

Something for Nothing The Who and How Much Bill Salience Effects on Energy Consumption

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Agenda



Project Background



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Project Background & Methodology

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Utility customers experience a **disconnect between energy consumption and energy cost**. Consumers use energy nearly constantly but receive their bill once a month. So, the **cost of energy is not very salient** when it is used, compared to other household expenses.

This study is looking at bill salience impacts: **changes in energy consumption associated with receipt of a bill** due to that bill raising the salience of energy consumption for customers with competing demands for their attention.

We build upon past findings to allow practical application and added value.



Research Questions



Average Impacts

Does a measurable bill salience effect exist for SCE customers?

If so, how large is it and how long does it last?



Distribution of Impacts

Beyond the average impacts, are there identifiable customer groups (e.g. demographic, geographic) that exhibit the impacts to greater or lesser degrees?

Are there external factors (e.g. weather, season) that drive the impacts?



Bill Element Drivers

What elements of the bill itself are particularly salient?

Are there elements of a bill that may inhibit this impact?



Research Approach

Focus of this presentation





Quantitative Impact Analysis Steps





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We Used Single-Bill Event Estimates and Machine Learning Techniques to Determine Key Drivers

We estimated bill salience impacts for each unique account and bill combination, controlling for weather using a within-subject modeling approach.

Then, we used machine learning techniques to identify which variables in the metadata were associated with high values of these estimates.

These models suggested that salience impacts are correlated with income, bill delivery type, and various payment information associated with the account.



We Used Fixed Effects Panel Models to Estimate Average Impacts, Subsetting by Key Variables

We estimated overall percent savings, percent savings by "post day",¹ and percent savings by hour of the day during the 10 days following the statement.

Looking at these three different categorizations of savings allowed us to understand better when and if there is a bill salience effect.

We analyzed bill salience impacts by customer segment to estimate

- Overall impacts,
- day-specific impacts, and
- income-group-specific impacts.

1. "Post day" refers to the ordered count of days after the bill statement date. That is, on the day after the statement date post day = 1, the day after that post day = 2, etc.



We Modeled Consumption Controlling with Fixed Effects and Controlling for Weather to Estimate Percentage Changes

 $asinh(kWh)_{it}$

- $= \beta_1 Post_{it} + \beta_2 asinh(CDH)_{it} + \beta_3 asinh(HDH)_{it}$
- $+ \beta_4 \operatorname{asinh}(CDH^2)_{it} + \beta_5 \operatorname{asinh}(HDH^2)_{it} + \beta_6 \operatorname{asinh}(CDH * HDH)_{it}$ + $\alpha_t + \gamma_i + \epsilon_{it}$

 kWh_{it} is the average kWh consumption by account *i* on day *t*;

- Post_{it} is a binary variable taking the value of 0 during the 7 days prior to a bill statement being created and 1 during the 10 days following creation of the statement for account *i* at time *t*;
- CDH_{it} and HDH_{it} are the number of cooling and heating degree hours for account *i* at time *t*;
- β_k are regression slope coefficients;
- α_i , and γ_i are year-month and account fixed effects; and

 ϵ_{it} is an idiosyncratic error term. © TRC Companies, Inc. All rights reserved



Results Summary

- 1 Bill salience impacts exist among SCE residential customers.
- 2 Average bill salience impacts are small but vary significantly between groups of customers.
- 3 Delivery of a bill is an opportunity to engage customers about ways to save energy and money, particularly if the bill is an abnormally large one.





Key Findings

Small, but significant bill salience impacts exist.

Overall, our models found that on average there is a **positive bill salience impact of approximately 0.18% in the 10 days after the statement is created**, meaning there is a small but statistically significant decrease in energy usage following the creation of a bill statement.

• This amounts to a roughly 0.06% reduction in overall consumption.



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A Note on Figures

All figures in this section display percent savings Average Treatment Effect (ATE) point estimates along with their 90% confidence interval using cluster-robust standard errors at the account level.

- A positive ATE indicates our models show a decrease in energy usage following the creation of a bill statement.
- The confidence intervals show the uncertainty level around the point estimate, attributable to uncontrolled variation in the data or small sample sizes.

The n value shown next to each segment displays the total number of accounts which represent the particular subgroup at least once in the data.

 For some characteristics, the status of an account changes (e.g. payment method) and so the sum of the n-values may be much greater than the total number of accounts.



The savings vary by post day, with the highest savings occurring on the 6th and 7th day after a statement is created.

Average Percent Savings by Post Day





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Savings Vary by Delivery Type

 Customers who receive electronic bills through SCE.com appear to have lower average bill salience impacts than customers who receive paper bills or bills through the CheckFree system.

Percent Savings by Bill Delivery Type





Average savings are higher when customers engage with their bill and payment.

Classification by bill delivery method (paper vs. electronic) and payment method (active vs. passive) reveals **no salience effect for accounts with electronic delivery and a passive form of payment.**

All other forms show positive effects, suggesting that customers who either receive a physical (paper) bill or actively make a payment for their bill have higher salience effects. Average Percent Savings by Delivery & Payment





Average savings from bill salience are larger for lower income customers.

Although there is large uncertainty around each estimate, lower income accounts show higher salience effects than higher income accounts.

Additionally, several other characteristics echoed this pattern, showing higher salience effects for lower income groups. Overall Percent Savings by Income Level



Note: TRC assigned accounts into income quantiles based on each customer's discrete income level and the number of persons living in their household. We grouped this into the lowest decile, and then up to the 40%, 60%, 80%, 100% percentiles.

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Home Energy Report (HER) Participation Weakens Bill Salience

- Using HER enrollment start dates, the team estimated impacts for billaccount combinations which received HERs vs those which did not.
- The results show that accounts which receive a HER appear to have slightly lower salience effects than those which did not receive a report.
- We hypothesize that accounts which receive HERs use the report as their signal for energy usage rather than their utility bill.

Overall Percent Savings by HER Enrollment





Our Qualitative Interviews Shed Light on Possible Reasons for our Results

- Bills were confusing for a majority of customers.
 - More than half (n=11, 57%) of respondents found one or more parts of their SCE bill to be confusing or difficult to understand.
 - Others (26% of respondents) had issues with the **specific vocabulary used** in the bill and noted that specific terms did not make sense to them.
- About half of **respondents had expectations** about their bill amount.
 - If the bill amount was in line with expectations they did not pay much attention.
- About half of respondents felt their **bill amount was not in their control**.
 - Some thought it was incorrect, other thought they were already doing all they could.



Synthesis and Conclusion

A Customer's Income Matters for Bill Salience

Our quantitative models found that **income** plays an important role in bill salience, with lower income levels exhibiting higher salience effects, on average.

While some households may have the latitude to pay their bill no matter the amount, for a household with less disposable income, a bill may be a more powerful cue to curb energy use.

 Notably, two interview respondents shared their experiences of feeling scared or stressed by their bill amount.



Quantitative Impact Analysis Shows the Importance of Engagement

Engagement with Delivery and Payment are Key

- Our models indicate that accounts which receive an electronic bill and use a passive form of payment (e.g., auto-pay) have approximately no salience effect.
- Accounts which receive a paper bill and/or use an active form of payment, have a positive salience effect.



Utilities should see times of increased salience as an opportunity to connect with customers.

Although these factors may reduce the likelihood that customers are motivated to reduce their energy use after receiving a bill, it is clear from the quantitative analysis that a reduction is taking place.



Connect with customers at these times of high salience to increase energy savings and customer experience.



Make clear the actions customers can take at the beginning of the bill where customers are more likely to pay attention.



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Thank You

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