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# Regional and Income Distribution Effects of Alternative Retail Electricity Tariffs

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# Regional and Income Distribution Effects of Alternative Retail Electricity Tariffs

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**Abstract:** Since 2001, California's investor-owned utilities have operated with very steep increasing-block residential electricity tariffs, under which the marginal price increases as the customer's monthly usage rises. At the same time, these utilities have imposed little or no monthly fixed charge, despite the fact that a significant share of their costs do not vary with the customer's consumption quantity. There are now moves to reduce the steepness of the increasing-block pricing (IBP) and to impose fixed monthly charges (FCs). Building on Borenstein (forthcoming), I examine how such changes would impact different regions of the state and households in different income brackets. I find that, contrary to frequent assertions, IBP does not penalize customers in high-use (*i.e.,* hot) areas on average because the baseline quantities for IBP reflect regional differences in average consumption. In fact, a switch to a flat electricity price would not change average customer bills in these areas. Imposing a FC that is equal for customers in all regions and reducing the price on the higher tiers to offset that revenue would have a slight benefit for customers in hot areas. In my earlier work, I showed that moving from IBP to a flat tariff would harm low-income customers, though the impact is muted by the CARE program, a means-tested program that offers lower rates to low-income households. I examine here the impact on households in different income brackets of imposing a FC and reducing the price on higher tiers to offset the revenue change. I find that low-income households who are not on the CARE program would receive little of the benefit from lowering marginal prices, so the bills of such households in the lowest income quintile (approximately) would increase on average by 69%-92% of the fixed charge. Unlike moving to a flatter marginal rate schedule, imposing fixed charges is likely to have little or no incentive effect for low-income households.

**Keywords:** electricity regulation, increasing-block pricing, inclining-block pricing, two-part tariffs, low-income tariffs, electricity rate restructuring

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## I. Introduction

The residential electricity tariffs of California's investor-owned utilities differ from typical rates elsewhere in the U.S. in three significant ways. First, California has the steepest increasing-block price (IBP) schedules in the country, with marginal consumption on higher tiers costing three times or more the level of baseline consumption. Second, residential customers pay little or no fixed monthly fee. And, third, the effective tariff schedule exhibits substantial differences regionally within a utility's service territory. This is because, while the same IBP prices apply throughout the service territory, the baseline quantities that determine the amount of consumption available on each step of the IBP tariff differ regionally. Areas of higher average consumption have higher baseline quantities.

Increasing-block pricing, also called inclining-block pricing, is fairly common in the United States, with over 40% of the largest utilities employing it at least part of the year.[2] Many energy consultants advocate use of IBP on the argument that raising marginal rates reduces consumption.[3] While this may be true, it will depend on where the marginal rate increases occur and how customers respond to more complex non-linear rates, as shown by Ito (2010). More importantly, the goal is not to simply reduce consumption, but to do so to the optimal extent. If consumers face marginal rates that are above the true social marginal cost of supplying power, they will inefficiently over-conserve on electricity. That is almost certainly the case in California for customers on the higher tiers of the IBP tariffs.

Many market participants and regulators in California have suggested changing residential tariffs to make them more like tariffs elsewhere in the U.S.: eliminating or greatly reducing the steepness of the increasing-block pricing and instituting significant fixed charges. While some of the policy discussion has focused on aligning prices with costs, there has also been concern about distributional impacts of these changes. Much of the concern is for low-income customers as a ratepayer class. Another focus has been the regional impact of these potential rate changes.

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[2] See BC Hydro, 2008.

[3] See, for instance, Faruqui, 2008, Orans et al, 2009, and Pollock and Shumilkina, 2010.

In a previous paper, Borenstein (forthcoming), I used detailed customer-level data to analyze the potential efficiency and income-distributional impact of a revenue-neutral change from IBP to a flat rate for electricity. In this paper, I extend those results to analyze the regional impact of such a change. While it is frequently argued that IBP causes a subsidy from the hotter inland regions of each utility's service territory to the cooler coastal regions, I show that this is not the case. The share of revenues contributed by inland regions is virtually the same.

I also examine the potential impact of imposing a fixed monthly charge per customer and offsetting the revenue gain by reducing prices on the higher tiers of the IBP tariff. The argument in support of this change is that there is a true fixed cost per customer that is independent of quantity consumed and that the marginal prices on the 3 highest tiers of the 5-tier structure are well above social marginal cost, even including the costs of the environmental externalities. The prices on the two lowest tiers are held much lower by state law, and are probably at or below social marginal cost.

I find that the regional impact of introducing a fixed charge is, on average, a slight bill decrease to customers in inland areas and a slight increase to coastal customers. The reason is that while the fixed charge imposes the same cost on all customers, the lower marginal price on higher tiers benefits inland customers more because they consume more kilowatt-hours (kWh) – though not a higher proportion of their kWh – on the higher tiers.

The income distribution impact of a fixed fee is more stark. The proposal to balance the revenue from a fixed charge on all customers by reducing prices on tiers 3, 4 and 5 means that the net bill change is inverse to the proportion of consumption on those tiers. I estimate that poor customers make up a fairly small share of the total consumption on the higher tiers, so the net increase in their bills is 69%-92% of the fixed monthly charge on average. An important caveat to this finding is that it applies only to the poor customers who are not on the CARE program, the means-tested program that offers lower rates to low-income households. It is likely that somewhere between half and two-thirds of households in the lowest income bracket are on CARE. I present results for the impact of imposing a fixed charge on CARE customers as well, but argue that the economics of making such a change are far less compelling.

Section II describes the data I analyze and the alternative tariffs that I study in the paper. Section III evaluates the regional impact of IBP and FCs using the climate regions defined by each utility. Section IV reviews my earlier work on the income distributional impact of IBP and then applies the same techniques to study the income distributional impact of FCs. In section V, I consider the how the results change when customers can respond to changes in the marginal and average price they face. I show that for the most plausible parameters, demand response will have almost no impact on the distributional impact. Section VI concludes.

**II. Data and Alternative Tariffs**

The analysis is based on customer-level residential electricity billing data from the three largest investor-owned utilities in California: Pacific Gas & Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E). The data are described in detail in Borenstein (forthcoming). With the exception of master-metered premises, the data include nearly every residential customer in these utilities' service territories. They include the customer premise id, dates of the billing period, consumption during the billing period, the quantities of consumption assigned to each of the 5 tiers, and whether the customer was on the CARE program. I combine these data with the average tariff of each utility during 2006 to create bills for each billing period and then aggregate up to annual bills for each customer.[4]

I compare bills from the average IBP tariff to two alternative scenarios. One is a flat rate for all customers of the utility. The flat rate is set to raise the same total revenue under an assumption of zero price elasticity. Borenstein (forthcoming) discusses in detail the impact of elasticity on income redistribution and economic efficiency. I discuss the topic briefly here as well, showing that the results of this analysis would change very little with the incorporation of demand elasticity.

The second alternative is an IBP tariff with a fixed monthly charge (FC). In this analysis, I consider a monthly charge of $5. This is approximately the middle of the distribution of fixed monthly charges imposed by utilities in the U.S. with most fixed charges between $2

[4] I use an average tariff for the year, but there was very little change in any of the utilties' tariffs during 2006.

| | Fixed Charge | Tier 1 | Tier 2 | Tier 3 | Tier 4 | Tier 5 |
|---|---|---|---|---|---|---|
| percent of baseline | | 0%-100% | 100%-130% | 130%-200% | 200%-300% | over 300% |
| **Southern California Edison** | | | | | | |
| IBP | $0.00 | $0.1162 | $0.1361 | $0.2201 | $0.3049 | $0.3049 |
| Flat rate | $0.00 | $0.1731 | $0.1731 | $0.1731 | $0.1731 | $0.1731 |
| IBP + FC | $5.00 | $0.1162 | $0.1361 | $0.2023 | $0.2802 | $0.2802 |
| **Pacific Gas & Electric** | | | | | | |
| IBP | $0.00 | $0.1143 | $0.1299 | $0.2178 | $0.2987 | $0.3394 |
| Flat rate | $0.00 | $0.1643 | $0.1643 | $0.1643 | $0.1643 | $0.1643 |
| IBP + FC | $5.00 | $0.1143 | $0.1299 | $0.1963 | $0.2692 | $0.3058 |
| **San Diego Gas & Electric** | | | | | | |
| IBP | $0.00 | $0.1287 | $0.1488 | $0.2312 | $0.2401 | $0.2571 |
| Flat rate | $0.00 | $0.1690 | $0.1690 | $0.1690 | $0.1690 | $0.1690 |
| IBP + FC | $5.00 | $0.1287 | $0.1488 | $0.2055 | $0.2134 | $0.2285 |

Table 1: Standard 2006 IBP tariff, alternative flat rate, and alternative IBP + fixed charge

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and $10 per month. I then calculate equal-proportion decreases in the prices on tiers 3, 4 and 5 that would make the change revenue-neutral under the assumption that there would be no change in consumption in response to the tariff change. This allocation of the fixed charge revenue is the focus in California, because rates on the two lowest tiers have been essentially frozen since 2001, while rates on the top 3 tiers have increased substantially. I then also discuss the impact that price elasticity would have.

In all cases, I maintain the revenue separation of CARE and standard tariff customers. The argument for making these tariff changes for CARE customers – holding constant the revenue from such customers – is much less compelling than for standard tariff customers. Though CARE customers face IBP in California, the price changes across the blocks are substantially smaller for CARE customers than for standard tariff customers. In the case of PG&E at least, even the highest rate may be below long-run marginal cost. Unless the suggestion of flattening IBP tariffs or introducing a FC is coupled with the suggestion that the discounts in the CARE program be altered overall, the policy is hard to justify. So, I maintain separation of the revenue streams. Results for CARE customers are presented in the appendix.

Table 1 presents the rates under the standard IBP tariff, the alternative flat tariff and

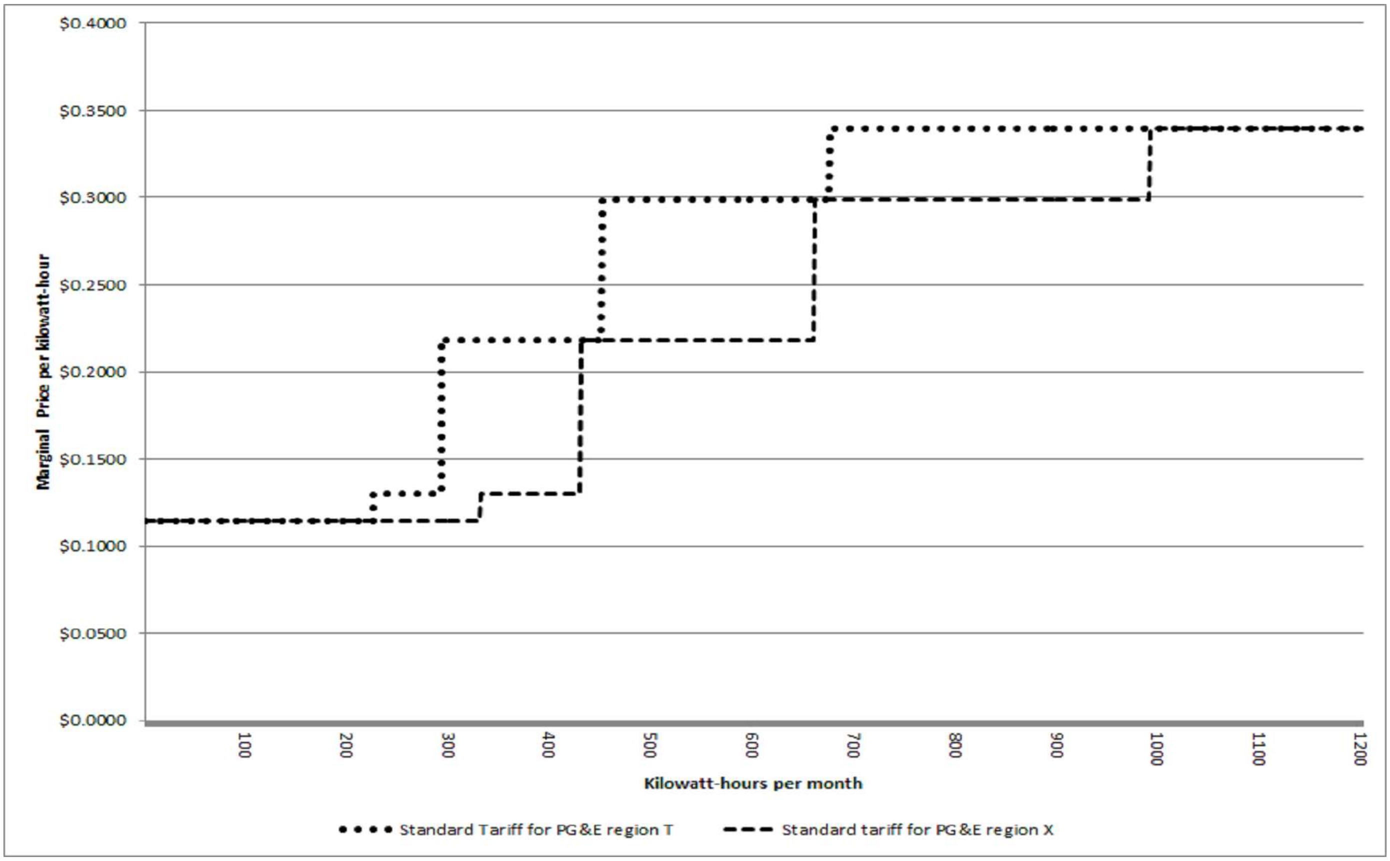


Figure 1: Monthly price schedule for households in two PG&E climate regions

the alternative IBP with $5/month FC.

I do not focus in this paper on the efficiency gains from tariff changes. Borenstein (forthcoming) explores that issue in detail for a switch from IBP to a flat tariff. For the switch from IBP to IBP with a fixed charge, the effect is relatively straightforward. The elasticity of electricity hookups with respect to a fixed charge is likely to be extremely close to zero, so the FC would have not a direct efficiency effect. Lowering the marginal prices on higher tiers is likely to improve efficiency if marginal prices are above the marginal cost of the power delivered. For the standard IBP tariffs shown in table 1, the marginal price is well above most estimates of marginal cost, even including environmental and other externalities, and likely to remain well above marginal cost after the offsetting reductions from adding a FC. The reductions would move marginal prices closer to marginal cost, so would be likely to improve efficiency.[5]

## III. Regional Impacts of Alternative Tariffs

All three of the utilities that I study here have multiple climate regions that are assigned different baseline quantities for use in the IBP tariffs. In 2006, PG&E had 10 climate regions, SCE had 6, and SDG&E had 4, as shown in the baseline region maps in the appendix. For a given utility, the baselines in each climate region are set in order to reflect approximately the same proportion of average household consumption within the climate region. So, for instance, SCE's hottest inland climate regions have much higher baselines in the summer months than the coastal regions, but in each region the baseline quantity is intended to be approximately 55% of the average residential consumption. As a result, while consumers in different climate regions face the same prices on each tier, they face different price schedules. Figure 1 presents the price schedules for the two most populous baseline regions in PG&E's service territory. Region T is on the coast and quite temperate, while region X is further inland and experiences wider temperature swings.

The effect of this targeting of baseline quantities is that the distribution of consumption across the tiers does not vary a great deal across climate regions. Table 2 shows the share of consumption on each tier within each climate region, broken out by CARE and standard tariff customers. The table also shows the summer baseline quantity for customers who are not on the all-electric tariff (which has higher baselines). This is a good indication of the harshness of summer weather. Table 2 shows that the hot summer areas do not systematically have more consumption on high tiers. While there is some variation, particularly among the climate regions that include a very small share of total load, the larger climate regions have very similar distributions due to the baseline setting process.

As a result, table 3 shows that the average bill by region would not change very much if customers were charged a simple flat rate per kWh rather than the standard IBP tariff. There would, of course, be quite a bit of variation *within* each climate region – lower-use consumers would pay more and higher-use consumers would pay less – but there would

[5] Ito (2010) shows that customers facing IBP are more likely to respond to average price than marginal price. Even average price is likely at or above marginal cost for customers on tiers 4 and 5. But on tier 3, a conclusion about the effect of lowering marginal price is more uncertain if customers respond to average price.

| Region | Share of Total Residential Usage | Share of Total Residential Households | Avg Daily Use | Summer Baseline Quantity | % of usage on tier 1 | % of usage on tier 2 | % of usage on tier 3 | % of usage on tier 4 | % of usage on tier 5 |
|---|---|---|---|---|---|---|---|---|---|
| **Southern California Edison** | | | | | | | | | |
| 10 | 27.4% | 31.1% | 17.4 | 10.2 | 53.4% | 10.5% | 15.7% | 10.3% | 10.2% |
| 13 | 2.9% | 2.1% | 26.6 | 19.4 | 52.2% | 11.3% | 17.9% | 11.8% | 6.8% |
| 14 | 5.6% | 4.8% | 23.0 | 17.0 | 54.3% | 11.5% | 17.5% | 10.7% | 5.9% |
| 15 | 3.8% | 2.4% | 31.5 | 47.6 | 55.4% | 9.6% | 13.9% | 9.3% | 11.7% |
| 16 | 1.4% | 1.6% | 17.2 | 10.0 | 58.4% | 10.2% | 15.0% | 9.3% | 7.1% |
| 17 | 38.2% | 32.8% | 23.0 | 15.4 | 51.8% | 10.9% | 17.1% | 11.6% | 8.6% |
| **Pacific Gas & Electric** | | | | | | | | | |
| P | 3.8% | 2.9% | 25.4 | 15.3 | 64.9% | 10.8% | 13.9% | 6.8% | 3.6% |
| Q | 0.1% | 0.1% | 32.0 | 7.5 | 42.5% | 10.2% | 17.9% | 14.3% | 15.1% |
| R | 9.1% | 6.9% | 25.6 | 17.1 | 56.3% | 11.0% | 16.5% | 10.2% | 6.1% |
| S | 16.2% | 12.7% | 24.4 | 15.3 | 55.9% | 11.2% | 16.6% | 10.1% | 6.2% |
| T | 13.8% | 19.2% | 13.8 | 7.5 | 59.2% | 10.4% | 14.8% | 8.6% | 7.0% |
| V | 0.7% | 0.8% | 18.5 | 12.0 | 52.5% | 10.0% | 14.4% | 8.7% | 14.5% |
| W | 4.2% | 3.1% | 25.8 | 18.5 | 54.5% | 11.0% | 17.1% | 11.1% | 6.4% |
| X | 32.2% | 32.5% | 19.0 | 11.0 | 57.9% | 10.7% | 15.1% | 8.9% | 7.4% |
| Y | 1.0% | 0.9% | 19.7 | 11.7 | 65.1% | 9.7% | 12.9% | 6.8% | 5.5% |
| Z | 0.04% | 0.06% | 13.5 | 7.9 | 72.2% | 8.4% | 10.6% | 5.5% | 3.3% |
| **San Diego Gas & Electric** | | | | | | | | | |
| Coastal | 46.2% | 47.7% | 16.5 | 9.6 | 56.3% | 10.1% | 14.7% | 9.6% | 9.3% |
| Inland | 39.6% | 34.0% | 19.8 | 11.2 | 54.5% | 10.5% | 15.9% | 10.5% | 8.5% |
| Mountain | 0.04% | 0.04% | 18.0 | 14.8 | 63.0% | 9.4% | 12.9% | 8.4% | 6.3% |
| Desert | 1.2% | 0.7% | 28.3 | 16.4 | 57.0% | 11.0% | 16.1% | 9.8% | 6.0% |

Note: Usage and household shares do not add to 100% -- remainder are on CARE program.
See appendix for region maps

Table 2: Consumption on tiers of IBP tariff by climate region

not be a systematic redistribution of payments to or from the hotter climate regions.

One way to see an aggregate picture of whether and in which direction revenue obligations shift is to look at the share of revenue coming from the climate regions with more extreme temperatures, as measured by the summer baseline of the regions. For each of the utilities, I have grouped the regions into the above-average and below-average summer baseline groups, though the split isn't exactly at 50% of total demand due to the lumpiness of regions. I've then calculated the share of total revenue coming from the regions with more extreme climate under alternative tariffs.

The results are shown in the bottom row of each panel. In the case of SCE for instance, the more extreme climate regions are 13, 14, 15 and 17. These regions in aggregate constituted 63.73% of standard tariff residential usage in 2006, so they would have paid

| Region | Share of total residential usage | Share of total residential households | Avg Daily Use | Summer Baseline Quantity | Average Annual Bill with IBP | Average Annual Bill flat rate | % change from IBP to flat | Average Annual Bill IBP+FC | % change from IBP to IBP+FC | $ change from IBP to IBP+FC |
|---|---|---|---|---|---|---|---|---|---|---|
| **Southern California Edison** | | | | | | | | | | |
| 10 | 27.4% | 31.1% | 17.4 | 10.2 | $1,100 | $1,100 | 0.0% | $1,110 | 0.9% | $10 |
| 13 | 2.9% | 2.1% | 26.6 | 19.4 | $1,670 | $1,679 | 0.6% | $1,655 | -0.9% | -$15 |
| 14 | 5.6% | 4.8% | 23.0 | 17.0 | $1,413 | $1,456 | 3.0% | $1,413 | -0.1% | -$1 |
| 15 | 3.8% | 2.4% | 31.5 | 47.6 | $1,982 | $1,992 | 0.5% | $1,953 | -1.4% | -$28 |
| 16 | 1.4% | 1.6% | 17.2 | 10.0 | $1,035 | $1,087 | 5.0% | $1,053 | 1.7% | $18 |
| 17 | 38.2% | 32.8% | 23.0 | 15.4 | $1,462 | $1,453 | -0.7% | $1,455 | -0.5% | -$7 |
| Share of Revenue from 13,14,15,17 | | | | | 63.80% | 63.73% | | 63.45% | | |
| **Pacific Gas & Electric** | | | | | | | | | | |
| P | 3.8% | 2.9% | 25.4 | 15.3 | $1,400 | $1,523 | 8.8% | $1,402 | 0.2% | $3 |
| Q | 0.1% | 0.1% | 32.0 | 7.5 | $2,278 | $1,922 | -15.6% | $2,184 | -4.1% | -$94 |
| R | 9.1% | 6.9% | 25.6 | 17.1 | $1,548 | $1,537 | -0.8% | $1,528 | -1.3% | -$20 |
| S | 16.2% | 12.7% | 24.4 | 15.3 | $1,478 | $1,464 | -0.9% | $1,461 | -1.2% | -$17 |
| T | 13.8% | 19.2% | 13.8 | 7.5 | $822 | $829 | 0.9% | $841 | 2.3% | $19 |
| V | 0.7% | 0.8% | 18.5 | 12.0 | $1,211 | $1,109 | -8.4% | $1,200 | -0.9% | -$11 |
| W | 4.2% | 3.1% | 25.8 | 18.5 | $1,588 | $1,549 | -2.5% | $1,562 | -1.6% | -$26 |
| X | 32.2% | 32.5% | 19.0 | 11.0 | $1,144 | $1,141 | -0.2% | $1,146 | 0.2% | $2 |
| Y | 1.0% | 0.9% | 19.7 | 11.7 | $1,108 | $1,181 | 6.6% | $1,120 | 1.1% | $12 |
| Z | 0.04% | 0.06% | 13.5 | 7.9 | $708 | $807 | 14.0% | $743 | 5.0% | $35 |
| Share of Revenue from P,R,S,V,W,Y | | | | | 43.16% | 43.13% | | 42.70% | | |
| **San Diego Gas & Electric** | | | | | | | | | | |
| Coastal | 46.2% | 47.7% | 16.5 | 15.3 | $1,015 | $1,019 | 0.3% | $1,021 | 0.6% | $6 |
| Inland | 39.6% | 34.0% | 19.8 | 15.3 | $1,229 | $1,223 | -0.5% | $1,221 | -0.6% | -$8 |
| Mountain | 0.0% | 0.0% | 18.0 | 17.1 | $1,058 | $1,109 | 4.8% | $1,070 | 1.1% | $12 |
| Desert | 1.2% | 0.7% | 28.3 | 7.5 | $1,714 | $1,744 | 1.8% | $1,687 | -1.6% | -$28 |
| Share of Revenue from Inland/Mountain/Desert | | | | | 47.08% | 46.90% | | 46.78% | | |

Note: Usage and household shares do not add to 100% -- remainder are on CARE program.
See appendix for region maps

Table 3: Bill changes under alternative tariffs by climate region

63.73% of total revenues if there had been a flat-price tariff.[6] With the actual IBP tariff in 2006, these same customers paid 63.80% of total revenues from standard tariff residential customers, so the IBP raised their share of total revenues by 0.07 percentage points or, put differently, raised the average price they paid per kWh by 0.11%.[7]

Put differently, table 3 indicates that the average price paid per kWh is very nearly equal across climate regions, since there is almost no change from the flat-rate tariff when the average price is equal by construction. From an equity perspective, there are two

[6] Throughout this discussion, I continue to assume zero price elasticity.

[7] The total revenue collected is unchanged by construction and the total usage is unchanged by assumption, so the percentage of revenue increase translates directly to a price increase: $\frac{63.80}{63.73} - 1 = 0.0011$ In the case of PG&E, IBP raised the average price of the hotter climate regions that constitute 43.13% of demand by 0.07%. In the case of SDG&E, IBP raised the average price of the hotter climate regions that constitute 46.90% of demand by 0.4%.

sources of significant cost differences across regions that could justify different average prices by climate region. First, hotter climates consume a higher share of their power during peak demand periods, which is when power is more expensive to provide, suggesting that cost-based tariffs would be higher in hotter regions. In ongoing work, I am exploring the impact of the time variation in consumption, including how consumption patterns vary across climate areas (Borenstein 2011). Second, there are fixed costs per customer that are recovered through these volumetric charges and that probably don't vary systematically across climate regions – billing and metering, local distribution, and overhead. Since, customers in hotter climate consume more overall, tariffs designed to cover each customer's total cost (including equal share of fixed cost for each customer) would tend to have a lower price per kWh in the hotter regions as these fixed costs per customer are spread over more consumption. Given that prices don't vary by hour, however, and that recovering fixed costs through volumetric charges generally results in inefficient marginal prices, these arguments have more traction in terms of fairness than in terms of economic efficiency.

The right-hand set of columns of table 3 show the impact of switching from the standard IBP tariff to a IBP with a $5/month fixed charge, where the additional revenue is offset by equal-proportion reductions in marginal rates on tiers 3, 4, and 5. For all three utilities, this causes the revenue share of the hotter regions to decline by 0.2 to 0.5 percentage points, implying price drops of 0.6% to 1.1%. The change is small, but it isn't a random occurrence. It results from the fact that the fixed charge harms all customers equally, but the decline in prices on the upper tiers disproportionately benefits customers in higher-use regions. These customers consume more kWh on those high tiers, even though they don't consume a higher *share* of their total usage on those tiers.

Overall, the regional impact of these possible changes in retail tariffs is very limited. Switching to a flat retail price for all power would have essentially no redistributive impact across regions. Adding a fixed charge to the 5-tier tariff structure – then using the revenue to lower the rates on higher tiers – would slightly benefit the areas with more extreme climates, but the effect would still be 1.1% of bills or less on average.

## IV. Impacts of Tariff Changes on Low-Income Customers

In contrast to the regional impacts, the impact of these potential tariff changes on low-income customers is potentially substantial. This section presents an approach to analyzing these impacts that I developed in earlier work and applies the approach to the same potential tariff changes that were analyzed in the previous section. Instead of comparing the relative impact on hotter versus milder climates, the comparison here is between households in different income brackets. In particular, I divide customers into five household income brackets and evaluate differential impacts across these brackets.

The exercise would be as straightforward as in the previous section if one knew the income of every household, but those data are not available. Instead, census data are used to estimate the incomes of households. The customers are identified at the 9-digit zip code level and those data are matched to census block groups (CBGs). The census releases data on the income distribution of households in every CBG, based on the long-form census, which is collected from one out of every 6 households. Among the CBG-level information is the proportion of households in each of 16 income brackets. In many CBGs, many of the brackets are empty, and the variation in actual household income probably can't be identified with that much precision, so I aggregate these brackets to 5 income brackets that are approximately quintiles in California: $0-$20,000, $20,000-$40,000, $40,000-$60,000, $60,000-$100,000 and over $100,000.[8]

With household-level electricity billing data and only CBG level income distribution data, the question is how to assign households within a CBG to different income brackets. I first do this in two ways that are intended to give bounds on the variation. Then I create an estimate of the actual distribution by taking a weighted average of the bounds, where the weights are set by calibration to other indicators. The approach is described in much more detail in Borenstein (forthcoming).

*A. A bit more explanation of assigning household to income brackets*

To give somewhat more detail here, households within each CBG are first assigned randomly to income brackets in proportion to the actual census distribution of household incomes in that CBG. This ignores any within-CBG correlation between income and elec-

[8] As discussed in Borenstein (forthcoming), many studies use median household income by CBG to represent the income of all households in the CBG. I show that there is a great deal of heterogeneity within CBGs, so such analyses fail to capture much of the cross-sectional income variation.

tricity usage – a correlation that is almost certainly positive – so it tends to assign too many low-usage households to high income brackets and too many high-usage households to low brackets. Then, as an alternative, households within a CBG are ordered by usage and are then assigned to income brackets in the order of usage, so the lowest-usage households are assigned to the lowest income brackets and the highest-usage households to the highest brackets. The bracket breaks are still determined by the census data so that the proportion of households in each bracket still matches the census data for each CBG.

The matching is complicated (or actually assisted) by the fact that the billing data also indicate whether the customer is on the CARE tariff or not. Thus, for each CBG, the share of customers on CARE is known. Furthermore, there are estimates of the penetration of CARE participation among eligible customers. I use this information to separately allocate CARE and standard tariff customers across income brackets in a way that causes CARE customers to be disproportionately allocated to the lower income brackets within each CBG. See Borenstein (forthcoming) for further details.

The two bounding approaches deliver estimates of average bill by income bracket and tariff, but the estimates differ substantially across the approaches. That is, the bounds are not very tight. Luckily, the approaches also yield estimates of average annual consumption by household within each income bracket. This ancillary attribute is then used to calibrate the estimation by comparing the implied averages to estimates of these averages that I derive from a completely different dataset. Essentially, I take a weighted average of the results from the bounding approaches where the weight is the value that yields average consumption levels by income bracket that most closely match the estimates from the other dataset. Because the estimates from the other dataset are imprecise, so is the estimate of the weighting that most closely matches these estimates. I use the distribution of possible weightings to derive the mean, distribution, and confidence intervals of the estimated changes in bills from the alternative tariff structures.

The result is an estimated change in average annual customer bill and a confidence interval for that change. In the remainder of this section, I present those estimates.

*B. Results*

As in the previous section, I present results separately for customers on the standard

| Income Bracket | Share of Total Residential Usage | Share of Total Residential Households | Avg Daily Use | % of usage on tier 1 | % of usage on tier 2 | % of usage on tier 3 | % of usage on tier 4 | % of usage on tier 5 |
|---|---|---|---|---|---|---|---|---|
| **Southern California Edison** | | | | | | | | |
| $0-$20k | 3.2% | 5.4% | 11.7 | 77.8% | 8.5% | 8.7% | 3.4% | 1.5% |
| $20k-$40k | 9.8% | 11.7% | 16.6 | 64.3% | 10.7% | 13.8% | 7.1% | 4.1% |
| $40k-$60k | 16.1% | 16.8% | 19.0 | 57.8% | 11.1% | 15.9% | 9.4% | 5.9% |
| $60k-$100k | 25.2% | 23.5% | 21.2 | 53.1% | 11.1% | 17.0% | 11.0% | 7.8% |
| over $100k | 24.9% | 17.4% | 28.3 | 41.8% | 10.4% | 18.3% | 14.4% | 15.1% |
| **Pacific Gas & Electric** | | | | | | | | |
| $0-$20k | 3.8% | 6.0% | 12.4 | 75.3% | 8.6% | 9.5% | 4.1% | 2.5% |
| $20k-$40k | 11.4% | 12.6% | 17.4 | 64.0% | 10.4% | 13.7% | 7.2% | 4.7% |
| $40k-$60k | 16.0% | 16.3% | 18.9 | 60.4% | 10.8% | 15.0% | 8.3% | 5.5% |
| $60k-$100k | 24.2% | 23.4% | 19.9 | 58.0% | 11.0% | 15.8% | 9.1% | 6.1% |
| over $100k | 25.7% | 20.9% | 23.7 | 50.4% | 11.0% | 17.4% | 11.6% | 9.7% |
| **San Diego Gas & Electric** | | | | | | | | |
| $0-$20k | 3.1% | 6.8% | 7.8 | 88.1% | 5.5% | 4.5% | 1.4% | 0.5% |
| $20k-$40k | 10.8% | 15.5% | 11.8 | 74.8% | 9.2% | 9.8% | 4.1% | 2.1% |
| $40k-$60k | 16.2% | 17.9% | 15.3 | 64.3% | 10.6% | 13.7% | 7.1% | 4.3% |
| $60k-$100k | 26.5% | 23.6% | 19.1 | 55.7% | 11.2% | 16.2% | 9.8% | 7.1% |
| over $100k | 30.4% | 18.5% | 28.0 | 40.5% | 10.3% | 18.3% | 14.7% | 16.2% |

Table 4: Consumption on tiers of IBP tariff by income bracket

tariff and on CARE, focusing on the customers on the standard tariff. The results for customers on CARE are shown in the appendix. Implicit in this approach is the assumption that tariff changes will not alter CARE participation.

The format of the presentation follows that in the previous section, except customers are now differentiated by income bracket instead of climate region and average bill changes are estimated for each group, rather than just calculated, because the match of households to income brackets is estimated by the method just discussed.

Table 4 shows the estimated distribution of consumption across the tiers by income bracket for customers who are on the standard tariff. Though all customers with household income below $20,000 per year are eligible for CARE, I estimate that about 26% of SCE low-income customers are not on it.[9] Table 4 shows that among standard tariff customers,

[9] The number is somewhat higher for PG&E and SDG&E. The data indicate this because, for instance, there are some CBGs in which there are a higher proportion of households with income below $20,000

those with lower income households consume less electricity, so a much higher proportion of their consumption is on lower tiers, suggesting that a switch to a flat tariff or addition of a fixed fee would be more likely to harm them.

Table 5 bears this out. For SCE's standard tariff customers in the lowest income bracket, changing from the 5-tier structure to a flat rate would raise the average annual bill by about $157 or about $13 per month. It is worth noting that the impact is much smaller for the estimated 71% of lowest-bracket households customers of SCE that are on CARE, whose increase is only $22 per year (see appendix). The overall increase for low-income customers is about $62 per year or $5 per month. For PG&E's standard tariff customers who are in the lowest income bracket, the result is a slightly smaller increase than SCE, $116/yr or about $9.67/month, and still smaller for SDG&E, an increase of about $98/yr or $7.50/month.[10] These results repeat those shown in Borenstein (forthcoming), though in slightly different format.

The impact of a fixed monthly fee with a reduction in higher-tier prices can be decomposed into the change in the fixed and marginal fees. I assume a $5/month fixed fee, so it costs each customer $60/year. The net change shown for SCE's standard tariff customers in the lowest income bracket is $48 per year, so these customers on average get back about 20% from the lower marginal prices on high tiers. The net impact on standard tariff customers in the lowest income bracket would be an average bill increase of about $4 per month, or 80% of the fixed fee. Because a price elasticity of zero is assumed in these calculations, the results are linear in the size of the fixed fee, so, for instance, a $10 per month fixed fee is estimated to raise the net monthly bills of these customers by about $8 per month. I estimate that an average PG&E customer in the lowest income bracket would see a $41 net annual increase from the fixed fee (69% of the annual fixed charge) and SDG&E customers would see a $55 net annual change (92% of the annual fixed charge) on average.

In all three utilities areas, the impact of adding a fixed charge would also be a significant increase for the second-lowest income bracket, those with an annual income between

than there are customers on CARE in the CBG.

[10] The 95% confidence intervals on annual change are: SCE [-161,-147], PG&E [-126,-100], and SDG&E [-96,-81].

| Income Bracket | Share of Total Residential Usage | Average Annual Bill with IBP | Average Annual Bill flat rate | % chg from IBP to flat | Average Annual Bill IBP+FC | % change from IBP to IBP+FC | $ change from IBP to IBP+FC | 95% confidence interval |
|---|---|---|---|---|---|---|---|---|
| **Southern California Edison** | | | | | | | | |
| $0-$20k | 3.2% | $581 | $738 | 27.0% | $629 | 8.3% | $48 | [42,53] |
| $20k-$40k | 9.8% | $930 | $1,046 | 12.6% | $958 | 3.1% | $28 | [21,36] |
| $40k-$60k | 16.1% | $1,134 | $1,198 | 5.7% | $1,148 | 1.3% | $14 | [12,19] |
| $60k-$100k | 25.2% | $1,325 | $1,337 | 0.9% | $1,326 | 0.1% | $1 | [0,1] |
| over $100k | 24.9% | $1,996 | $1,790 | -10.3% | $1,947 | -2.5% | -$49 | [-60,-40] |
| **Pacific Gas & Electric** | | | | | | | | |
| $0-$20k | 3.8% | $628 | $744 | 18.5% | $669 | 6.6% | $41 | [34,47] |
| $20k-$40k | 11.4% | $980 | $1,046 | 6.7% | $998 | 1.8% | $18 | [13,23] |
| $40k-$60k | 16.0% | $1,096 | $1,130 | 3.1% | $1,104 | 0.7% | $8 | [6,10] |
| $60k-$100k | 24.2% | $1,181 | $1,191 | 0.8% | $1,182 | 0.1% | $1 | [1,1] |
| over $100k | 25.7% | $1,531 | $1,421 | -7.2% | $1,501 | -2.0% | -$30 | [-36,-24] |
| **San Diego Gas & Electric** | | | | | | | | |
| $0-$20k | 3.1% | $387 | $479 | 23.7% | $442 | 14.3% | $55 | [50,58] |
| $20k-$40k | 10.8% | $639 | $730 | 14.3% | $681 | 6.5% | $42 | [28,54] |
| $40k-$60k | 16.2% | $887 | $947 | 6.8% | $910 | 2.6% | $23 | [12,39] |
| $60k-$100k | 26.5% | $1,170 | $1,180 | 0.9% | $1,169 | -0.1% | -$1 | [-2,1] |
| over $100k | 30.4% | $1,909 | $1,728 | -9.5% | $1,833 | -4.0% | -$76 | [-107,-53] |

Table 5: Bill changes under alternative tariffs by income bracket

$20,000 and $40,000, though smaller than for those the poorest bracket. Customers in the third and fourth brackets would see smaller negative changes (or approximately zero) on average, while the average customer in the highest income bracket would see a substantial net bill decline. Note that because there are relatively few households in the lowest income bracket that are on the standard tariff, in all three utility areas more of the transfers to the high-bracket customers would come from the second-lowest income bracket than from the lowest. In SCE and SDG&E, customers in the third bracket would also contribute more in aggregate than those in the lowest bracket.

## V. Incorporating Elasticity Effects

The results in tables 3 and 5 assume there would be no demand response to the changes in tariffs, but there would likely be some change. In order to gauge the size of this impact, I look to Ito (2010). Ito presents compelling evidence that residential consumers facing increasing block pricing respond to average rather than marginal price. He also estimates

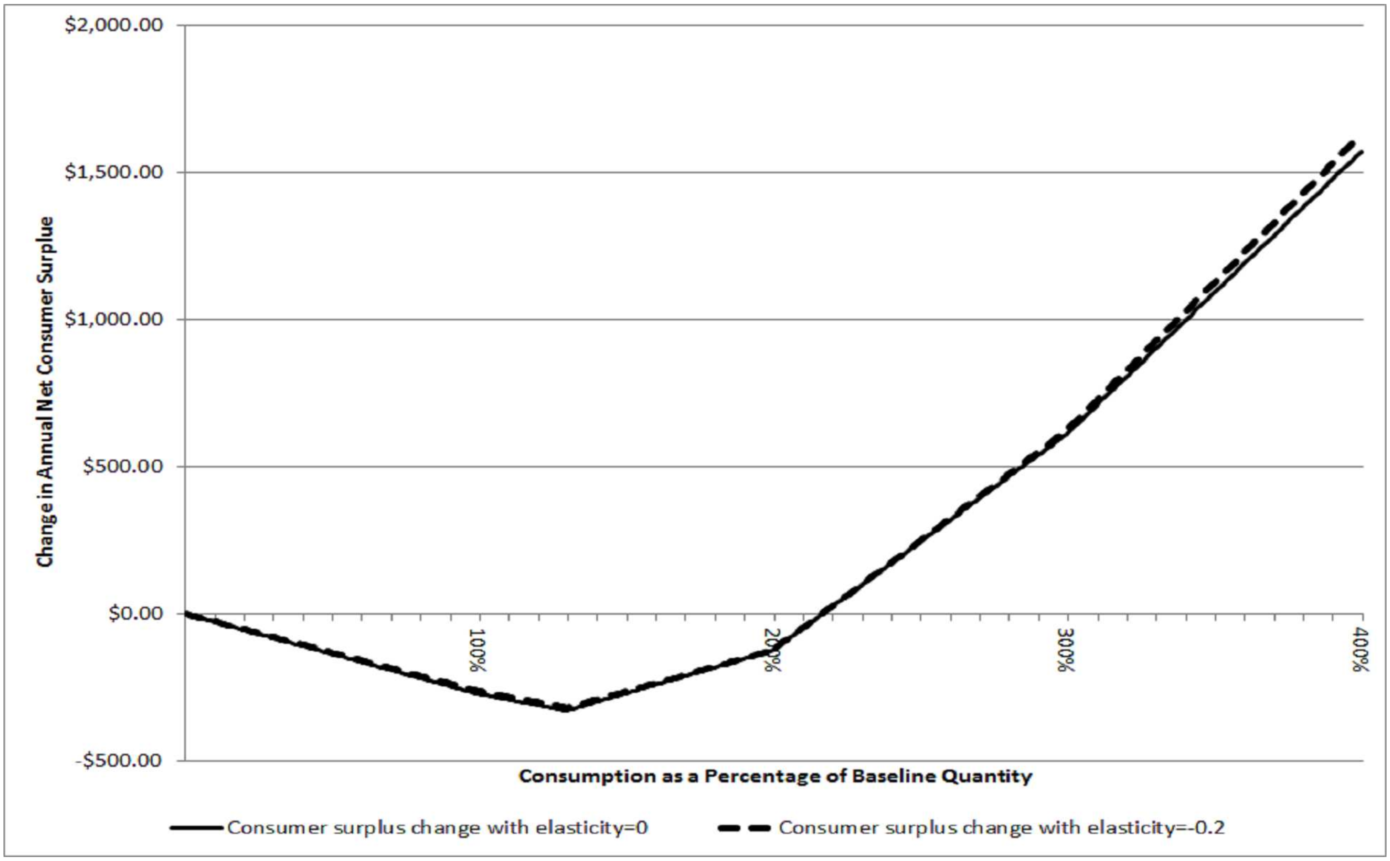


Figure 2: Consumer Surplus change from IBP to flat rate for SCE customer with and without demand elasticity

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that the average elasticity for customers in his sample – a set of SCE and SDG&E customers located near the boundary between the two utilities – is between -0.1 and -0.2.

In order to explore how much customer price response is likely to change the results, figure 2 presents the change in consumer surplus with and without such response using the standard SCE IBP and the alternative flat rate. The solid line shows the change in annual consumer surplus for a customer with a baseline quantity allocation of 15 kWh per day, which was about the customer-weighted average for SCE residential customers in 2006. The dashed line shows the change in consumer surplus under the assumption that the customer responds to a change in average price with an elasticity of -0.2.[11] In

[11] To be precise, the starting quantity (on the horizontal axis) is assumed to be the customer's possibly non-optimizing response to the *average* price implied by the standard IBP in table 1. That is, the

all cases, ignoring consumer adaptation to the price change biases the consumer surplus change in the negative direction, but the bias is quite small. Incorporating consumer response changes the change in consumer surplus by less than 5% at all consumption levels up to 400% of baseline.

Figure 2 is calculated for a change from the standard IBP to a flat rate. The effect of consumer response is even smaller for the change from standard IBP to IBP plus a fixed charge. The $5/month fixed charge changes no marginal price so it creates virtually zero consumer response.[12] The associated change in the upper three tiers still leaves those marginal prices well above the counterfactual flat-rate tariff, and there is no change in the marginal prices on the lower two tiers. Thus, the bias is much smaller than the already small bias in analyzing the change to a flat rate.

## VI. Conclusion

There are strong policy arguments for regulators to avoid the sort of steeply increasing block electricity rates that California now has. The rates are not cost based and add complexity to billing that makes it more difficult to incorporate price variation that is cost-based, such as time-varying pricing. While household consumption level is correlated with income, the distributions make clear that there are many poor households with high electricity consumption and many wealthy customers with low consumption. Borenstein and Davis (forthcoming) found the same result in natural gas, and present evidence that it is caused by the poorer energy efficiency of low-income households. Of course, one of the concerns with marginal prices that don't reflect cost is that they distort behavior. In previous work, Borenstein (forthcoming), I showed that the distortion from IBP tariffs is likely to be large relative to the amount of income they redistribute to poorer households, making this an unattractive approach to accomplishing such redistribution.

Nonetheless, I find no support for one of the most common arguments against IBP in

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customer has chosen the quantity at which her marginal value is equal to average price, consistent with the idea that she knows her value, but has not taken the time or attention to figure out the true marginal price. Then the alternative quantity is calculated assuming a price change from the average price at the starting quantity to the flat rate and an elasticity of -0.2. The net change in consumer surplus is measured as the change in gross consumer surplus along the customer's actual marginal value curve minus the change in payments.

[12] Income effects change the analysis very little, as discussed in Borenstein (forthcoming).

California, that it hurts customers in regions with more extreme climate. Moving to a flat rate would have virtually no impact on the average bill paid by customers in the areas of the state that have hotter summers and colder winters. Introducing a significant fixed monthly charge and lowering the rates on the higher tiers of the IBP tariff would benefit these customers on average, but the effect would be very small, likely no more than a 1% savings.

In Borenstein (forthcoming), I estimated the change in consumer surplus for low-income households that would result from moving from IBP to a flat-rate tariff. I present those results in a slightly different format here, focusing on the subset of low-income customers who are not on the means-tested CARE program and showing that those customers would see bills increase by 18% to 27% across the three large utilities. I then extend the analysis to examine the impact of introducing a fixed charge while maintaining the IBP and lowering the prices on the highest tiers. I find that among the lowest-income households (less than $20,000 per year household income) that are not on the CARE program, introducing a fixed monthly charge would on average cause a net increase in their bills of between 69% and 92% of the fixed charge.

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**Pacific Gas & Electric**

Standard Tariff

| | Fixed | Tier 1 | Tier 2 | Tier 3 | Tier 4 | Tier 5 |
|---|---|---|---|---|---|---|
| IBP | $0.00 | $0.1143 | $0.1299 | $0.2178 | $0.2987 | $0.3394 |
| Flat rate | $0.00 | $0.1643 | $0.1643 | $0.1643 | $0.1643 | $0.1643 |
| IBP + FC | $5.00 | $0.1143 | $0.1299 | $0.1963 | $0.2692 | $0.3058 |

CARE Tariff

| | Fixed | Tier 1 | Tier 2 | Tier 3 | Tier 4 | Tier 5 |
|---|---|---|---|---|---|---|
| IBP | $0.00 | $0.0832 | $0.0956 | $0.0956 | $0.0956 | $0.0956 |
| Flat rate | $0.00 | $0.0874 | $0.0874 | $0.0874 | $0.0874 | $0.0874 |
| IBP + FC | $5.00 | $0.0832 | $0.0956 | $0.0557 | $0.0557 | $0.0557 |

**Southern California Edison**

Standard Tariff

| | Fixed | Tier 1 | Tier 2 | Tier 3 | Tier 4 | Tier 5 |
|---|---|---|---|---|---|---|
| IBP | $0.00 | $0.1162 | $0.1361 | $0.2201 | $0.3049 | $0.3049 |
| Flat rate | $0.00 | $0.1731 | $0.1731 | $0.1731 | $0.1731 | $0.1731 |
| IBP + FC | $5.00 | $0.1162 | $0.1361 | $0.2023 | $0.2802 | $0.2802 |

CARE Tariff

| | Fixed | Tier 1 | Tier 2 | Tier 3 | Tier 4 | Tier 5 |
|---|---|---|---|---|---|---|
| IBP | $0.00 | $0.0834 | $0.1053 | $0.1691 | $0.1717 | $0.1717 |
| Flat rate | $0.00 | $0.1060 | $0.1060 | $0.1060 | $0.1060 | $0.1060 |
| IBP + FC | $5.00 | $0.0834 | $0.1053 | $0.1260 | $0.1280 | $0.1280 |

**San Diego Gas & Electric**

Standard Tariff

| | Fixed | Tier 1 | Tier 2 | Tier 3 | Tier 4 | Tier 5 |
|---|---|---|---|---|---|---|
| IBP | $0.00 | $0.1287 | $0.1488 | $0.2312 | $0.2401 | $0.2571 |
| Flat rate | $0.00 | $0.1690 | $0.1690 | $0.1690 | $0.1690 | $0.1690 |
| IBP + FC | $5.00 | $0.1287 | $0.1488 | $0.2055 | $0.2134 | $0.2285 |

CARE Tariff

| | Fixed | Tier 1 | Tier 2 | Tier 3 | Tier 4 | Tier 5 |
|---|---|---|---|---|---|---|
| IBP | $0.00 | $0.1026 | $0.1187 | $0.1758 | $0.1764 | $0.1776 |
| Flat rate | $0.00 | $0.1168 | $0.1168 | $0.1168 | $0.1168 | $0.1168 |
| IBP + FC | $5.00 | $0.1026 | $0.1187 | $0.1002 | $0.1005 | $0.1012 |

Table A1: Standard 2006 IBP tariff, alternative flat rate, and alternative IBP + fixed charge

| Region | Share of Total Residential Usage | Share of Total Residential Households | Avg Daily Use | Summer Baseline Quantity | % of usage on tier 1 | % of usage on tier 2 | % of usage on tier 3 | % of usage on tier 4 | % of usage on tier 5 |
|---|---|---|---|---|---|---|---|---|---|
| **Southern California Edison** | | | | | | | | | |
| Standard Tariff | | | | | | | | | |
| 10 | 27.4% | 31.1% | 17.4 | 10.2 | 53.4% | 10.5% | 15.7% | 10.3% | 10.2% |
| 13 | 2.9% | 2.1% | 26.6 | 19.4 | 52.2% | 11.3% | 17.9% | 11.8% | 6.8% |
| 14 | 5.6% | 4.8% | 23.0 | 17.0 | 54.3% | 11.5% | 17.5% | 10.7% | 5.9% |
| 15 | 3.8% | 2.4% | 31.5 | 47.6 | 55.4% | 9.6% | 13.9% | 9.3% | 11.7% |
| 16 | 1.4% | 1.6% | 17.2 | 10.0 | 58.4% | 10.2% | 15.0% | 9.3% | 7.1% |
| 17 | 38.2% | 32.8% | 23.0 | 15.4 | 51.8% | 10.9% | 17.1% | 11.6% | 8.6% |
| Total | 79.3% | 74.8% | | | | | | | |
| CARE | | | | | | | | | |
| 10 | 6.4% | 9.7% | 12.9 | 10.2 | 68.6% | 10.6% | 12.7% | 5.7% | 2.4% |
| 13 | 1.4% | 1.4% | 20.1 | 19.4 | 64.7% | 11.0% | 14.4% | 7.1% | 2.7% |
| 14 | 2.3% | 2.2% | 20.7 | 17.0 | 60.3% | 11.3% | 15.7% | 8.6% | 4.1% |
| 15 | 0.8% | 0.6% | 26.7 | 47.6 | 70.0% | 10.2% | 11.7% | 5.3% | 2.8% |
| 16 | 0.2% | 0.3% | 18.0 | 10.0 | 59.5% | 11.0% | 15.4% | 8.8% | 5.3% |
| 17 | 9.6% | 11.0% | 17.2 | 15.4 | 65.6% | 10.6% | 13.6% | 7.0% | 3.3% |
| Total | 20.7% | 25.2% | | | | | | | |
| **Pacific Gas & Electric** | | | | | | | | | |
| Standard Tariff | | | | | | | | | |
| P | 3.8% | 2.9% | 25.4 | 15.3 | 64.9% | 10.8% | 13.9% | 6.8% | 3.6% |
| Q | 0.1% | 0.1% | 32.0 | 7.5 | 42.5% | 10.2% | 17.9% | 14.3% | 15.1% |
| R | 9.1% | 6.9% | 25.6 | 17.1 | 56.3% | 11.0% | 16.5% | 10.2% | 6.1% |
| S | 16.2% | 12.7% | 24.4 | 15.3 | 55.9% | 11.2% | 16.6% | 10.1% | 6.2% |
| T | 13.8% | 19.2% | 13.8 | 7.5 | 59.2% | 10.4% | 14.8% | 8.6% | 7.0% |
| V | 0.7% | 0.8% | 18.5 | 12.0 | 52.5% | 10.0% | 14.4% | 8.7% | 14.5% |
| W | 4.2% | 3.1% | 25.8 | 18.5 | 54.5% | 11.0% | 17.1% | 11.1% | 6.4% |
| X | 32.2% | 32.5% | 19.0 | 11.0 | 57.9% | 10.7% | 15.1% | 8.9% | 7.4% |
| Y | 1.0% | 0.9% | 19.7 | 11.7 | 65.1% | 9.7% | 12.9% | 6.8% | 5.5% |
| Z | 0.04% | 0.06% | 13.5 | 7.9 | 72.2% | 8.4% | 10.6% | 5.5% | 3.3% |
| Total | 81.1% | 79.2% | | | | | | | |
| CARE | | | | | | | | | |
| P | 0.9% | 0.7% | 24.5 | 15.3 | 68.2% | 10.0% | 12.5% | 6.1% | 3.1% |
| Q | 0.005% | 0.0% | 33.9 | 7.5 | 41.1% | 9.6% | 17.4% | 15.3% | 16.6% |
| R | 4.2% | 3.7% | 21.8 | 17.1 | 63.9% | 10.7% | 14.3% | 7.6% | 3.5% |
| S | 3.9% | 3.7% | 20.2 | 15.3 | 64.8% | 10.6% | 14.0% | 7.3% | 3.4% |
| T | 2.9% | 4.6% | 12.1 | 7.5 | 67.1% | 10.1% | 12.8% | 6.2% | 3.9% |
| V | 0.3% | 0.3% | 18.7 | 12.0 | 49.6% | 8.3% | 12.1% | 8.6% | 21.4% |
| W | 2.0% | 1.9% | 20.8 | 18.5 | 65.2% | 10.5% | 13.9% | 7.3% | 3.0% |
| X | 4.4% | 5.7% | 14.9 | 11.0 | 70.4% | 9.8% | 11.7% | 5.3% | 2.9% |
| Y | 0.2% | 0.2% | 24.6 | 11.7 | 62.6% | 10.0% | 13.4% | 7.6% | 6.3% |
| Z | 0.003% | 0.003% | 22.5 | 7.9 | 65.7% | 9.6% | 12.7% | 7.6% | 4.3% |
| Total | 18.9% | 20.8% | | | | | | | |
| **San Diego Gas & Electric** | | | | | | | | | |
| Standard Tariff | | | | | | | | | |
| Coastal | 46.2% | 47.7% | 16.5 | 9.6 | 56.3% | 10.1% | 14.7% | 9.6% | 9.3% |
| Inland | 39.6% | 34.0% | 19.8 | 11.2 | 54.5% | 10.5% | 15.9% | 10.5% | 8.5% |
| Mountain | 0.04% | 0.04% | 18.0 | 14.8 | 63.0% | 9.4% | 12.9% | 8.4% | 6.3% |
| Desert | 1.2% | 0.7% | 28.3 | 16.4 | 57.0% | 11.0% | 16.1% | 9.8% | 6.0% |
| Total | 87.0% | 82.4% | | | | | | | |
| CARE | | | | | | | | | |
| Coastal | 6.2% | 9.4% | 11.2 | 9.6 | 76.0% | 8.9% | 9.6% | 3.9% | 1.6% |
| Inland | 6.6% | 8.1% | 14.0 | 11.2 | 71.6% | 9.3% | 11.1% | 5.3% | 2.7% |
| Mountain | 0.01% | 0.01% | 20.8 | 14.8 | 64.5% | 9.9% | 13.7% | 8.5% | 3.4% |
| Desert | 0.1% | 0.1% | 26.8 | 16.4 | 62.6% | 10.6% | 14.2% | 7.9% | 4.6% |
| Total | 13.0% | 17.6% | | | | | | | |

Table A2: Consumption on tiers of IBP tariff by climate region

| Region | Share of total residential usage | Share of total residential households | Avg Daily Use | Summer Baseline Quantity | Average Annual Bill with IBP | Average Annual Bill flat rate | % change from IBP to flat | Average Annual Bill IBP+FC | % change from IBP to IBP+FC | $ change from IBP to IBP+FC |
|---|---|---|---|---|---|---|---|---|---|---|
| **Southern California Edison** | | | | | | | | | | |
| Standard Tariff | | | | | | | | | | |
| 10 | 27.4% | 31.1% | 17.4 | 10.2 | $1,100 | $1,100 | 0.0% | $1,110 | 0.9% | $10 |
| 13 | 2.9% | 2.1% | 26.6 | 19.4 | $1,670 | $1,679 | 0.6% | $1,655 | -0.9% | -$15 |
| 14 | 5.6% | 4.8% | 23.0 | 17.0 | $1,413 | $1,456 | 3.0% | $1,413 | -0.1% | -$1 |
| 15 | 3.8% | 2.4% | 31.5 | 47.6 | $1,982 | $1,992 | 0.5% | $1,953 | -1.4% | -$28 |
| 16 | 1.4% | 1.6% | 17.2 | 10.0 | $1,035 | $1,087 | 5.0% | $1,053 | 1.7% | $18 |
| 17 | 38.2% | 32.8% | 23.0 | 15.4 | $1,462 | $1,453 | -0.7% | $1,455 | -0.5% | -$7 |
| Share of Revenue from 13,14,15,17 | | | | | 63.80% | 63.73% | | 63.45% | | |
| CARE | | | | | | | | | | |
| 10 | 6.4% | 9.7% | 12.9 | 10.2 | $489 | $500 | 2.1% | $507 | 3.6% | $17 |
| 13 | 1.4% | 1.4% | 20.1 | 19.4 | $785 | $779 | -0.8% | $768 | -2.2% | -$17 |
| 14 | 2.3% | 2.2% | 20.7 | 17.0 | $837 | $803 | -4.1% | $804 | -4.0% | -$33 |
| 15 | 0.8% | 0.6% | 26.7 | 47.6 | $1,002 | $1,033 | 3.1% | $978 | -2.4% | -$24 |
| 16 | 0.2% | 0.3% | 18.0 | 10.0 | $734 | $698 | -4.9% | $710 | -3.3% | -$24 |
| 17 | 9.6% | 11.0% | 17.2 | 15.4 | $667 | $664 | -0.4% | $662 | -0.7% | -$5 |
| Share of Revenue from 13,14,15,17 | | | | | 68.79% | 68.21% | | 67.76% | | |
| **Pacific Gas & Electric** | | | | | | | | | | |
| Standard Tariff | | | | | | | | | | |
| P | 3.8% | 2.9% | 25.4 | 15.3 | $1,400 | $1,523 | 8.8% | $1,402 | 0.2% | $3 |
| Q | 0.1% | 0.1% | 32.0 | 7.5 | $2,278 | $1,922 | -15.6% | $2,184 | -4.1% | -$94 |
| R | 9.1% | 6.9% | 25.6 | 17.1 | $1,548 | $1,537 | -0.8% | $1,528 | -1.3% | -$20 |
| S | 16.2% | 12.7% | 24.4 | 15.3 | $1,478 | $1,464 | -0.9% | $1,461 | -1.2% | -$17 |
| T | 13.8% | 19.2% | 13.8 | 7.5 | $822 | $829 | 0.9% | $841 | 2.3% | $19 |
| V | 0.7% | 0.8% | 18.5 | 12.0 | $1,211 | $1,109 | -8.4% | $1,200 | -0.9% | -$11 |
| W | 4.2% | 3.1% | 25.8 | 18.5 | $1,588 | $1,549 | -2.5% | $1,562 | -1.6% | -$26 |
| X | 32.2% | 32.5% | 19.0 | 11.0 | $1,144 | $1,141 | -0.2% | $1,146 | 0.2% | $2 |
| Y | 1.0% | 0.9% | 19.7 | 11.7 | $1,108 | $1,181 | 6.6% | $1,120 | 1.1% | $12 |
| Z | 0.04% | 0.06% | 13.5 | 7.9 | $708 | $807 | 14.0% | $743 | 5.0% | $35 |
| Share of Revenue from P,R,S,V,W,Y | | | | | 43.16% | 43.13% | | 42.70% | | |
| CARE | | | | | | | | | | |
| P | 0.9% | 0.7% | 24.5 | 15.3 | $779 | $781 | 0.3% | $761 | -2.3% | -$18 |
| Q | 0.0% | 0.0% | 33.9 | 7.5 | $1,121 | $1,083 | -3.4% | $937 | -16.4% | -$184 |
| R | 4.2% | 3.7% | 21.8 | 17.1 | $698 | $696 | -0.3% | $677 | -3.0% | -$21 |
| S | 3.9% | 3.7% | 20.2 | 15.3 | $645 | $644 | -0.2% | $633 | -2.0% | -$13 |
| T | 2.9% | 4.6% | 12.1 | 7.5 | $385 | $386 | 0.1% | $405 | 5.1% | $20 |
| V | 0.3% | 0.3% | 18.7 | 12.0 | $610 | $596 | -2.3% | $556 | -8.9% | -$55 |
| W | 2.0% | 1.9% | 20.8 | 18.5 | $665 | $664 | -0.1% | $651 | -2.1% | -$14 |
| X | 4.4% | 5.7% | 14.9 | 11.0 | $471 | $474 | 0.6% | $488 | 3.6% | $17 |
| Y | 0.2% | 0.2% | 24.6 | 11.7 | $789 | $785 | -0.5% | $751 | -4.8% | -$38 |
| Z | 0.00% | 0.00% | 22.5 | 7.9 | $719 | $718 | -0.1% | $698 | -2.9% | -$21 |
| Share of Revenue from P,R,S,V,W,Y | | | | | 61.49% | 61.33% | | 59.88% | | |
| **San Diego Gas & Electric** | | | | | | | | | | |
| Standard Tariff | | | | | | | | | | |
| Coastal | 46.2% | 47.7% | 16.5 | 15.3 | $1,015 | $1,019 | 0.3% | $1,021 | 0.6% | $6 |
| Inland | 39.6% | 34.0% | 19.8 | 15.3 | $1,229 | $1,223 | -0.5% | $1,221 | -0.6% | -$8 |
| Mountain | 0.0% | 0.0% | 18.0 | 17.1 | $1,058 | $1,109 | 4.8% | $1,070 | 1.1% | $12 |
| Desert | 1.2% | 0.7% | 28.3 | 7.5 | $1,714 | $1,744 | 1.8% | $1,687 | -1.6% | -$28 |
| Share of Revenue from Inland/Mountain/Desert | | | | | 47.08% | 46.90% | | 46.78% | | |
| CARE | | | | | | | | | | |
| Coastal | 6.2% | 9.4% | 11.2 | 15.3 | $469 | $476 | 1.4% | $483 | 2.8% | $13 |
| Inland | 6.6% | 8.1% | 14.0 | 15.3 | $605 | $598 | -1.2% | $591 | -2.3% | -$14 |
| Mountain | 0.0% | 0.0% | 20.8 | 17.1 | $933 | $886 | -5.1% | $846 | -9.3% | -$87 |
| Desert | 0.1% | 0.1% | 26.8 | 7.5 | $1,212 | $1,141 | -5.8% | $1,074 | -11.4% | -$138 |
| Share of Revenue from Inland/Mountain/Desert | | | | | 52.85% | 52.19% | | 51.53% | | |

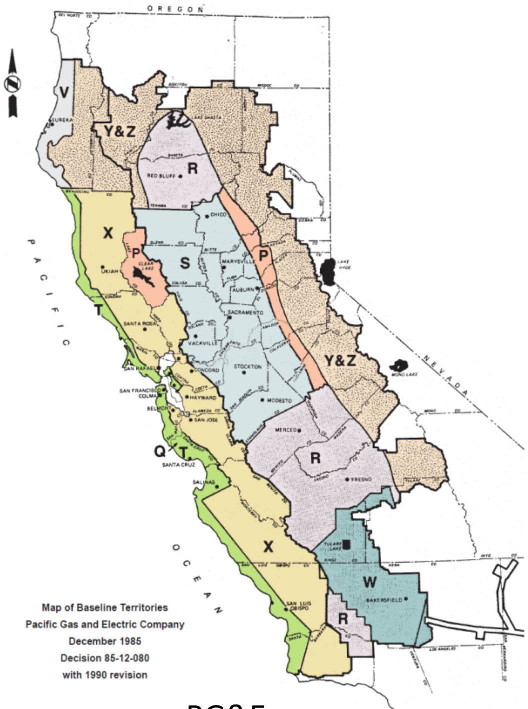
Table A3: Bill changes under alternative tariffs by climate region

| Income Bracket | Share of Total Residential Usage | Share of Total Residential Households | Avg Daily Use | % of usage on tier 1 | % of usage on tier 2 | % of usage on tier 3 | % of usage on tier 4 | % of usage on tier 5 |
|---|---|---|---|---|---|---|---|---|
| **Southern California Edison** | | | | | | | | |
| Standard Tariff | | | | | | | | |
| $0-$20k | 3.2% | 5.4% | 11.7 | 77.8% | 8.5% | 8.7% | 3.4% | 1.5% |
| $20k-$40k | 9.8% | 11.7% | 16.6 | 64.3% | 10.7% | 13.8% | 7.1% | 4.1% |
| $40k-$60k | 16.1% | 16.8% | 19.0 | 57.8% | 11.1% | 15.9% | 9.4% | 5.9% |
| $60k-$100k | 25.2% | 23.5% | 21.2 | 53.1% | 11.1% | 17.0% | 11.0% | 7.8% |
| over $100k | 24.9% | 17.4% | 28.3 | 41.8% | 10.4% | 18.3% | 14.4% | 15.1% |
| Total | 79.3% | 74.8% | | | | | | |
| CARE | | | | | | | | |
| $0-$20k | 9.1% | 12.5% | 14.3 | 71.5% | 9.9% | 11.5% | 5.1% | 2.1% |
| $20k-$40k | 9.0% | 10.4% | 17.0 | 64.7% | 11.0% | 14.1% | 7.0% | 3.2% |
| $40k-$60k | 2.5% | 2.1% | 22.9 | 53.0% | 12.4% | 18.6% | 10.6% | 5.3% |
| $60k-$100k | 0.2% | 0.1% | 32.9 | 38.4% | 10.7% | 21.0% | 17.6% | 12.4% |
| over $100k | 0.0003% | 0.0003% | 20.5 | 46.1% | 8.0% | 13.9% | 12.9% | 19.2% |
| Total | 20.7% | 25.2% | | | | | | |
| **Pacific Gas & Electric** | | | | | | | | |
| Standard Tariff | | | | | | | | |
| $0-$20k | 3.8% | 6.0% | 12.4 | 75.3% | 8.6% | 9.5% | 4.1% | 2.5% |
| $20k-$40k | 11.4% | 12.6% | 17.4 | 64.0% | 10.4% | 13.7% | 7.2% | 4.7% |
| $40k-$60k | 16.0% | 16.3% | 18.9 | 60.4% | 10.8% | 15.0% | 8.3% | 5.5% |
| $60k-$100k | 24.2% | 23.4% | 19.9 | 58.0% | 11.0% | 15.8% | 9.1% | 6.1% |
| over $100k | 25.7% | 20.9% | 23.7 | 50.4% | 11.0% | 17.4% | 11.6% | 9.7% |
| Total | 81.1% | 79.2% | | | | | | |
| CARE | | | | | | | | |
| $0-$20k | 9.2% | 11.0% | 16.0 | 69.6% | 9.7% | 11.9% | 5.7% | 3.1% |
| $20k-$40k | 7.4% | 7.9% | 18.0 | 65.3% | 10.5% | 13.6% | 6.9% | 3.8% |
| $40k-$60k | 1.9% | 1.6% | 22.4 | 57.5% | 11.7% | 16.6% | 9.1% | 5.1% |
| $60k-$100k | 0.4% | 0.2% | 30.0 | 45.7% | 11.6% | 20.0% | 13.8% | 8.9% |
| over $100k | 0.004% | 0.002% | 27.5 | 45.4% | 10.6% | 19.1% | 15.4% | 9.5% |
| Total | 18.9% | 20.8% | | | | | | |
| **San Diego Gas & Electric** | | | | | | | | |
| Standard Tariff | | | | | | | | |
| $0-$20k | 3.1% | 6.8% | 7.8 | 88.1% | 5.5% | 4.5% | 1.4% | 0.5% |
| $20k-$40k | 10.8% | 15.5% | 11.8 | 74.8% | 9.2% | 9.8% | 4.1% | 2.1% |
| $40k-$60k | 16.2% | 17.9% | 15.3 | 64.3% | 10.6% | 13.7% | 7.1% | 4.3% |
| $60k-$100k | 26.5% | 23.6% | 19.1 | 55.7% | 11.2% | 16.2% | 9.8% | 7.1% |
| over $100k | 30.4% | 18.5% | 28.0 | 40.5% | 10.3% | 18.3% | 14.7% | 16.2% |
| Total | 87.1% | 82.4% | | | | | | |
| CARE | | | | | | | | |
| $0-$20k | 5.7% | 9.6% | 10.0 | 82.5% | 7.2% | 6.9% | 2.5% | 1.0% |
| $20k-$40k | 5.8% | 6.8% | 14.4 | 70.4% | 10.2% | 11.8% | 5.2% | 2.3% |
| $40k-$60k | 1.2% | 1.0% | 21.7 | 54.4% | 12.3% | 18.2% | 10.0% | 5.2% |
| $60k-$100k | 0.3% | 0.1% | 29.0 | 41.8% | 10.6% | 19.8% | 15.7% | 12.2% |
| over $100k | 0.009% | 0.005% | 28.7 | 40.5% | 10.2% | 18.6% | 16.0% | 14.7% |
| Total | 12.9% | 17.6% | | | | | | |

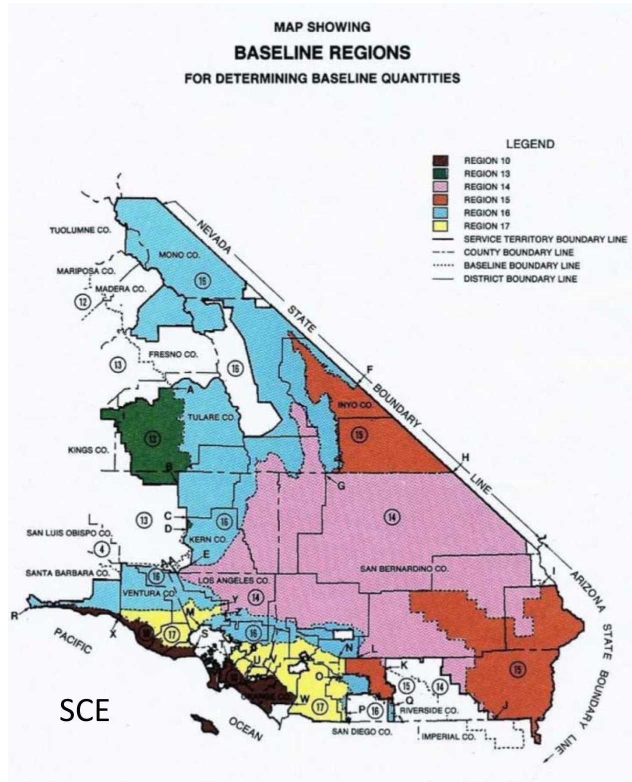
Table A4: Consumption on tiers of IBP tariff by income bracket

| Income Bracket | Share of Total Residential Usage | Average Annual Bill with IBP | Average Annual Bill flat rate | % change from IBP to flat | Average Annual Bill IBP+FC | % change from IBP to IBP+FC | % change from IBP to IBP+FC | 95% conf interval |
|---|---|---|---|---|---|---|---|---|
| **Southern California Edison** | | | | | | | | |
| Standard Tariff | | | | | | | | |
| $0-$20k | 3.2% | $581 | $738 | 27.0% | $629 | 8.3% | $48 | [42,53] |
| $20k-$40k | 9.8% | $930 | $1,046 | 12.6% | $958 | 3.1% | $28 | [21,36] |
| $40k-$60k | 16.1% | $1,134 | $1,198 | 5.7% | $1,148 | 1.3% | $14 | [12,19] |
| $60k-$100k | 25.2% | $1,325 | $1,337 | 0.9% | $1,326 | 0.1% | $1 | [0,1] |
| over $100k | 24.9% | $1,996 | $1,790 | -10.3% | $1,947 | -2.5% | -$49 | [-60,-40] |
| CARE | | | | | | | | |
| $0-$20k | 9.1% | $531 | $553 | 4.2% | $549 | 3.4% | $18 | [12,23] |
| $20k-$40k | 9.0% | $662 | $657 | -0.8% | $657 | -0.8% | -$5 | [-8,-3] |
| $40k-$60k | 2.5% | $973 | $888 | -8.8% | $907 | -6.7% | -$66 | [-85,-49] |
| $60k-$100k | 0.2% | $1,561 | $1,272 | -18.6% | $1,356 | -13.2% | -$205 | [-228,-183] |
| over $100k | 0.0003% | $940 | $795 | -15.5% | $850 | -9.6% | -$90 | [-92,-87] |
| **Pacific Gas & Electric** | | | | | | | | |
| Standard Tariff | | | | | | | | |
| $0-$20k | 3.8% | $628 | $744 | 18.5% | $669 | 6.6% | $41 | [34,47] |
| $20k-$40k | 11.4% | $980 | $1,046 | 6.7% | $998 | 1.8% | $18 | [13,23] |
| $40k-$60k | 16.0% | $1,096 | $1,130 | 3.1% | $1,104 | 0.7% | $8 | [6,10] |
| $60k-$100k | 24.2% | $1,181 | $1,191 | 0.8% | $1,182 | 0.1% | $1 | [1,1] |
| over $100k | 25.7% | $1,531 | $1,421 | -7.2% | $1,501 | -2.0% | -$30 | [-36,-24] |
| CARE | | | | | | | | |
| $0-$20k | 9.2% | $509 | $512 | 0.5% | $521 | 2.3% | $12 | [8,15] |
| $20k-$40k | 7.4% | $576 | $575 | -0.1% | $572 | -0.7% | -$4 | [-5,-3] |
| $40k-$60k | 1.9% | $723 | $715 | -1.2% | $683 | -5.6% | -$41 | [-52,-28] |
| $60k-$100k | 0.4% | $985 | $958 | -2.8% | $858 | -12.9% | -$127 | [-144,-106] |
| over $100k | 0.004% | $902 | $876 | -2.9% | $786 | -12.9% | -$117 | [-130,-100] |
| **San Diego Gas & Electric** | | | | | | | | |
| Standard Tariff | | | | | | | | |
| $0-$20k | 3.1% | $387 | $479 | 23.7% | $442 | 14.3% | $55 | [50,58] |
| $20k-$40k | 10.8% | $639 | $730 | 14.3% | $681 | 6.5% | $42 | [28,54] |
| $40k-$60k | 16.2% | $887 | $947 | 6.8% | $910 | 2.6% | $23 | [12,39] |
| $60k-$100k | 26.5% | $1,170 | $1,180 | 0.9% | $1,169 | -0.1% | -$1 | [-2,1] |
| over $100k | 30.4% | $1,909 | $1,728 | -9.5% | $1,833 | -4.0% | -$76 | [-107,-53] |
| CARE | | | | | | | | |
| $0-$20k | 5.7% | $408 | $428 | 4.9% | $440 | 7.7% | $31 | [19,49] |
| $20k-$40k | 5.8% | $622 | $613 | -1.4% | $605 | -2.7% | -$17 | [-29,-8] |
| $40k-$60k | 1.2% | $1,024 | $926 | -9.5% | $884 | -13.7% | -$140 | [-206,-91] |
| $60k-$100k | 0.3% | $1,475 | $1,235 | -16.3% | $1,152 | -21.9% | -$323 | [-399,-257] |
| over $100k | 0.009% | $1,475 | $1,225 | -17.0% | $1,143 | -22.5% | -$332 | [-408,-281] |

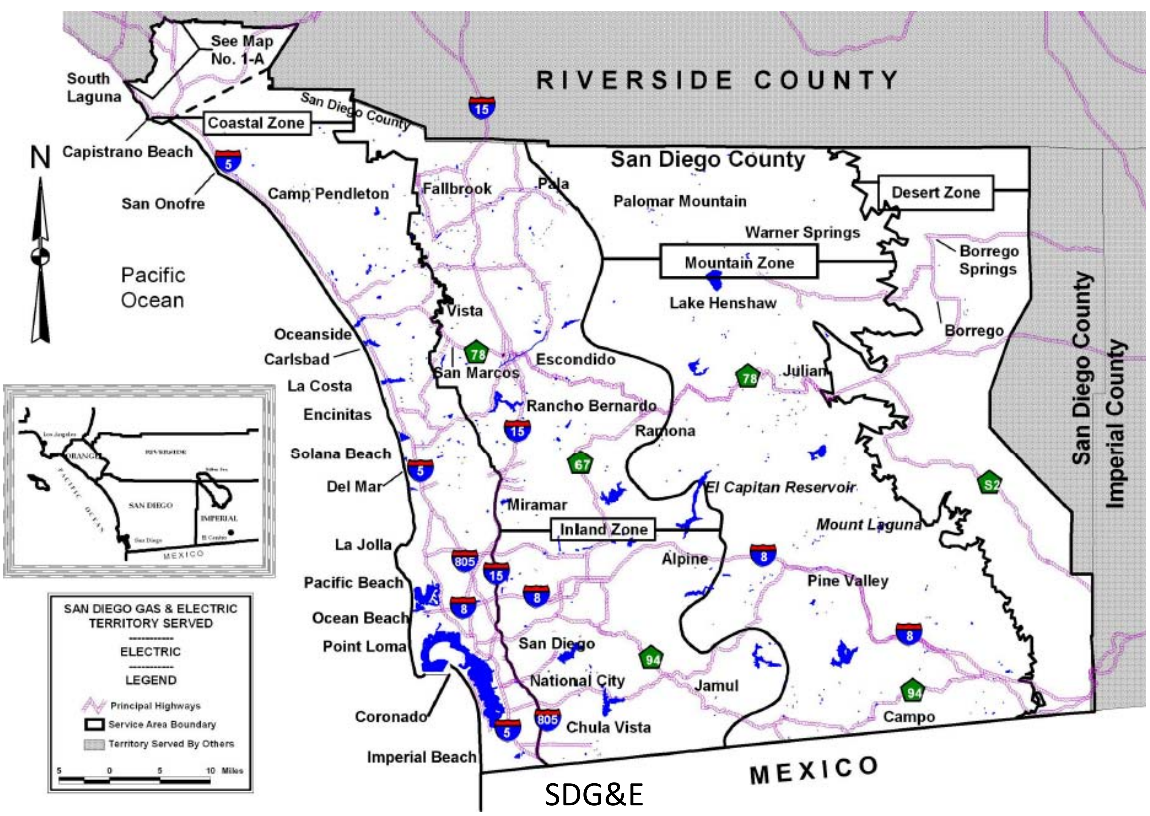
Table A5: Bill changes under alternative tariffs by income bracket




PG&E




SCE




SDG&E

Baseline Region Maps for Utilities as of 2006