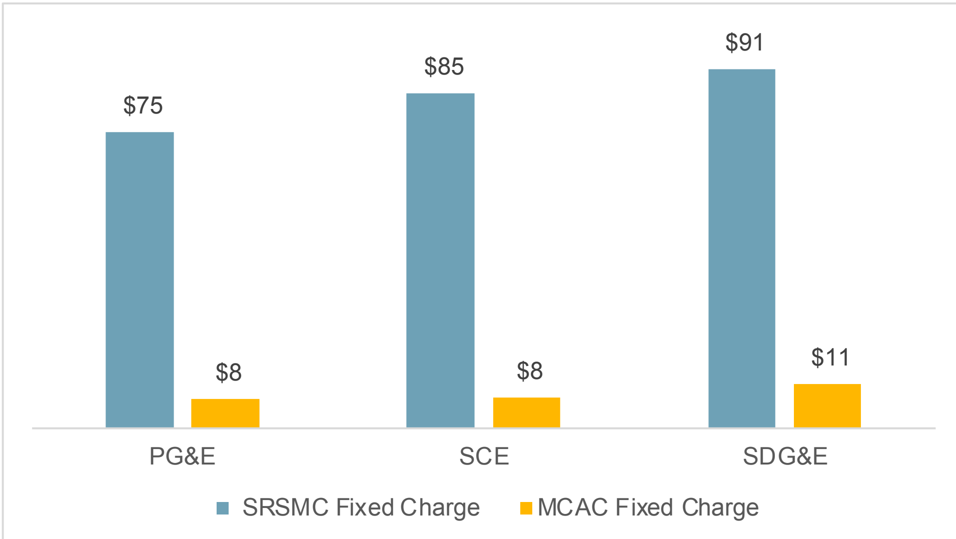
As seen above, monthly fixed charges vary among utilities. The exact drivers of this difference is beyond the scope of this report, but likely relate to how various cost categories were calculated by each utility, revenue requirements, total load and customer base, past investments, CARE population percentages, and other factors.

The figure below provides a comparison of fixed charges based on monthly customer access costs (calculated in the section above) to those based on the exclusion of social marginal costs.

[36] Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 1399, *Interagency Working Group on Social Cost of Greenhouse Gases*, United States Government, Table ES-1, p. 5.

[37] This is accomplished by using each IOU's hourly load profile from the E3 tool multiplied by average statewide marginal emissions rates in each hour.

Figure 9. Monthly Fixed Charges Based on Marginal Customer Access Cost and Social Marginal Cost Approach to Fixed Charges



6. Guidance For How to Assign Fixed Charges to Cost Categories

It is important that a fixed charge is instituted based on sound economic principles, discussed in the sections above, to guide practical decisions about the economic rationale for which utility costs ought to be included in a fixed charge.

A fixed charge should be set no lower than the marginal customer access cost, and no higher than the exclusion of social marginal cost, both calculated above for each IOU using E3 tool inputs and assumptions. We note that pure economic theory might simply follow the latter approach, whereby variable charges should be set at social marginal costs, with all other costs embedded in a fixed charge. However, utilities operate far from the idealized competitive market equilibrium, and pricing schemes, that underlies this theory. A practical approach to rate design that balances policy goals, fairness, and economic efficiency is required.

For purposes of the exercise of assigning certain cost categories for inclusion (or not) in a fixed charge, we find that the principle of cost causation, which is central to fair and economically supported rate design,[38] is a helpful guide to what can appropriately be included in a fixed charge. Namely, understanding and examining cost causation can help determine whether a certain type of cost should be included in the variable or fixed charge. To determine this, we

[38] This principle often surfaces in the context of cost allocation – not an issue here since we are only considering fixed charges for the residential class.

encourage stakeholders to examine the purpose or function of each cost – why has it been incurred, and can it be reasonably be avoided through shifts in consumption behavior? If a utility cost can be reasonably avoided by customer behavior – i.e. by reducing or shifting electricity usage – it does not belong in a fixed charge.

The foregoing sections quantified a range of outcomes for the CPUC's consideration and provides underlying economic theory to help guide stakeholders and the Commission in its deliberation on a progressive fixed charge. California is on the forefront of energy policy issues and should move deliberately to address unnecessary inequities in its current rate design.