Customer Preferences Market Research (CPMR)

A Market Assessment of Time-Differentiated Rates Among Residential Customers in California

Research Conducted

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Executive Summary

Background

The Residential Customer Preferences Market Research (CPMR) study was conducted as part of the Statewide Pricing Pilot (pilot). The focus of the Residential CPMR was on understanding the preferences that customers have for the various specific features that might be combined to create new time-differentiated (TD) electricity pricing options, and on understanding how those preferences might translate into the number or share of customers selecting different pricing options that might be made available to them. While other activities conducted as part of the SPP experiment were designed to provide estimates of the way customers actually change their use of electricity when placed on a time-varying rate, the CPMR research was designed to estimate how customers might respond if offered the opportunity to sign up for one or more time-varying rates.

More specifically, this research was designed to answer the following questions:

- If one or more time-differentiated (TD) electricity options are offered in the marketplace, how many customers might reasonably be expected to adopt each of those options?
  - How will adoption rates differ depending on how the specific options are constructed?
  - How will adoption rates differ depending on how the portfolio of options made available to customers is constructed?
  - How will adoption rates differ depending on the starting condition to which customers are assigned (opt-in or opt-out)?
  - Which customers are more likely to acquire which options?

- If, in order to facilitate the ability to respond to time-varying prices, home appliance control systems are offered in the marketplace, how many customers might be expected to adopt these systems?
  - How does this differ depending on the cost and functionality of the control system offered?
  - Which customers are more likely to acquire which options?

Of course, in developing these responses it is important to recognize that this research is constrained by the fact that ultimately it is customer research and not a real market environment. As a result the responses customers offer to the research questions may not map exactly to the responses they would exhibit in a “real” environment.

A “real” environment in which time-differentiated rates might be offered to customers might involve different rates than those tested here, would certainly involve a different set of educational activities, and would require that customers be prepared to actually deal with the consequences of their expressed preferences. All of this means that the preferences that customers express in any research setting will not map exactly to the preferences they are likely to express in the “real world.” Having said that, however, the goal of research is to design a test environment that allows us to estimate as best as possible the choices that customers will actually make when they have the opportunity to do so.

Methodology

One of the complications in testing potential marketplace response to new product offerings comes in dealing with new products that have many variable features. It is relatively easy to test customer response to a product, for example, that can only differ by size and price (a new can of peas, for example, that only comes in two sizes and two prices). In such cases, it is easy to test customer response to all possible combinations of the product (in the pea example, there are only four possible combinations). For more complicated products, however, this is not possible, and this description applies to the time-differentiated electricity pricing options tested in this research.

Each of the pricing options could differ along several dimensions (i.e., the amount of savings, whether there were Critical Peak periods or not, whether every day had a peak price, what the on-peak hours were, etc.) and there were several design options for every dimension (i.e., on the on-peak hour dimension there were multiple options including 2-5 pm, 2-6 pm, 12-6 pm, 12-8 pm, etc.).

Besides being complicated, however, it is important to understand that the pricing products tested with customers were unfamiliar to them. Most residential customers have little or no experience with time-differentiated rates, and as a result, had to become familiar with a whole new set of product features, as well as with a logic for why such rates might be offered.

There is a well established survey methodology available to deal with the product complexity inherent in situations like this one, if not with the product familiarity problem[1]. A technique called discrete choice makes it possible to estimate how individual survey respondents would evaluate all of the different ways that a product might be constructed, even when there are too many product combinations to test individually.

Discrete choice works by essentially providing survey respondents with a sample of all of the possible product combinations in sets of three and then asking the respondent to indicate which of the three proposed options they would select, given a choice among them (respondents can also say that they would want to choose none of the options). If the product combinations are constructed and grouped randomly, it is possible to use each respondent's evaluations of a series of such choices to estimate the relative value that each respondent would attach to each feature of the products tested (in this case, the different pricing products), and the degree to which they find each feature to be important in determining whether or not they would want to adopt such an option.

While this analytic technique "works" from a technical perspective, it is worth noting that some questions remain about its relationship to customer choices in "real" markets. While a good deal could be written on this subject, the bottom line here is that discrete choice – like almost any research context – works by asking customers to indicate what choices they would make under certain constraining conditions. Whether or not those are the choices customers would make under real conditions (i.e., when customers have "skin in the game,"

[1] The team attempted to deal with the familiarity problem by providing a good deal of education for respondents within the context of the survey, and by providing several opportunities for respondents to think about the way that time-differentiated rates might work for them and about how they might choose to respond (or not respond to those rates). The fact that typical responses were consistent and sensible suggests that this education was reasonably effective, though no independent measure of this effectiveness is available.

that is that they have to live with the consequences of their choices), and whether or not the constraining conditions assumed in the research either accurately represent the key features of real markets, or do not affect customer choices ultimately, are all factors that can affect the inherent validity of the data collected through discrete choice analysis.

This analysis presumes that – while not an exact representation of the choices customers might make in an actual marketplace – discrete choice analysis allows us to understand the general shape of customer preferences (what things they value more versus less and which differences are large versus small) and to develop estimates of likely behavior that are at least in the right "ballpark."

The analytical approach used in this research further presupposes that it is possible to estimate how much value individual survey respondents would assign to a new TD rate or appliance control product that can be defined by the features tested in the survey. Since we know how each respondent assigns value to each specific program feature, we can essentially add up the value each respondent would attach to the group of features that make up a specifically tested option. The sum of the individual values that each respondent would assign to a given pricing product is called the "total utility" for that product for that respondent (this total utility value is, essentially, a summary quantitative measure of the total value the customer would assign to that product).

Given a choice among rate options, the analysis assumes that we can estimate how customers would go about making a choice by comparing the "total utility" values they would assign to each of the tested options. Customers are assumed to be more likely to prefer the option that has the higher calculated total utility. The analysis assumes that customers rarely prefer one option to the exclusion of all others. That is, they may like one option more than the others (though sometimes there will be ties), but they usually like each option to some degree.

As a result, the analysis distributes a given respondent's "preference" proportionally across the available options based on a logistic regression equation. For any given set of rate options, then, the logistic regression analysis yields an estimate of the share (or proportion) of a given respondent's preference that would be allocated to each option (as an example, a given respondent might have an 80% preference for Option 1 and a 20% preference for Option 2). The analysis then treats the estimates of share of preference, once they have been weighted and aggregated across all customers as an estimate of the way that customer's "share of preference" is distributed across the options. <u>However, to say that Option A has a 50% share of preference does not mean that 50% of all customers would choose that option in a "live" environment.</u>

It is widely recognized that customers do not always act on their preferences. While customers may say, and even mean, that they would rather be on a new TOU rate rather than their current inclining block rate, they may not go to the trouble of making this change for a variety of reasons:

- Simple inertia (the fact that it is always easier to do nothing) may overcome their marginal preference for a new option.
- The perceived transaction costs are high (or uncertain); or stated otherwise, customers might assume that going through the process of changing rates is difficult and time-consuming, or at least that it is not clear at the start how difficult and/or time consuming it will be.
- While on the face of it a new rate might be appealing, because it is new, it is also likely to be viewed as risky, and those customers who tend to be very risk averse

may choose to "wait and see" rather than acting to select an option they might otherwise define as attractive.
- A lack of awareness of the existence of such a rate may prevent them from acting simply because they do not know about the possibility of changing.

In order to reflect the existence of customer inertia and risk avoidance, the team used the core questionnaire to estimate the impact of these two factors on each survey respondent. The index scores were calculated for inertia and risk aversion for each respondent and applied to each respondent's stated share of preference. These scores were used to adjust each respondent's stated preferences so that their expressed preference better accounted for the fact that they may tend to "stick to the tried and true," and / or avoid potentially risky options. A more detailed explanation of the creation and application of these indices can be found in the methodology section of this report.

In short, however, the adjustments operate so that customers with high inertia scores are defined as being more likely to stay with the default condition in a given scenario, regardless of which rate option is the default, while customers with a high risk avoidance score are assumed to be more likely to choose a traditional non-time-differentiated rate option, regardless of whether or not such a rate is the default choice[2]

Note that in addition to the adjustments for inertia and risk avoidance, the estimates of likely market response have also been adjusted to take into account customer awareness of alternative rate options. While it is common, and easy, to assume for purposes of customer modeling that awareness of new options will be 100%, this is almost never the case. For this reason, estimates of market response that account for the fact that some, but not all, customers are likely to be aware that they have other than their default condition options available to them have been provided.

Since it is not possible to estimate awareness on a respondent-by-respondent basis, and since awareness will vary depending on the scale and effectiveness of the communication efforts made, we have provided estimates for "High Awareness" (70% aware), "Moderate Awareness" (50%), and "Low Awareness" (30%) conditions.

[2] Please note that a companion calculation tool provided as one of the deliverables of this analysis is a market simulation tool that can provide estimates of potential market response across a wide variety of potential market scenarios. The final version of the simulator used for this report is version 2.2.

Summary of Findings –Understanding Likely Response to TD Pricing Options

While the analytic approach used in this work makes it possible to model literally hundreds of pricing options and thousands of different market scenarios, the analysis reported here makes use of only the eleven pricing options listed in Table 1.1.

The three rates labeled as "SPP" were chosen because they map as closely as it was possible to do so to the pricing options currently being used in the residential SPP program. Two other rates without a TOU component (Pure CPP-F and CPP-V) were chosen as potentially interesting for investigation by the project team.

The team also wished to investigate the potential preference achieved for each of these five rates if customers were offered the best possible savings (labeled "best savings"). The last rate is, of course, the current inclining block rate.

Table 1.1 – Base Pricing Options for Market Share Analysis

Rate Option	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11
Rate Type	CPP-F (SPP)	CPP-F (Best Savings)	TOU (SPP)	TOU (Best Savings)	CPP-V (SPP)	CPP-V (Best Savings)	Pure CPP-V	Pure CPP-V (Best Savings)	Pure CPP-F	Pure CPP-F (Best Savings)	Current Inclining Block Rate
Bill impact max adjustments 20%, 15%, 10%	10%	20%	10%	20%	10%	20%	10%	20%	10%	20%	
Bill impact some adjustments 10%, 5%, 0%	2.5%	10%	2.5%	10%	2.5%	10%	5%	10%	5%	10%	
Bill impact no adjustments 0%, 5% higher, 10% higher	0%	0%	0%	0%	0%	0%	5% higher	0%	5% higher	0%	
On-peak period 12-6, 12-7, 12-8, 2-5, 2-6, 2-7, Varies	2-7	2-7	2-7	2-7	Varies	Varies	Varies	Varies	2-7	2-7	
On-peak periods occur Every weekday, Only on critical days	Every weekday	Every weekday	Every weekday	Every weekday	Every weekday	Every weekday	Only on critical days	Only on critical days	Only on critical days	Only on critical days	
Number of critical days 0, 5, 10, 15, 20	15	15	0	0	15	15	20	20	20	20	
Controls provided No / Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	No	
Critical day notice N/A, Day before, That morning	Day before	Day before	N/A	N/A	That morning	That morning	That morning	That morning	Day Before	Day Before	

The pricing options described above were evaluated for market response by using a market simulation tool developed from the data collected in this survey. The market simulation tool makes it possible to construct different market scenarios in which alternative pricing options are available to customers, with different assumptions made about which option is the default (or starting point) condition.

The first set of market scenarios presented in Table 1.2 below assume that customers begin on their current inclining block rate and are allowed to opt-in to one of the TD rates if they choose to do so. Table 1.2 provides summary results for each of the TD rates investigated, with columns for share of preference adjusted for risk avoidance, inertia, and awareness at 70%, 50%, and 30% levels.

Please note that in a market scenario in which the current inclining block rate is the starting or default condition, we would expect that decreases in awareness will result in reduced share for each of the TD rates.

Table 1.2 on the following page suggests that in situations where customers start with a default condition under which they can choose to stay with their current rate (and do so by "doing nothing"), but could choose to move to one of these time-differentiated rates roughly resembling the SPP pilot rates, we would expect any one of these rates to attract approximately 15-24% of all customers, as a real world estimate under reasonable awareness levels (50-70%), with the remaining customers opting to stay with the current rate.

Under the assumption that awareness of TD options was 100%, the proportion opting to select one of these TD rates might reach one-third of all customers. Modifying these alternatives to a "pure" CPP-F or CPP-V option does not significantly modify customer response.

However, as seen in the several rows of Table 1.2, it is possible for a rate to achieve a larger share than a third if a sufficiently attractive rate (albeit possibly unrealistic) is constructed (see for example the rows providing estimated market response for the different "best savings" rate options).

<u>A Note About Confidence Intervals</u>

It is important to recall that the market share estimates provided in Table 1.2 below and in similar tables that follow are not actually point estimates, but are rather, point estimates with an associated range or confidence interval. That is, the 34% share estimate in the first row of the table, while represented there as a point estimate, is actually an estimate that has a 95% confidence interval of +/- 6.3%. Confidence intervals for other example percentages are as follows:

90% +/- 3.9%
80% +/- 5.3%
70% +/- 6.0%
60% +/- 6.4%
50% +/- 8.4%
40% +/- 6.4%
30% +/- 6.0%
20% +/- 5.3%
10% +/- 3.9%

These confidence intervals are not provided within each relevant table and graphic simply because many of these graphics and tables are already quite dense, and the addition of information about the confidence intervals associated with every estimate would make them substantially more difficult to read.

Table 1.2 – Market Scenarios with Starting (Opt-in) Condition Set as Current Inclining Block Rate

Starting / Default Condition	Opt-in Condition	Share for T.D. Rate (Adjusted for Risk Avoidance and Inertia)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 70% Awareness)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 50% Awareness)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 30% Awareness)
Current Rate (CR)	CPP-F (pilot)	34%[3]	24%	17%	10%
CR	TOU (pilot)	33%	23%	17%	10%
CR	CPP-V (pilot - *assumes available to all*)	34%	24%	17%	10%
CR	CPP-V (pilot – *assumes available only to those with CAC*)	21%	15%	11%	6%
CR	Pure CPP-F	31%	22%	16%	9%
CR	Pure CPP-V (*assumes available to all*)	30%	21%	15%	9%
CR	CPP-F (Best savings)	47%	33%	24%	14%
CR	TOU (Best savings)	47%	33%	24%	14%
CR	CPP-V (Best savings – *assumes available to all*)	45%	32%	23%	14%
CR	CPP-V (Best savings – *assumes available only to those with CAC*)	28%	20%	14%	8%

[3] Please note that the percentages represented in this table are not actually point estimates, but have an associated confidence interval. See the note on the prior page for information about these confidence intervals.

The second set of market scenarios presented in Table 1.3 assumes that customers are placed on a TD rate roughly resembling one of the SPP pilot rates but allowed to opt out of the rate to go back on to their current inclining block rate if they so choose.

From Table 1.3 we see that we would expect three-quarters or more of all customers to remain on a TD rate similar to an SPP pilot rate under reasonable expectations about awareness (at 50-70%), with the remainder deciding to opt-out of such a rate, back on to their current rate. The last rows of Table 1.3 also indicate that an even larger number of customers could potentially stay on a TD rate if an even more attractive rate were constructed, assuming that such “best savings” rates were possible.

Table 1.3 – Market Scenarios with Starting /Default Condition Set as a Time-differentiated Rate

Starting / Default Condition	Optional Condition	Share for T.D. Rate (Adjusted for Risk Avoidance and Inertia)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 70% Awareness)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 50% Awareness)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 30% Awareness)
CPP-F (pilot)	Current rate (CR)	67%	77%	83%	90%
TOU (pilot)	CR	70%	79%	85%	91%
CPP-V (pilot - *assumes available to all*)	CR	60%	72%	80%	88%
CPP-V (pilot – *assumes available only to those with CAC*)	CR	34%	39%	42%	46%
CPP-F (best savings)	CR	89%	92%	94%	97%
TOU (best savings)	CR	91%	94%	95%	97%
CPP-V (best savings – *assumes available to all)*	CR	86%	90%	93%	96%
CPP-V (best savings – *assumes available only to those with CAC)*	CR	45%	47%	48%	49%

Table 1.4 presents the results from a set of scenarios in which the current rate is once again the default or starting condition, but rather than offering customers one TD rate as an alternative, they are offered a second as well.

From Table 1.4 we conclude that offering multiple TD products does not significantly increase the number of opt-in switchers when the current rate is the default rate, with one exception. Offering a second TD rate in addition to the CPP-V SPP rate or CPP-V "best possible" rate made available only to CAC owners does work to significantly increase the percentage of customers choosing a TD rate (increases of 14% and 20%, respectively, using the examples tested here).

Generally speaking, regardless of the combination of example rates offered (and assuming the rates are made available to all customers), the utilities could expect approximately two-thirds to remain on their current inclining block rate if assuming perfect awareness. The number remaining on the inclining block rate *could* be further reduced if additional attractive rates were offered as modeled here with the "best savings" rates.

Table 1.4 summarizes these findings as well as the impact of less than perfect awareness which in these scenarios works to reduce the number of customers that would adopt a TD rate. As noted previously, in scenarios such as these where the current rate is the default or starting condition, decreases in awareness levels would result in decreases in the percentage of customers opting in to a TD rate.

Table 1.4 – Market Scenarios with Default Condition the Current Rate with Two TD Rate Opt-in Options

Starting / Default Cond.	Opt-in Condition	Opt-in Condition	Share for T.D. Rates (Adjusted for Risk Avoidance and Inertia)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 70% Awareness)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 50% Awareness)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 30% Awareness)
Current Rate (CR)	CPP-F (pilot)	TOU (pilot)	CPP-F – 22% TOU – 14% CR – 64%	CPP-F – 15% TOU – 10% CR – 75%	CPP-F – 11% TOU – 7% CR – 82%	CPP-F – 7% TOU – 4% CR – 89%
CR	CPP-V (pilot – *assumes available to all*)	TOU (pilot)	CPP-V – 18% TOU – 19% CR – 63%	CPP-V – 13% TOU – 13% CR – 74%	CPP-V – 9% TOU – 10% CR – 81%	CPP-V – 5% TOU – 6% CR – 89%
CR	CPP-V (pilot – *assumes available only to those with CAC*)	TOU (pilot)	CPP-V – 10% TOU – 25% CR – 65%	CPP-V – 7% TOU – 18% CR – 75%	CPP-V – 5% TOU – 13% CR – 82%	CPP-V – 3% TOU – 8% CR – 89%
CR	Pure CPP-F (pilot)	TOU (pilot)	Pure CPP-F – 19% TOU – 18% CR – 63%	Pure CPP-F – 13% TOU – 13% CR – 74%	Pure CPP-F – 10% TOU – 9% CR – 81%	Pure CPP-F – 6% TOU – 5% CR – 89%
CR	Pure CPP-V (pilot – *assumes available to all*)	TOU (pilot)	Pure CPP-V – 16% TOU – 21% CR – 63%	Pure CPP-V – 11% TOU – 15% CR – 74%	Pure CPP-V – 8% TOU – 11% CR – 81%	Pure CPP-V – 5% TOU – 6% CR – 89%
CR	Pure CPP-V (pilot – *assumes available only to those with CAC*)	TOU (pilot)	Pure CPP-V – 10% TOU – 26% CR – 64%	Pure CPP-V – 7% TOU – 18% CR – 75%	Pure CPP-V – 5% TOU – 13% CR – 82%	Pure CPP-V – 3% TOU – 8% CR – 89%
CR	CPP-F (best savings)	TOU (best savings)	CPP-F – 28% TOU – 21% CR – 51%	CPP-F – 20% TOU – 15% CR – 65%	CPP-F – 14% TOU – 11% CR – 75%	CPP-F – 8% TOU – 6% CR – 86%
CR	CPP-V (best savings – *assumes available to all*)	TOU (best savings)	CPP-V – 22% TOU – 27% CR – 51%	CPP-V – 15% TOU – 19% CR – 66%	CPP-V – 11% TOU – 14% CR – 75%	CPP-V – 7% TOU – 8% CR – 85%
CR	CPP-V (best savings – *assumes available only to those with CAC*)	TOU (best savings)	CPP-V – 13% TOU – 35% CR – 52%	CPP-V – 9% TOU – 25% CR – 66%	CPP-V – 7% TOU – 18% CR – 75%	CPP-V – 4% TOU 11% CR – 85%
CR	Pure CPP-F (best savings)	TOU (best savings)	Pure CPP-F – 29% TOU – 20% CR – 51%	Pure CPP-F – 20% TOU – 14% CR – 66%	Pure CPP-F – 15% TOU – 10% CR – 75%	Pure CPP-F – 9% TOU – 6% CR – 85%
CR	Pure CPP-V (best savings – *assumes available to all*)	TOU (best savings)	Pure CPP-V – 25% TOU – 25% CR – 50%	Pure CPP-V – 18% TOU – 18% CR – 64%	Pure CPP-V – 13% TOU – 13% CR – 74%	Pure CPP-V – 8% TOU – 8% CR – 84%
CR	Pure CPP-V (best savings – *assumes available only to those with CAC*)	TOU (best savings)	Pure CPP-V – 15% TOU – 34% CR – 51%	Pure CPP-V – 11% TOU – 24% CR – 65%	Pure CPP-V – 8% TOU – 17% CR – 75%	Pure CPP-V – 5% TOU – 10% CR – 85%

Table 1.5 presents the results from a set of scenarios in which a TD rate is once again the default or starting condition, but rather than offering customers only the option to opt-out of a TD rate back on to their current rate, we have modeled what would happen if an additional TD rate were made available.

For these scenarios we find that the percentage opting to choose the current inclining block rate was roughly 28% on average assuming perfect awareness (vs. roughly a third when the current rate is the only opt-out option), regardless of the specific other options provided. When CPP-V is the default, a few more customers opt to select the current rate. When the current inclining block rate is not made available, we find the largest number of customers opting to stay on the TD rate they are initially placed on (see the last row of Table 1.5). Decreases in awareness in these scenarios, however, will work to increase the number of customers that would remain on the default TD rate.

Table 1.5 – Market Scenarios with Default Condition Set as TD Rate with Current Rate and Second TD Opt-in Rates

Starting / Condition	Opt-in Cond.	Opt-in Condition	Share for T.D. Rates (Adjusted for Risk Avoidance and Inertia)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 70% Awareness)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 50% Awareness)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 30% Awareness)
CPP-F (pilot)	Current Rate (CR)	TOU (pilot)	CPP-F – 64% TOU – 7% CR – 29%	CPP-F – 75% TOU – 5% CR – 20%	CPP-F – 81% TOU – 4% CR – 15%	CPP-F – 89% TOU – 2% CR – 9%
TOU (pilot)	CR	CPP-F (pilot)	TOU – 66% CPP-F – 7% CR – 27%	TOU – 76% CPP-F – 5% CR – 19%	TOU – 82% CPP-F – 4% CR – 14%	TOU – 90% CPP-F – 2% CR – 8%
TOU (pilot)	CR	CPP-V (pilot – *assumes available to all*)	TOU – 64% CPP-V – 10% CR – 26%	TOU – 75% CPP-V – 7% CR – 18%	TOU – 82% CPP-V – 5% CR – 13%	TOU – 88% CPP-V – 3% CR – 9%
TOU (pilot)	CR	CPP-V (pilot, *assumes available only to those with CAC*)	TOU – 67% CPP-V – 5% CR – 28%	TOU – 76% CPP-V – 4% CR – 20%	TOU – 83% CPP-V – 3% CR – 14%	TOU – 90% CPP-V – 2% CR – 8%
TOU (pilot)	CR	Pure CPP-F (pilot)	TOU – 64% Pure CPP-F – 10% CR – 26%	TOU – 75% Pure CPP-F – 7% CR – 18%	TOU – 82% Pure CPP-F – 5% CR – 13%	TOU – 89% Pure CPP-F – 3% CR – 8%
TOU (pilot)	CR	Pure CPP-V (pilot - *assumes available to all*)	TOU – 63% Pure CPP-V – 11% CR – 26%	TOU – 74% Pure CPP-V – 8% CR – 18%	TOU – 81% Pure CPP-V – 6% CR – 13%	TOU – 89% Pure CPP-V – 3% CR – 8%
TOU (pilot)	CR	Pure CPP-V (pilot – *assumes available only to those with CAC*)	TOU – 66% Pure CPP-V – 6% CR – 28%	TOU – 76% Pure CPP-V – 4% CR – 20%	TOU – 83% Pure CPP-V – 3% CR – 14%	TOU – 90% Pure CPP-V – 2% CR – 8%
CPP-V (pilot – *assumes available to all*)	CR	TOU (pilot)	CPP-V – 55% TOU – 13% CR – 32%	CPP-V – 69% TOU – 9% CR – 22%	CPP-V – 77% TOU – 7% CR – 16%	CPP-V – 86% TOU – 4% CR – 10%
CPP-V (pilot – *assumes available only to those with CAC*)	CR	TOU (pilot - *assumes those without CAC placed on this rate initially*)	CPP-V – 31% TOU – 39% CR – 30%	CPP-V – 38% TOU – 42% CR – 20%	CPP-V – 41% TOU – 44% CR – 15%	CPP-V – 45% TOU – 46% CR – 9%
CPP-F (pilot)	TOU (pilot)	Pure CPP-F (pilot)	CPP-F – 72% TOU – 16% Pure CPP-F – 12%	CPP-F – 81% TOU – 11% Pure CPP-F – 8%	CPP-F – 86% TOU – 8% Pure CPP-F – 6%	CPP-F – 91% TOU – 5% Pure CPP-F – 4%

Though not tested in the SPP Program, the team also wished to investigate scenarios in which the starting or opt-out rate was a TD rate without a TOU component. Two different "pure" CPP rates were tested, a CPP-F and a CPP-V rate (the exact specifications of which can be found in Table 11). Table 1.6 summarizes these results, including the impact of less than perfect awareness which works to increase the number of customers that would remain on the default TD rate.

The results for the Pure CPP-F rates are similar to what was found for the rates with a TOU component (Table 1.5) –- assuming perfect awareness we would expect between 28-33% to opt-out of the rate and move back to the inclining block rate, regardless of the alternatives offered.

However, the specific Pure CPP-V alternatives offered and whether or not the CPP-V rate and/or its alternatives will be offered to those without CAC, has a much greater impact on the expected share for each. The Pure CPP-V rate still has a powerful impact in terms of limiting the number of customers that will opt-out back on to their current rate when the TOU rate option is offered. However, when the alternative rate is the CPP-V example rate with a TOU component, we would expect that approximately 40-44% would choose to opt-out of the default rate and choose the current inclining block rate (regardless of whether the default rate or opt-in rate is offered to all consumers or just those with CAC).

When dealing with a default Pure CPP-V rate and an alternative CPP-V rate (with a TOU component) that are *both* only available to those with CAC, we see the largest numbers remaining on the current inclining block rate – in the example from the last row of Table 1.6, 66% assuming perfect awareness.

Table 1.6 – Market Scenarios with Default Condition Set as TD Rate (without a TOU Component) with Current Rate and Second TD Opt-in Rates

Starting (opt out) Condition	Opt-in Condition #1	Opt-in Condition #2	Share of Preference -- (Adjusted for Risk Avoidance and Inertia)	Share of Preference (Adjusted for Risk, Inertia and Awareness – 70% awareness)	Share of Preference (Adjusted for Risk, Inertia and Awareness –50% awareness)	Share of Preference (Adjusted for Risk, Inertia and Awareness –30% awareness)
Pure CPP-F	CR	TOU	Pure CPP-F – 59% TOU – 13% CR – 28%	Pure CPP-F – 71% TOU – 9% CR – 20%	Pure CPP-F – 79% TOU – 7% CR – 14%	Pure CPP-F – 88% TOU – 4% CR – 8%
Pure CPP-F	CR	CPP-V (available to all)	Pure-F – 57% CPP-V – 11% CR – 32%	Pure CPP-F – 70% CPP-V – 8% CR – 22%	Pure CPP-F – 78% CPP-V – 6% CR – 16%	Pure CPP-F – 87% CPP-V – 3% CR – 10%
Pure CPP-F	CR	CPP-V (available only to those with CAC)	Pure CPP-F – 61% CPP-V – 6% CR – 33%	Pure CPP-F – 73% CPP-V – 4% CR – 23%	Pure CPP-F – 80% CPP-V – 3% CR – 17%	Pure CPP-F – 88% CPP-V – 2% CR – 10%
Pure CPP-V (available to all)	CR	TOU	Pure CPP-V -47% TOU – 22% CR – 31%	Pure CPP-V – 63% TOU – 15% CR – 22%	Pure CPP-V – 73% TOU – 11% CR – 16%	Pure CPP-V – 84% TOU – 7% CR – 9%
Pure CPP-V (available to all)	CR	CPP-V (available to all)	Pure CPP-V – 48% CPP-V – 12% CR – 40%	Pure CPP-V – 64% CPP-V – 8% CR – 28%	Pure CPP-V – 74% CPP-V – 6% CR – 20%	Pure CPP-V – 84% CPP-V – 4% CR – 12%
Pure CPP-V (available to all)	CR	CPP-V (available only to those with CAC)	Pure CPP-V – 51% CPP-V – 8% CR – 41%	Pure CPP-V – 65% CPP-V – 6% CR – 29%	Pure CPP-V – 75% CPP-V – 4% CR – 21%	Pure CPP-V – 86% CPP-V – 2% CR – 12%
Pure CPP-V (available only to those with CAC)	CR	TOU *(Those w/o CAC started here instead)*	Pure CPP-V – 26% TOU – 45% CR – 29%	Pure CPP-V – 34% TOU – 46% CR – 20%	Pure CPP-V – 38% TOU – 45% CR – 15%	Pure CPP-V – 43% TOU – 48% CR – 9%
Pure CPP-V (available only to those with CAC)	CR	CPP-V *(available to all – those without CAC started here instead)*	Pure CPP-V – 24% CPP-V – 32% CR – 44%	Pure CPP-V – 33% CPP-V – 36% CR – 31%	Pure CPP-V – 38% CPP-V – 40% CR – 22%	Pure CPP-V – 43% CPP-V – 44% CR – 13%
Pure CPP-V (available only to those with CAC)	CR	CPP-V (available only to those with CAC)	Pure CPP-V – 26% CPP-V – 8% CR – 66%	Pure CPP-V – 34% CPP-V – 6% CR – 61%	Pure CPP-V – 38% CPP-V – 4% CR – 58%	Pure CPP-V – 43% CPP-V – 3% CR – 54%

In summary, the scenarios investigated here tell us that:

- Regardless of whether customers are given the option to opt-in to one or two TD rates from their current inclining block rate, we could expect roughly 1/3 of customers to do so, regardless of the specific rates offered, assuming perfect awareness of these options. The percentage opting-in to a TD rate would, of course, be lower under more realistic assumptions about awareness, in the neighborhood of 15-25% opting in.

- When customers are placed on a TD rate as their default rate, we can expect roughly 2/3 of customers to remain on a TD rate, regardless of whether they are given a second TD rate option to opt-in to or not. This is, again, assuming perfect awareness. The percentage of customers remaining on the default TD rate would increase as awareness that customers have choices to move to, or back to, other rates decreases.
    - One exception to this finding can be found when the default rate is CPP-V available only to CAC owners. Given that only 51% of customers own and pay for their CAC, the number on a TD rate when this is the only rate available will, necessarily, be smaller. Offering a second TD rate along with this one, however, results in approximately 2/3 of customers on TD rates (again assuming 100% awareness), though with most of these on the non-CPP-V version of the TD rate.

Summary of Findings –Understanding Likely TD Rate Takers

This section of the report profiles the likely takers for three specific rate options (see Tables 1.7—1.10 for this data) that were specified to be as close as possible to several of the rates used in the SPP. Note that the analysis was not extended to rates not explored in the SPP (i.e., to such rates as a "pure" CPP-F or "pure" CPP-V). The logic for this was twofold: first, the objective of the analysis was to determine if there were differences in the types of customers likely to be attracted to the types of rates tested in the SPP, and secondly, based on the finding that "likely taker" profiles were similar across these rates, it was also highly likely that developing such profiles for additional rates that were not dramatically different from the SPP rates would also be unlikely to show substantial differences in taker profiles.

For this analysis a "likely taker" has been identified at the top 10% of customers with the highest utility scores for a given product. Characteristics that distinguish the "likely takers" for a particular rate are provided in the following tables, and these characteristics have been identified by the computation of an index value for each characteristic.

The index values were computed for each characteristic by dividing the percent of "likely takers" (as defined above) that have a characteristic of interest (i.e. the percent of "likely takers" with single family homes) by the percent of all respondents with the characteristic (i.e. the percent of all respondents with single family homes) and multiplying the result by 100. As the magnitude of difference increases between the resulting index value and 100 (the population average), the more useful the characteristic is for identifying "likely takers."

To take an example that might serve to illustrate the computation of this index, if 20% of likely takers have a single family home, while 10% of all respondents have a single family home then the index value for single family homes would be 200 (20% / 10%), indicating that takers are twice as likely to have that characteristic than are customers in general. If likely takers are similar to customers overall, the index value will be 100, while if they are more likely than customers overall the index value will be greater than 100. If likely takers are less likely to have the characteristic, the index value will be less than 100.

While there are several unique differences that emerge between the groups of takers for each of the example rates, the most interesting finding here is just how *similar* these groups of customers are to one another. These similarities can be grouped into the following categories:

- *Climate zone* – Takers of these rates are somewhat more likely than the average customer to live in climate zones 2 or 4.
- *Energy use* – Likely takers tend to be customers who use more energy[4] than the average customer as measured directly and indirectly by such indicators as:
  - High summer electric bills (bills over $100)
  - Presence of room AC and central AC
  - One or more loads of laundry done on summer afternoons
  - Larger (1,500 square feet or more) homes
  - Single family homes
- *Home location* – Likely takers are somewhat more likely to live in suburban neighborhoods.
- *Home ownership* - There is also a slight tendency among likely takers to own the home rather than rent.

Table 1.7 – Most Likely Takers of the CPP-F Pilot Rate

	Indexed Values
Climate Zone	
Zone 4[5]	201
Electricity Usage	
High Usage	123
Climate Zone by Usage	
Zone 2, High Usage	181
Presence of AC	
Room or at least Central AC	142
Presence of Central AC by Climate Zone	
CAC, Zone 2	209
CAC, Zone 4	203
Loads of Laundry – Summer Afternoons	
One or more	125
Home Square Footage	
1500 sq. ft. or more	134
Home Location	
Suburban	121
Type of Home	
Single Family	125
Best Notification Method	
E-mail to business address	430
Overall Interest in Time-Differentiated Rates	
Very Interested	293

[4] Note that lower-energy and higher- energy use customers are responding to similarly constructed CPP-F rates at this point (that is, they are seeing similar savings levels). It may be the case in fact that lower energy use customers are more likely to see savings from many TD programs without having to make any adjustment in their energy use. This issue is not accounted for in this analysis, however, since this analysis proceeds by assuming that customers are responding to programs defined in similar terms to all.

[5] Note that for Climate Zone and for the other attributes, the only categories that have been listed here are the ones for which the index value is significantly higher than 100 (meaning that the category is significantly more likely to appear among likely takers of the specified rate). If a category is not listed, that means that the category is either "average" or "lower than average" in the contribution to likely takers.

Overall Interest in Appliance Controls	
Very Interested	228
Poverty Level	
At OR Below 200% Above Poverty Level	156
Education Level	
Some College or Less	116
Age	
35-64	118

Table 1.8– Most Likely Takers of the TOU Pilot Rate

	Indexed Values
Climate Zone	
Zone 4	181
Presence of AC	
Room or at least Central AC	128
Presence of Central AC by Climate Zone	
CAC, Zone 4	213
Loads of Laundry – Summer Afternoons	
One or more	139
Home Square Footage	
1,500 sq. Ft. or More	136
Type of Home	
Single Family	121
Actions Taken Since 2001 Crisis	
Taking More / Same Actions as in 2001 Crisis	132
Most Important Reasons for Signing Up for TOU	
Save by Already Using Less Electricity During Peak Periods	147
Overall Interest in Time-differentiated Rates	
Very Interested	264
Age	
35-64	127

Table 1.9– Most Likely Takers of the CPP-V Pilot Rate

	Indexed Values
Climate Zone	
Zone 2	142
Electricity Usage	
High Usage	134
Climate Zone by Electricity Usage	
Zone 2, High Usage	271
Presence of CAC by Climate Zone	
CAC, Zone 2	171
Presence of Electric Cooking Appliances	
No Electric	118
Number of Refrigerators/Freezers	
1	116
Type of Home	
Single Family	117
Home Ownership	
Own	123
Overall Interest in Appliance Controls	
Very Interested	232
Risk Avoidance	
Least Risk Averse	131
Ethnicity	
Hispanic	151

Table 1.10 – Most Likely Takers of the CPP-V Pilot Rate for CAC Owners Only

	Indexed Values
Climate Zone	
Zone 2	163
Electricity Usage	
High Usage	116
Climate Zone by Electricity Usage	
Zone 2, High Usage	258
Presence of CAC by Climate Zone	
CAC, Zone 2	163
Loads of Laundry Done in Summer Afternoons	
1+	130
Home Sq. Footage	
1,500 sq. Ft. or More	129
Type of Home	
Single Family	118
Home Ownership	
Own	124
Years in Home	
5 or more years	136
Home Location	
Suburban	119
Action Taken Since 2001 Crisis	
As Much or More as During 2001 Crisis	141
Most Important Reasons for Signing up for TOU	
To Contribute to Creating a More Secure Energy Future	161
Best Notification Method	
Email to Business Address	275
Overall Interest in Time-Differentiated Rates	
Very Interested	232
Overall Interest in Appliance Controls	
Very Interested	278
Some Interest	139
Risk Avoidance	
Least Risk Averse	141
Provider / Product Stickiness	
Somewhat Sticky	152
Income	
Above $50K	155

Summary of Findings – Understanding Likely Customer Response to Specific Appliance Control Options

A similar analysis was conducted for a set of appliance control options that might be made part of a TD pricing plan. The ten specific appliance control options investigated in-depth for this report are displayed in Table 1.11. These options were selected because they represent a reasonable range (from basic to extensive) of products that the utilities may consider offering, with options for both a utility-programmed control system and a customer-programmed system.

In addition, an option has been included to represent, as closely as possible, the program currently offered by Gulf Power (we are unable to reproduce exactly the Gulf Power offering here since our model limits us to modeling monthly costs for an extensive control product of $15 - $22.50).

To account for different levels of awareness of the systems once introduced, customer share of preference estimates are provided that have been adjusted for different assumptions regarding awareness. More specifically, estimates have been calculated for "high" awareness (70%), "moderate awarness" (50%) and "low" awareness (30%). Note, however, that unlike the TD rate response analysis, share of preference for the appliance control systems has not been adjusted for customer intertia or risk aversion. These adjustments were not made for this product category based on the fact that customers typically have more experience with purchasing these types of products and are better able to estimate their actual likely response to new options in this category.

Table 1.12 presents the anticipated customer response to each of the 10 options investigated.

Table 1.11 – Base Appliance Control options for Market Share Analysis

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10 (Gulf Power Model)
How Extensive Controls are (Basic, Moderate, Extensive)	Basic Control	Basic Control	Basic Control	Moderate Control	Moderate Control	Moderate Control	Moderate Control	Extensive Control	Extensive Control	Extensive Control
Monthly Cost ($0.0 to $22.50)	$2.50	$2.50	$0	$7.50	$7.50	$7.50	$7.50	$17.50	$17.50	$15.00
Bill impact (Total) (2.5% savings to 15% savings)	8.75% savings	8.75% savings	10% savings	15% savings	15% savings	8.75% savings	8.75% savings	8.75% savings	8.75% savings	12% savings
System Prog./Control (customer or utility programs/Customer or utility specs/Can or cannot override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer *cannot* override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override

Table 1.12 – Summary of Simple Share of Preference: All Options vs. No Control

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10 (Gulf Power Model
How Extensive Controls are (Basic, Moderate, Extensive)	Basic Control	Basic Control	Basic Control	Moderate Control	Moderate Control	Moderate Control	Moderate Control	Extensive Control	Extensive Control	Extensive Control
Monthly Cost ($0.0 to $22.50)	$2.50	$2.50	$0	$7.50	$7.50	$7.50	$7.50	$17.50	$17.50	$15.00
Bill impact (Total) (2.5% savings to 15% savings)	8.75% savings	8.75% savings	10% savings	15% savings	15% savings	8.75% savings	8.75% savings	8.75% savings	8.75% savings	12% savings
System Prog./Control (customer or utility programs/Customer or utility specs/Can or cannot override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer *cannot* override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override
Share of Preference (Total Population) (Against the alternative of no appliance controls)	**13%**	**28%**	**17%**	**45%**	**59%**	**40%**	**55%**	**8%**	**8%**	**19%**
Share of Preference Adjusted for Awareness (Total Population) (Against the alternative of no appliance controls) 70% 50% 30%	9% 7% 4%	20% 14% 8%	12% 9% 5%	32% 23% 14%	41% 30% 18%	28% 20% 12%	39% 28% 17%	6% 4% 2%	6% 4% 2%	13% 10% 6%
Share of Preference (CAC Owners Only – Represent 51% of Pop.) (Against the alternative of no appliance controls	**14%**	**30%**	**18%**	**41%**	**58%**	**37%**	**54%**	**9%**	**9%**	**19%**
Share of Preference Adjusted for Awareness (CAC Owners Only – Represent 51% of Pop.) (Against the alternative of no appliance controls) 70% 50% 30%	10% 7% 4%	21% 15% 9%	13% 9% 5%	29% 21% 12%	41% 29% 17%	26% 19% 11%	38% 27% 16%	6% 5% 3%	6% 5% 3%	13% 10% 6%

The results generated from the simulations investigated here lead us to several key findings.

- The system features that have the biggest impact on share are the type of control system offered (basic, moderate, extensive) and the type of programming and activation offered. The biggest changes in share of preference can be seen when manipulating these two features, where the preferred features are a moderate appliance control that allows the customer to program and activate the system herself.

- The monthly fee and potential savings features have much less of an impact on customer preference for a particular system. So much so, in fact, that if the utilities decided to offer a system at a price other than the lowest price tested, then they might as well offer it at the highest price tested. Furthermore, little share is lost by offering less monthly savings.

- Based on these findings, it is not surprising that options 4-7 achieved the largest share of preference, achieving 40-55% share. Even more interesting, however, is how much little share is lost when the percentage savings the customer could expect is reduced from 15% to 8.75% for identical products – approximately 4-5%.
    - Taking awareness into account, however, will necessarily reduce the share of preference here, depending whether one assumes high, moderate or low levels of awareness of these systems.
    - The shares reported here would also be reduced by approximately half if it was determined these systems were only relevant for CAC owners.

- Results here further suggest that both basic and extensive options similar to the ones tested here would achieve a much smaller share of preference than a similar moderate option.

Summary of Findings –Understanding Likely Appliance Control Takers

There were some fairly interesting and consistent patterns identified in terms of the similarities and differences among the likely takers for the four moderate control options tested in this report.

<u>Overall, the key similarities among those most interested in the moderate appliance control options included the following:</u>

- Those most interested in moderate control options tend to live in smaller, two person households and tend to be non-Hispanic.

- The moderate appliance control options tend to capture the interest of those who would otherwise have little interest in appliance control systems generally.

There were also some interesting differences found between the most likely takers of a moderate control system that allows for customer programming versus utility programming with a customer override.

<u>The likely takers of moderate control systems that can be programmed by the customer have the following characteristics:</u>

- They tend to be customers with high electricity use. Those with high electricity use not only have more end uses that could be potentially curbed or controlled, but more end uses that they may wish not to control at any given moment. For that reason, these customers may wish to keep their electricity use as much as possible under their own control.

- Those with higher electricity use also tend to be more attracted to the higher potential savings offered by a moderate, customer-programmable system.

- This moderate control option seems to be more attractive to those who have been in their home five or more years and to those aged 65+ at the 15% savings level.

The likely takers of moderate control systems that are programmed by the utility, but have a customer override have the following characteristics:

- Unlike the moderate control option that allows the customer to program the system, this option does not appear to differentially capture high electricity use customers. In fact, those with low, medium and high overall electricity use are just as likely to be interested in this option.

- This option appears to be more appealing to customers aged 35-64.

The profiles for three of these four products has been provided in Tables 1.13– 1.15 for illustration purposes.

Table 1.13 – Most Likely Takers – Option 5 (Moderate, $7.50, 15% Bill Impact, Customer programs, 59% Share of Preference)

	Indexed Values
Electricity Usage by Climate Zone	
Zone 3, High Usage	161
Presence of Room and Central AC by Climate Zone	
AC, Zone 3	139
Number of Refrigerators/Freezers	
2+	144
Household Type	
Single Family Household	119
Household Size	
2	139
Number of Years in Home	
5 Years or More	123
Action Taken During 2001 Crisis	
No Action Taken	159
Age	
65+	176

Table 1.14 – Most Likely Takers – Option 7 (Moderate, $7.50, 8.75% Bill Impact, Customer programs; 55% Share of Preference)

	Indexed Values
Household Size	
2	149
Electricity Usage by Climate Zone	
Zone 2, Medium	156
Number of Refrigerators/Freezers	
2+	139
Years in Home	
5 or More Years	123

Table 1.15 – Most Likely Takers – Option 6 (Moderate, $7.50, 8.75% Bill Impact, Utility programs/ Customer Override, 40% Share of Preference)

	Indexed Values
Electricity Usage	
Low	169
Electricity Use by Climate Zone	
Zone 2, Low Usage	229
Household Size	
2	138
Home Location	
Urban	129
Action Taken During 2001 Crisis	
3+ Actions	80
Age	
35 – 64	117
Education Level	
College Degree or Higher	150

There were some interesting patterns identified among the likely takers for the three basic control options tested in this report.

Likely takers of the basic control options tended to be:

- Hispanic
- Living in households with a medium level of electricity use ($40 - $100 monthly bills, approximately).
- Living in rural or non-urban areas.
- Aged 35-64 when the basic control system is programmed by the utility with a customer override.

For illustration purposes a profile of the likely takers for basic control option 2 has been provided in Table 1.16 below.

Table 1.16 – Most Likely Takers – Option 2 (Basic, $2.50, 8.75% Bill Impact, Customer programs, 28% Share of Preference)

	Indexed Values
Electricity Use	
Medium	133
Presence of Room AC	
No	115
Home Location	
Rural	168
Overall Interest in Appliance Controls	
Little / No Interest	121
Ethnicity	
Hispanic	180

General Summary and Conclusions

The research and analysis conducted as part of this project suggests the following general findings and conclusions with regard to the way that consumers in California would likely react to time-differentiated electricity pricing options:

- Both price and non-price features can have dramatic effects on the proportion of customers likely to select a new TD rate offering, though price/savings differences have somewhat larger maximum impacts on potential response (moving preference shares by 40-50% when moving from worst-possible to best-possible savings levels) than do non-price rate features (which can move preference shares by 30-40% when moving from worst-possible to best-possible levels).
  - This means that while manipulating price / savings levels represent a significant lever that can be used to affect customer response, non-price rate features can also have a meaningful impact on customer willingness to participate in such rates
  - Note, however, that small changes in non-price features do not yield large differences in likely customer response, and that in fact, movement to extreme values of non-price attributes (either the most extremely desirable or the most extremely undesirable levels of several such attributes) would be necessary in order to see substantial (that is, 5-10 or more percentage changes in share) impacts on market share

- For the limited range of options tested in the analysis (since this analysis focused on plausible rate options, for the most part), regardless of whether customers are given the option to opt in to one or two TD rates from their current inclining block rate, we could expect roughly 1/3 of customers to do so, regardless of the specific rates offered and assuming perfect awareness of these options. The percentage opting in to a TD rate would, of course, necessarily decrease as awareness decreases.
  - More reasonable estimates of likely awareness levels suggest that the proportion of customers likely to adopt a new TD rate offering under an opt-in scenario amount to 15-20% of all customers for most plausible rate offerings, though 20-25% might choose to adopt a TD rate if it offered best-possible savings levels.

- When customers are placed on a TD rate as their default rate, we can expect roughly 2/3 of customers to remain on that TD rate, regardless of whether they are given a second TD rate option to opt in to or not on the assumption of perfect awareness. Under more likely awareness conditions, we would expect 80-85% of customers to remain on an assigned TD rate in this scenario, under most plausible rate options, with that number rising to 90-95% if best-possible savings levels were offered.

- As a general rule, the customers likely to choose to participate in any given TD rate are similar, regardless of the specific details of the rate, and these customers tend to be higher-energy users.

- Appliance control packages also have the potential to win meaningful numbers of customer participants (with 15-30% of customers selecting such options) if the packages offered focus on basic and / or moderate controls (rather than extensive controls), and if they offer customers the ability to program the system to their own specifications, or at least the opportunity to override any utility control.

Background & Objectives

For a variety of well-recognized reasons, there is significant interest in better understanding how California residential customers might respond to time-differentiated electricity prices. Many economists have argued that a more rational electricity market could be constructed if customers were faced with electricity prices that better reflected the time-varying cost of generating electricity as this varies across seasons, days and hourly periods. With this information in hand, customers would potentially make decisions about when and how much electricity to use that might defer the cost of generating and purchasing electricity at peak times of the year when generating costs are at their highest.

As part of the effort to explore the potential for such a change in electricity pricing structures for investor-owned utilities in California, a Statewide Pricing Pilot (pilot) was developed and implemented. The primary purpose of the pilot has been to measure price elasticities of demand in order to understand how residential customers placed on time-varying electricity rates -- such as a time-of-use (TOU) rate or a critical peak pricing (CPP) rate – change the way they use energy.

As a companion to the pilot assessment of changes in energy use, this research effort – known as the Customer Preferences Market Research (CPMR) study – was conducted. The focus of the CPMR was on understanding the preferences that customers have for the various specific features that might be combined to create new time-differentiated electricity pricing options and how those preferences might translate into the number or share of customers selecting different pricing options that might be made available to them.

In summary the SPP experiment was designed to provide estimates of the way that customers change their use of electricity when placed on a time-varying rate, while the CPMR research was designed to estimate how customers might respond if offered the opportunity to sign up for one or another time-varying rate.

More specifically, the CPMR research was designed to answer the following questions:

- If one or more time-differentiated electricity options are offered in the marketplace, how many customers might reasonably be expected to adopt each of those options?
    - How will adoption rates differ depending on how the specific options are constructed?
    - How will adoption rates differ depending on how the portfolio of options made available to customers is constructed?
    - How will adoption rates differ depending on the starting condition to which customers are assigned (opt-in or opt-out)?
    - Which customers are more likely to acquire which options?

- If, in order to facilitate the ability to respond to time-varying prices, home appliance control systems are offered in the marketplace, how many customers might be expected to adopt these systems?
    - How does this differ depending on the cost and functionality of the control system offered?
    - Which customers are more likely to acquire which options?

Of course, in developing these responses it is important to recognize that this research is constrained by the fact that ultimately it is customer research and not a real market environment. As a result, the responses customers offer to the research questions may not map exactly to the responses they would exhibit in a “real” environment.

A “real” environment in which time-differentiated rates might be offered to customers might involve different rates than those tested here, would certainly involve a different set of educational activities, and would require that customers be prepared to actually deal with the consequences of their expressed preferences. All of this means that the preferences that customers express in any research setting will not map exactly to the preferences they are likely to express in the “real world.” Having said that, however, the goal of research is to design a research environment that allows us to estimate as best as possible the choices that customers will actually make when they have the opportunity to do so, recognizing that no such research environment exactly maps to real world choices.

Methodology

This section of the report describes both the field methodology used to collect the data for this research effort and key elements of the approach used to analyze that data. More specifically, the discussion covers the following issues:

- Data collection methodology
- Sample management and data weighting
- Use of discrete choice analysis to evaluate alternative pricing designs
- Use of discrete choice analysis to evaluate alternative choice designs
- Translating percentage bill savings into absolute bill savings values in the discrete choice exercises
- Forecasting anticipated customer response to pricing and control options
- Statistical accuracy of the reported results

Data Collection Methodology

The data used to produce this report were collected through a survey of residential heads-of-household living in the service territories of one of three participating utilities (PG&E, SCE, and SDG&E). In order to qualify for the survey, households had to meet each of the following criteria:

- A directly billed residential customer of one of the three participating utilities
- Have a postal code that is fully within the service territory of one of the three participating utilities
- Are not participating in, and had not been solicited to participate in, the Statewide Pricing Pilot

Individual respondents, in order to qualify to respond to the survey, were additionally screened to ensure that they met the following criteria:

- At least 18 years of age
- Responsible for paying, or are co-equally responsible for paying, the electric bill
- <u>Not</u> an employee (and <u>no</u> other adult in the household is an employee) of:
    - One of the three participating utilities
    - A market research firm
    - An advertising agency or public relations firm

Potential respondents to the survey were solicited for participation through one of two methods:

- An existing online national panel of consumers who have indicated their willingness to participate in surveys (Surveysavvy.com)
- A random sample of households living in the relevant geographies were contacted by telephone and solicited for participation in the survey.

Members of the online panel[6] were pre-screened on the basis of their indicated postal code of residence and multiple waves of invitations were sent to random draws of panelists who had previously indicated that they lived in a qualifying zip code.

Using an online panel, of course, is a potentially controversial decision for research such as this. Traditionally, research with residential utility customers has been conducted with telephone or mail surveys. Using an online panel is a relatively recent capability, and one that is still being evaluated for its implications. It is worth taking some time to note, therefore, some issues with online panels – especially volunteer online panels – that are relevant to evaluating the validity of the data collected from such a source.

Before considering potential biases associated with online panels, however, the following section first explores the reasons why the team chose to use such a sample source:

- Online research is faster to implement and has lower field costs than do either telephone research or in-person interviewing. These advantages are well known, and are often the primary reason for selecting this sort of an approach.

- Access to people via the telephone has been declining due a variety of both social factors (e.g., time spent at home) and changing technology (e.g., the use of answering machines and caller ID to screen calls), and this is likely to continue to decline over time as a result of both the implications of public policy (e.g., the interpretation of do-not-call lists (while market research is not directly affected by such lists, many people on the lists appear to believe that it is, or should be, affected)) and technology trends (e.g., the increasing proportion of the population that will forego a home landline connection in favor of a purely wireless telecom connection). As a result, even if telephone-based interviewing were preferable, its ability to effectively represent the population of consumer households is being eroded more and more each day.

- Online research allows for the inclusion of automated skip patterns and question customization based on prior responses that both simplify navigation of the questionnaire for the respondent and ensure that choices are relevant to the specific nature of the respondent's situation.

- Online research allows for the visual display of stimulus material and the visual display of response categories (as do printed self-administered questionnaires). There appear to be advantages in this approach over telephone-based surveys in which respondents are required to listen to, and then retain, information about both the question and the response categories before they respond.

- Online research allows respondents to complete surveys at a time of the day that is convenient for them, rather than within the window of time typically allowed for telephone interviewing. Most telephone interviewing is conducted from 5 pm to 9 pm local time, and respondents who are not home or who are not available at this time are not included in the pool of potential

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[6] *For the reader interested in or concerned about the validity of data generated from online research panels, see the accompanying volume of appendix and research materials for a white paper that explores this issue in more detail.*

respondents. Online interviewing, on the other hand, allows all respondents with internet access to complete a survey at a time of their own choosing.

- Online research also reduces data entry error. Since respondents enter their own responses directly, this means that a step in the response translation/data entry process has been removed (i.e., the role of the interviewer as response coder and data entry clerk). This does not mean that respondents cannot make mistakes, of course, though the same problem exists for telephone interviewing (that is, respondents can misreport their response, or misuse/misunderstand scales or scale end points).

- Responses from volunteer panels appear to be more reliable across multiple waves of data collection than that collected by telephone. Respondents to the online panel, in other words, were more consistent in their answers to the same question across several different waves of surveying, suggesting that responses from the online panel contain less random error than those from other sources.

- Responses from the volunteer panel yielded higher predictive validity for key measures of interest than did responses collected in telephone-based surveys. The issue here is a critical one. It means that online survey respondents provide answers that are more logically consistent from one response to another, and as a result, makes it possible to build more predictive models of opinion and behavior. The advantage to online surveys, then, is that because there is less random error in the responses, the answers that respondents make from one question to another are more sensible and tie together more consistently. To quote the authors, "volunteer respondents were more precise in their reporting." As a result, it is possible to build more predictive models (what affects what in terms of either opinions or behavior), or stated differently, to build a better understanding of the drivers of behavior and opinion.

While the advantages noted above are important ones, and represent the key reasons why this methodology was selected for this project, it is also true that there are downsides to online research, and specifically to the use of volunteer panels. These include that:

- Online panels, by definition, do not include – and therefore are unlikely to be representative of – consumers that do not have access to the internet. More specifically, volunteer panels, while large are a further selection from among the people that have internet access. The purely physical limitation of internet access, in other words, is multiplied by the fact that internet panels include only those consumers who have indicated a willingness to participate in surveys (and to do so for compensation).

  And these differences in population access do show up in the demographics of the resulting populations. Krosnick and Chang (2000), for example, report that respondents from a volunteer panel were, in comparison with a telephone-based survey sample, less representative of both younger and older respondents, as well as women, those with lower education, and those with lower incomes. The correlation coefficient (a measure of the degree to which two distributions are similar to one another) for the demographic characteristics of telephone-based survey respondents compared with census estimates for the region in question was 0.96 (with 1.0 being perfect). Telephone surveying, in other words, did a very good job of representing the "true" demographic profile of the region. The volunteer online panel, on the other hand, had a demographic correlation with the census data of 0.87. This value is meaningfully lower, though it must still be said, still quite high. Ultimately, the authors concluded that, while it is possible to reduce the impact of this difference through the application of appropriate sample weights, it is not possible to eliminate these differences entirely.

- Online research is more subject to the manipulation of qualifying criteria by respondents than is telephone-based research. In a telephone interview, interviewers at least have the possibility of discerning gaming behavior on the part of respondents attempting to qualify for the survey (although this is less common than with online surveys). The tradeoff here is that, since interviewers want to generate completed interviews, there is the counter trend in telephone surveys of interviewers coaching respondents to provide answers that will make them qualified respondents.

- The bigger issue for online research is that respondents know they are being paid to complete a survey, and as a result, have compensation as their primary motivation. While compensation is often provided for telephone surveys, this is not always the case, and a "for the greater good" motive underlies at least some portion of telephone-based interviewing participation. The key concern about this difference for online research is that respondents will tend to "game" their answers in a way that gets them through the survey as quickly as possible (i.e., answering similarly across multiple questions, or answering in patterns) without reference to the validity of their responses.

- A related issue here is the concern that online panels create "professional respondents" who become used to completing surveys, and as a result, complete them differently, and give different answers, than would "naïve" (untrained by prior surveys) respondents.

- While, as we noted above, it is true that online surveys eliminate the potential for interviewers to create biases in the responses provided to surveys, it is also true that interviewers are not present to encourage/probe respondents on open-ended questions, or to encourage appropriate responses to other questions (to reduce "don't know" responses, for example).The reality is that most people are more comfortable providing a verbal response than in writing out the same set of words in "longhand." As a result; in writing their answers to open-ended questions, respondents are likely to use shorthand phrases, and/or take other steps to shorten and simplify their responses.

While there are benefits to using online, volunteer panels to complete research efforts such as these, it is also true that such panels are in their early stages of evolution and the market research industry does not yet know everything there is to know about the biases (to be more specific, the unique biases, since all research methodologies embed biases) that might be introduced from such a research approach. Ultimately, the project team chose to use the online panel, recognizing that it might introduce unspecifiable biases into the results, in part because those biases did not seem to be uniquely associated with the specific content of the research, and in part because the clear advantages of the methodology appeared to outweigh the potential for the introduction of biases that could neither be specified nor weighed.

Online panelists willing to participate in the survey were first asked to complete a screening survey designed to ensure that the panelist met the survey eligibility criteria described above (see the accompanying report volume that includes all of the research materials used in the project for a copy of the screening questionnaire). Those panelists passing the eligibility criteria (and pending the sample quota limits noted below) were asked to complete the main portion of the survey which typically took from 30-60 minutes to complete. Respondents were offered an incentive payment of $15 to complete the survey.

As a supplement to the online panel, an augmentation sample of survey respondents was selected on the basis of random-digit-dialing into qualifying zip codes. Telephone interviewers used the same screening questionnaire to determine household and respondent eligibility, and qualifying households were solicited to complete the main version of the questionnaire. Cooperating respondents were given the opportunity to complete the survey online or by having a hardcopy of the questionnaire mailed to them (with their responses to the mailed survey collected through a follow-up phone call). Respondents completing the survey in either of these two forms were also provided with an incentive payment equal to that offered to online panelists.

One of the reasons for collecting data from the randomly selected augmentation sample was to ensure that the population of respondents surveyed from the online panel did not differ dramatically from the results that would be observed in a more traditionally selected telephone-survey population. While this issue is explored at some length in the white paper on online survey validity noted above, the team also reviewed example results from this survey to explore the existence, and implications, of any differences that may have been observed.

As the example results provided in Table 2.1 demonstrate, there are small but noticeable differences between the two samples in their demographics, though not always in the direction that might have been expected. The telephone-based respondents, for example, are slightly more likely than online survey respondents to be older, but also more likely to have higher incomes and to have a college education. Online survey respondents, on the other hand, are slightly more likely to be renters, say they “often” operate their central air conditioning system during weekday summer afternoons, and report somewhat higher maximum summer electric bills.

Table 2.1: Example Demographic Differences between Random Telephone-Based Sample and Online Panel Based Survey Sample

	Telephone-Based Sample (N=986)	Online Panel-Based Sample (N=210)
Renters	29%	40%
Income above $50,000	47%	39%
Age 55+	32%	28%
College + education	45%	35%
Total home square footage (mean)	1634	1545
People home summer weekday afternoons = 1+	84%	88%
People home summer weekday afternoons = 2+	54%	57%
Use CAC on summer weekday afternoons "often"	37%	47%
Highest summer electric bill	$142	$152

The overall picture on the demographic front then is mixed. The two groups are largely similar, though differences do exist. The directionality of those differences when they occur is inconsistent, however. It is not the case that online panel respondents are higher income or more likely to be college educated, for example, as we might have guessed a priori, though they do include fewer older respondents.

Moving to energy-related reported behaviors and responses to the tested concepts, we again find a pattern of largely similar response, with only small differences between the two populations for the most part. Table 2.2 below, for example, shows that the two populations are very similar in terms of the way they say they responded to the 2001 energy crisis in California, and in terms of the way they say they would respond to several of the tested pricing and control options. The largest difference reported here is one in which telephone-based respondents indicate a somewhat greater level of interest in one of the "holdout" tasks used in the pricing section (an example, CPP-F rate)[7]. This tendency – for telephone-based respondents to be marginally, but consistently – higher in their ratings of the other pricing holdout tasks is consistent across the other holdout tasks as well. This suggests that a purely telephone-based sampling process might have yielded slightly – though only slightly – higher response rates to the pricing options tested in this work.

[7] A "holdout" task refers to a rating task that respondents were given that asks every respondent to specifically rate a given rate option. Rather than the typical discrete choice tasks, which ask respondents to select their preferred option from among a group of randomly constructed rate options, a holdout task obtains individual preferences for a specific rate option on its own. These tasks are often used for exactly the purpose referenced above; that is, to verify the extent to which different respondent groups rate a given option similarly.

Table 2.2: Example Differences between Random Telephone-Based Sample and Online Panel Based Survey Sample on Energy-Related Issues

	Telephone-Based Sample (N=986)	Online Panel-Based Sample (N=210)
Changed electricity use in 2001 CA energy crisis	78%	76%
Of those who say they changed energy use, those reporting still making those changes	85%	83%
Interest in Base CPP-F rate (defined as those rating the relevant holdout task as a "9" or a "10")	25%	20%
Reported likely change if adopted new rate: Maximum adjustments	31%	32%
Reported likely change if adopted new rate: Some adjustments	63%	59%
Interest in Basic Control option (those rating 9/10)	5%	5%
Interest in Moderate Control options (those rating 9/10)	4%	3%
Interest in signing up for RTP (those rating 9/10)	8%	7%

Questionnaire Development and Administration

Note that all versions of the survey (screeners and main questionnaires in online, telephone-script, and hardcopy versions) were available to respondents in Spanish as well as English, though only a handful (fewer than 10) were completed in Spanish.

Ultimately, 1196 valid, completed surveys were received, with 210 of these coming from the telephone-based sample, and 986 of these coming from the online panel. Data were collected from December 1 - 22, 2003.

It is important to recognize that while the project team made every effort to insure that the questionnaires ultimately administered were clear, concise, meaningful, and well understood by respondents, the reality is that the research design required a lengthy and complex questionnaire instrument that asked respondents to make choices among rate options that were distinguished on the basis of attributes that respondents had not seen before, and as a result, with which they were in many cases completely unfamiliar. Most respondents took between 30 minutes and an hour to complete the survey, and completing the survey "correctly" (that is, honestly) required a good deal of intellectual investment on the part of respondents.

It is reasonable to ask if all respondents made – or could make – the intellectual investment necessary to complete the survey accurately, and it is certainly reasonable to suspect that some did not or could not. In addition, it is reasonable to ask if all respondents sufficiently understood the tasks they were asked to complete, and / or if the choices they were expressing were consistent with their real preferences (or if, alternatively, they might have expressed different choices if they better understood, or were more familiar with, the options being described.

The bottom line is that it is impossible to tell the real extent to which these issues may have occurred. The project team attempted to do everything possible to design an appropriate research instrument, and to provide the appropriate education so that respondents could answer effectively. In examining the research results, it seems reasonably clear that most respondents answered consistently and in a sensible way (given the computed results of the discrete choice analysis, for example), but ultimately, it is still the case that a survey of this length and complexity leaves open the possibility that some portion of the data provided by respondents should not be viewed as providing accurate insight.

Sample Management and Data Weighting

Several of the objectives of the research plan required the ability to examine survey responses within a variety of specific population subgroups. As a result, it was important to manage the types of respondents qualifying to participate in the survey on an ongoing basis to ensure that important subgroups were adequately represented. This meant placing caps on the participation of some groups (i.e., younger respondents) and attempting to enhance response rates among other groups (i.e., older, minority, lower income respondents), yielding an intentionally disproportionate sample. The sample size floor and ceiling values, and the final number of completed surveys by sample management cell are reported in the table below:

Table 2.3: Sample Quota Targets and Final Sample Sizes by Quota Cell

		Quota Target Floor	**Final Sample**	Quota Target Ceiling
Electricity provider	PG&E	497	**498**	607
	SCE	454	**534**	554
	SDG&E	130	**164**	158
Climate zone	1	140	**150**	172
	2	486	**517**	594
	3	346	**389**	422
	4	119	**140**	145
Home ownership	Own	--	**705**	--
	Rent	250	**491**	500
Type of housing	Single-family	--	**719**	--
	Multi-family	250	**477**	500
Age	65+	70	**101**	150
	35-64	200	**616**	750
	18-34	200	**479**	500
Ethnicity (self-reported)	Hispanic	120	**111**	450
	Other non-white	120	**224**	350
Affluence	>/+ 200% poverty line	--	**906**	--
	< 200% poverty line	120	**190**	300

As the table indicates, the final sample characteristics on all of the tracked attributes were within the target quota ranges (i.e., equal to or above the floor value and lower than or equal to the ceiling values) for all of the various sub-samples with one exception (Hispanics), and for this population, the final sub-sample size was only off by a small amount (including 111 such respondents vs. the target value of 120)).

Because the final sample was intentionally disproportionate in character relative to the underlying population of eligible households in the sample universe (i.e., it intentionally over-represented some groups and under-represented others), it was necessary to weight the final sample so that a final weighted sample population could be developed that was, demographically speaking, representative of the universe of eligible households. The weighted sample, in other words, is intended to both provide the opportunity to conduct analysis of specific demographic sub-groups of adequate size for individual assessment, while at the same time providing an aggregate representation of the population of interest, and in each case, to provide a demographically balanced and representative sample of each.

It is important to note here, however, that weighting a sample so that it is demographically representative of an underlying population does not guarantee that all potential biases are removed from such a sample. Weighting can, for example, ensure that respondents from a given geographic area exert only as much influence on a set of aggregate results as they "should" given their representation in the overall population. Weighting cannot, however, control for biases that are not linked to any of the demographic attributes that are not managed by the weighting scheme, nor can it ensure that the respondents within a given demographic group are necessarily representative of the population of respondents in that group. As a result, while population weighting is typically applied as a method to manage the most obvious effects of intentional oversampling, it should not be viewed as a panacea for the removal of all possible effects of sample bias.

In order to weight the total sample to the appropriate set of demographic characteristics, it was first necessary to specify the distribution of the relevant characteristics in the "true" underlying population. In some cases (e.g., number of households served by each utility and number of households by climate zone), these figures were available directly from the utilities. In other cases (i.e., distributions for the age of heads of household, ethnicity, etc.), this was done by accessing a variety of secondary statistical sources[8] and using those sources to estimate the proportion of households (or heads of households) in the service territories of the three investor-owned utilities that had the relevant attribute.

Where direct indicators of the characteristics of the population residing in the territories of the three utilities in question were not available, and these values had to be estimated from state-level data, estimates for the three service territories in question were typically made by using estimates for the total population of California and deleting from those totals the figures for Sacramento County and one-half of the value for Los Angeles County.

Table 2.4 reports the initial and final weighted sample distributions for all of the managed sample characteristics. The table indicates that the weighted sample maps well against the population target values (the estimates of the true distribution of households on these attributes), with the delta (or difference) between the weighted proportions and true population proportions less than 4% in every case, and less than 2% in most cases.

[8] *"California Current Population Survey Report," March 2002; California Dept of Finance; additional ad hoc analyses conducted by request in January 2004 by the California Dept of Finance; US Census Bureau, online data resources*

Table 2.4: Initial and Final Weighted Sample Demographic Distributions

Target	Sample Count	Sample %	Population %	Weighted %	Delta Weighted % vs. Population %
PG&E	498	41.6%	**45.7%**	43.4%	2.3%
SCE	534	44.6%	**42.1%**	44.3%	-2.2%
SDG&E	164	13.7%	**12.2%**	12.4%	-0.2%
	1196	**100%**	**100%**		
Zone 1	150	12.5%	**12.5%**	11.0%	1.5%
Zone 2	517	43.2%	**45.1%**	42.6%	2.5%
Zone 3	389	32.5%	**31.6%**	32.5%	-0.9%
Zone 4	140	11.7%	**10.8%**	13.9%	-3.1%
	1196	**100%**	**100%**		
Rent	491	41.1%	**41.7%**	38.0%	3.7%
Own	705	58.9%	**58.3%**	62.0%	-3.7%
	1196	**100%**	**100%**		
Multi-family	477	39.9%	**38.4%**	36.9%	1.5%
Single Family	719	60.1%	**61.6%**	63.1%	-1.5%
	1196	**100%**	**100%**		
65+	101	8.4%	**16.9%**	18.6%	-1.7%
35-64	616	51.5%	**59.4%**	57.7%	1.7%
18-34	479	40.1%	**23.7%**	23.7%	0.0%
	1196	**100%**	**100%**		
Hispanic	111	9.3%	**24.3%**	24.3%	0.0%
Other non-white	224	18.7%	**19.3%**	19.3%	0.0%
White	861	72.0%	**56.4%**	56.4%	0.0%
	1196	**100%**	**100%**		
< 200% poverty line	190	15.9%	**32.6%**	32.6%	0.0%
200% PL+	1006	84.1%	**67.4%**	67.4%	0.0%
	1196	**100%**	**100%**		

The Use of Discrete Choice Analysis to Evaluate Alternative Pricing Designs

Most of the core research objectives focused on understanding how residential electricity customers in California make tradeoffs when evaluating different pricing options that might be made available to them. More specifically, the interest was in understanding how customers might trade off different features of new time-differentiated pricing plan, and as a result, explain how and why customers might choose to participate in newly offered time-differentiated electricity pricing plans.

One of the complications in testing potential marketplace response to new product offerings comes in dealing with new products that have many variable features. It is relatively easy to test customer response to a product, for example, that can only differ by size and price (a new can of peas, for example, that only comes in two sizes and two prices). In such cases, it is easy to test customer response to all possible combinations of the product (in the pea example, there are only four possible combinations).

For more complicated products, however, this is not possible. The description of "complicated" certainly applies to the time-differentiated electricity pricing options tested in this work. Each of the pricing options could differ along several dimensions (e.g., the amount of savings, whether there were Critical Peak periods or not, whether every day had a peak price, what the on-peak hours were, etc.). In addition, there were several design options for every dimension (e.g., for the on-peak hour dimension there were multiple options including 2-5 pm, 2-6 pm, 12-6 pm, 12-8 pm, etc.). In total, pricing options were allowed to differ in the following ways:

- Bill impact with maximum adjustments consistently employed
  - 20% savings
  - 15% savings
  - 10% savings

- Bill impact with some adjustments employed
  - 10% savings
  - 5% savings
  - 0% savings

- Bill impact with no adjustments made
  - 0% savings
  - 5% higher bill
  - 10% higher bill

- On-peak period
  - Always Noon - 6 pm weekdays
  - Always Noon – 7 pm weekdays
  - Always Noon – 8 pm weekdays
  - Always 2 pm – 5 pm weekdays
  - Always 2 pm – 6 pm weekdays
  - Always 2 pm – 7 pm weekdays
  - Varies; usually 2 pm – 7 pm weekdays, but time period usually shorter on CRITICAL days

- On-peak periods occur
  - "Every weekday" – Every weekday has an on-PEAK period
  - "ONLY on CRITICAL days" – The on-peak periods are only on CRITICAL days (not on every weekday)

- Number of CRITICAL days per summer
  - 0
  - 5
  - 10
  - 15
  - 20

- Controls provided (ONLY PRESENT WHEN CRITICAL DAYS NOT EQUAL O)
  - No; manual/current equipment
  - Yes; automated to how you want your system to run

- Notice of CRITICAL days provided (ONLY PRESENT WHEN CRITICAL DAYS NOT EQUAL 0)
    - N/A
    - The day before
    - That morning

This specification of possible rate program attributes highlights both the complexity of the products to be tested and the fact that most customers have relatively little experience dealing with such attributes. While many residential customers have some experience dealing with time-of-use pricing in other product areas (such as cell phone service), the reality is that most are completely unfamiliar with the notion of TD pricing in electricity, nor have they given any thought to the implications of the issues noted above.

The research sought to deal with these issues by providing a good deal of education to respondents within the context of the survey (explaining the concept of time-differentiated rates and the logic for implementing them), and by providing an opportunity for respondents to think about and explore the way that they might respond to those rates and on how difficult such response might be. Even so, with these best efforts to familiarize respondents with the nature of these rates and their features, it must be recognized that the rates were still new concepts for most people, and as a result, might be viewed differently as customers come to understand both the rates more completely, and the implications of how they might respond to those rates more fully.

Because of the pure complexity of the rate options, it was not possible to test customer response to all possible product combinations. There is, however, a survey methodology that is commonly used to deal with situations like this one. The technique – called discrete choice analysis – makes it possible to estimate how individual survey respondents would evaluate all of the different ways that a product might be constructed, even when there are too many product combinations to test individually.

Discrete choice works by essentially providing survey respondents with a sample of all of the possible product combinations in sets of three and then asking the respondent to indicate which of the three proposed options they would select, given a choice among them (respondents can also say that they would want to choose none of the options). If the product combinations are constructed and grouped randomly, it is possible to use each respondent's evaluations of a series of such choices to estimate the relative value that each respondent would attach to each feature of the products tested (in this case, the different pricing products), and the degree to which they find each feature to be important in determining whether or not they would want to adopt such an option.

In this survey, each respondent evaluated fifteen different choice tasks in which each task asked them to select their preferred option from among one of three different pricing program designs, or alternatively, to indicate that they would prefer "none" of the three options, implicitly indicating that they would prefer to stay on their current pricing plan.

Each of the three time-differentiated pricing plans tested in each task were described in terms of the eight dimensions listed above. Across respondents, there were eight different task "rotations" (meaning that there were eight different randomly selected sets of fifteen different choice tasks), and respondents were randomly allocated to one of the eight different choice task rotations. In order to guard against consistent order and fatigue effects in the data, the order of presentation of the choice tasks within a given rotation was randomized across respondents so that two respondents who received the same rotation (group of choice tasks) did not see those tasks in the same order.

Methodology

The data resulting from the choice tasks (that respondent X chose Option 1 in Task 1 of their assigned rotation of fifteen choice tasks, for example) was then analyzed to develop estimates for each person of the way that they assign value and importance to each of the different pricing design features listed above. Formally stated, the discrete choice design used what is called a "partial profile" approach, and the arithmetic used to make substantive sense of the survey responses is reasonably complex. Essentially, the analytic team estimated the relevant utilities using a Hierarchical Bayesian/Metropolitan Hastings methodology that allows for heterogeneity to be accounted for at the individual respondent level. This analytic methodology provides a better fitting model at the individual respondent level than does conventional aggregate-level logit estimation, and it also makes it possible to incorporate prior information that might be available for each respondent (i.e., the size of their bills) into the analysis.

The analytic output of the modeling work yields both average measures of the utility (or value) that respondents in general associate with each level of each attribute, and also information about the distribution of individual respondent values on these scores (meaning that it is possible to conduct post-hoc segmentation around these values). This utility information can ultimately be used to develop estimates of the way that individual survey respondents (and by extrapolation, the relevant customer universe) might be anticipated to assess a new set of pricing options that could be offered to them. The process used to move from these initial preferences to developing forecasts of anticipated customer response is described in the section on "Forecasting" below, while the section below provides more details about the statistical analysis used to develop the initial preference share estimates.

Estimating Preference Shares

The discrete choice exercises used in the pricing analysis and in the appliance controls analysis (see the discussion below) provided data for estimating utility functions to express consumer preferences for the proposed product features. In the choice exercise, respondents selected between three product alternatives A, B, and C, each made up of the different levels of the features tested (experimental effects). In addition, a "none of the above" choice was also permitted, if the respondent found none of the alternatives to be appealing relative to "doing nothing."

Modeling equations

With a "pick one" dependent variable, a multinomial logit model was appropriate, since the choices represented probabilities of selection for any alternative choice i among j possible alternatives in a given task. More formally, we estimated a hybrid conditional logit model:

a) Some of the design features were conditional on the alternative shown (i.e. Controls provided being relevant in the Pricing exercise only if the number of critical days were non-zero, or when Monthly Cost levels for the Controls exercise were conditional on an alternative in each Controls task having a particular level of control—Basic, Moderate, or Extensive)
b) The context for bill impact was not merely the relative % impact, but the calculated dollar savings ($) in absolute terms, since the absolute size of each respondent's current bill could vary as well. Hence, we needed to estimate both an experimental effect (a characteristic of the choice), and the income payoff (an interaction of the characteristic of the choice, % Bill Impact, and a characteristic of the chooser, Current Bill). Such an approach, with a respondent demographic acting as a covariate with an experimental variable, is called a "hybrid" model in the choice literature.

The parameterization of each model is shown in the tables below:

Pricing Model

Feature	Estimation	Coding	Type of effect
Bill impact with maximum adjustment (% savings/cost)	Log-Vector	Logarithmic of ratio to current, mean-centered	Experimental
Bill impact with some adjustments (% savings/cost)	Log-Vector	Logarithmic of ratio to current, mean-centered	Experimental
Bill impact with no adjustments (% savings/cost)	Log-Vector	Logarithmic of ratio to current, mean-centered	Experimental
Duration of on-peak periods	Part-worth	Separate levels, last level as reference	Experimental
Frequency of on-peak periods	Part-worth	Separate levels, last level as reference	Experimental
Number of critical days	Part-worth	Separate levels, last level as reference	Experimental
Controls provided	Part-worth	Separate levels, last level as reference	Experimental
Notice of critical days provided	Part-worth	Separate levels, last level as reference	Experimental
Bill impact with maximum adjustment ($ savings/cost)	Vector	Mean-centered	Covariate
Bill impact with some adjustments ($ savings/cost)	Vector	Mean-centered	Covariate
Bill impact with no adjustments ($ savings/cost)	Vector	Mean-centered	Covariate

Controls Model

Feature	Estimation	Coding	Type of effect
Extensiveness of controls	Part-worth	Separate levels, last level as reference	Experimental
Monthly cost (basic)	Log-Vector	Logarithmic, mean-centered	Experimental
Monthly cost (moderate)	Log-Vector	Logarithmic, mean-centered	Experimental
Monthly cost (extensive)	Log-Vector	Logarithmic, mean-centered	Experimental
Bill impact (% savings)	Log-Vector	Logarithmic of ratio to current, mean-centered	Experimental
System programming control	Part-worth	Separate levels, last level as reference	Experimental
Bill impact ($ savings)	Vector	Mean-centered	Covariate

Depending upon the type of feature to be estimated in the modeling, and the way that they would be addressed in the simulator, we utilized three different coding schemes:

Part-worth parameterization

For features that were defined qualitatively (e.g. duration of on-peak periods), a part-worth coding scheme that utilized orthogonalized effect-coding was employed. This results in utility scores that are relative to a hypothetical average of 0 within feature, with the utility scores summing to 0 across that feature's levels.

In the model estimation, for any feature with k levels, we estimated k-1 parameters to preserve full-rank coding. We treated the last level of a part-worth coded feature as the reference level (the one parameter held out). Otherwise, for each of the k-1 parameters within feature, we coded 1 for the particular feature level, 0 if not that feature level, and -1 for the reference feature level. Thus, we can derive the utility of the reference level by summing that feature's levels and multiplying by -1.

Part-worth coding can be more useful to an analyst than indicator (dummy) coding, where a particular level of a feature is set to 0, and the utilities are relative to a particular reference level. In that case, the interpretation may change depending upon the reference level chosen, and hence requires special knowledge of the feature to be meaningful. With part-worth coding, the estimation is invariant of the reference level chosen.

Additionally, use of indicator-coded features can be confounded with the "none" parameter, because all levels of the experimental parameters estimated are set to 0 when the "none" choice is in the design matrix. Consequentially, it can be confused with an alternative where all levels of the features are at the reference level.

Vector parameterization methods: Vector and Log-Vector

While qualitative, part-worth coding is appropriate when the levels of a feature only are of interest. There were some features where it was desirable to be able to interpolate instead of only looking at the levels addressed. That is, not only estimate the impact of the actual levels shown (for example, 20%/15%/10% savings with maximum adjustment), but to look at intermediate levels in that range (such as a 17% savings, or a 12% savings).

Although we could have shown more levels of these features to respondents, that would have increased the size of the experimental design, the number of tasks shown to each respondent and in total, and would have decreased the precision around the individual parameter estimates involved for the sample.

Thus, we decided to estimate a continuous vector effect for these features. Rather than estimate separate parameters for these feature levels, we estimated a single parameter for each feature involved, assuming linearity. Linearity assumes a constant elasticity (a fixed degree of impact as a unit change in the independent variable occurs across the entire range of the variable in question). Such a model is more parsimonious because fewer terms are estimated. The cost is that we lose some of the information between the levels of those features.

One way around this information loss is to use higher order terms in a model (such as quadratic or cubic effects). Another more parsimonious approach is to assume *curvilinearity* rather than simple linearity. This method, common in econometrics, involves taking the log of variables such as price and percentage bill impact. The log effects captures curvature, where the degree of change varies as a unit change in the variable in question occurs. A log-transformed feature's elasticity does not have to be strictly constant, as a result. The direction of change depends on the parameter to be estimated.

We utilized a Log-Vector approach for the experimental effects for Bill Impact (defined in % terms) and Monthly Cost (defined in dollars), and a simple Vector approach for the covariate effect of the respondent's current bill with the degree of % Bill Impact (defined in dollars).

For capturing Bill Impact (%) in both the Pricing and Controls model, we converted the % savings to a ratio of the current bill prior to logarithmic conversion (since we cannot take the log of a negative number, in cases where the bill impact could involve a cost).   That is, a savings of 20% represented a ratio of 0.8, relative to a current level of 1.0. For Monthly Cost, we took the log of price directly.

While we could have assumed curvilinearity for the dollarmetric Bill Impact effect, we preserved simple linearity to account for dollar increases in a bill due to increased cost as well as dollar-based bill savings, because we found that a curvilinear effect did not improve the model fit.

Regardless of whether a simple Vector or a Log-Vector effect was to be estimated, we then did the following:

a) Mean-centered the levels of Vector features by subtracting the average coded level (raw or in logarithmic terms) from each of the individual levels

b) Orthogonalized the levels by dividing by the mean-centered levels by the range between the lowest and highest mean-centered levels, and multiplying the result by 2

By completing these steps, the Vector estimated features could be defined in the same range as the qualitative, effect-coded features (-1 to +1 across the feature levels with a mean of 0). This is of great value in interpretation of the utilities as all effects would be part-worths, and defined in standardized levels. Once we derived the model estimates, we can compute utilities for specific levels of the Vector-coded features of interest.

Shortcomings of traditional MNL modeling estimation

As mentioned previously, we utilized multinomial logit estimation (MNL) for modeling the consumer preferences. Traditionally, an MNL model is fit at the aggregate level, using Maximum Likelihood estimation methods, because we do not have enough tasks completed per respondent to fit independent preference functions for each individual consumer (as we typically do with full-profile or adaptive conjoint methods based on OLS regression). However, such a model has two major disadvantages:

a) It is assumed that respondent preferences are identical for all individuals in a given model
b) MNL models are highly sensitive to the violations of the IIA property (Independence of Irrelevant Alternatives)

The first issue involves the notion that a model can be "one size fits all". Whether we conduct modeling in total or at a segment level, it is assumed with traditional MNL that consumers have homogeneous preferences.

An illustration where this is not tenable would be where the average utilities for a feature are relatively flat. That would imply, for instance, that respondents value having automatic vs. manual controls identically. While on average this might be true, if preferences are highly polarized (an approximately equal number valuing each type of control in an extreme case), then the model will poorly reflect the relative importance to individuals in making preference decisions. If there is a group of people that would switch plans based on the type of control, we would miss them entirely.

In addition to providing relatively poor model fit at a total level, an aggregate-level model would need to be estimated for each segment of interest (PG&E customers, Climate Zone 1, PG&E/Climate Zone 1, etc.). This would require relatively large sample sizes to be practical, and an a-priori understanding of what segments are to be analyzed. Further, it would not be possible to conduct any ad-hoc segmentation as needed.

The second modeling issue involves the assumption of MNL that adding new product alternatives (or changing an existing one in a particular fashion) will result in proportional draw from other possible alternatives.

To illustrate, were we to have products in a market simulation where a new product were added that was identical to an existing choice except for having automatic controls (vs. manual for the existing product), the conventional "share of preference" simulation from an aggregate-level MNL model would give the existing product and the new product nearly identical shares.

More seriously, the combined impact of both products on preference would be exaggerated. A realistic simulation would divide the existing interest in the two, nearly identical products to capture incremental reach from consumers that might desire automatic controls (that wasn't reflected in the market otherwise). Thus, the net reach of the two similar alternatives would reflect reality better.

We can partially avoid this latter problem by building models with product availability effects. Unfortunately, these effects can move in counter-intuitive directions (price goes up, and preference for other, similar products goes down). Fortunately, a considerably simple solution is possible today.

How Hierarchical Bayesian estimation works

We utilize Hierarchical Bayesian methodology (HB) to overcome these shortcomings of traditional, aggregate-level modeling. HB builds upon a relatively recent development in modeling technology, the Metropolis-Hastings Sampler, and modern computer speed to infer a preference function for individuals based upon an assumed statistical distribution that describes those preferences in total.

With HB, we can substantially improve model fit because we can then conduct simulations at a respondent level (and then aggregate them up to whatever segment scheme is desired). With individual-level simulations, we can utilize a **first choice rule** and avoid the IIA problem substantially. Respondents that would shift based on, say, automatic controls, would have high positive utilities for that feature (and large negative utilities for manual), while other respondents might weakly favor manual controls. Thus, only the former would move to a new product with automatic controls, while the manual control respondents would stay with their current choice.

HB takes advantage of multiple observations per respondent (i.e. the 12 choice tasks for each exercise that each person sees). Thus, there is a hierarchy of tasks within individuals. Bayesian estimation involves the notion that an estimate for a given individual is the product of a sequential series or "draws" of preferences in a chain. Each conditional preference or draw is a "prior" of the next one.

An HB estimation starts with a set of "priors" for each person (usually determined from conventional regression). Then, we use that prior estimate and add an independently drawn variate from the sampling element to improve the overall fit for the sample at a high degree of acceptance. The variate gets "smarter", using the estimates from one draw to inform how the variate should be drawn in the next draw. The draws continue until we reach a point where the parameter variation doesn't change very much across several thousand iterations.

With multiple tasks per person, we can also "borrow" information between individuals based on the overall likelihood of a common set of answers given a similar design scheme. The borrowing effect acts to stabilize individuals so that not only the total estimation is stable, but the individual respondent-level estimates achieve a minimal degree of change over the draws. The borrowing element goes into the way that the sampler achieves its acceptance rates.

Finally, we assume normality for the distribution of estimates for each parameter individually, and multivariate normality for the way that the parameters work at the total sample level, along with the multinomial logit link to the choice preferences. With these assumptions, we can optimize estimates with the goal of maximizing the precision of the estimates (minimizing the errors around each parameter estimate).

Not only is the precision determined at the total level, however. We also get a draw of estimates for each individual, so we have a much larger body of information to build utilities from than any conventional estimation method for regression. All we need is multiple observations per respondent for consistent estimation, and a large enough sample to provide some measure of stabilization in total.

In our application, we conducted 2000 "burn-in" draws to achieve initial stability, and then executed 10,000 further estimates so that we can arrive at 1000 separate estimates of the utilities for each person (i.e. taking each 10th draw to avoid any possible autocorrelation problems in the estimation). The draws are then averaged for each person to provide their final preference functions.

The use of multiple estimates, essentially a sample of functions for each person, also allows us to impose modeling constraints that are not easily implemented otherwise. For example, we can choose to only use "draws" that have bill impact effects that move in a particular direction (more savings = more preference). It is also possible to use directional constraints for part-worth features.

To illustrate the improvement in model fit for an HB model vs. a conventional MNL estimation, we present the following measures of variation explained (perfect fit=1.0):

Model	Pricing	Controls
Aggregate MNL estimation	0.0932	0.0337
Hierarchical Bayes estimation	0.6313	0.4625

We also see that the parameters estimated are larger, with higher t-values (representing differences from the null hypothesis of parameter=0). For illustration, consider the type of control:

Type of Control	MNL Mean	MNL Standard Error	MNL t-value	HB Mean	HB Standard Error	HB t-value
Manual	0.024	0.031	0.774	0.150	0.026	5.769
Automatic	-0.024	0.031	0.774	-0.150	0.026	-5.769

The Use of Discrete Choice Analysis to Evaluate Alternative Controls Designs

Besides the interest of the project team in understanding the way that customers trade off different elements of time-differentiated pricing plans, there was also an interest in understanding customer decision-making around the acquisition of home appliance control systems. The objectives for understanding this set of decisions were similar in their logic to the types of objectives that existed for time-differentiated rates (to understand how customers trade off different specific elements of the feature functionality and pricing of control systems and how these tradeoffs are likely to affect customer adoption of these technologies).

The key analytic issues were similar for this set of "products" to those relevant to the assessment of time-differentiated rates. There were, in this case as well, several different dimensions along which control systems could differ, and the goal of the research was to understand the combined tradeoffs that customers make as they evaluate their response to these options. Since the issues were similar, the team used a similar approach (i.e., discrete choice analysis) to develop the relevant customer insights.

In total, control options were allowed to differ in the following ways:

- Monthly cost – Basic controls
  - $0
  - $2.50
  - $5.00
  - $7.50

- Monthly cost – Moderate controls
  - $7.50
  - $10.00
  - $12.50
  - $15.00

- Monthly cost – Extensive controls
  - $15.00
  - $17.50
  - $20.00
  - $22.50

- How extensive the controls are
  - Extensive
  - Moderate
  - Basic

- Bill impact
  - 2.5%
  - 8.75%
  - 15%

- System programming and control
  - You program the system according to how you want the system to run
  - Your utility programs the system according to how you want the system to run
  - Your utility programs the system according to how it wants the system to run, but you can choose to override the system if you need to
  - Your utility programs the system according to how it wants the system to run, but you cannot override the controls

As with the exercises for time-differentiated rates, each respondent completed a series of choice tasks that asked them to select among three different control options (each of which were described as a combination of the attributes and levels outlined above) or to indicate that they would rather have "none" of the options. In this section, respondents each evaluated twelve different choice tasks, and there were four different rotations of tasks that were randomly assigned across respondents.

Translating Percentage Bill Savings into Absolute Bill Savings Values in the Discrete Choice Exercises

In order to make the savings estimates provided in both of the discrete choice exercises more meaningful to respondents, the team chose to translate percentage bill savings estimates into absolute dollar value savings estimates based, in large part, on respondent-provided information about their monthly summer electric bills. Rather than seeing a savings of "10%" on their bill in a discrete choice exercise, respondents saw an absolute dollar savings value that was based on their real, reported bill value (in the simplest case, if their average summer electric bill was $100, then a discrete choice option that implied a 10% savings was described to that customer as a potential monthly savings of $10, whereas for a customer with a monthly bill of $50, that same percentage savings was portrayed to the customer as a potential savings of $5). As a result, survey respondents never saw the percentage savings claims, and only ever saw the way these percentage savings estimates were translated into absolute dollar values that mapped to their actual summer electricity bills.

The specification of values for the base bill value, however, was not as simple as asking respondents what their average monthly summer bill was and simply using this value as the starting point. The team had two concerns that needed to be addressed in developing a methodology for establishing a base bill value for each respondent:

- Some respondents do not know or are not able to provide (or estimate) on their own the amount of their summer monthly electric bill

- Because the survey would be administered on paper for some respondents, there was a need to constrain the total number of possible different versions of the questionnaire. Without constraining the number of questionnaire versions a priori, for example, it might have been the case that 1,200 different versions of the document would be necessary (since each respondent might, conceivably, report a different bill value). Logistically, this was not feasible to implement.

In order to deal with these problems, the team needed to develop a manageable set of bill values (no more than 20) that could be applied as approximations of actual summer monthly electric bills for all respondents. Once this list was developed, the team then had to have a reasonable method for assigning each respondent to one of the bill values (with the methodology relevant for both respondents who knew or could estimate their monthly summer bills, and for those who could not do so).

The first part of this process – generating the manageable list of bill values – was conducted by first developing a set of plausible bill categories for each utility by climate zone. Once these bill categories were developed, an examination of the distribution of bills within each category, the true mean bill values within category, and the similarity in categories across utilities led to the construction of "mean" bill values for each bill category that minimized the total number of "mean" bill values across utilities and climate zones. The specific steps used in this process were the following:

- Each utility provided information about the distribution of summer bills by climate zone
- The team specified a set of nine-to-eleven bill categories within each utility/climate zone combination (in some cases utilities aggregated information across multiple climate zones); the bill categories were specified so that, as much as possible, there was similarity in categories across utilities/climate zones, but that unique differences across utilities were represented as necessary
- "Mean" values were specified for each bill category that were not "true means" of the category, but which represented point bill values that were both reasonably representative of the distribution of the bills in the category and were values that could be mapped across different utilities and climate zones.

Consider an example from the tables below. The second bill category for SDG&E, climate zone 2 is $16-$30. The team chose $26 as the "mean" bill value for this category, in part, because it is was representative of the actual bills in the category, but also because $26 could be used as the "mean" bill value for at least one other bill category (e.g., SCE bill category two in Climate Zones 3/4).

The three tables below describe the bill categories and bill "means" for each category, organized by climate zone and utility.

Table 2.5: SDG&E Bill Categories and "Means" by Climate Zone

Climate Zone 2	
Bill Categories	**Bill "Mean" and Label**
1 $0 - $15	$9 = Low 1
2 $16 - $30	$26= Low 2
3 $31 -$55	$49= Medium 1
4 $56 - $80	$70= Medium 2
5 $81-$120	$100= High 1
6 $121 - $160	$140= High 2
7 $161 - $200	$180= High 3
8 $201 - $240	$220 = High 4
9 Over $240	$280 = High 5
Climate Zones 3-4	
1 $0 - $20	$9= Low 1
2 $21 - $40	$26= Low 2
3 $41 - $70	$49= Medium 1
4 $71 - $100	$85= Medium 2
5 $101 - $150	$120= High 1
6 $151 - $200	$180= High 2
7 $201 - $250	$220= High 3
8 $251 - $300	$280= High 4
9 Over $300	$350= High 5

Table 2.6: PG&E Bill Categories and "Means" by Climate Zone

Climate Zone 1	
Bill Categories	**"Mean" and Label**
1 $0 - $20	$12.50 = Low 1
2 $21 - $40	$40 = Low 2
3 $41 - $60	$49 = Medium 1
4 $61 - $80	$70 = Medium 2
5 $81 - $100	$100 = High 1
6 $101 - $120	$120 = High 2
7 $121 - $160	$120 = High 3
8 $161 - $200	$180 = High 4
9 Over $200	$240 = High 5
Climate Zone 2	
1 $0 - $20	$12.50= Low 1
2 $21 - $40	$40 = Low 2
3 $41 - $80	$70 = Medium 1
4 $81 - $120	$100 = Medium 2
5 $121 - $140	$120 = High 1
6 $141 - $180	$180 = High 2
7 $181 - $220	$180 = High 3
8 $221 - $260	$240 = High 4
9 Over $260	$325 = High 5
Climate Zone 3	
1 $0 - $30	$12.50= Low 1
2 $31 - $60	$40 = Low 2
3 $61 - $90	$70 = Medium 1
4 $91 - $120	$100 = Medium 2
5 $121 - $160	$120 = High 1
6 $161 - $200	$180 = High 2
7 $201 - $250	$240 = High 3
8 $251 - $300	$240 = High 4
9 Over $300	$400 = High 5
Climate Zone 4	
1 $0 - $30	$12.50= Low 1
2 $31 - $60	$40 = Low 2
3 $61 - $90	$70 = Medium 1
4 $91 - $120	$100 = Medium 2
5 $121 - $160	$120 = High 1
6 $161 - $200	$180 = High 2
7 $201 - $300	$240 = High 3
8 $301 - $400	$325 = High 4
9 Over $400	$500= High 5

Table 2.7: SCE Bill Categories and "Means" by Climate Zone

Climate Zone 2	
Bill Categories	**Bill "Means" and Label**
1 $0 - $15	$12.50= Low 1
2 $16 - $30	$26= Low 2
3 $31 - $40	$40= Medium 1
4 $41 - $55	$49= Medium 2
5 $56 - $75	$70= Medium 3
6 $76 - $90	$85= High 1
7 $91 - $105	$100= High 2
8 $106 - $130	$120 = High 3
9 $131 - $180	$140= High 4
10 Over $180	$280= High 5
Climate Zone 3	
1 $0 - $25	$12.50= Low 1
2 $26 - $35	$26= Low 2
3 $36 - $45	$40= Low 3
4 $46 - $65	$49= Medium 1
5 $66 - $95	$85= Medium 2
6 $96 - $135	$120= Medium 3
7 $136 - $155	$140= High 1
8 $156 - $175	$180= High 2
9 $176 - $215	$195= High 3
10 $216 - $275	$240= High 4
11 Over $275	$400= High 5
Climate Zone 4	
1 $0 - $30	$12.50= Low 1
2 $31 - $44	$40= Low 2
3 $45 - $60	$49= Low 3
4 $61 - $84	$70= Medium 1
5 $85 - $114	$100= Medium 2
6 $115 - $160	$140= Medium 3
7 $161 - $184	$180= High 1
8 $185 - $210	$195= High 2
9 $211 - $254	$240= High 3
10 $255 - $330	$280= High 4
11 Over $330	$500= High 5

Once the bill categories and bill "mean" values identified above had been specified, the team was able to develop the aggregate list of "mean" bill values. A total of nineteen such values were specified in total, and these are listed in Table 2.8, along with the utilities/climate zones for which they were relevant. Ultimately, this set of nineteen bill values was the total set of bill values used in the survey to specify bill savings. Each respondent, in other words, was assigned to one of these nineteen bill values.

Table 2.8: Aggregate Listing of "Mean" Bill Values

$9	SDG&E / Zones 2-4 / Low 1
$12.50	PG&E / Zones 1-4 / Low 1; SCE / Zones 2-4 / Low 1
$26	SDG&E / Zones 2-4 / Low 2; SCE / Zones 2-3 / Low 2
$40	PG&E / Zones 1-4 / Low 2; SCE / Zones 2 (medium 1), 3 (low 3), 4 (low 2)
$49	SDG&E / Zones 2-4 / Medium 1; PG&E / zone 1 / medium 1; SCE / Zones 2 (medium 2), 3 (medium 1) 4 (low 3)
$70	SDG&E / Zone 2 / Medium 2; PG&E / zones 1(medium 2), 2-4 (medium 1); SCE / zones 2 (medium 3), 4 (medium 1)
$85	SDG&E / Zones 3-4 / Medium 2; SCE / zones 2 (high 1), 3(medium 2)
$100	SDG&E / Zone 2 / High 1; PG&E / zones 1(high 1), 2-4(medium 2); SCE / zones 2 (high 2), 4 (medium 2)
$120	SDG&E / zones 3-4 / high 1; PG&E / zones 1(high 3), 2-4 (high 1); SCE / zones 2 (high 3), 3 (medium 3)
$140	SDG&E / zone 2 / high 2; SCE / zones 2 (high 4), 3 (high 1), 4 (medium 3)
$180	SDG&E / zones 2(high 3), 3-4 (high 2); PG&E / zones 1 (high 4), 2 (high 3), 3 (high 2), 4 (high 2); SCE / zones 3 (high 2), 4 (high 1)
$195	SCE / zones 3 (high 3), 4 (high 2)
$220	SDG&E / zones 2 (high 4), 3-4 (high 3)
$240	PG&E / zones 1 (high 5), 2 (high 4), 3 (high 3), 4 (high 3); SCE / zones 3 (high 4), 4 (high 3)
$280	SDG&E / zones 2 (high 5), 3-4 (high 4); SCE / zones 2 (high 5), 4 (high 4)
$325	PG&E / zones 2 (high 5), 4 (high 4)
$350	SDG&E / zones 3-4 / high 5
$400	PG&E / zone 3 / high 5; SCE / zone 3 / high 5
$500	PG&E / zone 4 / high 5; SCE / zone 4 / high 5

Once the aggregate list of "mean" bill values was specified, the team turned to identifying the logic by which each survey respondent was assigned to one of the nineteen bill values. The logic for assigning survey respondents to one of the "mean" bill values is outlined in Table 2.8, but essentially, the logic is as follows:

- If a respondent provided a specific estimate for their summer monthly bill, then the respondent was assigned to a "mean" bill value that took that reported bill amount into account, but also took into account their utility and climate zone
  - To take an example from the first line of the table below, if an SDG&E customer in climate zone 2 said their bill was $6, they were assigned a "mean" bill value for purposes of estimating their bill savings for the discrete choice exercises of $9.
  - Looking at the first line of the table in the PG&E section, we would note that a respondent reporting an actual bill of $6 in climate zone 1 would be assigned a "mean" bill value of $12.50.

- If a respondent said they did not know what their monthly summer bill was in answer to the appropriate question on the survey, they were offered a set of bill categories that mapped to their utility and climate zone (see the list of bill categories provided above in Table 2.5-2.7) and asked which bill category was most appropriate as an estimate of their bill. The "mean" bill value assigned to that category was then used as their calculated bill value.

- A respondent in SDG&E territory climate zone 2, therefore, who said initially that they did not know the size of their monthly summer electric bill was offered the appropriate list of bill categories from Table 2.5. If they selected bill category 1 ($0-$15), then they were assigned a calculated bill value of $9 (per the table below).

Table 2.9: Logic for Assigning Calculated Bill Values

SDG&E
If SDG&E & climate zone=2 & (reported bill=0-15 or reported bill category=1) then bill=$9
if SDG&E & climate zone=2 & (reported bill=16-30 or reported bill category=2) then bill=$26
if SDG&E & climate zone=2 & (reported bill=31-55 or reported bill category=3) then bill=$49
if SDG&E & climate zone=2 & (reported bill=56-80 or reported bill category=4) then bill=$70
if SDG&E & climate zone=2 & (reported bill=81-120 or reported bill category=5) then bill=$100
if SDG&E & climate zone=2 & (reported bill=121-160 or reported bill category=6) then bill=$140
if SDG&E & climate zone=2 & (reported bill=161-200 or reported bill category=7) then bill=$180
if SDG&E & climate zone=2 & (reported bill=201-240 or reported bill category=8) then bill=$220
if SDG&E & climate zone=2 & (reported bill GT 240 or reported bill category=9) then bill=$280
if SDG&E & climate zone=3-4 & (reported bill=0-20 or reported bill category=1) then bill=$9
if SDG&E & climate zone=3-4 & (reported bill=21-40 or reported bill category=2) then bill=$26
if SDG&E & climate zone=3-4 & (reported bill=41-70 or reported bill category=3) then bill=$49
if SDG&E & climate zone=3-4 & (reported bill=71-100 or reported bill category=4) then bill=$85
if SDG&E & climate zone=3-4 & (reported bill=101-150 or reported bill cat=5) then bill=$120
if SDG&E & climate zone=3-4 & (reported bill=151-200 or reported bill cat=6) then bill=$180
if SDG&E & climate zone=3-4 & (reported bill=201-250 or reported bill cat=7) then bill=$220
if SDG&E & climate zone=3-4 & (reported bill=251-300 or reported bill cat=8) then bill=$280
if SDG&E & climate zone=3-4 & (reported GT 300 or reported bill category=9) then bill=$350
PG&E
If PG&E & climate zone=1 & (reported bill=0-20 or reported bill category=1) then bill=$12.50
if PG&E & climate zone=1 & (reported bill=21-40 or reported bill category=2) then bill=$40
if PG&E & climate zone=1 & (reported bill=41-60 or reported bill category=3) then bill=$40
if PG&E & climate zone=1 & (reported bill=61-80 or reported bill category=4) then bill=$70
if PG&E & climate zone=1 & (reported bill=81-100 or reported bill category=5) then bill=$100
if PG&E & climate zone=1 & (reported bill=101-120 or reported bill category=6) then bill=$120
if PG&E & climate zone=1 & (reported bill=121-160 or reported bill category=7) then bill=$120
if PG&E & climate zone=1 & (reported bill=161-200 or reported bill category=8) then bill=$180
if PG&E & climate zone=1 & (reported bill GT 200 or reported bill category=9) then bill=$240
If PG&E & climate zone=2 & (reported bill=0-20 or reported bill category=1) then bill=$12.50
if PG&E & climate zone=2 & (reported bill=21-40 or reported bill category=2) then bill=$40
if PG&E & climate zone=2 & (reported bill=41-80 or reported bill category=3) then bill=$70
if PG&E & climate zone=2 & (reported bill=81-120 or reported bill category=4) then bill=$100
if PG&E & climate zone=2 & (reported bill=121-140 or reported bill category=5) then bill=$120
if PG&E & climate zone=2 & (reported bill=141-180 or reported bill category=6) then bill=$180
if PG&E & climate zone=2 & (reported bill=181-220 or reported bill category=7) then bill=$180
if PG&E & climate zone=2 & (reported bill=221-260 or reported bill category=8) then bill=$240
if PG&E & climate zone=2 & (reported GT 260 or reported bill category=9) then bill=$325
If PG&E & climate zone=3 & (reported bill=0-30 or reported bill category=1) then bill=$12.50
if PG&E & climate zone=3 & (reported bill=31-60 or reported bill category=2) then bill=$40
if PG&E & climate zone=3 & (reported bill=61-90 or reported bill category=3) then bill=$70
if PG&E & climate zone=3 & (reported bill=91-120 or reported bill category=4) then bill=$100

if PG&E & climate zone=3 & (reported bill=121-160 or reported bill category=5) then bill=$120
if PG&E & climate zone=3 & (reported bill=161-200 or reported bill category=6) then bill=$180
if PG&E & climate zone=3 & (reported bill=201-250 or reported bill category=7) then bill=$240
if PG&E & climate zone=3 & (reported bill=251-300 or reported bill category=8) then bill=$240
if PG&E & climate zone=3 & (reported GT 300 or reported bill category=9) then bill=$400
If PG&E & climate zone=4 & (reported bill=0-30 or reported bill category=1) then bill=$12.50
if PG&E & climate zone=4 & (reported bill=31-60 or reported bill category=2) then bill=$40
if PG&E & climate zone=4 & (reported bill=61-90 or reported bill category=3) then bill=$70
if PG&E & climate zone=4 & (reported bill=91-120 or reported bill category=4) then bill=$100
if PG&E & climate zone=4 & (reported bill=121-160 or reported bill category=5) then bill=$120
if PG&E & climate zone=4 & (reported bill=161-200 or reported bill category=6) then bill=$180
if PG&E & climate zone=4 & (reported bill=201-300 or reported bill category=7) then bill=$240
if PG&E & climate zone=4 & (reported bill=301-400 or reported bill category=8) then bill=$325
if PG&E & climate zone=4 & (reported bill GT 400 or reported bill category=9) then bill=$500
SCE
if SCE & climate zone=2 & (reported bill=0-15 or reported bill category=1) then bill=$12.50
if SCE & climate zone=2 & (reported bill=16-30 or reported bill category=2) then bill=$26
if SCE & climate zone=2 & (reported bill=31-40 or reported bill category=3) then bill=$40
if SCE & climate zone=2 & (reported bill=41-55 or reported bill category=4) then bill=$49
if SCE & climate zone=2 & (reported bill=56-75 or reported bill category=5) then bill=$70
if SCE & climate zone=2 & (reported bill=76-90 or reported bill category=6) then bill=$85
if SCE & climate zone=2 & (reported bill=91-105 or reported bill category=7) then bill=$100
if SCE & climate zone=2 & (reported bill=106-130 or reported bill category=8) then bill=$120
if SCE & climate zone=2 & (reported bill=131-180 or reported bill category=9) then bill=$140
if SCE & climate zone=2 & (reported bill GT 180 or reported bill category=10) then bill=$280
if SCE & climate zone=3 & (reported bill=0-25 or reported bill category=1) then bill=$12.50
if SCE & climate zone=3 & (reported bill=26-35 or reported bill category=2) then bill=$26
if SCE & climate zone=3 & (reported bill=36-45 or reported bill category=3) then bill=$40
if SCE & climate zone=3 & (reported bill=46-65 or reported bill category=4) then bill=$49
if SCE & climate zone=3 & (reported bill=66-95 or reported bill category=5) then bill=$85
if SCE & climate zone=3 & (reported bill=96-135 or reported bill category=6) then bill=$120
if SCE & climate zone=3 & (reported bill=136-155 or reported bill category=7) then bill=$140
if SCE & climate zone=3 & (reported bill=156-175 or reported bill category=8) then bill=$180
if SCE & climate zone=3 & (reported bill=176-215 or reported bill category=9) then bill=$195
if SCE & climate zone=3 & (reported bill=216-275 or reported bill category=10) then bill=$240
if SCE & climate zone=3 & (reported bill GT 275 or reported bill category=11) then bill=$400
if SCE & climate zone=4 & (reported bill=0-30 or reported bill category=1) then bill=$12.50
if SCE & climate zone=4 & (reported bill=31-44 or reported bill category=2) then bill=$40
if SCE & climate zone=4 & (reported bill=45-60 or reported bill category=3) then bill=$49
if SCE & climate zone=4 & (reported bill=61-84 or reported bill category=4) then bill=$70
if SCE & climate zone=4 & (reported bill=85-114 or reported bill category=5) then bill=$100
if SCE & climate zone=4 & (reported bill=115-160 or reported bill category=6) then bill=$140
if SCE & climate zone=4 & (reported bill=161-184 or reported bill category=7) then bill=$180
if SCE & climate zone=4 & (reported bill=185-210 or reported bill category=8) then bill=$195
if SCE & climate zone=4 & (reported bill=211-254 or reported bill category=9) then bill=$240
if SCE & climate zone=4 & (reported bill=255-330 or reported bill category=10) then bill=$280
if SCE & climate zone=4 & (reported bill GT 330 or reported bill category=11) then bill=$500

In summary then, respondents were shown percentage bill savings that had been translated into absolute bill savings that were tailored to their current monthly electricity bills. This process worked by:

- Developing a limited set of bill categories and "mean" bill amounts that could be applied across utilities and climate zones
- Assigning each respondent to a bill category and "mean" bill amount based on information about their current bill (as provided by the respondent) and climate zone (based on zip code)
- Allowing respondents who said they could not estimate their electric bill to select a bill category, with the set of bill categories offered to respondents tailored by climate zone

Forecasting Anticipated Customer Response to Pricing and Control options

As we noted above, some of the critical outputs of the discrete choice analysis are the assessments of the relative value (or utility) that each respondent assigns to each level of each attribute that can be used to describe a pricing (or controls) option.

Consider an example attribute such as on-peak periods. The example data in Table 2.10 below describe the sort of data that exist for each respondent. In this example, Respondent 1 has a range of positive and negative utility values for different on-peak periods. Higher positive utility values mean Respondent 1 likes (attaches positive utility) to the specified on-peak period, while greater negative values means Respondent 1 dislikes (attaches negative value) to the specified on-peak period.

In this example dataset, Respondent 1 most likes the 2-5 pm weekday on-peak period and most dislikes the noon-8 pm period. Respondent 2 has the same pattern of most/least liked periods, but has more extreme tastes. Respondent 3 also has the same pattern of most/least liked periods, but has even more extreme preferences.

Table 2.10: Example Value (Utility) Data for On-Peak Period for Several Respondents

	EXAMPLE DATA		
On-Peak Periods	**Respondent 1**	**Respondent 2**	**Respondent 3**
Always Noon - 6 pm weekdays	0.2	0.6	-1.0
Always Noon – 7 pm weekdays	-0.5	-1.0	-2.0
Always Noon – 8 pm weekdays	-1.2	-1.9	-2.5
Always 2 pm – 5 pm weekdays	0.9	1.7	3.0
Always 2 pm – 6 pm weekdays	0.6	1.2	-1.2
Always 2 pm – 7 pm weekdays	-0.1	-1.1	-1.6
Varies; usually 2 pm – 7 pm weekdays, but time period usually shorter on CRITICAL days	0.1	0.0	1.2

Since this sort of data exists for every respondent for every attribute in the discrete choice design, it is possible to construct a measure of the total utility that respondents attach to a specified pricing option by summing the utilities that respondents attach to each of the attributes used to specify a given option.

Assume that we wish to know how a given respondent might value a given pricing option. First, we need to specify the pricing option in terms of the different attributes in the discrete choice design. For purposes of example, consider a CPP option that has 10 critical days, but which also has on-peak periods every day from 2-7 pm. We might specify the option in the following way:

- Bill impact with maximum adjustments consistently employed
  - 20% savings
- Bill impact with some adjustments employed
  - 5% savings
- Bill impact with no adjustments made
  - 0% savings
- On-peak period
  - Always 2 pm – 7 pm weekdays
- On-peak periods occur
  - Every weekday
- Number of CRITICAL days per summer
  - 10
- Controls provided
  - No; manual/current equipment
- Notice of CRITICAL days provided
  - The day before

In the same way that we described in Table 2.10 for "on-peak period," it is also the case that each respondent has a utility value associated with every level of every attribute. For Respondent 1, then, the utility they attach to the level "20% savings" for the attribute "bill impact with maximum adjustments" would be added to the utility they attach to the level "5% savings" for the attribute "bill impact with some adjustments," which would be added to the utility they attach to the level "0% savings" for the attribute "bill impact with no adjustments," etc. across all of the attribute levels used to describe this CPP rate option. In this way, a total utility (which represents the sum of the utilities for a given respondent that are associated with each of the attribute levels used to define a rate option) can be identified for each pricing option.

Note that each rate option has three different savings values associated with it (one each for the savings associated with "maximum," "some," and "no" adjustments). The relative attractiveness of any given rate option is calculated, at least in part, by summing the utilities associated with each of the three savings components of the given rate option.

In and of themselves, these total utility values are not particularly informative, but their value in the analysis is a comparative one. Since total utility values can be calculated for any pricing option that can be described by its different discrete choice attributes, it is possible to calculate total utility values for a wide variety of different pricing options and then compare those options in terms of their relative attractiveness to individual respondents (in addition, by default, the total utility associated with the current pricing plan can also be specified).

Estimates of the way that customers might respond to a given offer of new pricing options are then developed by comparing the way that respondents attach total utilities to those options. If we wish to know, for example, how customers might respond to an offer of two new pricing options (a TOU rate with a specific set of features and a CPP-F rate with a specific set of features), recognizing that they could also choose to stay on their current rate, the pricing product simulator starts by calculating the total utilities for each of the three options (the new TOU rate, the new CPP-F rate, and the "none" option).

Using what is called a "share of preference" model, the simulator then uses a logit-based equation to compare the total utilities for each respondent across the (in this example) three options and assigns a probability that each respondent would select each of the options. We call this probability the unadjusted estimate of market preference. When appropriately summed across all survey respondents and weighted, these summed estimates can be interpreted as estimates of the proportion of the relevant customer universe that could be expected to prefer each of the tested options, given the following set of assumptions:

- That all of the relevant customers were aware of, and fully informed about, the different options and their specific features
- That each of the relevant options was in fact available to all of the relevant customers
- That customers were not encumbered by transaction costs, inertia, or any other factor that might cause them to not act to implement their initial preference

The last issue noted above is an important one. Simply using unadjusted estimates of market preference to forecast the likely number of customers that would actually sign up for a given price offer in a given period assumes (among other things) that customers will act on their preferences, and that as a result, even a small incremental preference for one option over the others that customers face will lead them to go through the trouble of both finding out how to "sign up for" that option, and to actually go through with this behavior.

It is widely recognized, of course, that customers do not always act on their preferences. While customers may say, and even mean, that they would prefer to be on a new TOU rate, rather than their current inclining block rate, they may not go to the trouble of making this change for a variety of reasons:

- Simple inertia (the fact that it is always easier to do nothing) may overcome their marginal preference for a new option as will the inertia associated with the perception that perceived transaction costs are high (or uncertain); or stated otherwise, customers might assume that going through the process of changing rates is difficult and time-consuming, or at least that it is not clear at the start how difficult and/or time consuming it will be
- While on the face of it a new rate might be appealing, because it is new, it is also likely to be viewed as risky, and those customers who tend to be very risk averse may choose to "wait and see" rather than acting to select an option they might otherwise define as attractive

Since a critical goal of this research and analysis effort was to develop plausible (and not just academic) estimates of what might be described as anticipated customer adoption levels for a given new rate option (or set of new rate options) if these were offered in the marketplace, it was important to be able to development adjustments to the "market preference" values that would take these inertia and risk issues into account and facilitate the development of more realistic estimates of anticipated market response. The team did this by applying a methodology that attempts to take into account the effects of inertia and risk aversion that exist in the marketplace, and which recognizes that these factors affect customers differentially. Some customers, in other words, are more risk averse than others, while at the same time some customers are more affected by inertia than others. In order to reflect these facts, the team used the core survey questionnaire to estimate the impact of these two factors on each survey respondent. These two factors were then used to develop adjusted market preference estimates that were used to develop more textured estimates of anticipated customer response to new rate offerings.

In implementing these adjustments, the team used a methodology developed by the contractor for this research over the course of many years of conducting market forecasting research. While this methodology uses standard industry procedures for developing individual and market-based indices, it uses these indices to adjust estimates of likely behavior in a unique way. The methodology, then, while based on a good deal of experience, is ultimately judgmental, and represents a best-efforts method for adjusting for known errors in traditional methods of forecasting customer response. As a result, while it is impossible to demonstrate the mathematical purity of the methodology employed, the approach represents a logical, and tested in other markets, method for accounting for the fact that – without adjustment – customer responses are know to substantially overstate likely response to truly new products.

Implementing these adjustments meant first aggregating customer responses to individual "switching" items included in the questionnaire to create an individual inertia index score. In total, there were eleven switching items (from questions 37 and 38 in the questionnaire) and these items were placed on equivalent scales ranging from "1" to "7," with some responses inverted to ensure that high scores represent "sticky" responses. Scores across the eleven items were then summed for each respondent, yielding an additive, unadjusted value that could range from 11 to 77 for any given respondent. These unadjusted scores were then scaled from 0 to 100.

The resulting scaled values could then be viewed as akin to probabilities, with a "100" value interpreted to mean that the respondent had a probability of 100% of staying with their default starting point condition (whether that default starting condition was their current rate or some new rate) even if the discrete choice analysis suggested that the person should prefer another option. Alternatively a "0" value was interpreted as meaning that the person was unaffected by any "bias" or affinity for their default condition and they would select the option predicted by their calculated utilities for each of the different pricing options available to them in the scenario. Intervening values (from 1 to 99) were interpreted as moving the given respondent further in the direction of adopting the default alternative (so that, for example, a value of 50 moves the respondent 50% of the way from their "natural" estimated probability of staying with the default value to being 100% likely to stay with the default).

Next, the team used the risk acceptance/avoidance items in the base questionnaire (questions 39, 40, and 43) to construct an individual risk avoidance index score using the same process outlined above. First, the six individual items were placed on equivalent scales, inverted as appropriate to ensure that high scores indicate risk avoiding options, and summed. Since there were six individual items in this group and the individual items had responses that could range from "1" to "7," the unadjusted additive values for this index could range from 6 to 42. These unadjusted scores were scaled from 0 to 100 with high scores assigned to customers identified as more likely to exhibit risk avoiding behavior.

Like the switching factor, the risk avoidance factor functions as a probability adjustment to the individual respondent's calculated preferences. In this case, a score of 100 means that a respondent is accorded a 100% probability of accepting their current rate. The logic here is that customers tend to see their current condition as the least risky option available to them ("the devil you know is better than the devil you don't"). Alternatively, a value of 0 defines the person as risk accepting and means that their likelihood of accepting riskier options is consistent with their calculated preferences. Intervening values were treated in the same way as are the intervening inertia factor values described above.

It is worth noting that the inertia factor functions by making default choices more likely (at least for customers who score high on inertia) and that the risk avoidance factor functions by making the current rate option choice (whether or not it is the default) more likely (at least for customers who score high on risk avoidance). At the other end of the scale, the factors do not work to increase the "natural" probability of other choices, but simply function to allow the natural preferences for those choices to be expressed.

Being "high" on inertia, in other words, means having a bias toward staying with your current situation. Being "low" on inertia, however, does not meaning having a bias toward change, but being open to change. Similarly, being "high" on risk avoidance means having a bias towards staying on or moving back on to the current rate. Being "low" on risk avoidance does not mean having a "bias" toward riskier, unknown options, but does mean that a respondent is free to exercise their "natural" preferences for higher risk options.

As a last issue here, it is important to note that the inertia and risk avoidance factors have been applied to the forecasts of anticipated customer response to the pricing options, but not to the control options. The logic here is that the forecasts of customer response to the pricing options needed to consider different default, starting point conditions (i.e., the team wanted to model some situations in which customers can opt-in to a new time-differentiated rate, or be put in a situation in which they would have to opt-out of such a rate if they wanted to return to a traditional rate), needed to reflect the financial significance of the electric bill to at least some customers, and needed to reflect the fact that customers have relatively little experience making rate choice decisions for electricity (thereby making the issues of inertia and risk aversion potentially more significant).

The control options tested, on the other hand, have less uncertainty associated with them, and have comparable examples existing in the marketplace already. As a result, the team thought it was reasonable to treat the controls product adoption forecasts with a more traditional approach.

In addition, in providing the final estimates of likely market response, the team wanted to note the impact that different awareness levels would have on customer activity. Customers can only respond to an option if they know it exists, and it is rarely the case that every customer knows about any specific program option that might be available to them.

Estimates of what is likely to happen in a "real" marketplace must account for the fact that how many customers actually know that they can change (or change back) to an alternative electricity rate will not likely reach 100%. For this reason, this report provides market response estimates for "high" (70%), "moderate" (50%), and "low" (30%) awareness levels that will vary, of course, depending on the nature and extent of the communication made with customers about these options.

The Statistical Accuracy of the Reported Results

The survey is intended to provide a sample that once weighted, offers a representative and valid view of the underlying customer population the survey was drawn to reflect (i.e., residential households in the service territories of the three IOUs). Given this logic, the survey results can be described as having the levels of statistical accuracy described in the table below. With 95% confidence, we would expect percentage results described in this report for PG&E customers (to choose as an example the first line of data in the table below) to be within +/- 4.4% of the results that would be observed in the "true" population. For results described for the total population, we would expect reported percentages to be within +/- 2.8% (see the last line of the table).

Note that these confidence intervals apply to both basic percentage values reported from the survey, as well as to unadjusted market preference shares estimated using the choice simulators. Estimates of the appropriate confidence intervals to apply to the adjusted preference shares are less subject to precise statistical estimation. As the discussion in the previous section outlines, the unadjusted market preference shares have been adjusted for inertia and risk avoidance to develop market share estimates that do a better job of taking these "real life" issues into account. Due to the fact that these adjustments are in part judgmental, there is no single statistical translation that can be made to estimate the relevant confidence intervals. In order to accommodate this fact, the project team has proposed that, as a conservative estimate, the confidence interval for market shares start with the base estimated confidence interval for the total sample unadjusted shares (+/- 2.8%, for example) be multiplied by three (to account for the two adjustments made over and above the base estimate) (to a maximum value of 8.4%).

Table 2.11: 95% Confidence Intervals for Base Survey Results

		Sample Size	Maximum 95% Confidence Interval
Electricity provider	PG&E	498	+/- 4.4%
	SCE	534	+/- 4.2%
	SDG&E	164	+/- 7.7%
Climate zone	1	150	+/- 8.0%
	2	517	+/- 4.3%
	3	389	+/- 5.0%
	4	140	+/- 8.3%
Home ownership	Own	705	+/- 3.7%
	Rent	491	+/- 4.4%
Type of housing	Single-family	719	+/- 3.7%
	Multi-family	477	+/- 4.5%
Age	65+	101	+/- 9.7%
	35-64	616	+/- 3.9%
	18-34	479	+/- 4.5%
Ethnicity	Hispanic	111	+/- 9.3%
	Other non-white	224	+/- 6.7%
Affluence	>/+ 200% poverty line	906	+/- 3.3%
	< 200% poverty line	190	+/- 7.1%
Total	Total	1196	+/- 2.8%

Confidence intervals for the assessments of value and importance developed through the discrete choice analysis can also be specified. The first table below reports confidence intervals for the estimates of the value (utility) that customers attach to each level of each attribute (these are summarized at the attribute level in the table). Confidence intervals for the estimates of the relative importance customers attach to each of the tested attributes are listed in the last table below.

Table 2.12: 95% Confidence Intervals for Estimates of Attribute/Level Utilities Developed Through the Discrete Choice Analysis

Pricing Discrete Choice Utility Value Confidence Intervals	
Attributes	**95% Confidence Interval**
Bill impact with maximum adjustments (total impact)	+/- 0.06
Bill impact with some adjustments (total impact)	+/- 0.04
Bill impact with no adjustments (total impact)	+/- 0.08
Duration of on-peak periods	+/- 0.09
Frequency of on-peak periods	+/- 0.04
Number of critical days	+/- 0.04
Controls provided	+/- 0.05
Notice of critical days provided	+/- 0.03
Controls Discrete Choice Utility Value Confidence Intervals	
Extensiveness of controls	+/- 0.05
Monthly cost (basic)	+/- 0.02
Monthly cost (moderate)	+/- 0.02
Monthly cost (extensive)	+/- 0.02
Bill impact (total)	+/- 0.02
System programming/control	+/- 0.03

Table 2.13: 95% Confidence Intervals for Estimates of Attribute Importances Developed Through the Discrete Choice Analysis

Pricing Discrete Choice Attribute Importance Confidence Intervals	
Attributes	**95% Confidence Interval**
Bill impact with maximum adjustments (total impact)	+/- 0.8%
Bill impact with some adjustments (total impact)	+/- 0.4%
Bill impact with no adjustments (total impact)	+/- 0.8%
Duration of on-peak periods	+/- 0.6%
Frequency of on-peak periods	+/- 0.4%
Number of critical days	+/- 0.4%
Controls provided	+/- 0.4%
Notice of critical days provided	+/- 0.2%
Controls Discrete Choice Attribute Importance Confidence Intervals	
Extensiveness of controls	+/- 0.6%
Monthly cost	+/- 0.6%
Bill impact (total)	+/- 0.4%
System programming/control	+/- 0.6%

Note that it might be surprising to some readers that the 95% "confidence interval" for Utility Estimates (Table 2.12-2.13 above) tends to be much smaller in magnitude than the equivalent intervals for the Base Survey Results (Table 2.11 above). While anecdotally interesting, such a comparison is not directly useful, however:

- The Base Survey confidence intervals represent bands of sampling error at 95% confidence for a given sample size. For instance, the PG&E sampling error is +/- 4.4%. This reflects a sampling error calculation for a maximum case (proportion of 0.5/50% percentage).
- The Utility Value confidence intervals represent bands of sampling error at 95% confidence for the individual parameter estimates of each attribute, such as the +/- 0.06% around bill impacts with maximum adjustments. The units for the utility estimates are utils (part-worths for each level of each feature, averaged on a feature basis). They **do not** represent a percentage degree of error from the utility estimates, and as a result are not directly comparable to the Base Survey results.
- Further, the Utility Value estimates are total sample calculations, not calculated at a subgroup level as presented. Thus, comparison of relative error to the subgroup Base Survey error is not appropriate.

Even if the Utility Value Estimates and Base Survey estimates **were** on the same metric for an identical sample, the relative magnitude of the sampling errors is not surprising:

- The survey sampling errors can be easily validated by looking at a conventional sampling error formula, based on a single estimation of a variable from a random sample (i.e. no replication within individual).
- The utility estimate sampling errors are calculated from the distribution of utilities around each parameter estimate at the **individual** level, not from a theoretical formula of distribution around 1/0 proportions. Model estimates are taken from Hierarchical Bayesian estimation, and the results are averaged to the total level.
- Thus, with more sensitivity at the respondent level due to the multiple tasks seen by each person, there is less uncertainty about each respondent's estimates. With such replication, we have more power than from a single preference for each respondent (it is the same reason that dependent tests are generally more powerful than independent tests). It is a comparison of multiple, experimentally designed "trials" vs. a single Bernolli "trial". Consequentially, the errors will be smaller in the former than the latter.

Incidentally, the individual utility estimates were the engine behind the results in the "what-if" simulators, not the average utility scores.

Detailed Findings: Distinguishing "Likely Takers" of Time-Differentiated Rates

Perhaps an easy way to start the discussion of customer response to time-differentiated rates is to ask the question: Who would most want to sign-up for such rates? Leaving aside the question for now of how many customers might choose to sign up (under different conditions), we can start with the simpler question of whether or not those most likely to sign up are similar to or different from other customers.

It might be the case, for example, that the customers most likely to sign up for time-differentiated electricity prices are simply a random selection of customers. Alternatively, they might represent certain specific sub-groups that, for one reason or another, find such options appealing. We take up in this chapter the question of which customers are most likely to respond positively if given the option of signing up for a new time-differentiated electricity rate.

Data Used in This Analysis

In order to explore the general question of "who would be most interested in TD (time-differentiated) electricity pricing options," the team used customer responses to four specific "holdout" task questions administered in the survey. Besides the very detailed responses to the discrete choice exercises that will be discussed in the following chapter, customers were also asked four direct questions about their likelihood of participating in each of several specific pricing options.

The pricing options tested in these four holdout tasks were selected because they represented reasonable exemplars of basic TD options such as TOU, TOU/CPP-F, CPP-V, etc. Because it was not possible to administer a large number of holdout tasks, a representative set of such tasks were selected, recognizing that it is perhaps the case that takers for some time-differentiated rate alternatives not tested might be slightly different than those that could be tested.

The objective of these holdout tasks was twofold: first, to provide a direct assessment of customer response to a small set of program options that could be used to assess the results of the discrete choice-based calculations, and second, to provide an easy way to identify "likely takers" for time-differentiated rate options (the question addressed in this section).

Table 3.1 – Pricing Options Tested in the "Holdout" Tasks, And As a Result, Available for Use in the Taker Analysis

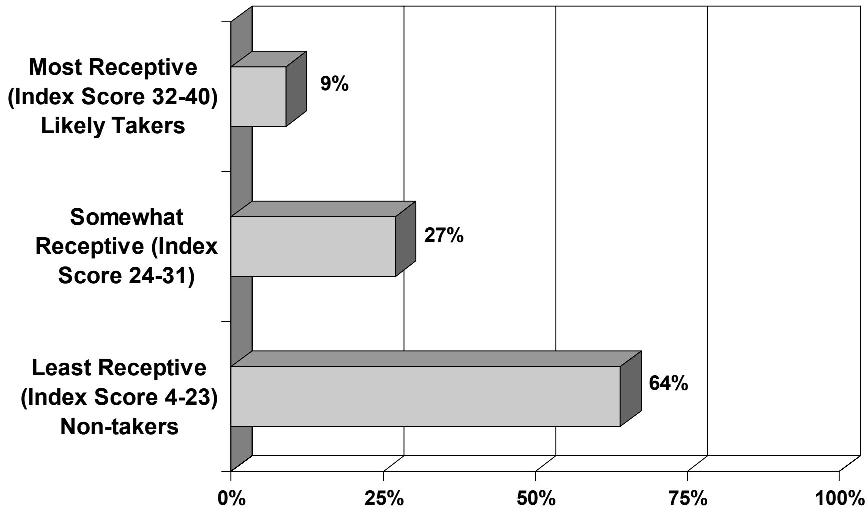
	TOU	CPP-F / TOU	TOU / CPP-F	CPP-V
Monthly Electricity Bill Savings Impact	10% (Max Adjust.) 5% (Some Adjust.) 5%+ (None)	10% (Max Adjust.) 5% (Some Adjust.) 10%+ (None)	20% (Max Adjust.) 10% (Some Adjust.) 5%+ (None)	5% (Max Adjust.) 0% (Some Adjust.) 5%+ (None)
Days when on-peak periods occur	Every weekday	Every weekday	Every weekday	Only on Critical Days
On-peak hours	Always 2-7pm	Always 2-7pm	Always 2-7pm	Varies
Number of Critical days per summer	0	5	20	20
Notice of critical days provided	N/A	Day before	Day before	Day before
Appliance controls provided	No	No	No	No

Using respondents' ratings to each of these product options, an additive index was created that summed each person's rating for each of the four pricing options together to yield a single value. The logic for taking this "additive" approach was because the focus of the inquiry at this point was not to determine if those customers who might respond to TOU options are different than those who might respond to CPP-V options, but to start with a simpler question. Across the different TD options, are "takers" (those most likely to say they would sign up for such options under a voluntary arrangement) different from those who say they would be unlikely to adopt such options.

The arithmetic we used in order to define "takers" vs. "non-takers" was to calculate the sum of the way that each respondent rated each of the four products on a 10-point interest scale. Thus, each person had an additive score that ranged from 4-40 (where a score of "4" meant they rated each pricing option a "1," the lowest possible interest score, and a score of "40" meant that they rated each option a "10," the highest possible interest score).

Respondents were then separated into three categories that ranged from likely takers / most receptive, to non-takers / least receptive. Those with a receptivity score of 32 or higher (roughly equivalent to giving each option a score of 8 or higher on a 10-point scale) were allocated to the taker / most receptive to TD rates group. Those with a receptivity score of 23 or lower (roughly equivalent to giving each option a score of six or less on a 10-point scale) are described as non-takers / least receptive. The sizes of each of these groups are reported in Chart 3.1 below.

Chart 3.1 – Receptivity to Time-differentiated Rates



QDC6 – QDC9. If a pricing plan were available to you now with the specific options listed below, how likely do you think you would be to sign up for this plan? (1=No chance I would sign up; 10=I would definitely sign up) n=1196

<u>It is important to note</u> here that by allocating 9% of customers to the "most receptive" or "likely takers" group, we are not suggesting that it is only this group, or even necessarily all of this group, that is the segment likely to respond to a given TD electricity pricing offering. We are not saying, in other words, that only 9% of all customers are likely to adopt any given TD pricing option if it was offered in the marketplace (issues of market size are taken up extensively later in this report).

Rather, the intent of this analysis is simply to identify the group that is "most likely" to participate across a variety of TD options. The proportion of customers that might be anticipated to select a given TD pricing option if it were offered, might well be larger, or smaller, than 9% depending on how that option was designed and marketed. Regardless of that proportion, however, we would expect the "most likely takers" defined in this analysis to be a core part of the group that would prefer to sign up for whatever TD option that was offered.

Across the variety of different TD pricing options that could be made are the customers who are most positive in their response to those options similar to or different from those less positive in their responses in important ways? Not surprisingly, the answer is "yes," though as always, the more interesting question is "how?"

Distinguishing Most Likely Takers from Non-Takers

Table 3.2 below provides the data that details the differences found between the most and least likely taker groups. Highlights of these differences include that:

- Likely Takers of TD pricing options tend to be open to new products and services generally. While it may be an overstatement to call this group "Innovators," it seems clear that consumers in the "likely taker" group are also open to new products and services generally (they tend to be less "sticky" to existing vendors and more risk accepting when considering options), and to new energy-related products. They are more likely to express interest, for example, not just in the TOU and CPP options embedded in the index used to define them, but also in premium-priced fixed priced plans and real time pricing plans, as well as appliance control options.

- Likely Takers, while having somewhat larger homes, run their air conditioning systems less often than do less likely takers. Across several measures, it is clear that likely takers are substantially less likely than others to run their central air conditioning system regularly – both during weekday afternoons and at other times.

- Likely Takers say they would be responsive in their energy use behavior to TD rates (as they say they were responsive in 2001), much more often than do less likely takers. Likely takers report higher rates of response to the 2001 energy crisis in California, compared to non-takers, and they are even more likely to say that they are continuing the energy conserving actions they started in 2001 today. Even given these reported reductions in energy use, however, they are also more likely to say that they think they would respond to a TD pricing option by making "maximum adjustments" during peak periods.

Table 3.2 – Differences between Those Most and Least Receptive to Time-differentiated Pricing

	Most Likely Takers / Most Receptive	Most Likely Non-Takers / Least Receptive
Interest in Other Alternative Pricing Options / Appliance Controls		
Interest in Premium Fixed Price Per Hour Plan	5.7[1, 2]	4.2
Interest in Real Time Pricing Plan	7.1	4.1
Very Interested in Appliance Controls[3]	43%	4%
Respondent Characteristics		
Least Risk Averse	47%	23%
Most Provider / Product Stickiness	27%	42%
Behavioral Differences		
Reduced electricity use during 2001 crisis	94%	72%
Took 3 or more actions to reduce electricity usage during 2001 crisis	84%	60%
Still taking actions to reduce electricity as much or more since 2001	59%	31%
Would reduce electricity use during all time periods under time-differentiated pricing	64%	27%
Do not find it that difficult to imagine making "maximum adjustments" in their electricity use if on a time-differentiated rate	71%	46%
Would make "maximum adjustments" if on a time-differentiated rate	54%	22%
Differences in Appliance holdings / Appliance use		
Has clothes washer in residence	90%	75%
Never runs Central AC during summer weekday afternoons (2-5pm)	36%	14%
Runs Central AC 4 or more days per week during summer afternoons (5-7pm)	27%	48%
Never runs CAC during other times	40%	15%
Characteristics of Home (Structure)		
Live in a house with 1500 or more square feet	56%	39%

[1] *All differences between the two groups are significant at the 95% confidence level.*
[2] *Mean ratings on a 10-point scale; 1=No interest, 10=Strong Interest*
[3] Calculated index; see "Detail Findings: General Interest in Appliance Controls" for calculation

Detailed Findings: Understanding Customer Response to Specific Pricing Program Features

One of the critical objectives of the research was to develop an understanding of how customers assess the different building blocks of a TD pricing program. Certainly, we expect them to care about the savings that might be implied by any such program, and to attach more value to the expectation of greater savings. But are potential savings the only thing they care about? Does everything else in terms of pricing program design pale in comparison? How much do on-peak hours matter, and to the extent they do, which on-peak periods do they like most (and least)? How much does the number of critical days matter (in CPP designs), and does each addition of critical days matter by the same amount?

In order to understand how to design a pricing program that has the best chance of being successful, or simply to design an option that appropriately takes into account the different tradeoffs that drive customer responses to TD options, it is important to understand first how customers respond to each element of TD options separately. Once we understand how customers evaluate each of the separate building blocks that can be used to construct a TD option, we can explore how to combine those building blocks to create attractive TD options and to estimate how customers are likely to respond to each of several pricing options that could be constructed from those building blocks.

Identifying Pricing Program "Building Blocks"

The first step in this process for the research team was to define the building blocks that could go into defining (or "constructing") a TD option. Ultimately, the team selected the following set of eight TD program building blocks:

- Bill impact with maximum adjustments: This element of a TD program involved describing for customers the savings they would be likely to see if they made "maximum adjustments" in the way they used electricity during peak periods. The questionnaire provided examples for respondents of what it would mean to make "maximum adjustments" and provided different examples for customers depending on their energy usage and whether or not they had electric heat. Bill savings levels tested in the survey varied from:
    - 20%
    - 15%
    - 10%

- Bill impact with some adjustments: This second building block used to define TD options in the research involved describing for customers the savings they might expect if they only made "some adjustments" in the way they use elected during peak periods. As with "maximum adjustments," "some adjustments" were defined for respondents, taking into account respondent energy use and appliance holdings. Bill savings from "some adjustments" could vary from:
    - 10%
    - 5%
    - 0% (no savings)

- Bill Impact with no adjustments: The next building block used to define TD alternatives for customers was to specify the bill impact they might expect if they made "no adjustments" to their usage during peak periods. Unlike the first two bill impact elements, the impact here could be negative. That is, under some scenarios, customers were told that if they made no adjustments, then there bill could actually increase by some amount. Bill impacts from making no adjustments could vary from:
  - 0% (no change)
  - 5% bill increase
  - 10% bill increase

- Duration of on-peak periods: The fourth building block used to define a TD pricing option, and the first that did not involve bill impacts, was to specify the times of the day when on-peak periods would occur. Leaving aside the question for now of on how many weekdays these peak periods would occur, these peak periods were allowed to vary from:
  - 12- 6 pm
  - 12-7 pm
  - 12-8 pm
  - 2-5 pm
  - 2-6 pm
  - 2-7 pm
  - Variable periods (defined as usually 2-7 pm, but sometimes shorter)

- When on-peak periods occur: This element of TD pricing design differentiates pricing options that have on-peak periods every weekday (such as TOU options or CPP-F / CPP-V options with an underlying TOU structure) from those that have on-peak periods only on critical days (such as a pure CPP options).

- Number of critical days: This program building block defines the number of critical peak days in the year (as distinguished from what might be thought of as the "everyday" peak periods that might occur with a TOU option) during which on-peak prices will be particularly high. This element can vary from:
  - 0 days
  - 5 days
  - 10 days
  - 15 days
  - 20 days

- Whether or not appliance controls are provided: One of the ways to make customer response to on-peak pricing easier is to automate their response to on-peak times. If customers were provided with an in-home appliance control system as part of the program design, this type of response would be enabled. This building block specifies whether or not such a control system is to be provided to customers.

- When notice of a critical day event is provided: The final TD building block is when customers are told that a given day will be a critical peak day (assuming the number of such days in the program is more than zero). This program feature could be either that notice was provided the day before a critical peak day was called, or only provided the morning of the critical day.

Given the specification of these building blocks, our next step was to explore how customers assign value to each (i.e., how much they "care" about each). As the Methodology section of this report outlines, the team used discrete choice analysis to understand customer preferences for these different program elements (see the Methodology section for a full discussion of the research tasks used and analysis procedures employed).

How Customers Value the Price-Related Program "Building Blocks"

Our key question at this point was to understand how much customers care about each of the different pricing program building blocks. In part, our question was, which building blocks do they care most about? In addition, however, we also care about understanding how much customers value different program building blocks in comparison with one another (that is, sure they care about savings, but is savings much more important than everything else?), and we care about understanding how much customers value the range of options that each program building block can take (i.e., we would expect them to like 20% savings more than 10% savings, but is the share of customers who would select a time-differentiated program twice as great if they can save 20% than it is if the maximum they can save is only 10%).

The data used to answer these questions are generated from the discrete choice analysis and these calculated values are called "utilities," with the label coming from a traditional economics-based notion of the term "utility" (that is, a measurement of the value that a person assigns to a thing). A "utility" value, in this language then, is simply an arithmetic representation of the relative value that respondents placed on each level of each building block. And while these utility values do not have a direct application or interpretation in the "real world," they are directly interpretable as indicators of the relative value that customers assign to different program building blocks.

Let's take an example. Consider Table 4.1 below. In this table we report average utility values for respondents in the survey (weighted to represent all customers in the eligible universe). What the table says is that, on average, customers assign a mean "utility" value to 20% savings of 1.23. The mean utility value for 15% is effectively zero, while the mean utility value for 10% savings potential is negative 1.21.

What does this tell us? For starters, since the utility value for 20% is positive, and the highest value, it tells us that customers value ("like") 20% savings the most, followed by 15% savings, followed by 10% savings. There is no surprise in those results, but the interesting part comes when we start comparing these results to those for other building blocks[9].

Table 4.1 – Utility Values for Bill Impact with Maximum Adjustments

Bill Impact with Maximum Adjustments	20%	1.23
	15%	-0.02
	10%	-1.21

[9] Note that the fact that the utility values for each building block sum to zero across the different levels is an artifact of the analytic procedure.

Table 4.2 provides comparative utility values across the different bill impact adjustment levels, and in reviewing the different patterns observed, several important outcomes emerge:

1) Customers appear to worry more about potential bill increases that might occur under a new TD pricing program than they care about the savings they might experience. This difference is indicated by the relative size of the extreme utility values for maximum vs. no adjustments. For maximum adjustments the highest positive utility is 1.23, while for no adjustments, the equivalent value is 1.62. While this may not appear to be a large difference, it represents a 32% difference in relative "value" to customers.

   The implication of this difference is that while customers care about – and value – the savings they can realize if they make maximum or some adjustments, they care even more about the possibility of "losing" money if they make no adjustments. The potential of "losing" 10% on their bill more than outweighs the positive value associated with moving from a savings of 10% to a savings of 20% on their bill.

2) Customers do not weigh what might appear to be equivalent economic outcomes the same. Implicit in what we said above is the finding that customers attach more value to a potential "loss" of 10% than a potential "gain" of 10% (moving from a 10% savings to a 20% savings on their bill). Simplistic economics might suggest that customers would be expected to attach a positive value to a potential 10% savings gain that is at least equal to the negative value they attach to a potential 10% loss. This is not the case, however.

   Adding to this asymmetrically is the fact that customers attach more value to the difference between a 10% savings and a 20% savings than they do the difference between a 0% savings and a 10% savings. Logically, both differences are 10% and might be expected to be "valued" equivalently. This is also not the case. In fact, customers attach more value to moving from 10% to 20% than from moving from 0% to 10%.

Table 4.2 – Utility Values for Bill Impacts across Adjustment Levels

Bill Impact with **Maximum** Adjustments	20%	+1.23
	15%	-0.02
	10%	-1.21
Bill Impact with **Some** Adjustments	10%	+1.04
	5%	-0.01
	0%	-1.03
Bill Impact with **No** Adjustments	0%	+1.62
	5% Increase	-0.02
	10% Increase	-1.60

Before moving on, it is worth noting another bit of complexity in the pattern of responses to potential bill impacts. In the choices that customers evaluated in the survey, they did not actually see descriptions of percentage bill impacts. Instead, customers were shown absolute dollar value bill impacts that mapped – in percentage terms – appropriately to their actual (or, at least approximate) bills.

Rather than seeing that a given TD program might save them 10% in other words, they were shown that it might save them $10 (if their bill was $100), or $5 (if their bill was $50). The reason for doing this was to simplify the exercise for respondents (so that they did not have to apply percentages to their own bills in their heads – leaving aside the issue of whether or not they could do so correctly), and to make it more relevant to them.

What this allowed the team to do in addition, however, was to explore the question of the degree to which the total "value" that respondents attach to each amount of potential savings was driven by: 1) the percentage value and 2) the size of their own electric bill. It might have been the case, for example, that everyone attached the same value to a 10% savings. Alternatively, it might have been the case that 10% savings is "worth more" to some respondents than others depending on the size of their bill. Is $10 "worth more" than $12 if they both represent a 10% savings on an electric bill?

The table below answers that question. The table first replicates from above the total value that customers attach to the different levels of savings that might accrue from maximum adjustments. Following this, the table decomposes (or, disaggregates) this total value into the portion that is accounted for by the percentage savings statements and the portion that is accounted for by the absolute size of the respondent's bill (reported as the dollar-metric values).

The results in the table indicate that most of the value associated with "bill impact with maximum adjustments" comes from the percentage statement of the savings (10%, 15%, and 20%). In addition, however, a small amount of additional value is attached to the higher savings values by those people with higher bills. For a 20% potential bill savings, the raw percentage savings contributes +1.06 out of the total of +1.23 total utility, but another +0.18 (or around 15% of the total utility) is contributed by the dollar-metric component. This means that the higher a respondent's current electric bill, the more they tend to like higher savings levels, and that on balance, the size of a respondent's electric bill contributes around 15% to the total value they attribute to a given savings level.

Table 4.3 – Utility Values for Bill Impacts Given MAXIMUM Adjustments Accounting for Dollar-metric Contribution

Total Bill Impact	20%	+1.23
	15%	-0.02
	10%	-1.21
Percentage Bill Impact	20%	+1.06
	15%	-0.02
	10%	-1.04
Dollar-metric Bill Impact	20%	+0.18
	15%	-0.00
	10%	-0.18

Similar patterns appear for the other bill impact values (under "some adjustment" and "no adjustment" options), as the data in Table 4.4 below show. In each case, the directional impact of the dollar-metric values is the same. Those customers with higher bills reinforce the value they give to percentage savings impacts (they tend to "like" a given percentage savings value more than do those with lower bills, and they tend to "dislike" a given percentage potential bill increase more than do those with lower bills).

Table 4.4 – Utility Values for Bill Impacts Given SOME and NO Adjustments Accounting for Dollar-metric Contribution

SOME Adjustments		
Total Bill Impact	10%	+1.04
	5%	-0.01
	0% (no change)	-1.03
Percentage Bill Impact	10%	+0.83
	5%	-0.01
	0% (no change)	-0.82
Dollar-metric Bill Impact	10%	+0.21
	5%	+0.00
	0% (no change)	-0.21
NO Adjustments		
Total Bill Impact	0% (no change)	+1.62
	5% increase	-0.02
	10% increase	-1.60
Percentage Bill Impact	0% (no change)	+1.23
	5% increase	-0.02
	10% increase	-1.21
Dollar-metric Bill Impact	0% (no change)	+0.38
	5% increase	+0.00
	10% increase	-0.38

How Customers Value Non Price-Related Program "Building Blocks"

The different values that survey respondents attached to the other five TD pricing program building blocks are reported in Table 4.5 below. These other building blocks have to do with the number / timing of on-peak periods and other related issues. An examination of this table tells us several things, including that:

- Of these five non price-related attributes, "duration of on-peak periods" is most important (since it is the program feature with the greatest positive and negative utility values among this group). Within this feature, customers most prefer the 2-5 pm on-peak period, followed by the 2-6 pm and the 12-6 pm on-peak periods.

- How often critical peak days occur (whether they are every day or only on critical days) is an important issue for respondents, though less so that on peak hours, and nearly as important as the total number of critical days.

- The number of critical peak days is also relatively important, and what is particularly interesting about this building block is that respondents, while as a general rule, customers prefer fewer critical days, they also actually value having five critical days more highly than they value having zero critical days.

- Issues of Critical Peak notice and whether or not automated controls are provided appear to be less important than other issues.

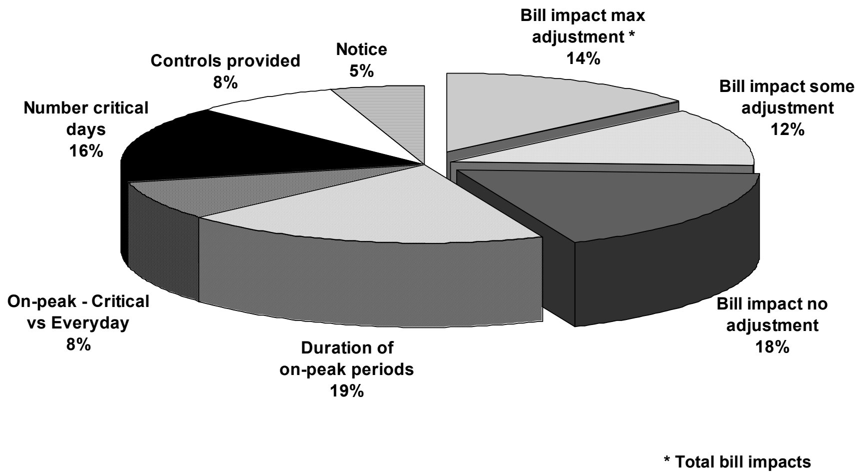
Table 4.5– Utility Values for Non Price-Related Program Features

PROGRAM FEATURE	Level	Utility
Duration of On-Peak Periods	12-6 pm	+0.18
	12-7 pm	-0.46
	12-8 pm	-1.09
	2-5 pm	+0.77
	2-6 pm	+0.54
	2-7 pm	-0.05
	Varies (typically 2-7 pm but could be shorter)	+0.11
How Often On-Peak Periods Occur	Every weekday	-0.43
	Only on Critical Peak days	+0.43
Number of Critical Peak Days	0	+0.25
	5	+0.49
	10	-0.01
	15	-0.23
	20	-0.50
Automated Appliance Controls Provided	No	+0.15
	Yes	-0.15
Notice of Critical Day Provided	The day before	+0.22
	That morning	-0.22

Chart 4.1 below provides an integrated summary of the relative importance of each of the pricing program features tested for predicting customer preference for a TD option. A customer's conclusion about how much they prefer a given TD pricing option might be described as being driven proportionally by the different building blocks that go into defining that option. The reported results say that 19% of a given preference is driven by the duration of the on-peak period and that 18% of that preference is driven by the bill impact with no adjustments, with the other building blocks contributing as indicated. A change in the way a given TD option is constructed that involves the duration of on-peak period should have a much greater effect on overall customer preference than might a change in the timing with which critical peak notice is provided.

It is worth noting that in aggregate the three savings-related program building blocks, taken together, drive 44% of customer preference for a given program design – a significant amount, but less than half. Alternatively, the program building blocks that have to do with when and how often on-peak periods and critical peak days occur, taken together, drive 43% of customer preference for a given program option, essentially equivalent to the contribution for savings potentials.

Chart 4.1 – Relative Importance of Pricing Features



Understanding Customer Variability in Preference for Specific Product Features

While the previous section describes average, or aggregate, information about the way that customers in total evaluate different pricing program building blocks, there is a second question looming here: Do customers differ substantially in the way they respond to these features? That is, do all customers tend to have the same reaction to each program feature – or to the relative importance of the different features – or do some customer groups respond consistently in a different way?

If the latter issue is true – if customers are systematically different in the way they evaluate different TD program building blocks – then this might have important implications for developing a segmented approach to the marketplace. It might mean, in other words, that different program combinations could be appropriate for specific customer groups.

In order to answer this question, the team looked not just at average utility values for each of the levels making up the different pricing program building blocks, but also at the way that different groups of customers assigned value to each feature. The team looked, for example, at customer segments defined by climate zone, utility, demographics (e.g., age, ethnicity, education, income), housing characteristics, appliance stocks, and other attributes, and compared the way each of these different groups assigned utility (or value) to each of the levels of each building block.

The goal of this analysis was to see if there were any patterns in the way that different customer groups assigned value to different features. Do families, for example, assign values to different TD pricing program features in a different way than do single-person households? Do customers in hotter climate zones assign values differently than do customers in cooler climate zones?[10]

Ultimately, while the end result of this analysis might have been very complicated (since there are many possibilities for differences between groups and it is easy to hypothesize ways in which, and reasons for which, different groups may have different opinions on issues such as these), there is a simple, and single, overriding outcome to the analysis[11]. It is that:

○

[10] It is important to recognize that this analysis explores a meaningfully different issue than does the "taker" analysis discussed elsewhere. Here, the issue is to understand which types of customers attach more or less importance to given specific features that can be used to define a time-differentiated program. Taker analysis explores simply which customer groups were generally more or less likely to sign up for a time-differentiated program. Results that might appear to be contradictory (that higher energy users are more likely to be takers, while those who use less energy attach more value to savings levels) are, as a result, not contradictory. In the given example, higher energy users can still be more likely takers, even though lower energy users say that savings have a bigger effect on their decisions, because of the impact of other program features and because of differences in overall interest levels.

[11] Certainly, the analytic team observed a number of other specific differences in the utility values that different specific population subgroups assigned to unique levels of the various particular program features when compared to customers overall. In each of these other cases, however, there did not appear to be any consistent pattern in those differences within subgroup across multiple program building blocks.

- Customers who use *less* energy (as measured indirectly by using other indicators such as climate zone, type of household [single or multi family], presence of electric cooking appliances, and presence of clothes dryer) attach *more* value to the savings that a TD program might yield even after the contribution of actual bill size-to-savings utilities has been taken into account.

In analyzing these results it was found that customers who use less energy tended to assign higher utilities to a given percentage savings level. This means that customers with smaller electricity bills "liked" a given percentage savings level (5%, 10%) more than did an equivalent customer with a higher bill. It was for this reason that the analysis of aggregate utilities included a "dollarmetric" component of utility for each savings level. The data presented earlier described a "total utility" for each savings level that was partly driven by the percentage savings level and partly driven by the average dollar amount of the respondent's electric bill.

What the results in this section suggest is that, once the contribution of a respondent's electric bill to their evaluation of the value of savings is taken into account, customers with lower usage still attach more utility to higher savings levels.

The tables below provide summary information about the impact that other key respondent differences make in the overall utilities respondents assign to basic bill impact measures.

Table 4.6 – Variation in Utilities by Utility Provider

Utility Provider	10% bill impact some adjustments	0% bill impact no adjustments
SCE	.90	1.15
PG&E	.76	1.23
SDG&E	.87	1.60
Total	.84	1.24

Table 4.7 - Variation in Utilities by Presence of AC by Climate Zone

Climate Zone	20% bill impact maximum adjustments	On-peak periods 12-8pm	On-peak periods 2-6pm
Zone 1	1.50	-.08	-.02
Zone 2	1.20	-.87	.50
Zone 3	.93	-.99	.41
Zone 4	1.12	-.84	.42
Total	1.09	-1.09	.54

Table 4.8 – Variation in Utilities by Household Type

Household Type	10% bill impact some adjustments
Single Family	.80
Multi Family	.92
Total	.84

Table 4.9 – Variation in Utilities by Presence of Electric Cooking Appliances

Cooking Appliances	20% bill impact maximum adjustments	On-peak periods 12-7pm	On-peak periods 2-5pm	On-peak periods 2-6pm
Any / All Electric	.94	-.31	.58	.38
No Electric	1.18	-.54	.88	.62
Total	1.09	-.46	.77	.54

Table 4.10 – Variation in Utilities by Presence of Electric Dryer

Clothes Dryer	10% bill impact some adjustments
Yes	.74
No	.90
Total	.84

Table 4.11 – Variation in Utilities by Presence of Electric Heat

Presence of Electric Heat	On-peak periods 12-7pm	On-peak periods 2-5pm	On-peak periods 2-6pm	On-peak periods Varies	0 Critical days	20 Critical days
Yes	-.31	.56	.32	.26	-.03	-.34
No	-.52	.85	.62	.05	.36	-.56
Total	-.46	.77	.54	.11	.25	-.50

Table 4.12 – Variation in Utilities by Household Size

HH Size	On-peak periods – only on critical days
One	.23
Three or more	.44
Total	.43

Table 4.13 – Variation in Utilities by Income

Income	On-peak periods 12-7pm
Below $50K	-.39
Above $50K	-.56
Total	-.46

Detailed Findings: Estimating Market Potential

The focus of the discussion so far has been on understanding how customers assign value to the different building blocks that make up a time-differentiated pricing program. At this point, however, the goal is to move beyond understanding how customers evaluate the different piece-parts of a new pricing program and understand how customers might react to whole pricing programs that could be offered. Specifically, the goals of this section of the report are to:

- Explore for several sample pricing options the way that program design affects anticipated customer response
- Explore the sensitivity of anticipated customer response for a specific program to changes in the details of program design
- Provide estimates for several sample market scenarios of the way that customers might be anticipated to respond to different pricing program market introduction strategies that vary in terms of the number of new TD programs offered and the default condition to which customers are assigned.

The Core Example Pricing Products Used in This Section

The remainder of this chapter uses the ten pricing options listed in Table 5.1 as the central examples used in the analysis of anticipated market response. Five of the ten specific pricing options (labeled as "pilot" in the table) were chosen, in part, because they map as closely as possible to the pricing options currently being used in the residential SPP program[12]. Additionally, several of the rates without TOU components were chosen in part because they represent other new pricing programs that the team viewed as potentially interesting. Additionally, the team felt it would be informative to understand how the "example" rates, modified to include the best possible savings as tested in this design, would fare

> Pricing Product Options
>
> The market simulator provided as an accompanying deliverable to this report makes it possible to estimate customer response to every pricing product that can be defined with variations in the pricing program building blocks specified earlier in this section. The pricing options that can be evaluated cover TOU options, CPP options (with both fixed and variable components), "pure" CPP options (with on-peak periods only on critical days), and others. In total, more than 7,560 different pricing options can be evaluated.

[12] Please note that the team did their best to accurately predict reasonable savings levels possible under each of the electricity usage scenarios presented to customers (maximum, some, and no adjustments in electricity usage behavior). However, hindsight being 20/20, it was found that the savings levels tested did not map as well as hoped once initial analysis was done on the SPP program data. Thus, the "example" rates here come as close as possible to the pilot rates tested given the constraints of our design.

Note also that the way the rate for each of these pricing options was communicated to respondents in the Customer Preferences Market Research was different from how it was communicated to SPP pilot participants, which has implications for our ability to specify the SPP rates using the features and levels tested in the conjoint. While SPP pilot participants were given prices per kwh for off-peak, peak, and super peak times, the CPMR participants were given an explanation of the rate by describing dollars saved for maximum, some, and no adjustments in electricity use behavior. At no time did the survey refer to prices per kwh. So, while perhaps not exact, we have as best as possible attempted to represent the SPP pilot rates through the various combinations of bill impacts at the maximum, some, and no adjustments levels.

against each other. Market response to a wide variety of other pricing programs could be estimated (see the sidebar on "Pricing Product Options"), and the products tested here are intended only as examples of the types of results that can be calculated for each product. The market simulation tool provided as an accompanying deliverable to this report allows analysts to explore anticipated customer response for every TD pricing product that can be estimated from the CPMR database.

Please note that the eleventh option, the current inclining block rate, is also used in this analysis of customer response to various market scenarios. Analysts can choose to include or exclude the current rate (listed as "none" in the market simulator that accompanies this report) in any market simulation, as well as set it as the default or opt-in option.

Table 5.1 – Base Pricing Options for Market Share Analysis

Rate Option	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11
Rate Type	CPP-F (Pilot)	CPP-F (Best Savings)	TOU (Pilot)	TOU (Best Savings)	CPP-V (Pilot)	CPP-V (Best Savings)	Pure CPP-V	Pure CPP-V (Best Savings)	Pure CPP-F	Pure CPP-F (Best Savings)	Current Inclining Block Rate
Bill impact max adjustments 20%, 15%, 10%	10%	20%	10%	20%	10%	20%	10%	20%	10%	20%	
Bill impact some adjustments 10%, 5%, 0%	2.5%	10%	2.5%	10%	2.5%	10%	5%	10%	5%	10%	
Bill impact no adjustments 0%, 5% higher, 10% higher	0%	0%	0%	0%	0%	0%	5% higher	0%	5% higher	0%	
On-peak period 12-6, 12-7, 12-8, 2-5, 2-6, 2-7, Varies	2-7	2-7	2-7	2-7	Varies	Varies	Varies	Varies	2-7	2-7	
On-peak periods occur Every weekday, Only on critical days	Every weekday	Every weekday	Every weekday	Every weekday	Every weekday	Every weekday	Only on critical days	Only on critical days	Only on critical days	Only on critical days	
Number of critical days 0, 5, 10, 15, 20	15	15	0	0	15	15	20	20	20	20	
Controls provided No / Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	No	
Critical day notice N/A, Day before, That morning	Day before	Day before	N/A	N/A	That morning	That morning	That morning	That morning	Day Before	Day Before	

Exploring a Starting Point Market Scenario

Recall that the focus in this section of the report is to translate the specific preferences that customers have for individual pricing program features into estimates of the way that customers might respond to an offer to participate in such programs if they were available in the marketplace today. We care here, in other words, not just about the degree to which customers "like" or "don't like" specific pricing design features, but about estimating how customers would respond in the marketplace if they had an opportunity to sign up for a new TD pricing option that might be offered.

We begin this discussion by working through a simple market scenario. This scenario will give us the opportunity to explore two issues that are critical to understanding the final estimates of anticipated customer response that will be provided later in this section for a selected group of market scenarios:

1) sensitivity to rate design features

2) market-based adjustments to customer share-of-preference estimates

The simple rate design scenario that will be used here to explore these issues is one in which we assume that customers have to express a preference between one of two options: the inclining block rate they are familiar with, or the rate described as the CPP-F (pilot) defined in Table 5.1. Note that for purposes of this example we start with a scenario

Estimating "Share of Preference"

The analytical approach used in this research presupposes that it is possible to estimate how much value individual survey respondents would assign to a new TD product that can be defined by the features tested in the survey. Since we know how each respondent assigns value to each specific program feature, we can essentially add up the value each respondent would attach to the group of features that make up a specifically tested option. The sum of the individual values that each respondent would assign to a given pricing product is called the "total utility" for that product for that respondent (this total utility value is, essentially, a summary quantitative measure of the total value the customer would assign to that product). Given a choice among rate options, the analysis assumes that we can estimate how customers would go about making a choice by comparing the "total utility" values they would assign to each of the tested options. Customers are assumed to be more likely to prefer the option that has the higher calculated total utility. The analysis assumes that customers rarely prefer one option to the exclusion of all others. That is, they probably like one option more than the others (though sometimes there will be ties), but they usually like each option to some degree. As a result, the analysis distributes a given respondent's "preference" proportionally across the available options based on a logistic regression equation. For any given set of rate options, then, the logistic regression analysis yields an estimate of the share (or proportion) of a given respondent's preference that would be allocated to each option (as an example, a given respondent might have an 80% preference for Option1 and a 20% preference for Option 2). The analysis then treats the estimates of share of preference, once they have been weighted and aggregated across all customers as an estimate of the way that customer "share of preference" is distributed across the options. To say that Option A has a 50% share of preference, however, does not mean that 50% of all customers would choose that option in a "live" environment. The issue of translating "share of preference" into "anticipated customer response" is taken up below.

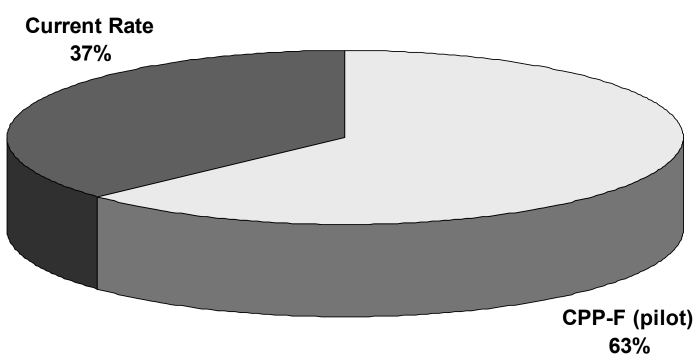
in which customers have to express a preference between these two options, meaning that there is no "starting point" or "default" condition (it is not the case that if they express no preference, then they are assigned to one or another condition; they are only assigned [on a proportional basis] to a condition based on the proportional distribution of their preference across the two options).

We recognize that this situation is atypical and indeed unlikely in the "real world." Even so, we use this example because it represents the simplest, starting point case for market assessment because it means that we are not making any adjustments to account for decision-making inertia, risk avoidance, or any other issues, and allows us to understand initial customer preferences for different options and the ways in which those preferences vary depending on pricing product features.

As a result, it is important to recall for this section that the share of preference estimates provided are an indication of simple, initial estimates of the way that customers would assign preference to different choice options, assuming they were fully aware of each option and that their preferences were completely unconstrained by any other factor. As such, **these share of preference values are not intended to be "market share forecasts" and should NOT be viewed as estimates of "likely market share**." We take up issues of translating estimates of share of preference into best available estimates of anticipated customer response later in this section. The goal for now is simply to explore how sensitive unadjusted share of preference values are to variability in pricing feature design.

Chart 5.1 below provides summary results for the situation described above: customers assign relative preferences to only two options (their current rate and the CPP-F pilot rate). In this scenario, the CPP-F rate achieves a 63% share of preference, while the current rate achieves a 37% share of preference.

Chart 5.1 – Simple Share of Preference: CPP-F (pilot) vs. Current Rate



Sensitivity to Rate Program Design

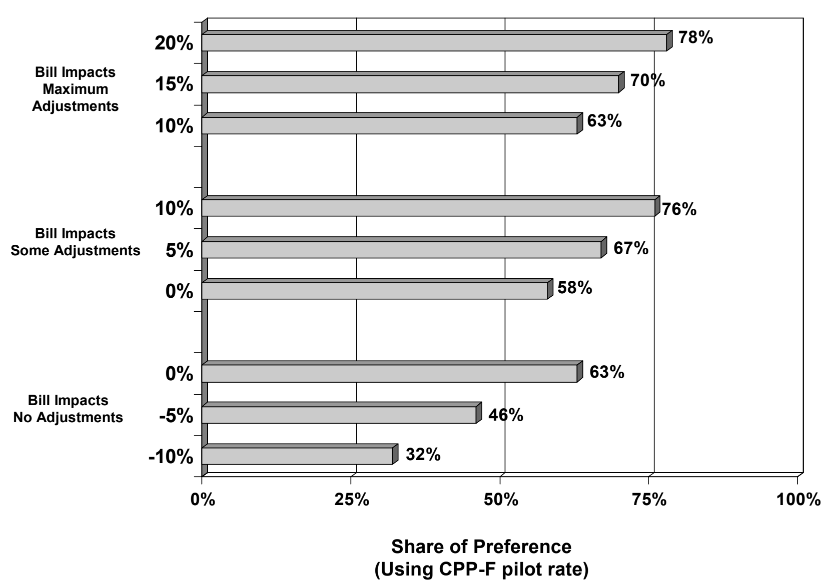
How sensitive is the share of preference for the CPP-F pilot rate to changes in design features, however? We might expect that since the range in utility values was greatest for the "bill impact with no adjustments" feature, that changes in this feature would have the largest effect on share of preference for this option, and that is what happens (see Chart 5.2 below).

The change in share of preference when moving from the most valued level on the "no adjustments" feature (a 0% increase in bill) to the least valued level (a 10% increase in bill) of this feature is larger than the change in share seen for either of the two other bill impact features. If instead of putting the bill impact for "no adjustments" at 0% for the CPP-F option, we put it at an increase of 5%, all other things equal, the share of preference for the CPP-F option decreases by 17 percentage points (from 63% to 46%). If we were to put the bill impact for no adjustments at a 10% increase, the affect is even more dramatic. At this level, the share of preference for CPP-F drops by 31 percentage points (from 63% to 32%).

In total, the difference in share of preference from worst (least valued) to best (most valued) levels of the "bill impacts with no adjustments" feature is 31 points (from 32% to 63% share of preference). For "some adjustments" (going from 0% savings to 10% savings), this range is 18 points (from 58% to 76%), and for "maximum adjustments" (going from 10% savings to 20% savings) this range is 15 points (from 63% to 78%).

What these data suggest is that customers more highly value avoidance of a potential negative outcome (i.e., the risk of an increase in their bill) than they value an equivalent positive outcome (i.e., the possibility of a bill reduction).

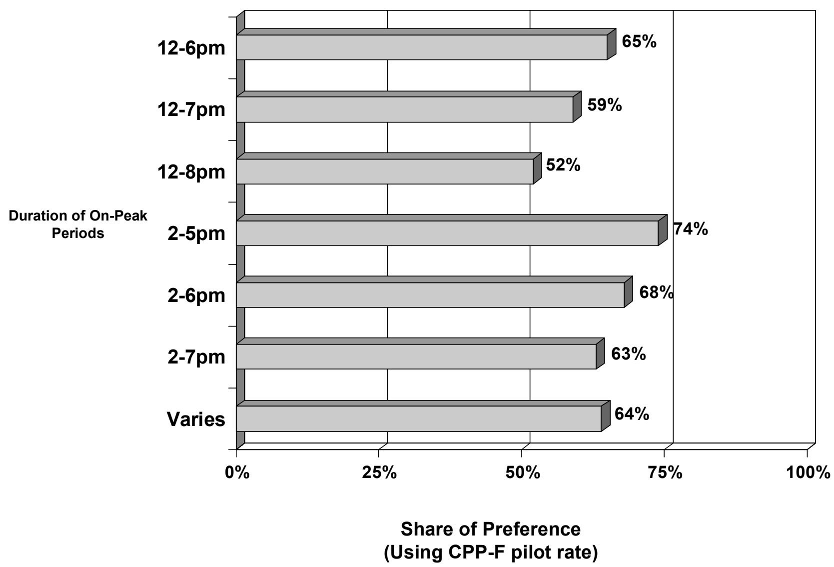
Chart 5.2 – Sensitivity to Differences in Bill Impacts



The next share of preference sensitivity issue to consider is to explore the potential impact of changing the duration of the on-peak periods. If the peak period started earlier or ended later, how large of an effect would this have on share of preference?

The data in Chart 5.3 indicate that share of preference is not correlated solely with number of hours of on-peak period, but more to when those hours occur, with hours earlier in the day affecting share of preference less than hours later in the day. Consider, for example, that changing the on-peak period from 2-7 pm to 12-6 pm (increasing from a five hour on-peak period to a six-hour on-peak period) actually increases share by 1% in this scenario.

Chart 5.3 – Sensitivity to Differences in Duration of On-Peak Periods



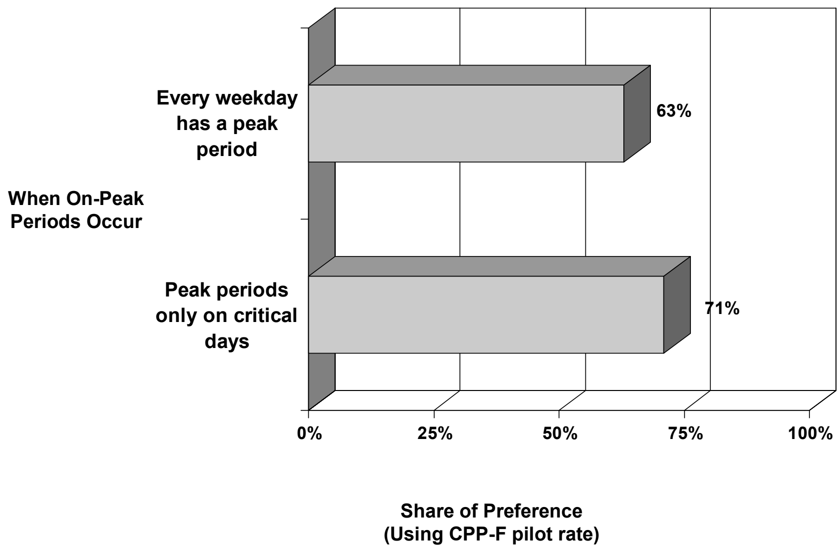
A review of the chart suggests two interesting things:

1) Each additional hour at the end of the day appears to have about the same cost to share-of-preference. That is, for example, moving from an end time of 5 pm to 6 pm, or from 6 pm to 7 pm, or from 7 pm to 8 pm all have a cost in share of preference of 5-6 percentage points, regardless of the start time. There is nothing to suggest, as a result, that the 6-7 pm hour is particularly more valuable to respondents in comparison to the 5-6 pm hour or the 7-8 pm hour.

2) Adding *two hours* earlier in the day (moving the start time from 2 pm up to noon) has about the same cost (4-5 percentage points) in share of preference as moving the end time by *one hour*.

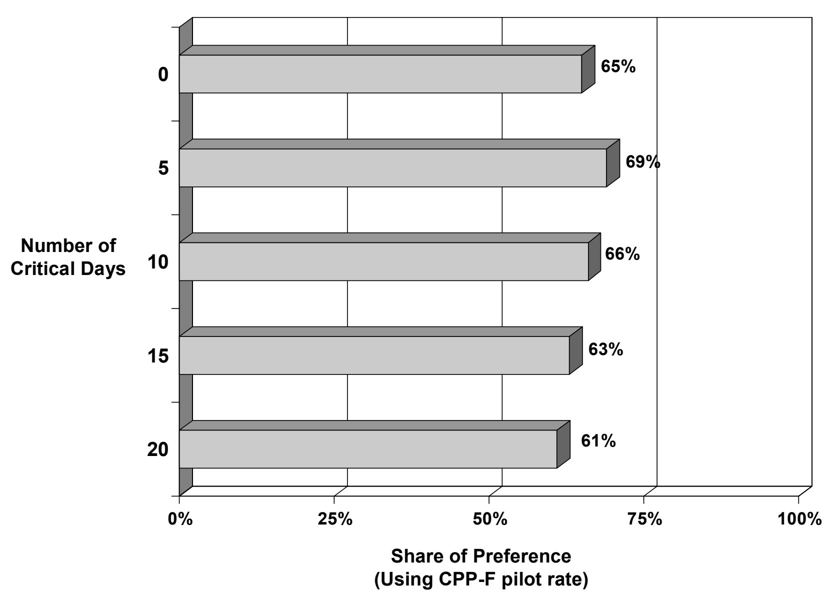
As the next issue in the sensitivity analysis, we consider the impact of moving from a CPP-F rate that has a TOU component to a “pure” CPP-F rate that has peak periods only on Critical Peak days and not on any every weekday basis. It might be surprising to see that, while there is an impact on share of preference with this change, that impact is not great (see Chart 5.4).

Chart 5.4 – Sensitivity to Differences in Occurrence of On-Peak Periods



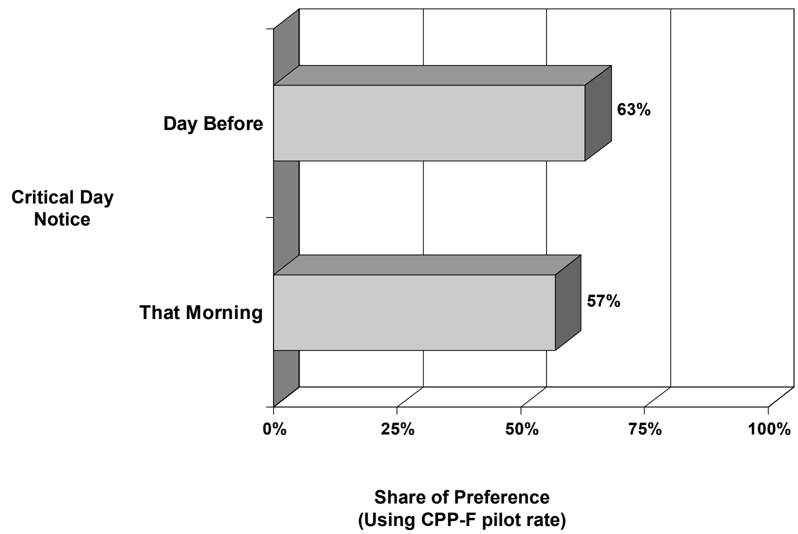
In looking at the sensitivity customers have to the number of critical days, the drop in share of preference for moving from 5 to 20 critical days is 8 percentage points, suggesting customers are not hugely sensitive to the number of critical days included in a rate design. The biggest drop in share of preference occurs when moving from 5 to 10 critical days. As a result, if a decision were made that a rate design required at least 10 days, these results suggest that little is lost in customer preference in terms of share by increasing this to 15 or even 20 critical days.

Chart 5.5 – Sensitivity to Differences in Number of Critical Days



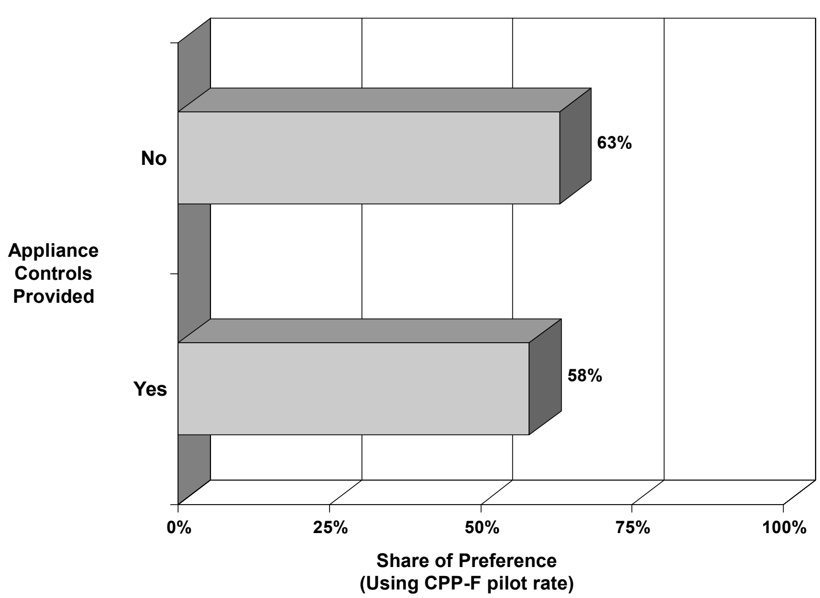
In considering the sensitivity of share of preference to differences in advance notification timing, the results in Chart 5.6 below suggest that share of preference is lower with later notification, though again the difference is not dramatic (only 6 percentage points).

Chart 5.6 – Sensitivity to Differences in Critical Day Notice



As the final issue in this section, we explore changes in share of preference for the CPP-F rate if appliance controls were provided along with the rate (rather than no appliance controls as is the case with the current rates customers face) and find that share of preference actually drops slightly (from 63% to 58%) when controls are offered.

Chart 5.7 – Sensitivity to Differences in Inclusion of Appliance Controls



In order to summarize the sensitivity analysis across the various features that can be used to construct a new time-differentiated pricing option, the team calculated share of preference estimates for each of several products that help to define the maximum and minimum preference shares that are possible for the time-differentiated rates tested in this work.

Chart 5.8 reports share of preference values for each of four different pricing options that, taken together, provide a sense for how much variability in share of preference is created by considering the most extreme differences in product features:

- The "worst possible" rate is defined as the pricing option that has the least valued level on every product feature
- The "best other features/worst price" rate has the least attractive bill impact/savings values, but the most valued levels on all on the non-price features
- The "best price/worst other features" rate has the highest savings levels across the board, but the least preferred levels on each of the other features
- The "best possible" rate has the most desired levels on every product features

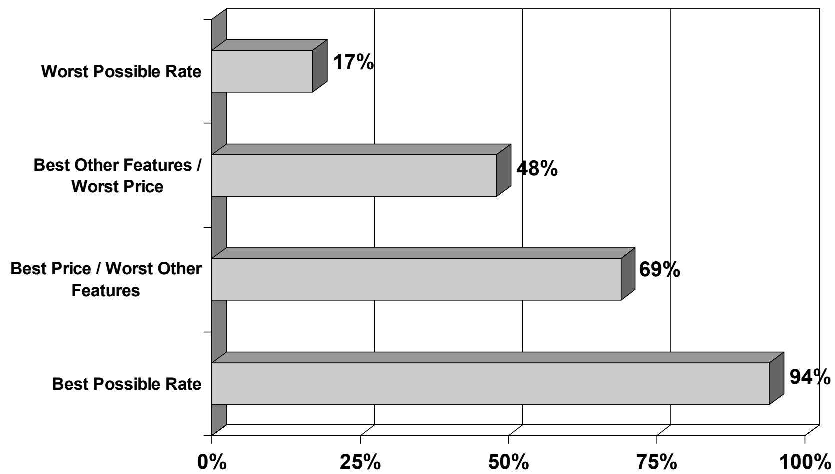
The results of this analysis indicate that the share of preference between the best-possible and worst-possible rates is huge (as we would expect) (with the "best" program getting 77 percentage points more share than the "worst" possible program). What is also interesting, however, is that, while price / savings levels have the largest effect on preference, non-price features account for a substantial portion of differences in preference between rate options. Adding all of the "best" non-price product features to the worst possible product in terms of savings offered, for example, improves its appeal by 31 percentage points. A "bad" rate, in other words, defined in terms of its savings potential, can be made substantially more attractive by improving its non-price features. Similarly, a "good" rate – defined as one that offers the best possible price / savings potentials – can be made substantially less attractive by reducing all of the non-price features to worst-possible levels (this reduces the share of preference for the "best" savings rate by 25 percentage points).

Changing all of the price/savings levels from best to worst, however, has a larger effect. Moving from the "worst" rate, for example, to the rate that is worst on non-price features, but has the best price/savings levels, improves share of preference by 52 percentage points (from 17% to 69%). Similarly, changing from having the "best" product to the product that has the worst savings/price levels but the best non-price levels loses 46 points of preference share (from 94% to 46%).

In total, the maximum impact of savings/price variation vs. non-price program features in driving share of preference is something on the order of a 2:1 ratio. A maximum of 50 points in share of preference change can be attributed to changing from best to worst prices, while a maximum of 25-30 points of difference in share of preference change can be attributed to the impact of non-price program features.

This means that, while price / savings level is the most obvious way to affect customer preference, significant differences in customer response can be expected if non-price program features are allowed to vary. A program with very attractive savings levels can still be relatively unattractive if the non-price features are unattractive. Alternatively, a rate option with less attractive savings values can be made substantially more attractive with the right non-price features.

Chart 5.8 – Sensitivity to "Best" and "Worst" Pricing Product Options

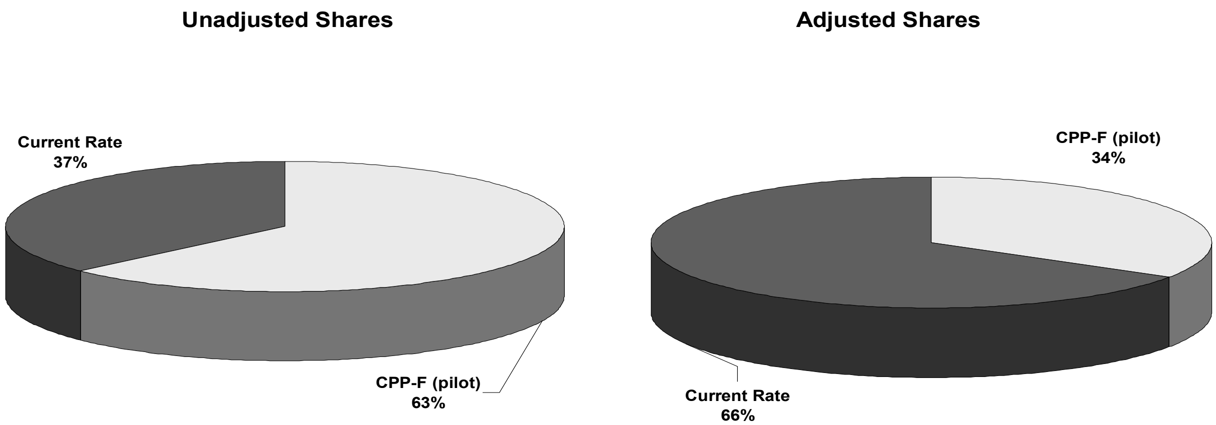


Estimating Customer Response to Baseline Rate Offering Scenarios

Now, let's turn to the issue of estimating how customers would respond in the marketplace, taking into account issues of risk avoidance, inertia, and awareness, if they had an opportunity to sign up for a new CPP-F pricing option that might be offered.

Chart 5.9 on the following page provides summary results for a scenario in which customers were on their current rate and given the opportunity to sign up for the CPP-F pilot rate. Once customer inertia and risk avoidance (see the discussion in the Methodology section of this report for a discussion of how these issues were accounted for), and initial preferences for the current rate are adjusted for these factors, the estimated likely share for the CPP-F pilot rate drops from 63% to 34% and the share of preference for the current rate increases from 37% to 66%.

Chart 5.9 – Simple Share of Preference, Adjusted and Unadjusted Starting Condition = Current Rate



In addition to the issues of customer inertia, risk avoidance, and preference for the current rate that will naturally impact choices customers make in the marketplace, we have the issue of awareness to contend with. While it is common and easy to assume for purposes of customer modeling that awareness of new options will be 100%, this is simply not realistic. For this reason, we have also provided estimates of anticipated market response that also account for the fact that some, but not all, customers are likely to be aware that they may have other than their default condition options. Since it is not possible to estimate awareness on a respondent-by-respondent basis, and since awareness will vary depending on the scale and effectiveness of the communication efforts, we have provided estimates for "High Awareness" (70% aware), "Moderate Awareness" (50%), and "Low Awareness" (30%) conditions.

Under a scenario in which the current inclining block rate is the default, decreases in awareness will result in decreases in overall share for the TD rates. A lack of awareness of the option to opt-in to a time-differentiated rate would necessarily result in a larger number of customers remaining on their current inclining block rate. Thus, taking the market share estimate of 34% for the CPP-F pilot rate reported in Chart 5.9, we would expect this share to drop to 24% if there was 70% awareness, to 17% with 50% awareness, and to 10% with 30% awareness.

The remainder of this section investigates 26 other market scenarios using the 10 rate options specified in Table 5.1 and provides estimates of anticipated customer response that take into account inertia and risk avoidance factors (by making appropriate adjustments on a respondent-by-respondent basis to adjust for the impact of these factors), and which account for different potential levels of market awareness of the pricing options available. These scenarios are grouped into four general types of scenarios:

1) Market scenarios in which customers begin on their current rate and are given the option to opt-in to a single TD rate.
2) Market scenarios in which the customer is placed on a TD rate and given the option to opt-out of that rate back on to their current rate
3) Market scenarios in which the customer begins on their current rate and are given the option to opt-in to two different TD rates.
4) Market scenarios in which the customer begins on a TD rate and is given the option to opt-out of the rate back on to their current rate or another TD rate.

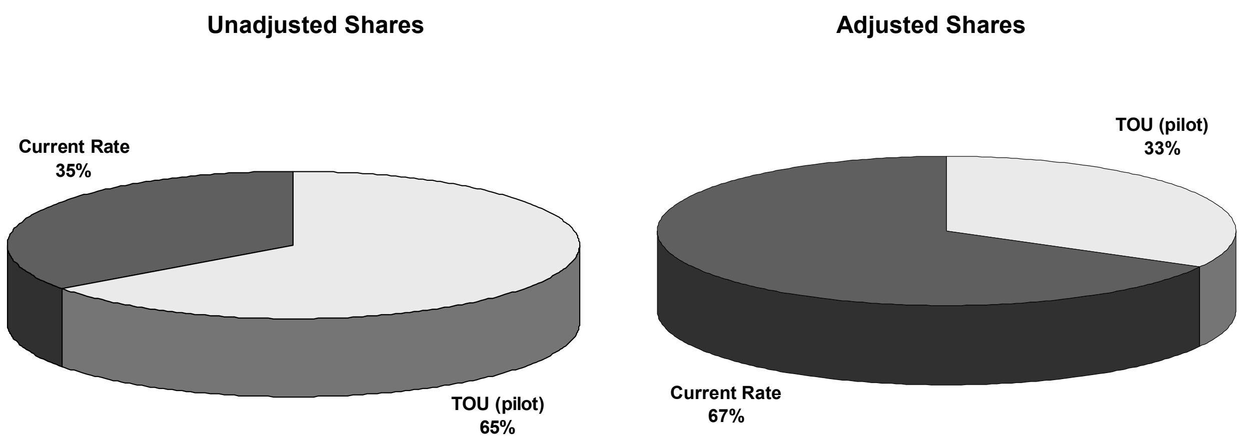
Again, there are numerous market scenarios that could be created, but for simplification purposes, this report will be limited to these 27. These scenarios were chosen with input from the three IOUs and other interested parties and were constructed using the following assumptions:

- In actual practice, any set of options offered in the marketplace will include the current inclining block rate and, thus, this option is included in all but one of the 27 scenarios.
- The starting condition could be today's rate or any of the new rates. Thus, all scenarios look at the take rates with both today's rate as the starting condition as well as some other rate as the starting condition.
- In practice, CPP-F and CPP-V will never be offered together, so we have not included both options together in any of these scenarios.

Before reviewing each of the other 26 scenarios, it is worth repeating a bit of caution about how such results should be interpreted. The results obtained by this simulation exercise should not be interpreted as market share estimates, strictly speaking. In actual practice, there are many external factors that may limit market share that cannot be accounted for in a survey setting. We have attempted to account for these issues as much as possible, but recognize that any specific market implementation will have its unique complications and idiosyncrasies.

The next scenario investigates the anticipated customer response obtained if instead of allowing customers to opt-in to the CPP-F pilot rate, they were allowed to opt-in to the TOU pilot rate (again, these rates are described in Table 5.1 on page 77).

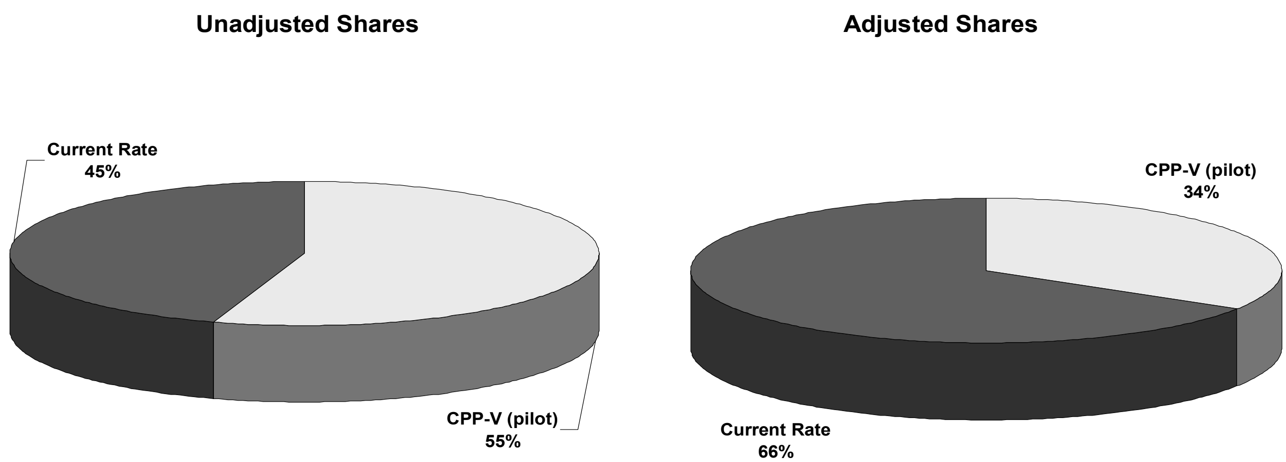
Chart 5.10 –Share of Preference, Unadjusted and Adjusted Starting Condition = Current Rate



After adjusting for inertia and risk, the TOU pilot rate receives a 33% share of preference, which is only slightly less than the adjusted share for the CPP-F pilot rate (34%).

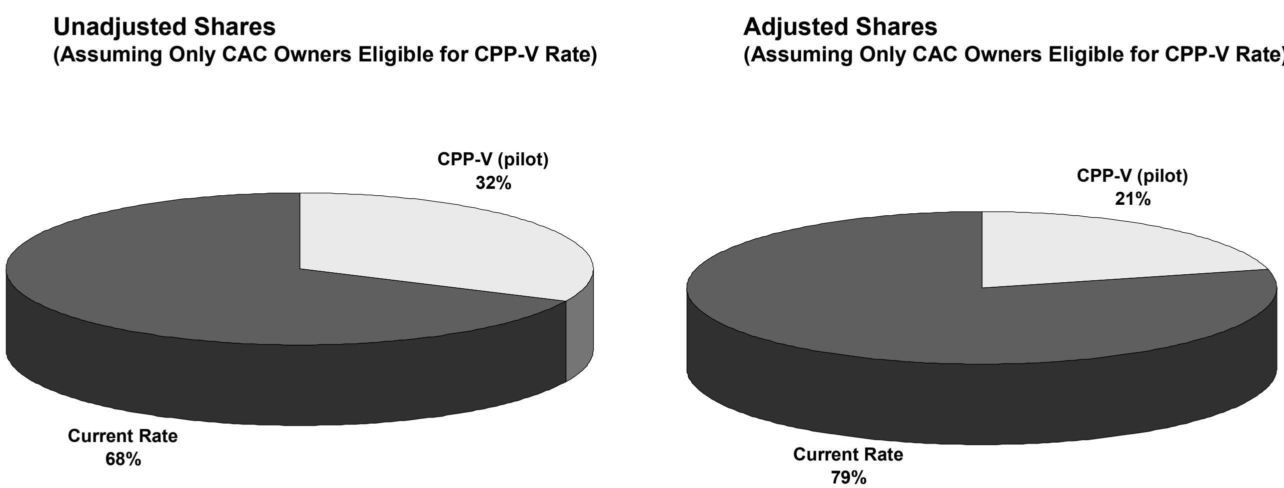
What happens if instead of the TOU or the CPP-F pilot rates, the CPP-V pilot rate was offered as an opt-in option? The CPP-V rate comes with the option to use a utility-provided appliance control system to help customers control their energy usage. Assuming this rate would be available to all customers, regardless of the presence of specific appliances in their home, after adjusting for inertia and risk, the CPP-V rate receives a 34% share of the preference (see Chart 5.11 on the following page).

Chart 5.11 –Share of Preference, Unadjusted and Adjusted Starting Condition = Current Rate



However, if the CPP-V rate required that customers own at least central air conditioning (CAC) that could be used with the appliance control system to take part in this rate, this would result in a drop in share since only 51% currently own and pay for their CAC. Adjusting for risk and inertia, there is a 13 percentage point drop in share (to a 21% share) (See Chart 5.12 below).

Chart 5.12 –Share of Preference, Unadjusted and Adjusted Among CAC Owners, Starting Condition = Current Rate



Note that there is relatively little variability in the share achieved for the CPP-F, TOU, and CPP-V pilot rates tested here, and that similarly, the "pure" CPP-F and CPP-V rates tested also generate similar response. The largest variance in customer response that does occur (with CPP-V) is driven by a scenario in which a significant portion of the population (49%) would not be eligible for the CPP-V rate if it required presence of central air conditioning paid for by the customer.

What would happen if instead customers were given the option to opt-in to one of these time-differentiated rates constructed such that each offered the best possible savings (20% savings for maximum adjustments, 10% savings for some adjustments, and no savings for no adjustments)? The results are quite similar.

Though overall share is much larger (by approximately 13 percentage points), there is little variability between the CPP-F, TOU, and CPP-V pilot rates, with each achieving 47%, 47% and 45% share respectively. A CPP-V rate offered only to CAC owners at the best possible savings, however, does only marginally better than our original example CPP-V rate, achieving a 28% share (vs. a 21% share).

As noted previously, given a market scenario in which the current inclining block rate is the starting or default condition, decreases in awareness will result in reduced share for each of the TD rates. Table 5.2 summarizes these results on the following page.

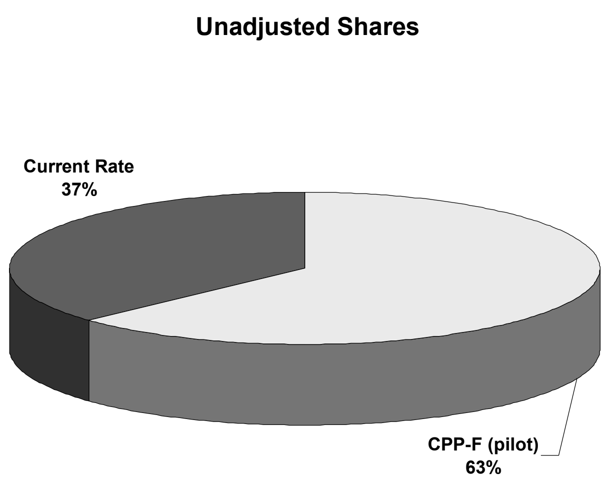
Table 5.2 – Market Scenarios with Starting (Opt-in) Condition Set as Current Inclining Block Rate

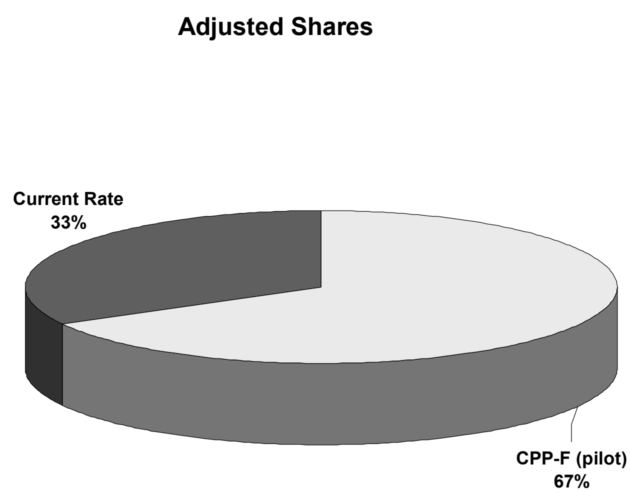
Starting / Default Condition	Opt-in Condition	Share for T.D. Rate (Adjusted for Risk Avoidance and Inertia)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 70% Awareness)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 50% Awareness)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 30% Awareness)
Current Rate (CR)	CPP-F (pilot)	34%	24%	17%	10%
CR	TOU (pilot)	33%	23%	17%	10%
CR	CPP-V (pilot - *assumes available to all*)	34%	24%	17%	10%
CR	CPP-V (pilot – *assumes available only to those with CAC*)	21%	15%	11%	6%
CR	"Pure" CPP-F	31%	22%	16%	9%
CR	"Pure CPP-V (*assumes available to all)*	30%	21%	15%	9%
CR	CPP-F (Best savings)	47%	33%	24%	14%
CR	TOU (Best savings)	47%	33%	24%	14%
CR	CPP-V (Best savings – *assumes available to all*)	45%	32%	23%	14%
CR	CPP-V (Best savings – *assumes available only to those with CAC*)	28%	20%	14%	8%

Thus, in a situation where customers would have the option to opt-in to one of these time-differentiated rates constructed similarly (though not identically) to the SPP pilot rates, we would expect any one of them to get about a third of electricity customers doing so, with the remaining two-thirds opting to stay with the current rate under a condition of 100% awareness of these options. However, as seen in Table 5.2 above, it is possible for a rate to achieve a larger share of preference than a third if a sufficiently attractive rate (albeit possibly unrealistic) is constructed, again with 100% awareness. With more likely assumptions about awareness levels (50-70%, for example), opt-in rates are more in the 15-25% range.

Now, what if customers are first put on a time-differentiated rate and then given the option to opt-out of that rate and back onto the current rate? How is the share of preference impacted? Taking first as our example the CPP-F pilot rate (see Chart 5.13 below), as one might expect, the share of preference for this rate increases dramatically in this scenario, from a 34% share of preference when customers opt-in to the rate, to a 67% share of preference when customers must opt-out of the rate, a 33 percentage point increase.

Chart 5.13– Share of Preference, Unadjusted and Adjusted Starting Condition = CPP-F (pilot)

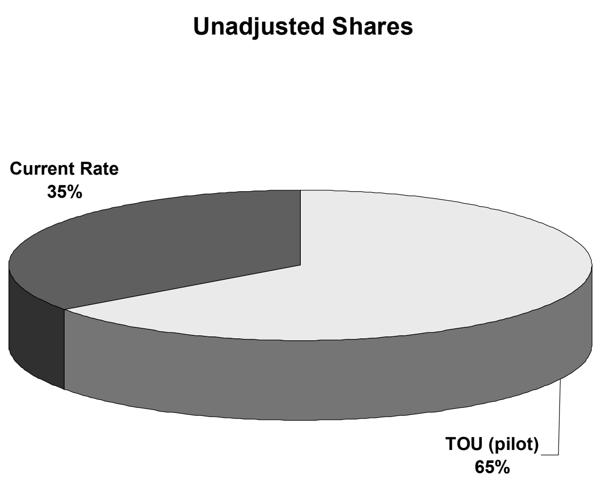


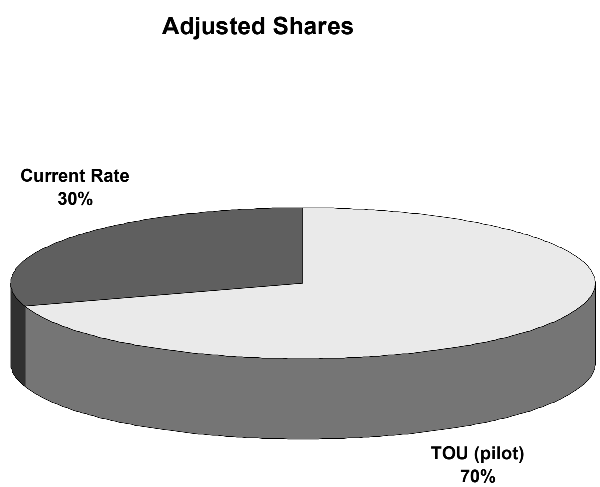


In scenarios such as this one where the TD rate is the default rate on which all customers are placed, a lack of awareness works to increase the share for these rates. In the case of the CPP-F pilot rate, if we were to assume 70% awareness, share would increase by 10 percentage points. If instead only 50% of customers were aware of the options available to them the resulting share would increase by 16 percentage points. A 30% awareness level would result in an increase of 23 percentage points.

Now, if the rate on which customers are started on is instead the TOU example rate, similar results are found. Setting the TOU rate as the default results in a 37 percentage point increase in share, only slightly greater than the share of preference achieved by the CPP-F rate (3 percentage points greater).

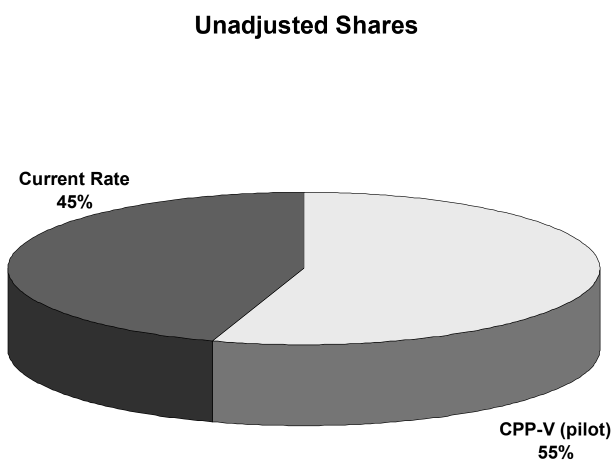
Chart 5.14 –Share of Preference, Unadjusted and Adjusted
Starting Condition = TOU (pilot)

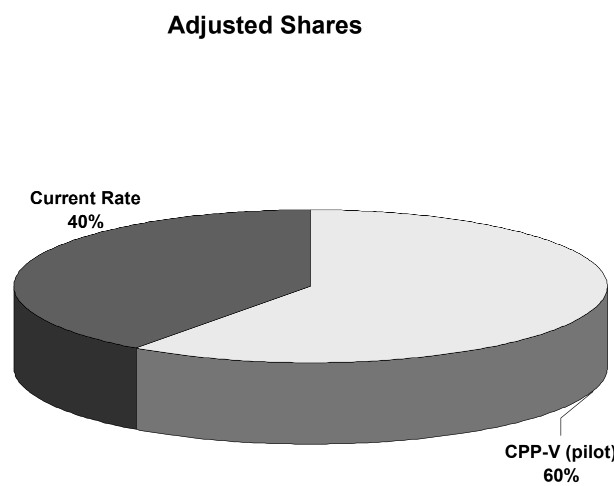




However, when the CPP-V example rate is set as the default or opt-out rate, the results are not quite as dramatic. Putting the CPP-V rate as the default does increase its share of preference, but only by 26%. Furthermore, the share of preference the current inclining block rate garners when it is the default (66%) is a bit higher than the share received by the CPP-V rate when it is set at the default (60%). In this case it appears that the current rate has more value than this particular time-differentiated rate, due to the inclusion of an appliance control found less appealing overall by customers and critical day notice that comes the morning of an on-peak period.

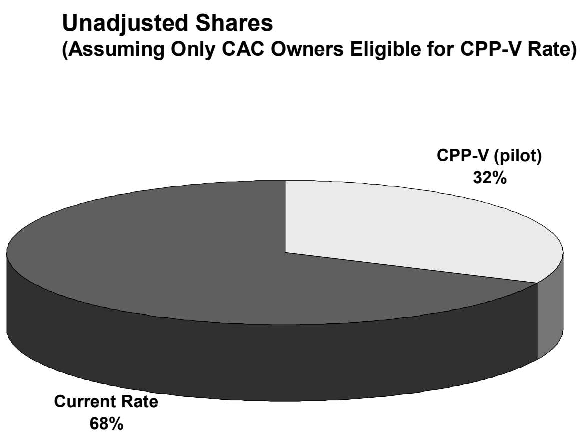
Chart 5.15 –Share of Preference, Unadjusted and Adjusted Starting Condition = CPP-V (pilot)

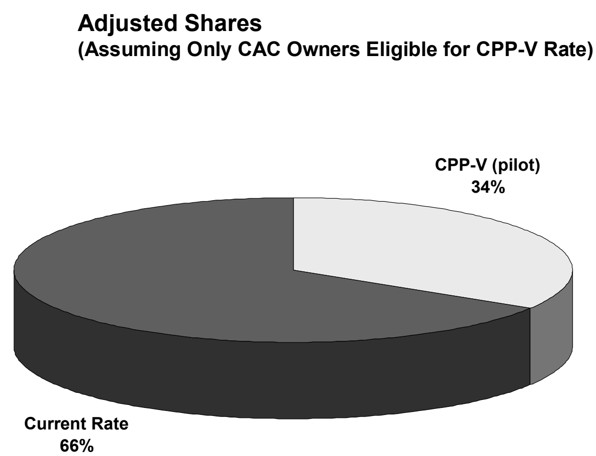




The increase in share is even less dramatic for the CPP-V rate if available only to CAC owners. When set as the default rate, its share increases only by 13 percentage points, increasing from 21% to 34%

Chart 5.16 –Share of Preference, Unadjusted and Adjusted, CAC Owners, Starting Condition = CPP-V (pilot)





Estimating Customer Response to Best Savings Rate Scenarios

Again, what would the result be if the TD rate that customers were placed on was constructed such that each offered the best possible savings (20% savings for maximum adjustments, 10% savings for some adjustments, and no savings for no adjustments)? The results are quite similar, only to a larger magnitude.

Overall share increases by approximately 22 percentage points for both the CPP-F and TOU rates, leaving them with roughly equal share. Alternatively, if the CPP-V rate is constructed with the best possible savings, a 26 percentage point increase in share for this option is the result, with the increase in this share for this option coming from the shares for the CPP-F and TOU rate options. The highly desirable savings potential seems to help overcome some of the less appealing aspects of the CPP-V rate. However, if the CPP-V rate with the best possible savings is only offered to customers with CAC, share increases by a much smaller margin – 11 percentage points.

As noted previously, given a market scenario in which a time-differentiated rate is the starting or opt-out condition, decreases in awareness will result in increased share for each of the TD rates. Table 5.3 summarizes these results.

Table 5.3 – Market Scenarios with Starting /Default Condition Set as a Time-Differentiated Rate

Starting / Default Condition	Optional Condition	Share for T.D. Rate (Adjusted for Risk Avoidance and Inertia)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 70% Awareness)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 50% Awareness)	Share for T.D. Rate (Adjusted for Risk, Inertia, and Awareness – 30% Awareness)
CPP-F (pilot)	Current rate (CR)	67%	77%	83%	90%
TOU (pilot)	CR	70%	79%	85%	91%
CPP-V (pilot - *assumes available to all*)	CR	60%	72%	80%	88%
CPP-V (pilot – *assumes available only to those with CAC*)	CR	34%	39%	42%	46%
CPP-F (best savings)	CR	89%	92%	94%	97%
TOU (best savings)	CR	91%	94%	95%	97%
CPP-V (best savings – *assumes available to all)*	CR	86%	90%	93%	96%
CPP-V (best savings – *assumes available only to those with CAC)*	CR	45%	47%	48%	49%

Thus, in a situation where customers are placed on a time-differentiated rate roughly resembling the SPP pilot rates but given the option to opt-out to their current inclining block rate, we would expect (at most) roughly two-thirds of customers to remain on the rate with about a third deciding to opt-out of the TD rate.

Furthermore, depending on actual levels of awareness achieved, an even smaller percentage may choose to opt-out of the TD rate.

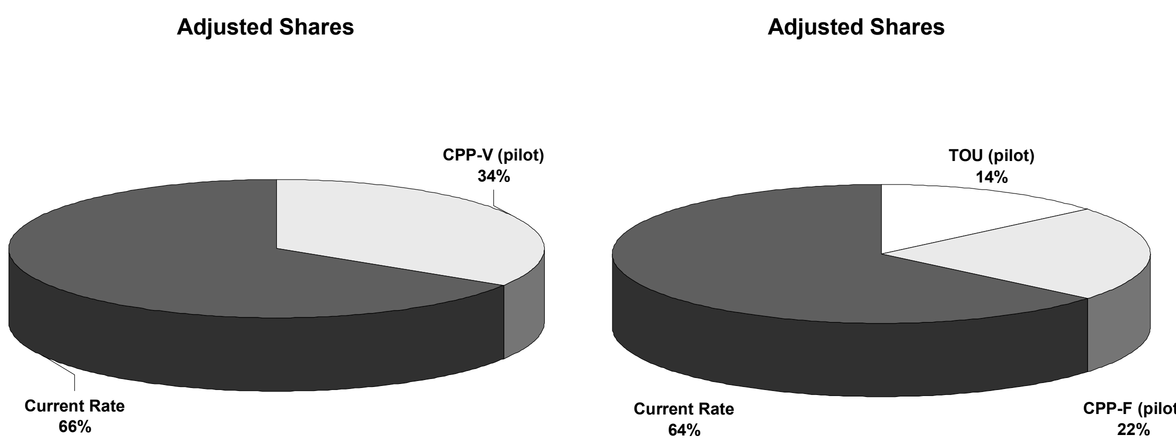
Also, as suggested in Table 5.3, an even larger number of customers could potentially stay on the TD rate if an even more attractive rate were constructed, assuming that such "best savings" rates could be implemented. Assuming a rate could be constructed with the best possible savings and which would be available to all customers, the utilities might expect to have 86-91% of their customers remaining on the TD rate. The percentage on these TD rates would increase slightly as levels of awareness decreased. If only CAC owning customers were placed on the CPP-V rate, however, the utilities could expect approximately 45-49% of their customers to remain on this rate.

Estimating Customer Response to Multiple TD Rate Offering Scenarios

The next set of scenarios considers the impact of having all customers begin on the current inclining block rate and allowing them to opt-in to not just one, but two different time-differentiated rates. How many more customers, if any, would choose to opt-in to a TD rate if given two options?

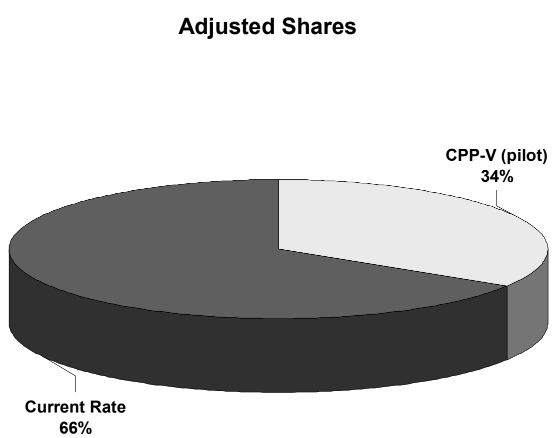
Recall that when given the option to opt-in to the CPP-F pilot rate, 34% would opt to do so, with 66% remaining on the current rate (assuming 100% awareness). How many more customers would opt-in to a TD rate if, in addition to the CPP-F pilot rate, the TOU example rate was also offered? As seen in Chart 5.17 on the following page, offering a second time-differentiated rate increases the total number of opt-in switchers, but only by 2%. Furthermore, rather than attracting greater numbers of switchers, the TOU rate acts to steal share from the CPP-F pilot rate.

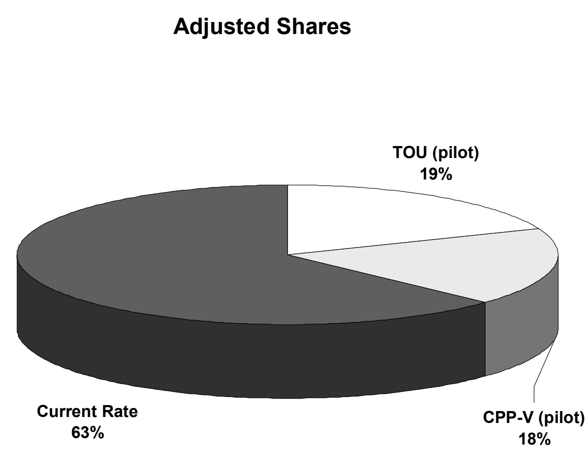
Chart 5.17 – Share of Preference, Adjusted
Starting Condition = Current Rate



Again, consider a situation in which the default rate is the current rate, but in addition to offering the CPP-V pilot rate, the TOU pilot rate was also offered. Would any more customers decide to opt-in to a time-differentiated rate? Again, the total number of those choosing to switch to a time-differentiated rate is only slightly higher, with an increase of only 3%. And, as seen previously, the TOU pilot rate actually steals share from the CPP-V rate rather than just encouraging customers to switch from the current rate to a time-differentiated rate.

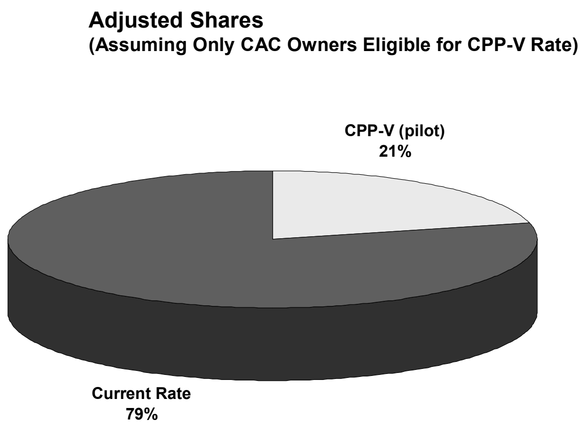
Chart 5.18 – Share of Preference, Adjusted
Starting Condition = Current Rate

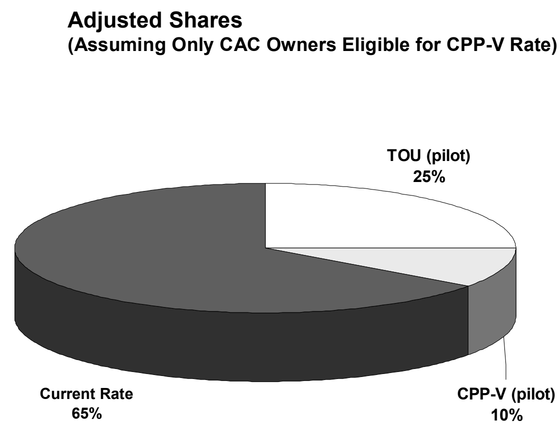




However, if the CPP-V rate is offered only to those with CAC, the result of offering a second TD rate (and, consequently, one that would be available to all customers) is much more dramatic. In this case, offering the TOU pilot rate increases the number that choose to opt-in to a time-differentiated rate by 14%. Furthermore, in addition to attracting customers away from the current rate, the TOU also attracts customers away from the CPP-V rate as well, reducing the number that would opt-in to the CPP-V rate that is available only to CAC owners by 11%.

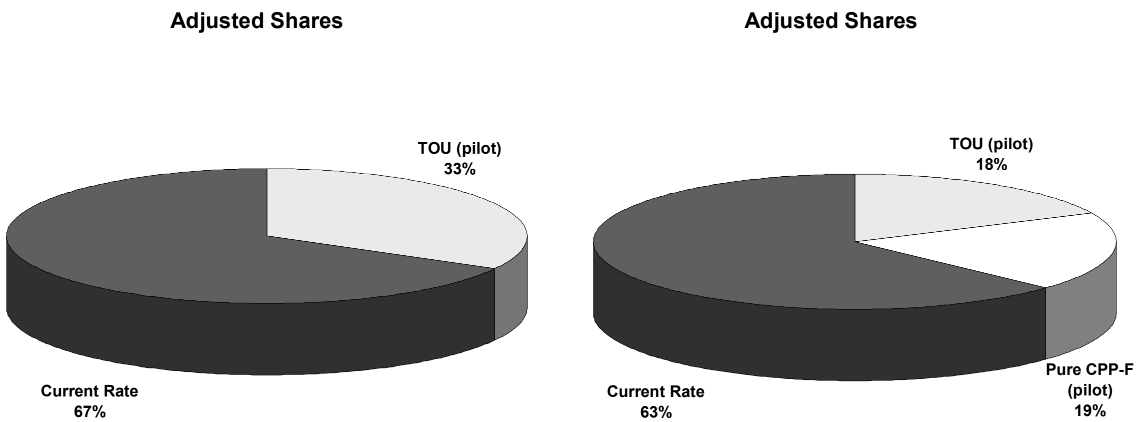
Chart 5.19 – Share of Preference, Adjusted, CAC Owners
Starting Condition = Current Rate





To what degree would customers choose to opt-in to a TD rate if instead of just offering the TOU example rate either a pure CPP-F rate were also offered?

Chart 5.20 – Share of Preference, Adjusted
Starting Condition = Current Rate

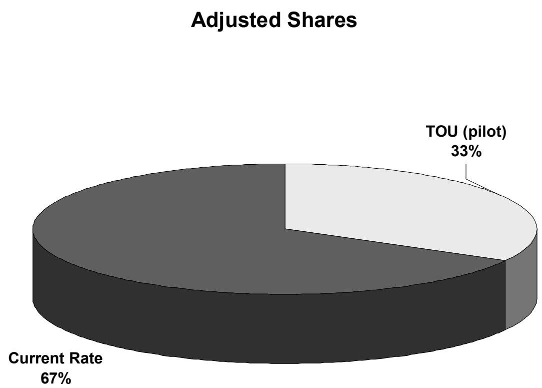


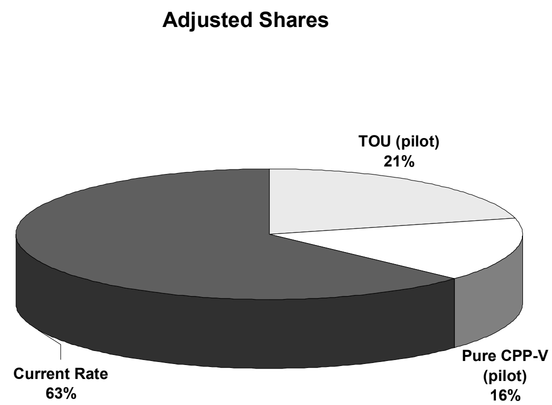
In this situation (see Chart 5.20), offering yet another TD rate only increases the percentage opting in to a TD rate by 4% if the pure CPP-F pilot rate was also offered. Furthermore, the pure CPP-F pilot rate would also act to steal share from those that might have otherwise chosen the TOU rate, resulting in roughly equal shares for each.

Detailed Findings: Estimating Market Potential

Lastly, what impact would offering a pure CPP-V example rate (available to all customers) have on the percentage of customers that would opt-in to a TD rate? The result here is nearly identical. We would expect only another 4% of customers to choose to opt-in to a TD rate. Furthermore, offering the CPP-V example rate would also work to effectively steal share from the TOU rate, with the percentage of customers opting-in to the TOU rate declining from 33% to 21%.

Chart 5.21 – Share of Preference, Adjusted
Starting Condition = Current Rate





We could also look at what impact offering two TD rates constructed such that each offered the best possible savings (20% savings for maximum adjustments, 10% savings for some adjustments, and no savings for no adjustments). As expected, improving the savings potential for each rate increases the percentage of customers that would opt-in to a time-differentiated rate. In each scenario we would expect 12-13% more customers would decide to opt-in to a TD rate, leaving 50-52% on their original inclining block rate, regardless of the combination of rates offered.

Table 5.4 summarizes these findings as well as the impact of less than perfect awareness which, in these scenarios, works to reduce the number of customers that would adopt a TD rate.

Table 5.4 – Market Scenarios with Starting or Default Condition Set as Current Inclining Block Rate with Two TD Rate Opt-in Options

Starting / Default Cond.	Opt-in Condition	Opt-in Condition	Share for T.D. Rates (Adjusted for Risk Avoidance and Inertia)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 70% Awareness)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 50% Awareness)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 30% Awareness)
Current Rate (CR)	CPP-F (pilot)	TOU(pilot)	CPP-F – 22% TOU – 14% CR – 64%	CPP-F – 15% TOU – 10% CR – 75%	CPP-F – 11% TOU – 7% CR – 82%	CPP-F – 7% TOU – 4% CR – 89%
CR	CPP-V (pilot – *assumes available to all*)	TOU (pilot)	CPP-V – 18% TOU – 19% CR – 63%	CPP-V – 13% TOU – 13% CR – 74%	CPP-V – 9% TOU – 10% CR – 81%	CPP-V – 5% TOU – 6% CR – 89%
CR	CPP-V (pilot – *assumes available only to those with CAC*)	TOU (pilot)	CPP-V – 10% TOU – 25% CR – 65%	CPP-V – 7% TOU – 18% CR – 75%	CPP-V – 5% TOU – 13% CR – 82%	CPP-V – 3% TOU – 8% CR – 89%
CR	Pure CPP-F (pilot)	TOU (pilot)	Pure CPP-F – 19% TOU – 18% CR – 63%	Pure CPP-F – 13% TOU – 13% CR – 74%	Pure CPP-F – 10% TOU – 9% CR - 81%	Pure CPP-F – 6% TOU – 5% CR – 89%
CR	Pure CPP-V (pilot – *assumes available to all*)	TOU (pilot)	Pure CPP-V – 16% TOU – 21% CR – 63%	Pure CPP-V – 11% TOU – 15% CR – 74%	Pure CPP-V – 8% TOU – 11% CR – 81%	Pure CPP-V – 5% TOU – 6% CR – 89%
CR	Pure CPP-V (pilot – *assumes available only to those with CAC*)	TOU (pilot)	Pure CPP-V – 10% TOU – 26% CR – 64%	Pure CPP-V – 7% TOU – 18% CR – 75%	Pure CPP-V – 5% TOU – 13% CR – 82%	Pure CPP-V – 3% TOU – 8% CR – 89%
CR	CPP-F (best savings)	TOU (best savings)	CPP-F – 28% TOU – 21% CR – 51%	CPP-F – 20% TOU – 15% CR – 65%	CPP-F – 14% TOU – 11% CR – 75%	CPP-F – 8% TOU – 6% CR – 86%
CR	CPP-V (best savings – *assumes available to all*)	TOU (best savings)	CPP-V – 22% TOU – 27% CR – 51%	CPP-V – 15% TOU – 19% CR – 66%	CPP-V – 11% TOU – 14% CR – 75%	CPP-V – 7% TOU – 8% CR – 85%
CR	CPP-V (best savings – *assumes available only to those with CAC*)	TOU (best savings)	CPP-V – 13% TOU – 35% CR – 52%	CPP-V – 9% TOU – 25% CR – 66%	CPP-V – 7% TOU – 18% CR – 75%	CPP-V – 4% TOU 11% CR – 85%
CR	Pure CPP-F (best savings)	TOU (best savings)	Pure CPP-F – 29% TOU – 20% CR – 51%	Pure CPP-F – 20% TOU – 14% CR – 66%	Pure CPP-F – 15% TOU – 10% CR – 75%	Pure CPP-F – 9% TOU – 6% CR – 85%
CR	Pure CPP-V (best savings – *assumes available to all*)	TOU (best savings)	Pure CPP-V – 25% TOU – 25% CR – 50%	Pure CPP-V – 18% TOU – 18% CR – 64%	Pure CPP-V – 13% TOU – 13% CR – 74%	Pure CPP-V – 8% TOU – 8% CR – 84%
CR	Pure CPP-V (best savings – *assumes available only to those with CAC*)	TOU (best savings)	Pure CPP-V – 15% TOU – 34% CR – 51%	Pure CPP-V – 11% TOU – 24% CR – 65%	Pure CPP-V – 8% TOU – 17% CR – 75%	Pure CPP-V – 5% TOU – 10% CR – 85%

From these findings we can conclude that offering multiple products does not significantly increase the number of opt-in switchers when the current rate is the default rate, with one exception. Offering a second TD rate in addition to the CPP-V example rate or CPP-V "best possible" rate made available only to CAC owners does work to significantly increase the percentage of customers choosing a TD rate (increases of 14% and 20%, respectively, using the examples tested here).

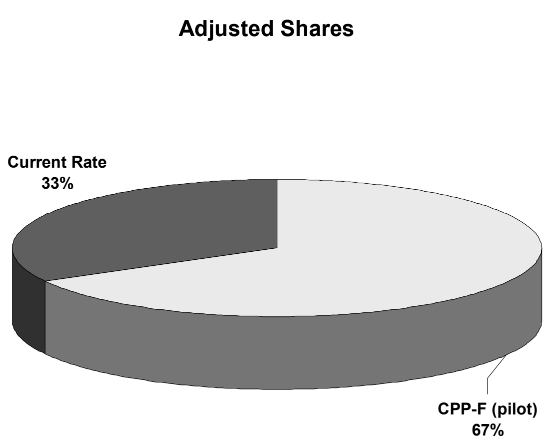
Regardless of the combination of example rates offered (and assuming only two were offered as modeled here), the utilities could expect approximately two-thirds to remain on their current inclining block rate (assuming 100% awareness). The number remaining on the inclining block rate could be further reduced if other, more attractive rates were offered as modeled here with the "best savings" rates which only left roughly 50% on the current inclining block rate. Program planners will need to investigate whether the expense of offering multiple rates will justify the additional load reduction resulting from having a few more customers on time-differentiated rates.

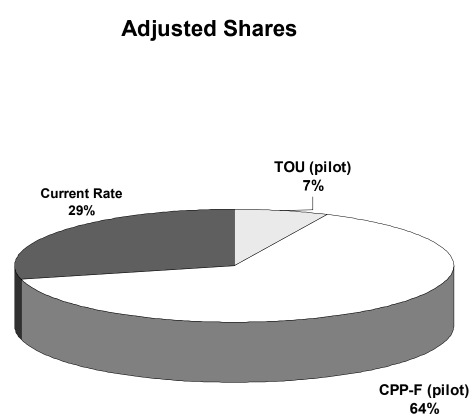
Estimating Customer Response to TD Default Condition Rate Offering Scenarios

Lastly, we again consider a scenario in which the current rate is *not* the default or starting condition, but rather the default is one of the time-differentiated rates. However, instead of offering customers just their current rate as an alternative, they are also offered a second TD rate as an alternative. Does giving customers a second alternative in this situation further reduce the number that will opt-out of TD rates entirely in favor of their current rate?

To investigate this, let's first take a situation in which the CPP-F example rate is the default rate and customers are allowed to opt-out of that rate and on to either their current rate or the TOU example rate. In Chart 5.22 we see that the percentage opting-out of a TD rate is reduced by 4% when a second TD rate is offered, with the majority choosing to remain with the default TD rate.

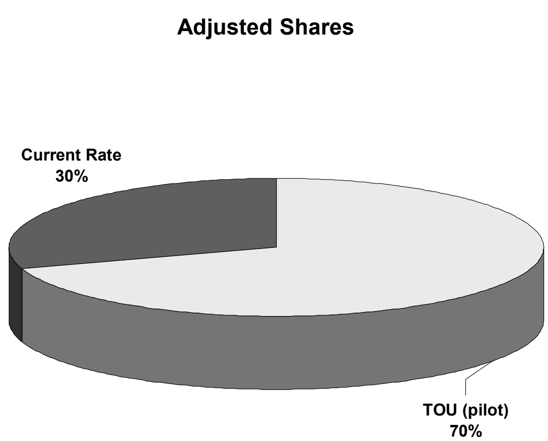
Chart 5.22 – Share of Preference, Adjusted
Starting Condition = CPP-F (pilot)

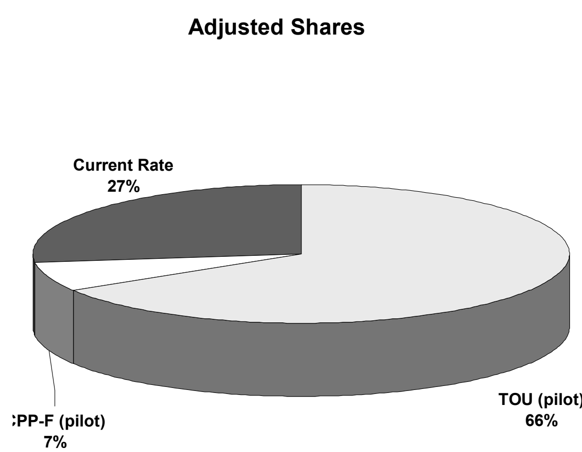




In a case where the TOU example rate is the default rate, offering the CPP-F pilot rate as well is slightly less effective in preventing customers from opting out to the current rate (see Chart 5.23 below). Offering this second rate only prevents an additional 3% from opting-out to the current rate.

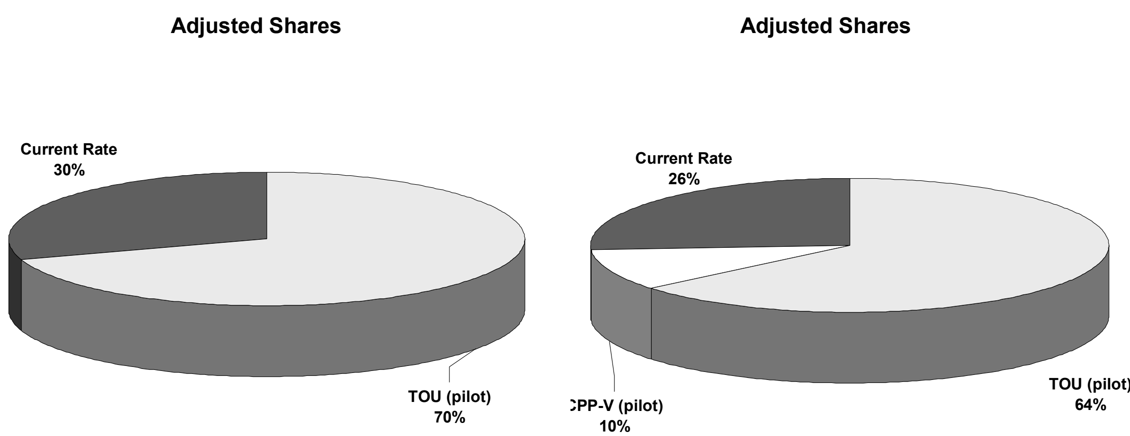
Chart 5.23 – Share of Preference, Adjusted Starting Condition = TOU (pilot)





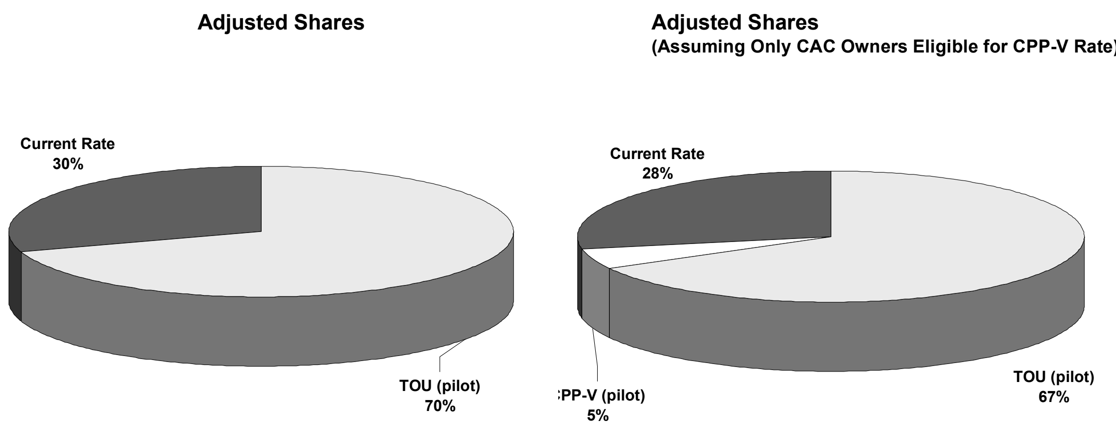
If instead of offering the CPP-F pilot rate as alternative to the default TOU pilot rate the CPP-V rate was offered, what impact would this have on the number of customers opting-out of a TD rate? In Chart 5.24 we see that the net result is very similar, with a 4% reduction in the number of customers that would opt-out of a TD rate.

Chart 5.24 – Share of Preference, Adjusted
Starting Condition = TOU (pilot)



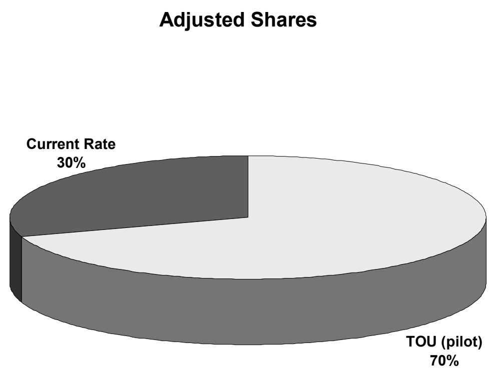
However, if this CPP-V rate was made available only to CAC owners, the impact of offering this second rate is even smaller, providing only a 2% reduction in the number of customers opting-out of a TD rate (see Chart 5.25 below).

Chart 5.25 – Share of Preference, Adjusted
Starting Condition = TOU (pilot)



Results are also similar when offering the pure CPP-F or pure CPP-V example rates as alternatives to the TOU default rate in addition to the current rate. Assuming that all customers are eligible for the rates, there is a 4% reduction in the number opting out of a TD rate (see Charts 5.26 and 5.27).

Chart 5.26 – Share of Preference, Adjusted
Starting Condition = TOU (pilot)


Adjusted Shares
Current Rate
30%
TOU (pilot)
70%

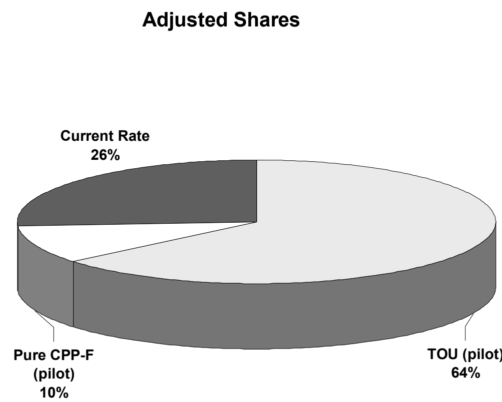
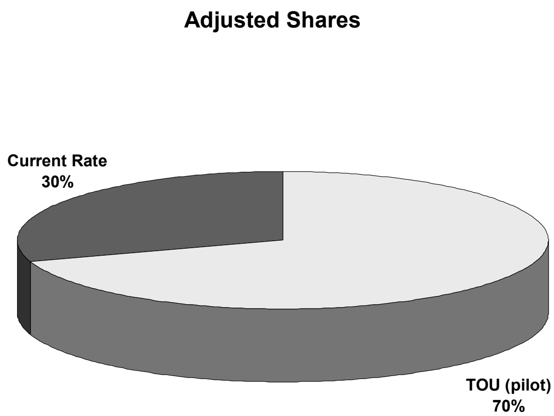
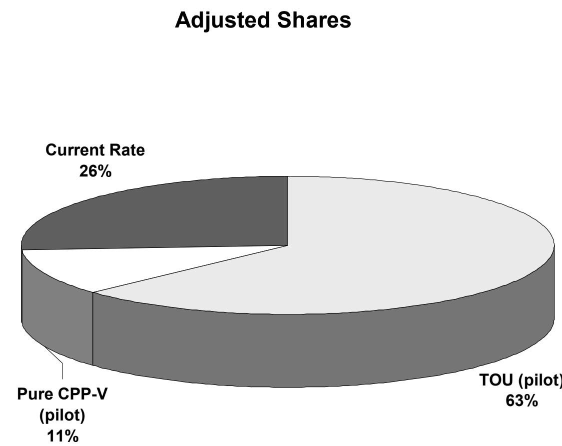

Adjusted Shares
Current Rate
26%
Pure CPP-F
(pilot)
10%
TOU (pilot)
64%

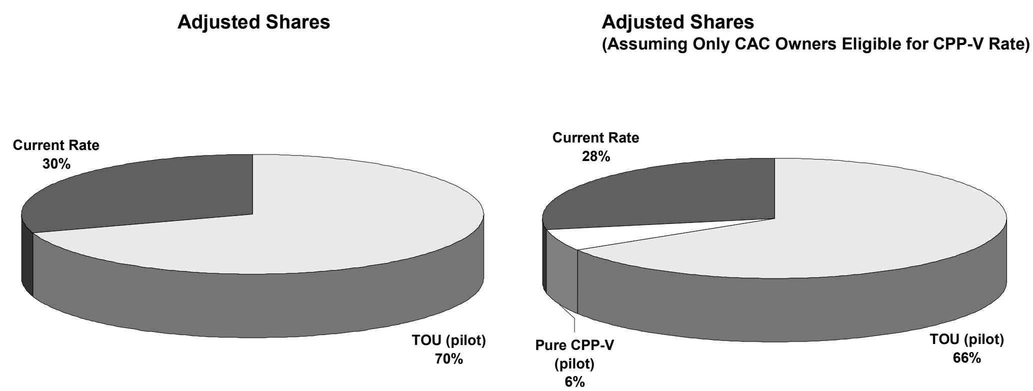
Chart 5.27 – Share of Preference, Adjusted
Starting Condition = TOU (pilot)





If, however, the CPP-V rate is made available to CAC owners only, the number choosing to opt out of a TD rate is reduced by only 2% rather than 4% (Chart 5.28)

Chart 5.28 – Share of Preference, Adjusted
Starting Condition = TOU (pilot)

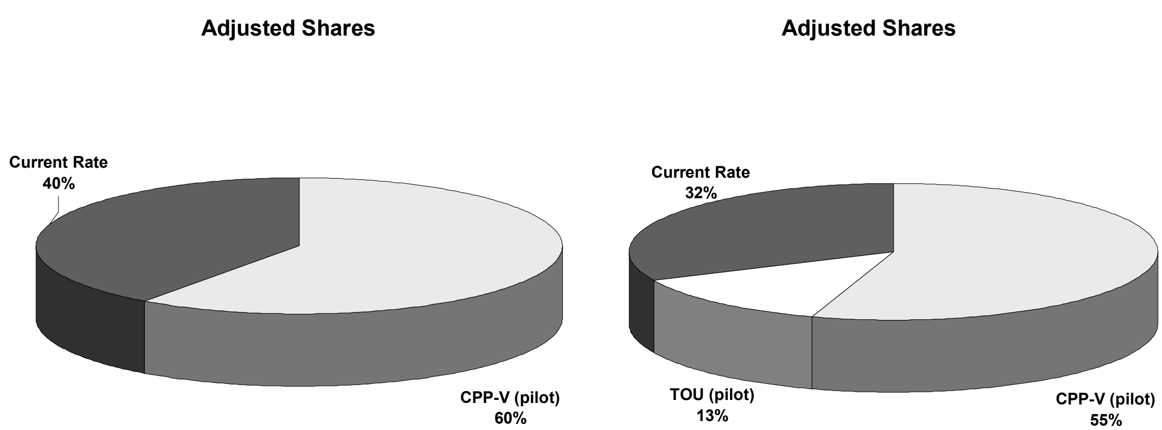


Thus far, the impact of including a second TD rate in the product portfolio when a TD rate is the default has minimal impact on the number that will choose to opt out of a TD rate and go back on the current inclining block rate.

However, when a less attractive rate is the default (as is the case with the CPP-V pilot rate), offering another TD rate option for participants to opt out to has a somewhat larger impact on the number that will choose to return to the inclining block rate.

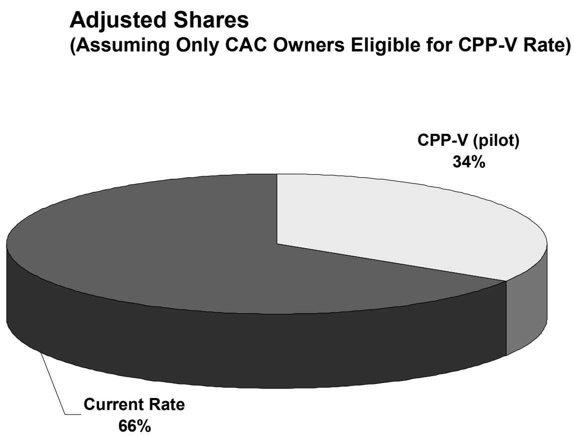
In this example, with the CPP-V rate (offered to all customers) as the default and with the inclusion of the TOU example rate as a second alternative, there is an 8% reduction in the number opting out of a TD rate and back on to the current rate (see Chart 5.29).

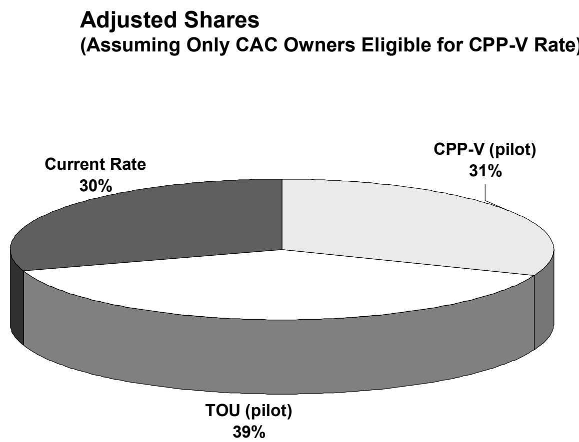
Chart 5.29 – Share of Preference, Adjusted Starting Condition = CPP-V (pilot)



If we are to assume, however, that the CPP-V rate is available only to those with CAC, the reduction in the number of customers on the current rate is dramatic (36%) when the TOU example rate is also offered as an option (see Chart 5.30).

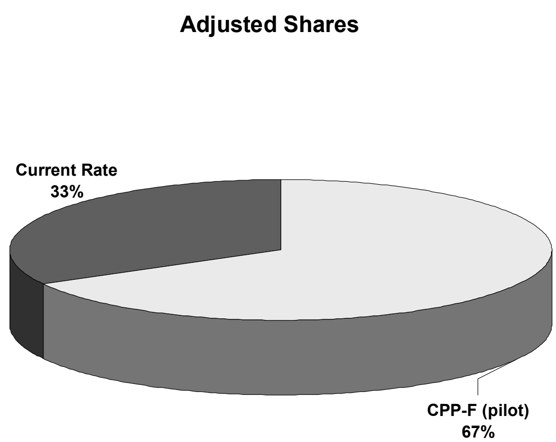
Chart 5.30 – Share of Preference, Adjusted
Starting Condition = CPP-V (pilot)





The team also wanted to investigate a scenario in which the current inclining block rate was not an option made available to customers. In the scenario investigated, the CPP-F pilot rate was set as the default, with the option to opt in to either the pure CPP-F pilot rate or the TOU example rate. In this scenario the result of removing the current rate as an option increases the number of customers that will remain on the CPP-F default rate by 5%, with the remaining 28% splitting their choice between the pure CPP-F and TOU example rates.

Chart 5.31 – Share of Preference, Adjusted
Starting Condition = CPP-F (pilot)



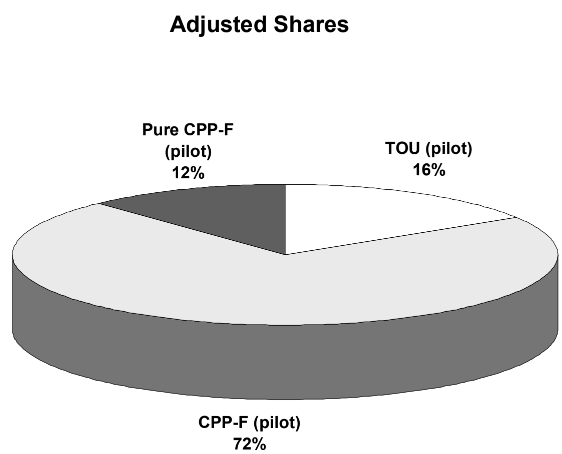


Table 5.5 summarizes these findings as well as the impact of less than perfect awareness, which in these scenarios works to increase the number of customers that would remain on the default TD rate.

Table 5.5 – Market Scenarios with Starting / Default Condition Set as TD Rate with Current Rate and Second TD Opt-in Rates

Starting / Condition	Opt-in Cond.	Opt-in Condition	Share for T.D. Rates (Adjusted for Risk Avoidance and Inertia)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 70% Awareness)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 50% Awareness)	Share for T.D. Rates (Adjusted for Risk, Inertia, and Awareness – 30% Awareness)
CPP-F (pilot)	Current Rate (CR)	TOU (pilot)	CPP-F – 64% TOU – 7% CR – 29%	CPP-F – 75% TOU – 5% CR – 20%	CPP-F – 81% TOU – 4% CR – 15%	CPP-F – 89% TOU – 2% CR – 9%
TOU (pilot)	CR	CPP-F (pilot)	TOU – 66% CPP-F – 7% CR – 27%	TOU – 76% CPP-F – 5% CR – 19%	TOU – 82% CPP-F – 4% CR – 14%	TOU – 90% CPP-F – 2% CR – 8%
TOU (pilot)	CR	CPP-V (pilot – *assumes available to all*)	TOU – 64% CPP-V – 10% CR – 26%	TOU – 75% CPP-V – 7% CR – 18%	TOU – 82% CPP-V – 5% CR – 13%	TOU – 88% CPP-V – 3% CR – 9%
TOU (pilot)	CR	CPP-V (pilot, *assumes available only to those with CAC*)	TOU – 67% CPP-V – 5% CR – 28%	TOU – 76% CPP-V – 4% CR – 20%	TOU – 83% CPP-V – 3% CR – 14%	TOU – 90% CPP-V – 2% CR – 8%
TOU (pilot)	CR	Pure CPP-F (pilot)	TOU – 64% Pure CPP-F – 10% CR – 26%	TOU – 75% Pure CPP-F – 7% CR – 18%	TOU – 82% Pure CPP-F – 5% CR – 13%	TOU – 89% Pure CPP-F – 3% CR – 8%
TOU (pilot)	CR	Pure CPP-V (pilot - *assumes available to all*)	TOU – 63% Pure CPP-V – 11% CR – 26%	TOU – 74% Pure CPP-V – 8% CR – 18%	TOU – 81% Pure CPP-V – 6% CR – 13%	TOU – 89% Pure CPP-V – 3% CR – 8%
TOU (pilot)	CR	Pure CPP-V (pilot – *assumes available only to those with CAC*)	TOU – 66% Pure CPP-V – 6% CR – 28%	TOU – 76% Pure CPP-V – 4% CR – 20%	TOU – 83% Pure CPP-V – 3% CR – 14%	TOU – 90% Pure CPP-V – 2% CR – 8%
CPP-V (pilot – *assumes available to all*)	CR	TOU (pilot)	CPP-V – 55% TOU – 13% CR – 32%	CPP-V – 69% TOU – 9% CR – 22%	CPP-V – 77% TOU – 7% CR – 16%	CPP-V – 86% TOU – 4% CR – 10%
CPP-V (pilot – *assumes available only to those with CAC*)	CR	TOU (pilot - *assumes those without CAC placed on this rate initially*)	CPP-V – 31% TOU – 39% CR – 30%	CPP-V – 38% TOU – 42% CR – 20%	CPP-V – 41% TOU – 44% CR – 15%	CPP-V – 45% TOU – 46% CR – 9%
CPP-F (pilot)	TOU (pilot)	Pure CPP-F (pilot)	CPP-F – 72% TOU – 16% Pure CPP-F – 12%	CPP-F – 81% TOU – 11% Pure CPP-F – 8%	CPP-F – 86% TOU – 8% Pure CPP-F – 6%	CPP-F – 91% TOU – 5% Pure CPP-F – 4%

For these scenarios we find that the percentage opting to choose the current inclining block rate is approximately 28% on average assuming perfect awareness, regardless of the specific other options provided. When CPP-V is the default, of course, a few more customers opt to select the current rate. When the current rate is not made available, we find the largest number of customers opting to stay on the TD rate they are placed on.

Though not tested in the SPP Pilot Program, the team also wished to investigate a scenarios in which the starting or opt-out rate was a TD rate without a TOU component. Two different "pure" CPP rates were tested, a CPP-F and a CPP-V rate (the exact specifications of which can be found in Table 5.1 on page 77). Table 5.6 summarizes these results, including the impact of less than perfect awareness which works to increase the number of customers that would remain on the default TD rate.

The results for the Pure CPP-F rates are similar to what was found for the rates with a TOU component (Table 5.5) –- assuming high awareness (70%) we would expect between 20-23% to opt out of the rate and back on the inclining block rate, regardless of the alternatives offered.

Table 5.6 – Market Scenarios with Starting / Default Condition Set as TD Rate (without a TOU Component) with Current Rate and Second TD Opt-in Rates

Starting (opt out) Condition	Opt-in Condition #1	Opt-in Condition #2	Share of Preference -- (Adjusted for Risk Avoidance and Inertia)	Share of Preference (Adjusted for Risk, Inertia and Awareness – 70% awareness)	Share of Preference (Adjusted for Risk, Inertia and Awareness –50% awareness)	Share of Preference (Adjusted for Risk, Inertia and Awareness –30% awareness)
Pure CPP-F	CR	TOU	Pure CPP-F – 59% TOU – 13% CR – 28%	Pure CPP-F – 71% TOU – 9% CR – 20%	Pure CPP-F – 79% TOU – 7% CR – 14%	Pure CPP-F – 88% TOU – 4% CR – 8%
Pure CPP-F	CR	CPP-V (available to all)	Pure-F – 57% CPP-V – 11% CR – 32%	Pure CPP-F – 70% CPP-V – 8% CR – 22%	Pure CPP-F – 78% CPP-V – 6% CR – 16%	Pure CPP-F – 87% CPP-V – 3% CR – 10%
Pure CPP-F	CR	CPP-V (available only to those with CAC)	Pure CPP-F – 61% CPP-V – 6% CR – 33%	Pure CPP-F – 73% CPP-V – 4% CR – 23%	Pure CPP-F – 80% CPP-V – 3% CR – 17%	Pure CPP-F – 88% CPP-V – 2% CR – 10%
Pure CPP-V (available to all)	CR	TOU	Pure CPP-V -47% TOU – 22% CR – 31%	Pure CPP-V – 63% TOU – 15% CR – 22%	Pure CPP-V – 73% TOU – 11% CR – 16%	Pure CPP-V – 84% TOU – 7% CR – 9%
Pure CPP-V (available to all)	CR	CPP-V (available to all)	Pure CPP-V – 48% CPP-V – 12% CR – 40%	Pure CPP-V – 64% CPP-V – 8% CR – 28%	Pure CPP-V – 74% CPP-V – 6% CR – 20%	Pure CPP-V – 84% CPP-V – 4% CR – 12%
Pure CPP-V (available to all)	CR	CPP-V (available only to those with CAC)	Pure CPP-V – 51% CPP-V – 8% CR – 41%	Pure CPP-V – 65% CPP-V – 6% CR – 29%	Pure CPP-V – 75% CPP-V – 4% CR – 21%	Pure CPP-V – 86% CPP-V – 2% CR – 12%
Pure CPP-V (available only to those with CAC)	CR	TOU *(Those w/o CAC started here instead)*	Pure CPP-V – 26% TOU – 45% CR – 29%	Pure CPP-V – 34% TOU – 46% CR – 20%	Pure CPP-V – 38% TOU – 45% CR – 15%	Pure CPP-V – 43% TOU – 48% CR – 9%
Pure CPP-V (available only to those with CAC)	CR	CPP-V *(available to all – those without CAC started here instead)*	Pure CPP-V – 24% CPP-V – 32% CR – 44%	Pure CPP-V – 33% CPP-V – 36% CR – 31%	Pure CPP-V – 38% CPP-V – 40% CR – 22%	Pure CPP-V – 43% CPP-V – 44% CR – 13%
Pure CPP-V (available only to those with CAC)	CR	CPP-V (available only to those with CAC)	Pure CPP-V – 26% CPP-V – 8% CR – 66%	Pure CPP-V – 34% CPP-V – 6% CR – 61%	Pure CPP-V – 38% CPP-V – 4% CR – 58%	Pure CPP-V – 43% CPP-V – 3% CR – 54%

However, when reviewing the Pure CPP-V rates, the specific alternatives offered and whether or not the CPP-V rate and/or those alternatives will be offered to those without CAC, has a much greater impact on the expected share for each.

The Pure CPP-V rate still does fairly well in terms of limiting the number of customers that will opt out back to their current rate when the TOU rate option is offered. However, when the alternative rate is the CPP-V example rate with a TOU component, we would expect that approximately 28-31% would choose to opt out of the default rate and choose the current inclining block rate (regardless of whether the default rate or opt-in rate is offered to all consumers or just those with CAC).

When dealing with a default Pure CPP-V rate and an alternative CPP-V rate (with a TOU component) that are *both* only available to those with CAC, we see the largest numbers ending up on the current inclining block rate – in the example from the last row of Table 5.6, 61% under the "high" awareness condition – in largest part because so many customers simply would not qualify for either TD option because they do not have CAC.

In Summary

The results generated from the analysis reported in this section leads to several conclusions.

- Both price and non-price features can have dramatic effects on the proportion of customers likely to select a new TD rate offering, though price/savings differences have somewhat larger maximum impacts on potential response (moving preference shares by 40-50% when moving from worst-possible to best-possible savings levels) than do non-price rate features (which can move preference shares by 30-40% when moving from worst-possible to best-possible levels).

- Regardless of whether customers are given the option to opt-in to one or two TD rates from their current inclining block rate, we could expect roughly 1/3 of customers to do so, regardless of the specific rates offered and assuming perfect awareness of these options. The percentage opting-in to a TD rate would, of course, necessarily decrease as awareness decreases.
    - More reasonable estimates of likely awareness levels suggest that the proportion of customers likely to adopt a new TD rate offering under an opt-in scenario amount to 15-20% of all customers for most plausible rate offerings, though 20-25% might choose to adopt a TD rate if it offered best-possible savings levels.

- When customers are placed on a TD rate as their default rate, we can expect roughly 2/3 of customers to remain on that TD rate, regardless of whether they are given a second TD rate option to opt-in to or not on the assumption of perfect awareness. Under more likely awareness conditions, we would expect 80-85% of customers to remain on an assigned TD rate in this scenario, under most plausible rate options, with that number rising to 90-95% if best-possible savings levels were offered.

- Under both opt-in and opt-out conditions, the specifics of whether the TD rate(s) offered are TOU rates, CPP-F rates, or otherwise do not have a dramatic effect on customer response; customer response is similar, in other words, regardless of the specific structure of the rate option (within the range of plausible alternatives)

- The exception to this rule is CPP-V rate options which, since they are available only to a limited set of customers, have lower net customer response.

There are obviously many other market scenarios that could be investigated, with this report limited to only those deemed most pertinent given the feasibility of offering certain rate options and certain product portfolios. The reader is, however, invited to explore further the impact of offering these rates and others, as well as other product portfolios, in the market share simulator that accompanies this report.

Notes on the Use of the Simulator

Accompanying this report is a simulator which will allow the user to simulate up to three different alternative rate options and the current rate (represented by "none" in the simulator). The simulator labeled as Version 2.2 is the final version and the one used to calculate the share of preference estimates described here. When opening the simulator, which has been created in Excel, the user will have to click the button for "enable macros" for the simulator to run properly.

On the simulator sheet there are three columns for specifying the three alternative rate options, labeled alternative A, B, and C. Alternative A is automatically included in each simulation. Alternatives B and C will only be included if the box below each of the two columns, which reads "include in simulation" is checked.

To specify the rate options for simulation, type in the appropriate percentage for each of the three bill impacts. The valid range for each of the three bill impacts (maximum, some and no adjustments) can be seen in the upper left hand corner of the screen. Any percentage in the valid ranges can be simulated. If invalid percentages are entered for the bill impacts, the product will be ignored in the simulations. For the remaining rate features, the levels for simulation are chosen from a drop down menu. Please note that for the "notice of critical days provided" feature there is no option for "N/A" which would be appropriate for a TOU rate. The simulator will automatically flag the critical day-dependent features, setting them to "N/A" if the number of critical days is equal to zero.

Before hitting the "run simulation" button at the top right of the screen, please note that there are options at the top middle of the screen for running uncalibrated shares, shares calibrated for stickiness only, and shares calibrated for stickiness and risk, which are selected from a drop down menu. The user may wish to look at all three to see the affect of each. Also, right below this is a drop down labeled "default." This option will allow the simulation to be run specifying "none" (or the current rate) or any of the three alternative rate options as the starting condition.

Once the "run simulation" button is hit, the program will automatically take the user to the results page. The top of the screen lists each of the rates simulated and the share of preference for each rate and for none (or the current rate). On the bottom portion of the screen, the simulator shows the share of preference for each alternative rate and none broken out by seven different subgroups.

The user can then click on the "simulator" tab at the bottom of the screen to specify a new simulation.

Likely Takers by Select TD Rate Options

Gaining a better understanding of the types of customers most likely to go on a TD rate can be helpful as the relevant parties think about the product portfolios that will be offered and their marketing efforts for these products. Profiling these customers can be helpful in terms of understanding both who to target as well as how to target them. For example, are those most interested in a TD rate more or less likely than the average customer to have certain levels of electricity use? Are they more or less likely to have certain appliance holdings?

This section of the report profiles the likely takers for three specific rate options (see Tables 5.6—5.9 below for this data) that were specified to be as close as possible to several of the rates used in the SPP. Note that the analysis was not extended to rates not explored in the SPP (i.e., to such rates as a "pure" CPP-F or "pure" CPP-V). The logic for this was twofold: first, the objective of the analysis was to determine if there were differences in the types of customers likely to be attracted to the types of rates tested in the SPP, and secondly, based on the finding that "likely taker" profiles were similar across these rates, it was also highly likely that developing such profiles for addition rates that were not dramatically different from the SPP rates would also be unlikely to show substantial differences in taker profiles.

For this analysis a "likely taker" has been identified as the top 10% of customers with the highest utility scores for a given product. Characteristics that distinguish the "likely takers" for a particular rate are provided in the following tables, and these characteristics have been identified by the computation of an index value for each characteristic.

The index values were computed for each characteristic by dividing the percent of "likely takers" (as defined above) that have a characteristic of interest (i.e. the percent of "likely takers" with single family homes) by the percent of all respondents with the characteristic (i.e. the percent of all respondents with single family homes) and multiplying the result by 100. As the magnitude of difference increases (either positive or negative) between the resulting index value and 100 (the population average), the more useful the characteristic is for identifying "likely takers."

While there are several unique differences that emerged between the groups of takers for each of the example rates used in this analysis, the most interesting finding here is just how *similar* these groups of customers are to one another. These similarities can be grouped into the following categories:

- *Climate zone* – Takers of these rates were somewhat more likely than the average customer to live in climate zones 2 or 4.

- *Energy use* – Likely takers tend to be customers who use more energy than the average customer as measured directly and indirectly by such indicators as:
    - High summer electric bills (bills over $100)
    - Presence of room AC and central AC
    - One or more loads of laundry done in summer afternoons
    - Larger (1,500 square feet or more) homes
    - Single family homes

- *Home location* – Likely takers are somewhat more likely to live in suburban neighborhoods.

- *Home ownership* - There is also a slight tendency to own the home rather than rent.

- *General interest in time-differentiated rates* – Takers of these rates tend to have a somewhat stronger general interest in time-differentiated rates, as well as the appliance controls meant to be used with the CPP-V rate, than the average customer.

Thus, the utilities could reasonably offer any of these rates and expect to attract a similar set of customers for each. These similarities, as well as some unique differences between these groups of takers, can be found in the following four tables (Tables 5.6 – 5.9).

Table 5.6 – Most Likely Takers of the CPP-F Pilot Rate

	Indexed Values
Climate Zone	
Zone 4[13]	201
Electricity Usage	
High Usage	123
Climate Zone by Usage	
Zone 2, High Usage	181
Presence of AC	
Room or at least Central AC	142
Presence of Central AC by Climate Zone	
CAC, Zone 2	209
CAC, Zone 4	203
Loads of Laundry – Summer Afternoons	
One or more	125
Home Square Footage	
1500 sq. ft. or more	134
Home Location	
Suburban	121
Type of Home	
Single Family	125
Best Notification Method	
E-mail to business address	430
Overall Interest in Appliance Controls	
Very Interested	228
Poverty Level	
At OR Below 200% Above Poverty Level	156
Education Level	
Some College or Less	116
Age	
35-64	118

[13] Note that for Climate Zone and for the other attributes, the only categories that have been listed here are the ones for which the index value is significantly higher than 100 (meaning that the category is significantly more likely than average to appear among likely takers of the specified rate). If a category is not listed, that means that the category is either "average" or "lower than average" in its representation among likely takers.

Table 5.7– Most Likely Takers of the TOU Pilot Rate

	Indexed Values
Climate Zone	
Zone 4	181
Presence of AC	
Room or at least Central AC	128
Presence of Central AC by Climate Zone	
CAC, Zone 4	213
Loads of Laundry – Summer Afternoons	
One or more	139
Home Square Footage	
1,500 sq. Ft. or More	136
Type of Home	
Single Family	121
Actions Taken Since 2001 Crisis	
Taking More / Same Actions as in 2001 Crisis	132
Most Important Reasons for Signing Up for TOU	
Save by Already Using Less Electricity During Peak Periods	147
Age	
35-64	127

Table 5.8– Most Likely Takers of the CPP-V Pilot Rate

	Indexed Values
Climate Zone	
Zone 2	142
Electricity Usage	
High Usage	134
Climate Zone by Electricity Usage	
Zone 2, High Usage	271
Presence of CAC by Climate Zone	
CAC, Zone 2	171
Presence of Electric Cooking Appliances	
No Electric	118
Number of Refrigerators/Freezers	
1	116
Type of Home	
Single Family	117
Home Ownership	
Own	123
Overall Interest in Appliance Controls	
Very Interested	232
Risk Avoidance	
Least Risk Averse	131
Ethnicity	
Hispanic	151

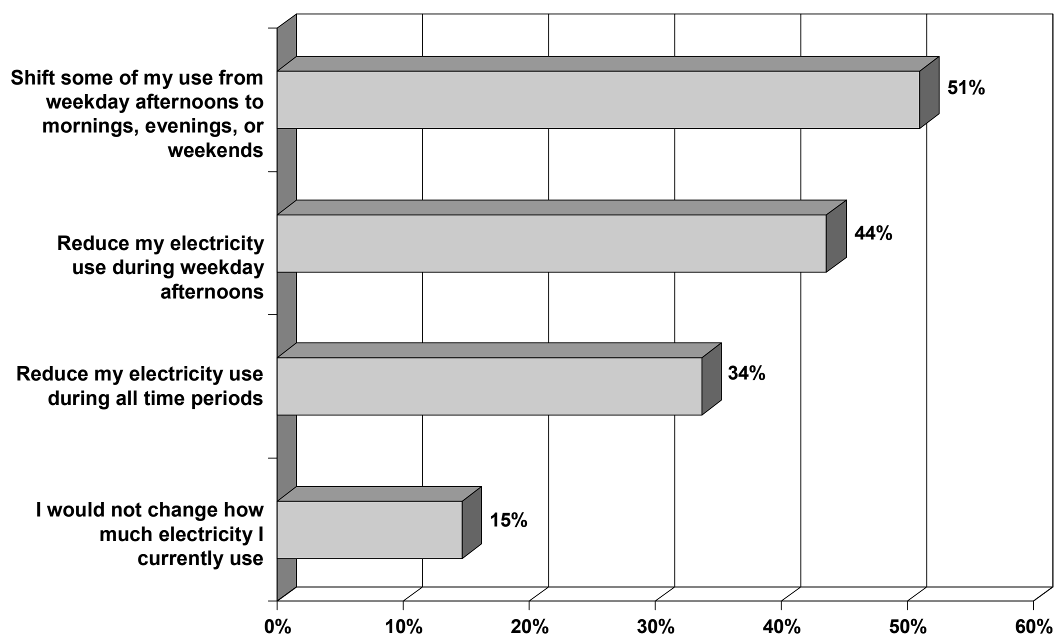
Table 5.9 – Most Likely Takers of the CPP-V Pilot Rate for CAC Owners Only

	Indexed Values
Climate Zone	
Zone 2	163
Electricity Usage	
High Usage	116
Climate Zone by Electricity Usage	
Zone 2, High Usage	258
Presence of CAC by Climate Zone	
CAC, Zone 2	163
Loads of Laundry Done in Summer Afternoons	
1+	130
Home Sq. Footage	
1,500 sq. Ft. or More	129
Type of Home	
Single Family	118
Home Ownership	
Own	124
Years in Home	
5 or more years	136
Home Location	
Suburban	119
Action Taken Since 2001 Crisis	
As Much or More as During 2001 Crisis	141
Most Important Reasons for Signing up for TOU	
To Contribute to Creating a More Secure Energy Future	161
Best Notification Method	
Email to Business Address	275
Overall Interest in Appliance Controls	
Very Interested	278
Some Interest	139
Risk Avoidance	
Least Risk Averse	141
Provider / Product Stickiness	
Somewhat Sticky	152
Income	
Above $50K	155

Likely Response to Time-Differentiated Pricing Plans

Obviously, in order for time-differentiated pricing to have the desired impact on load, customers have to not only be willing to go on time-differentiated rates, but also respond to these rates by either reducing or shifting their electricity usage. While other SPP activities measure actual response, the CPMR survey asked customers how they think they might respond under these pricing options. These results indicate that only 15% of customers say they are unwilling to change their electricity use if they were on time-differentiated pricing plans. The vast majority feel they would either reduce their total electricity use or shift it to other time periods outside of weekday afternoons.

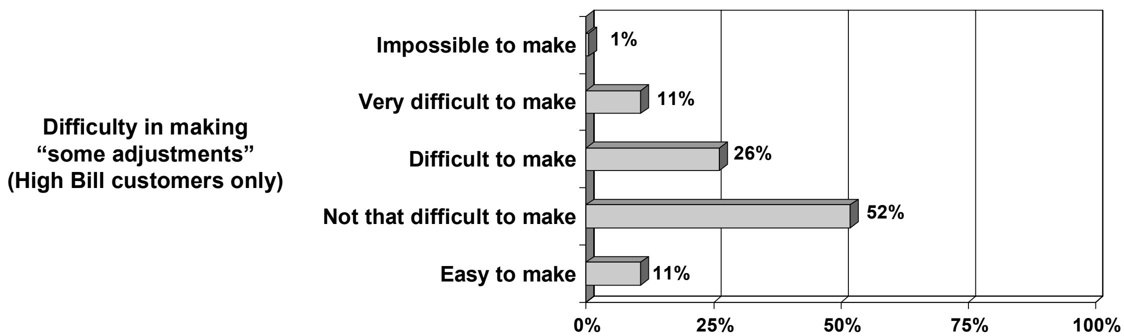
Chart 6.1 – Actions Most Likely to Take Under Time-Differentiated Pricing Plans

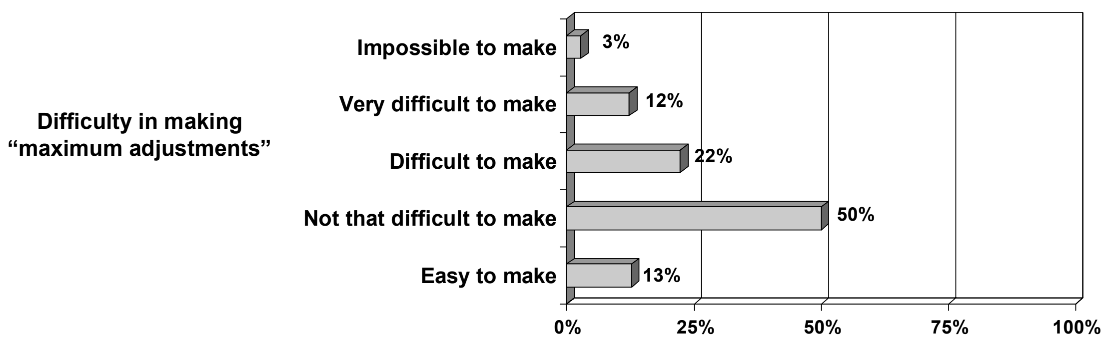


QDCB. Which of the following actions would you be likely to take under these new kinds of electricity pricing plans? (multiple selection)
n=1196

Furthermore, a little over half the respondents indicated that making "some" or "maximum" adjustments to their electricity use would not be that difficult, and even easy for some, suggesting again that if customers receive the right price signal (that is, there is enough of a benefit for changing electricity use or a penalty for *not* doing so), they will respond accordingly and reduce electricity use.

Chart 6.2 – Difficulty in Making "Some" or "Maximum" Adjustments in Electricity Use

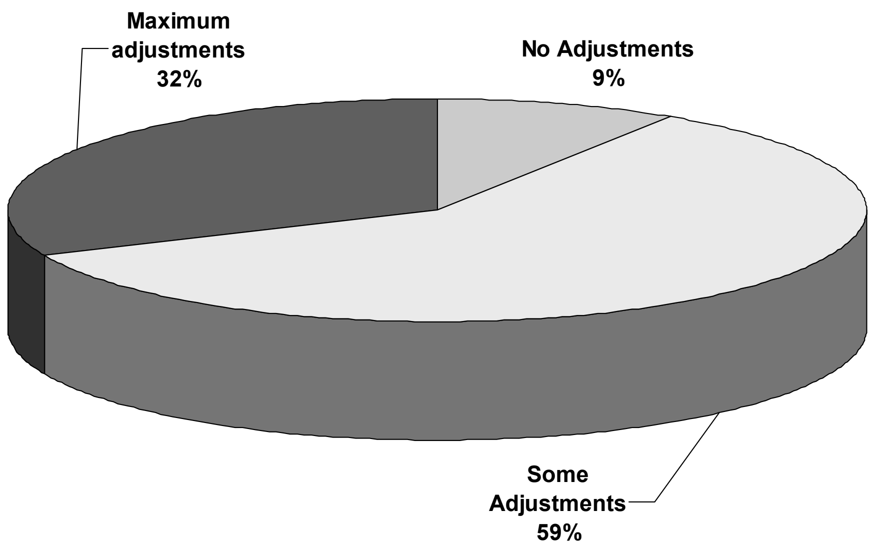




QDC1/QDC3. Thinking about how difficult it might be to make some (DC1) / maximum (DC3) adjustments in your electricity use on both PEAK and CRITICAL weekday afternoons, would you say these types of changes would be: n=508, DC1; n=1196, DC3

However, despite the ease with which respondents felt they could make "maximum adjustments" in their electricity use, most would expect to make only "some adjustments" to electricity use in the summer if it meant they would save money on their bill.

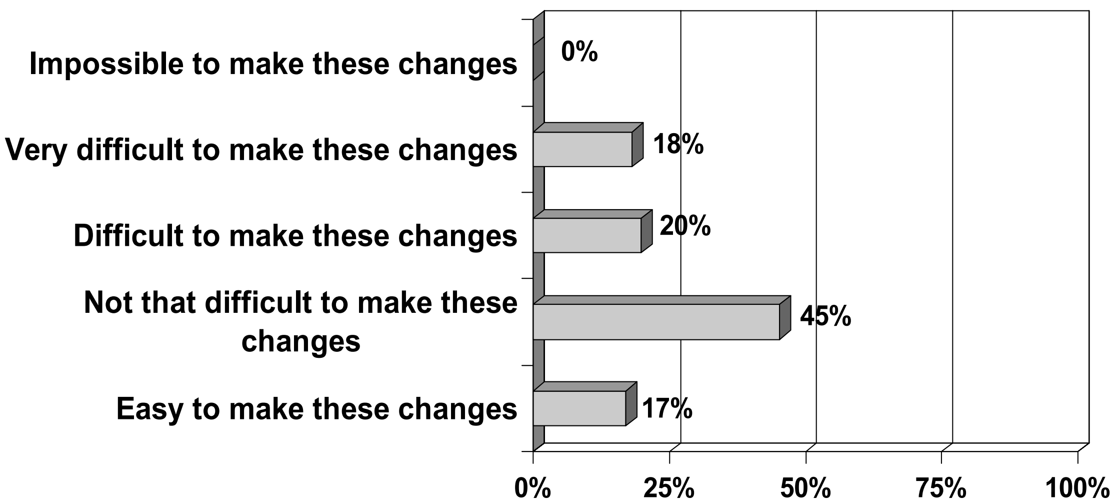
Chart 6.3 – "Adjustments" to Electricity Use Most Likely to Make



QDC4. Which of the types of changes do you think you would be most likely to make during the summer if it meant that you would be able to save money on your electric bill: maximum adjustments, some adjustments, or no adjustments; n=1196

Additionally, the majority of those with small electric bills, whose one major source of electricity use is their electric heating, felt that responding to these rates by adjusting their use of electric heating would also be fairly easy to do.

Chart 6.4 – Difficulty of Making Adjustments to Space Heating Use on Time-Differentiated Pricing Plans

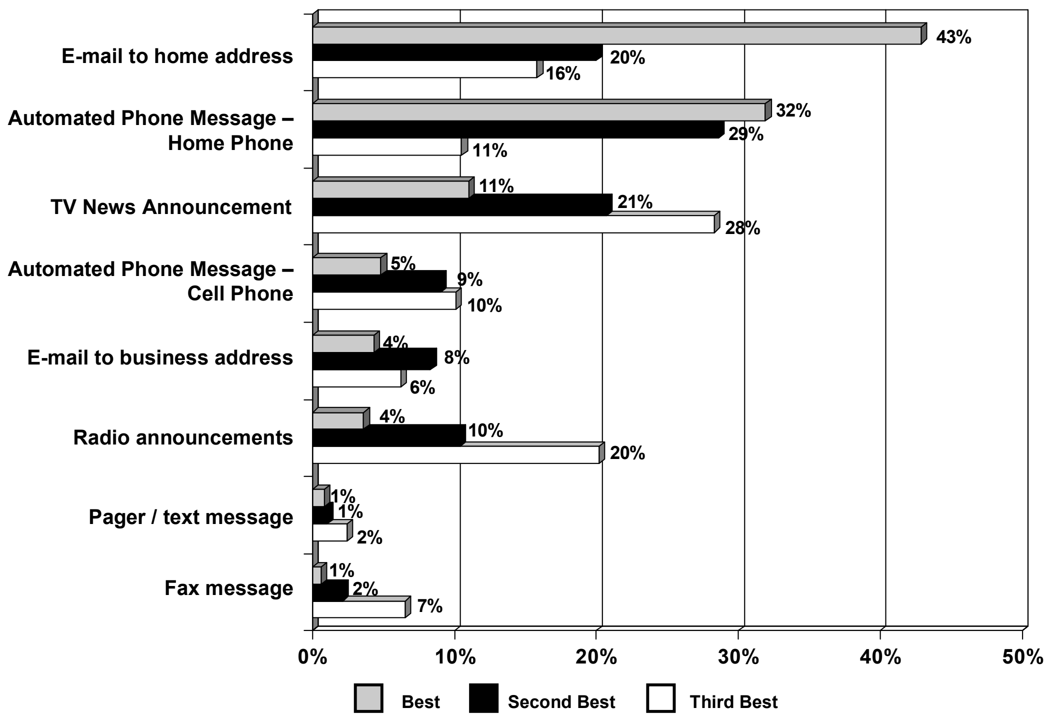


QDC5A. How difficult do you think it would be to change the way you use your electric space heating system during the winter in order to adjust to these different plans?: n=59 (Low usage/Electric heat respondents only)

Preferred Notification Methods for CPP Days

A majority of respondents felt the best method for notifying them of a critical pricing day was to contact them directly at home – via either email or their home phone. The second best method overall was through use of the mass media – either TV news announcements or radio announcements.

Chart 6.5 – Preferred CPP Day Notification Methods



Q36. What would be the best way to get this notice to you? Please select one option from each of the columns below to indicate the best ways to notify you about oncoming critical days. n=1196

Reasons for Signing Up for a Time-Differentiated Pricing Plan

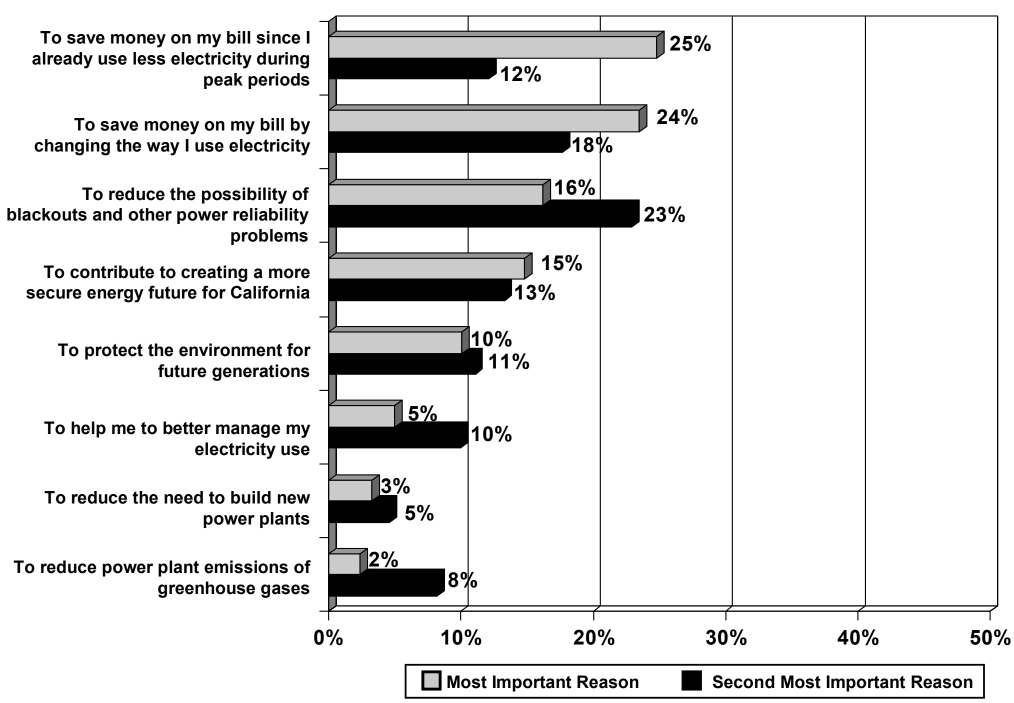
For the purposes of this research, respondents were given a description of time-differentiated pricing options that were purely descriptive, with no attempt made to "sell" respondents on the idea. Looking forward, however, it will be important for the utilities to understand how to communicate to customers about these pricing plans using the value propositions that are most compelling in terms of generating interest.

In looking at the value propositions tested (and there may be others not tested here), we see three major groupings of reasons in terms of their importance to respondents: those reasons directly affecting themselves, their family and their personal finances; those most directly affecting themselves and others in the State of California; and those reasons with the least direct impact on their families or others in their state, but impacting the overall "common good."

The ability to save money on electric bills, a reason or benefit that directly impacts the respondent and the respondent's family is, unsurprisingly, found to be the most important reason for signing up for a TD pricing plan overall.

Following the logic above then, reducing blackouts and power reliability problems and creating a secure energy future for California are all ideas of real importance to Californians who lived through the energy crisis of 2001 and were second most important overall as a reason for signing up for a TD pricing plan.

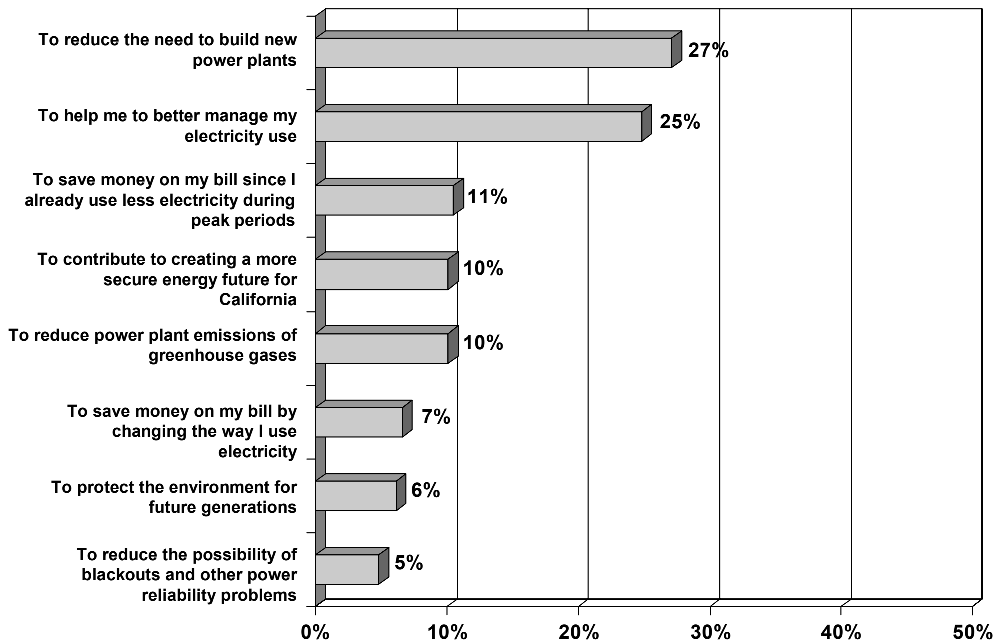
Chart 6.6 – Most Important Reasons for Signing Up for a TD Pricing Plan



Q35. Please choose the reason that would be **most** important to you when you think about signing up for such a pricing plan. n=1196

The other reasons tested were found to be much less important, potentially because their impact may not be completely understood (such as what the effect of reducing the need to build new power plants would have), their end benefit may not have been understood (why the management of electricity use outside of simply saving money is important), or their consequences are not immediate or tangible (reducing power plant emissions of green house gasses).

Chart 6.7 – Least Important Reasons for Signing Up for a TD Pricing Plan



Q35B. And, please choose the reason that would be **least most** important to you when you think about signing up for such a pricing plan.
n=1196

These results are also suggestive of the *types* of value propositions that might work best when communicating about these pricing options, with a combination of savings messages coupled with messages around the benefits for Californians as a whole potentially working best as the primary messaging to “sell” customers on these pricing plans.

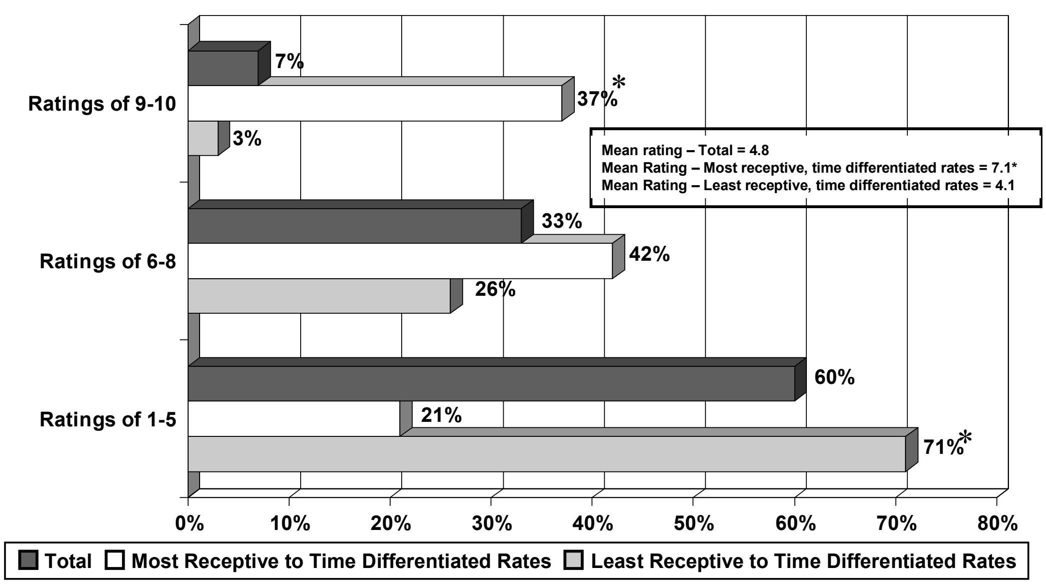
Detailed Findings: Reactions to Other Pricing Options

After considering the various TOU and CPP pricing options, respondents were then asked to consider some alternative pricing options not tested as part of the discrete choice conjoint tasks – a premium fixed price per hour plan and a real time pricing plan.

Reactions to the two alternative pricing plans were quite similar to reactions to the time-differentiated plans, at least in terms of the percentage of the sample expressing a strong interest in signing up, with only 7-8% of those surveyed having a strong interest in signing up for a real time or fixed pricing plan, respectively. Again, such ratings probably do not account for the inertia that would work to keep customers on a premium fixed pricing plan or a real-time pricing plan if placed on that plan initially and only given the option to opt out.

Receptivity to these alternative pricing plans also appears somewhat correlated to interest in time-differentiated plans as well. As shown in Charts 7.1-7.2, those most receptive to the idea of a time-differentiated pricing plan are also significantly more receptive to both real time pricing plans and premium fixed pricing plans, suggesting a potentially greater receptivity to change, risk and uncertainty in general among this set of respondents.

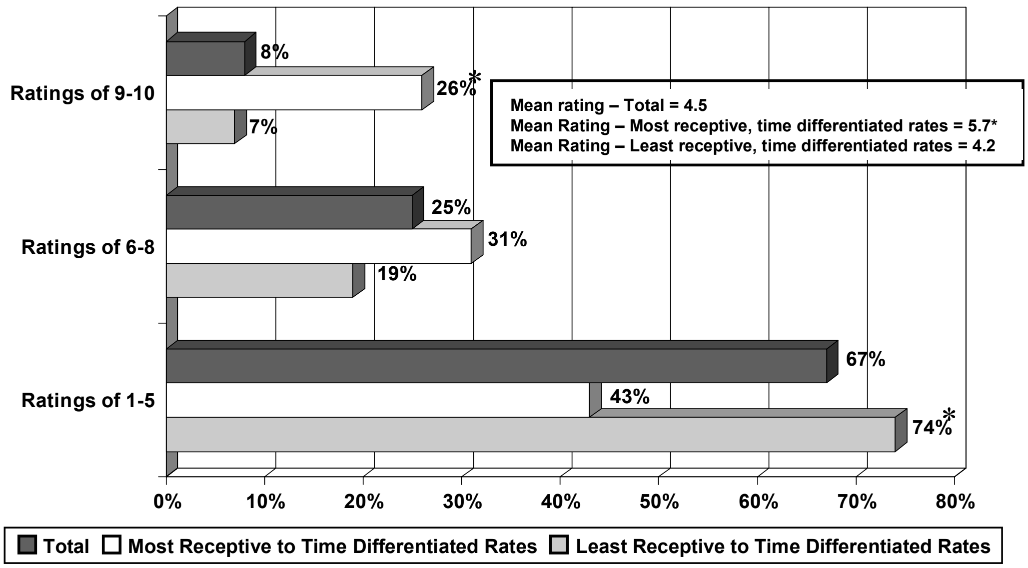
Chart 7.1 - Reactions to Real Time Pricing Plan



* Differences significant at the 95% confidence level

Q44. How likely would you be to participate in a real time pricing program? (1=No chance I would participate real time pricing; 10=I would definitely participate real time pricing) n=1196

Chart 7.2 – Reactions to Premium Fixed Price per Hour Plan

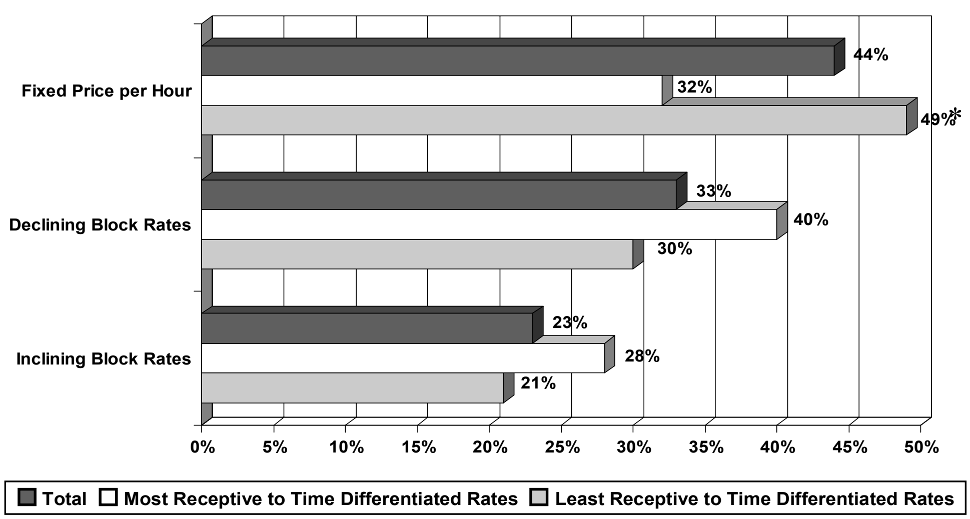


* Differences significant at the 95% confidence level

Q36e. If you knew that, on average, the price per hour under the fixed price per hour plan would be 10% higher than the average price per hour under a plan in which prices varied over the course of the day, how likely would you be to participate in such a program if it had this outcome? (1=No chance I would sign up for a fixed price per hour plan; 10=I would definitely sign up for a fixed price per hour plan)
n=1196

However, while not that appealing to the majority in and of itself, most survey respondents preferred a fixed price per hour plan when forced to choose between this option and declining or inclining block rate options.

Chart 7.3 – Preference for Fixed, Inclining and Declining Block Rates



* Differences significant at the 95% confidence level

Q36dd.If you had only the following three electricity pricing options to choose from, which option would you be most likely to choose?
n=1196

Furthermore, those least receptive to time-differentiated rate plans were significantly more likely to choose a flat rate plan than those most receptive to time-differentiated rates – potentially because they more highly value the perceived certainty that a fixed rate provides. From the Billing Heuristics focus group research conducted in the Fall of 2003, we also know that many express a preference for flat rate pricing over other rates which can be seen as potentially more complicated, difficult to respond to, and potentially punitive for households that feel they are unable to further reduce their electricity use in any meaningful way.

Though the focus group research participants suggested that a declining block rate made little sense for electricity since it would encourage wasteful use, the survey respondents in this research undoubtedly felt more comfortable in expressing a natural preference for a rate which would save them money, putting this rate as the second most preferred of the three.

It is also not surprising that few would prefer the inclining block rate option as those that tended toward higher electricity use found this model unfair in the focus group research – or at least unfair to them personally since they would end up paying higher electricity bills. In the focus group research, those with larger households in particular suggested that they would be penalized for having a family that uses more electricity not because they are wasteful, but rather simply because there are more people in the household.

Detailed Findings: Distinguishing "Likely Takers" of Appliance Controls

As with our initial investigation into customer interest in TD rates, an easy place to begin this discussion would be to ask ourselves who, generally speaking, would be interested in using electric appliance controls in their homes? How similar are these "likely takers" to other customers? And, assuming there are certain subgroups that find electric appliance controls more appealing than others, how similar are these groups of customers to those that were most interested in TD pricing?

This section takes up the question of what types of customers would be most likely to consider adopting electric appliance control systems, if these were made available to customers as part of a time-differentiated pricing plan.

The Data Used in This Analysis

To explore the issue of what types of customers would find appliance controls most appealing, the team focused on responses to three specific appliance control options that customers evaluated, in addition to their evaluation of the various options presented in the discrete choice tasks. These options were designed to be representative of the continuum of offerings under consideration from basic, moderate, and extensive controls; low, medium and high price; and low, medium and high monthly bill impact; and different levels of system programming/activation. Customers were asked to rate their likelihood of purchasing each of these appliance controls device options if they were made available to them. These three options are presented in Table 8.1.

Table 8.1 – Appliance Control Options Used in Taker Analysis

	Option #1	Option #2	Option #3
Monthly Cost	$5	$10	$20
How Extensive Controls are	Basic	Moderate	Extensive
Impact on Monthly Summer Electric Bill	2.5% (presented as actual dollar amount based on average bill)	8.75% (presented as actual dollar amount based on average bill)	15% (presented as actual dollar amount based on average bill)
System Programming and Activation	Utility programs to customer's specs	Utility programs / customer can override	Utility programs / customer can override

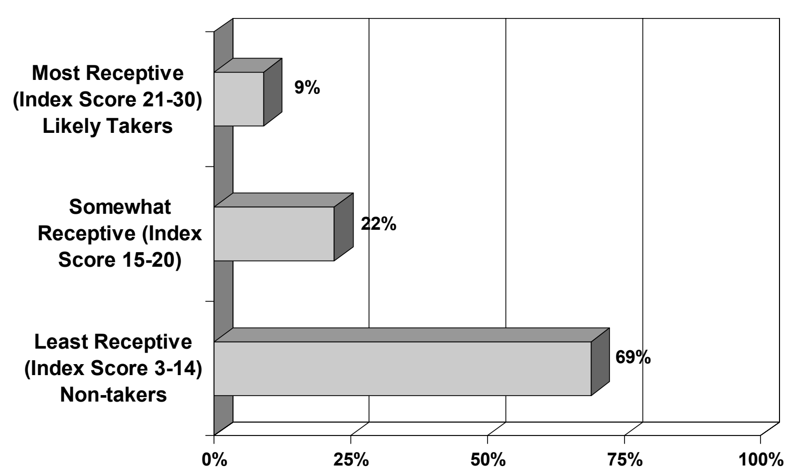
Customers rated each option on a scale from 1 to 10 where 1 meant "No chance I would purchase" and 10 meant "I would definitely purchase." Using respondents' ratings to each of these options, an additive index was created that summed each person's rating for each of the three options to yield a single value. This index, then, measures a customer's general interest in adopting or purchasing appliance controls if they were made available, rather than to a specific type of control option.

This index was computed for each respondent by adding together their ratings for each of the three appliance control options. Thus, each person was assigned an index score ranging from 3 to 30 (the range of values possible for this index, where a score of "3" meant they rated each option a "1" on the interest scale and a score of "30" meant that they rated each option a "10" on the interest scale). Respondents were then separated into groups that ranged from likely takers/most receptive to non-takers/least receptive. Those with a receptivity score of 21 or higher (roughly equivalent to giving each option a score of 7 or higher on the 10-point scale) were allocated to the likely takers/most receptive group to controls appliances. Those with receptivity scores of 14 or less were allocated to the non-takers/least receptive group.

It should be noted that the score required for classification as a likely taker in this exercise (typically ratings of 7 to 10) is somewhat less stringent than corresponding analysis of the "likely takers" of TD pricing (typically ratings of 8 to 10). Overall, there is somewhat less interest among customers in installing appliance controls than in signing up for time-differentiated electricity pricing. For this reason, the definition of a "likely taker" was expanded to provide sufficient data for analysis. This lack of interest in using appliance controls was also noted in the Residential Customer Understanding of Electricity Usage and Billing Report, which reports the results of qualitative research conducted in September to October of 2003 for the three California IOUs as support to the CPMR and SPP research. The report notes the concerns of focus group participants regarding the potential difficulty of programming and managing these devices, which greatly contributed to their lack of interest.

Chart 8.1 reports the sizes of each of these groups. It is important to note here that while Chart 8.1 indicates that 9% of the respondents in the current study are likely "takers" for appliance controls, this is not to suggest that this is the percentage of customers that we could expect to adopt any type of appliance control offered.

Chart 8.1 – Receptivity to Appliance Controls



WTP1-WTP3. If a home appliance controls option were available to you now with the specific configuration listed below, how likely do you think you would be to purchase that option? (1=No chance I would purchase; 10=I would definitely purchase) n=1196

In fact, the percentage of customers that would be likely to adopt a given appliance control option may well be larger or smaller than 9% depending on how it was designed, whether it was bundled or marketed with a significantly appealing TD rate option, etc. However, regardless of what specific appliance control option we may want to look at later, we would expect that those customers defined here as most likely "takers" of appliance controls generally make up a large part of the likely taker group for any appliance control option.

Now, the question becomes, how, if at all, do these likely takers differ from the non-takers and are these differences important?

Distinguishing Most Likely Takers from Non-Takers

Table 8.2 details the differences between the "takers" and "non-takers" for appliance controls. Some of the highlights of these differences include:

- Like those most receptive to TD pricing options, likely takers of appliance controls tend also to be more open to new products and services generally. Those most interested in appliance controls were significantly more interested in each of the three alternative pricing options explored in this study (TD, premium fixed price per hour and real-time pricing) and they tended to be more risk accepting when exploring new products and services.

- Likely takers of appliance controls, like those most interested in TD pricing options, are more likely to indicate a past and present willingness to reduce or change how they use electricity. This likely taker group was more likely to have reduced their electricity use during the 2001 crisis and indicated a willingness to do so again under a TD pricing plan.

- Likely takers of control systems tend to have more appliance holdings (and the resulting higher electricity use) with which these appliance controls could be used. It would seem obvious that the more appliances a customer has which could possibly be used with these appliances to control options, the more value they would have. Likely takers were more likely to have clothes washers, clothes dryers, spas/ hot tubs, and air conditioning.

- Likely takers' households tended also to be larger, with more people home weekdays (summer and winter) between the hours of 5 p.m. to 7 p.m. With more people home during peak hours, there appears to be more of an incentive to adopt a device that could help curb electricity used by those home during these time periods.

- Likely takers are slightly more likely to have been in their present home for less than five years. This finding may be suggestive of customers thinking that such appliance controls are more suitable to newer construction (though, the question does ask about number of years spent in the home, not age of the home, this may be correlated to a certain extent).

- The white and over age 55 groups are slightly underrepresented in this group of likely takers.

Table 8.2 – Differences between Those Most and Least Receptive to Appliance Controls

	Takers / Most Receptive	Non-Takers / Least Receptive
Interest in Other Alternative Pricing Options / Time-Differentiated Pricing		
Interest in Premium Fixed Price Per Hour Plan	6.3[1,2]	4.1
Interest in Real-Time Pricing Plan	6.7	4.2
Very Interested in Time-Differentiated Pricing[3]	43%	6%
Most Risk Averse	29%	42%
Behavioral Differences		
Reduced electricity use during 2001 crisis	88%	76%
Would reduce electricity use during all time periods under time-differentiated pricing	59%	28%
Would not change how use electricity under time-differentiated pricing	7%	18%
Differences in Appliance holdings / Appliance use / Energy Use		
High Electricity Use	62%	40%
Medium Electricity Use	21%	43%
Has clothes washer in residence	93%	75%
No clothes dryer in residence	9%	22%
No Spa / Hot Tub	79%	90%
No Air Conditioning	35%	51%
Uses Heat Pump Heating/ Cooling System	5%	19%
Rarely Uses Central Air Conditioning	1%	9%
Characteristics of Household / Respondent		
White	50%	60%
Aged 55-64	2.3%	11.4%
Aged 65+	19%	21%
Number in Household	3.6	2.9
Number home weekday summer afternoons (5-7pm)	3.1	2.4
Number home weekday winter afternoons (5-7pm)	3.2	2.5
Lived in Home 5 or more years	49%	56%

[1] All differences between the two groups are significant at the 95% confidence level.
[2] Mean ratings on a 10-point scale; 1=No interest, 10=Strong Interest
3 Calculated index; see "Detail Findings: General Interest in Time-Differentiated Pricing" for calculation

Detailed Findings: Understanding Customer Response to Specific Appliance Controls Features

There are various ways that program planners might think about designing a residential appliance control. One of the goals of this research was to understand how customers think about each of the components or "building blocks" that could be used to construct this design. For example, how important is the potential savings that could be achieved monthly through the use of these controls? How much of a savings do customers need to see for the appliance control to be seen as valuable? Is this potential savings from using the device more or less important to customers than the fixed cost per month for owning the device? Are customers willing to accept a device that is not free? How much are they willing to pay? In terms of the extensiveness of the controls, is more necessarily better? Most assume that customers need appliance control systems that are convenient and easy to use – but does this really translate into a preference for a utility-programmed appliance control?

In order to determine how to design an appliance control (or controls) that has the best chance of being adopted by customers, it is important to understand first how customers respond to each of the individual appliance control building blocks that could be part of this "package." Once this is understood, we can use this to inform us how to create attractive appliance control options.

Identifying the Appliance Control "Building Blocks"

The research team selected the following set of building blocks from which to construct the various appliance control options.

- Extensiveness of the controls: This appliance control building block involved describing for customers both the complexity of the appliance control as well as the number of different appliances that could be controlled with the device. The types of controls included:
    - Basic Controls: Described as including simple air conditioning thermostat controls
    - Moderate Controls: Described as including controls for several different appliances, though with only simple on/off, or single thermostat settings only.
    - Extensive Controls: Described as including controls for several different appliances with multiple operational settings for different times of the day

- Monthly cost for the system – Basic Controls: This building block defines the monthly price customers could expect to pay for a basic control. This component varies from:
    - $0 / month
    - $2.50 / month
    - $5.00 / month
    - $7.50 / month

- Monthly cost for the system – Moderate Controls: This building block defines the monthly price customers could expect to pay for a moderate control. This component varies from:
  - $7.50 / month
  - $10.00 / month
  - $12.50 / month
  - $15.00 / month

- Monthly cost for the system – Extensive Controls: This building block defines the monthly price customers could expect to pay for an extensive control. This component varies from:
  - $15.00 / month
  - $17.50 / month
  - $20.00 / month
  - $22.50 / month

- Impact on monthly summer electric bill: This building block described the monthly savings possible for using the appliance control. The potential savings ranged from:
  - 2.5% / month
  - 8.75% / month
  - 15% / month

- How the appliance control would be programmed and activated: This building block specifies who will program the control, to whose specifications the control will be programmed, and the degree to which the customer will be able to override the control's programmed settings. More specifically, this component includes the following options:
  - Customer programs the appliance control
  - Utility programs the appliance control to customer's specifications
  - Utility programs the appliance control to their specifications, and the customer can override
  - Utility programs the appliance control to their specifications but the customer is not allowed to override

Next, we can explore how much value customers assigned to each of these building blocks. This analysis is quite similar to that of the TD pricing program building blocks described in a previous section of this report. The team also used discrete choice analysis here to understand customer preferences for each of these appliance controls components. For a more detailed description of the discrete choice methodology employed, please see the Methodology section of this report.

How Customers Value Each of the Appliance Controls "Building Blocks"

One important question to answer here is, how much do customers care about each of the various options within each building block? That is, we might expect them to prefer a 15% savings potential to an 8.75% savings potential, but how much more do they really like 15%? Within regards to the complexity of the controls do customers more highly value basic, moderate or extensive controls?

Secondly, which of these building blocks do they care most about? We might assume that the savings potential would be most important to customers, but is that really the case? Are there other building blocks deemed more important?

As with our analysis of the TD rates in the previous chapter of this report, the data used to answer these questions are generated from the analysis of the discrete choice tasks. Survey respondents were asked to react to a series of choice tasks that contained various combinations of the appliance controls building blocks. Through statistical analysis, we are able to translate the preferences they express into a set of "utilities". Again, "utility" is the statistical term for what, in plain language, we would describe as the mathematical representation of the value respondents place on each of the levels or options within a building block.

These "utilities" or measures of attractiveness or importance have no absolute interpretation in the "real world" but represent an estimate of the relative value of each of the different levels of the building blocks.

To begin, let's take a look at the utilities for the level of controls in Table 9.1. In this table are the average utility values across all respondents in the survey. The utility for basic controls is .18, for moderate it's .38 and -.56 for extensive controls. Note that the utility value for a moderate control option is both positive and the largest value in the table. This tells us that customers value moderate controls the most, followed by basic controls. Extensive controls have a large negative value and are valued the least.

Table 9.1 – Utility Values for Extensiveness of Controls

Extensiveness of Controls	Basic	.18
	Moderate	.38
	Extensive	-.56

Moving on, we can explore customer response to the monthly cost building block. Table 9.2 compares the utility values across the monthly costs for basic, moderate, and extensive controls.

In reviewing how the utilities vary across the different cost levels for basic, moderate, and extensive, several key findings emerge.

- Customers are willing to pay significantly more for a moderate or extensive control than they are for a basic control. In looking at the utility values for each type of control we see, unsurprisingly, that the smallest monthly cost, regardless of the type of control, has the largest value to customers. However, the entry level price for both the moderate and extensive controls ($7.50 and $ 15.00 respectively) has a larger utility than does the entry level price for basic controls ($0). Furthermore, the impact of adding $2.50 to the monthly cost for the controls has a very different impact on customers' utilities depending on the type of control. Adding $2.50 to the entry level price for a basic control makes for a larger drop in utility than when adding $2.50 to the entry level price for either the moderate or extensive controls.

- Customers appear to equally value options that would result in quite different economic outcomes. A monthly cost of either $7.50 or $10.00 for a moderate control appear to be equally valuable as a monthly cost of $15.00 or $17.50, despite a preference overall for a moderate control.

Table 9.2 – Utility Values for Monthly Cost of Controls

Monthly Cost for Basic Controls	$0.00	.48
	$2.50	-.10
	$5.00	-.17
	$7.50	-.21
Monthly Cost for Moderate Controls	$7.50	.55
	$10.00	.13
	$12.50	-.20
	$15.00	-.47
Monthly Cost for Extensive Controls	$15.00	.55
	$17.50	.19
	$20.00	-.34
	$22.50	-.40

The utilities that customers attach to system programming are reported in Table 9.3 below. They indicate that customers value the options most highly that give them the most control. Within this feature, customers most prefer the ability to program the appliance control system themselves, followed by the utility programming the system, but allowing for customer override.

Table 9.3 – Utility Values for System Programming

System Programming & Activation	Customer programs	.68
	Utility programs to customer's specs	-.39
	Utility programs, but customer can override	.29
	Utility programs, but customer cannot override	-.58

Lastly, Table 9.4 reports the utilities associated with monthly summer bill savings. The reader will note that, similar to the evaluation of savings potential for the various TD rates, the choices evaluated in the survey by customers were not percentages. Rather, respondents were shown absolute dollar value bill impacts that were calculated based on their approximate monthly utility bills in order to simplify the presentation for respondents.

- In addition to the primary goal of respondent simplification, this allows us to evaluate the degree to which the value respondents attach to these savings levels were driven by the percentage value and the size of their own electric bill. That is, will a 15% savings be worth more if it equates to $15 rather than $10? Table 9.4 lists the utilities for both the percentage impact as well as the dollar-metric impact.

Table 9.4 – Utility Values for Monthly Bill Savings

Monthly Summer Bill Savings (Total Impact)	2.5% savings	-.37
	8.75% savings	-.01
	15% savings	.37
Monthly Summer Bill Savings (Percentage Impact)	2.5% savings	-.22
	8.75% savings	.00
	15% savings	.22
Monthly Summer Bill Savings (Dollar-metric Impact)	2.5% savings	-.13
	8.75% savings	.00
	15% savings	.13

Note in addition that this information also indicates that:

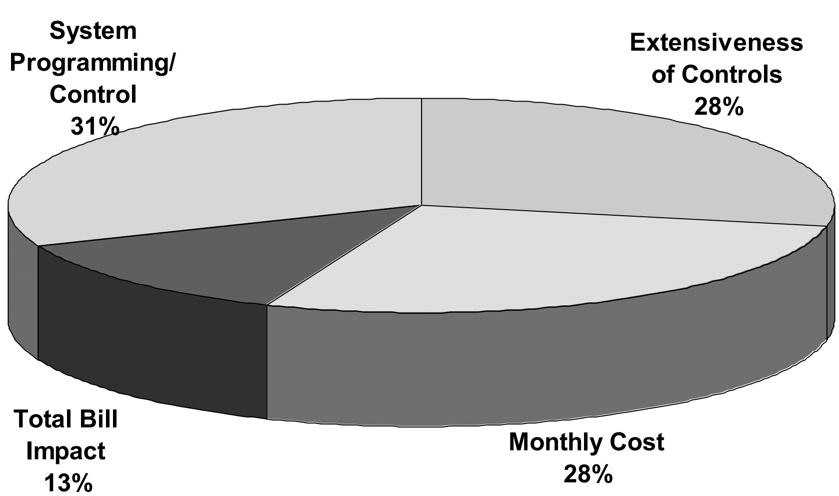
- Of the four appliance control components, the potential monthly summer bill savings is least important to customers (given that the range from highest to lowest utility is the smallest.) Unsurprisingly, customers expressed a preference for the highest savings values, with customers attaching the highest value to a savings level of 15%, followed by 8.75% and 2.5%.

- Most of the value associated with monthly summer bill savings comes from the percentage statement of the savings (2.5%, 8.75%, and 15%), though a small amount of additional value is attached to higher savings values by those people with higher bills. Thus, those with higher bills like higher savings levels.

In reviewing the utilities for all the different components in total, the reader will note the relatively smaller size of these utilities overall when compared to those found in the analysis of the TD pricing program components. The relatively small utilities or differences between the most preferred and least preferred levels for a particular component indicate a lack of strong preferences among customers and may reflect a general lack of interest in these devices by a majority of respondents.

Chart 9.1 presents a summary of the relative importance of each of the appliance control features tested. The percentages for each component in the chart represent the relative contribution of each towards a customer's stated preference for a given option. Thus, the chart indicates that 31% of customer preference for a given option is driven by the features chosen in the system programming and control component. Approximately 28% of customer preference is driven by the extensiveness of the controls and another 28% by the monthly cost of the system. A relatively small percentage of customer preference is driven by the total bill impact they could expect to see when using these controls. Thus, to change the way an appliance control option is constructed by changing the percentage of savings realized by the customer will have a much smaller effect on customer preference for the option than a change in how the system is programmed and controlled, how extensive the controls are, or the monthly cost of the controls.

Chart 9.1 – Relative Importance of Appliance Controls Features



Given the great importance attached to potential savings when constructing TD pricing programs, it may seem surprising to find that potential savings are least important for appliance controls. Respondents are not being inconsistent, seemingly suddenly unconcerned with savings. Certainly, there may be some consumers who would install these control devices and may be more motivated by a simple desire to conserve energy rather than by anticipation of savings on their electricity bill. More likely, however, is the fact that the other three components, dealing with issues of customer control, potentially complex appliance controls, and a known, usually positive monthly cost associated with these controls, were simply so much more important to customers than the potential for monthly savings.

Understanding Customer Variability in Preference for Specific Product Features

The previous section of this report described, on average, how customers responded to the various components or building blocks of an appliance control product. But, the question remains, are there certain groups of customers who respond to these different components in ways that are substantially different from others? To answer this question, the team looked at various different customer segments defined by, for example, climate zone, utility, demographics (age, income, ethnicity, and education), housing characteristics, and appliance holdings and use. The way in which utility or value was assigned to each level of the various appliance control components were then compared across these different groups.

The goal of this analysis is to identify any patterns in the way different customer groups assigned value to the product features. Do larger households, for example, more highly value certain components of an appliance control product than do smaller households? Do customers in different climate zones respond differently to the various components?

If customers are different in the way they evaluate the various appliance control components, then this might have implications for how the marketplace will be approached. It is possible, for example, that different combinations of appliance control features may be appropriate for certain customer segments and, in order to achieve adoption of these systems from a larger percentage of the customer population, it may be necessary to offer a couple of different options.

The next several tables enumerate the relatively few differences found in how customer subgroups assign value to the appliance control features. Most of the differences presented are either directly or indirectly related to energy usage (i.e., size of electric bill / electricity usage, climate zone, utility, size of household or number of people home on summer weekday afternoons). In looking at these differences, a couple of major themes emerge:

- Overall, customers that use more electricity (electricity bills of $100 or more) appear less resistant to the use of extensive controls than those with more limited electricity use, potentially due to the recognition that they could potentially benefit more from the ability to control more appliances with a greater number of operational settings given this higher level of use. Those with lower energy use appear to attach more value to moderate and basic controls.

- However, those with one or more persons routinely at home during summer weekday afternoons (and, consequently, higher electricity use during these time periods) are *more resistant* to the use of extensive controls than those with no one home on summer weekday afternoons. Like those with higher electric bills, those with more people home during weekday afternoons could theoretically benefit from the use of appliance controls to monitor their energy use during the on-peak periods.

  However, the use of such extensive controls, controlling multiple different appliances may be considered too much of an imposition on their comfort and convenience. On the other hand, those households in which no one is home during the afternoons may wish to maximize their conservation / savings through the use of extensive controls.

- Those with one or more persons home during summer weekday afternoons were much more resistant to the idea of a system that the utility programs and does not give them override capability than those with no one at home. A greater acceptance among those households with no one home during these time periods makes sense since there would be less reason for these households to be concerned about the need to override the utility's program since there is no one home anyway.

- Those with no one at home on weekday summer afternoons appear to be more willing to pay a higher monthly cost for a moderately extensive appliance control system, perhaps because these are multi-earner households with higher incomes and lower price sensitivity.

Table 9.5 – Variation in Utilities by Electricity Usage

Electricity Usage	Extensive Controls
Low Usage	-.64
High Usage	-.46
Total	-.56

A few relevant differences were found among customers in climate zones 1, 3, and 4. Climate zone may be considered somewhat of a proxy for electricity usage since it can be reasonably assumed that those in the hotter climate zones have higher electricity bills due to higher AC use. While Table 9.5 indicated less resistance to the use of extensive controls among high electricity-using customers, Table 9.6 indicates the greatest preference for moderate controls by lower electricity-using customers, or customers in climate zone 1. There may be less of a perceived need for a more extensive appliance control system since they already have fairly low summer electricity bills.

There were also differences found in terms of preferences for how the system would be programmed and activated among customers in different climate zones, though the reasons for this are not immediately apparent.

Table 9.6 indicates that customers in zone 4 have less value for an appliance control that is programmed by the utility but can be manually overridden by the user than customers in zones 1 and 3. Customers in zone 4 were less negative towards a system that would have the utility program it to their specifications. The overriding preference among customers in all climate zones, however, is for a device that would be programmed by the user to the user's specifications.

Table 9.6 – Variation in Utilities by Climate Zone

Climate Zone	Moderate Controls	System Programming Utility programs to your specifications	System Programming Utility programs/activates- you CAN override
Zone 1	.46	-.45	.32
Zone 3	.37	-.41	.31
Zone 4	.25	-.23	.19
Total	.38	-.39	.29

There were also some differences found among customers for the three utilities in how they assign value to the appliance control features. PG&E customers showed stronger preference for the basic control option and more extreme dislike for the extensive controls alternative. If we consider the fact that PG&E is the only utility that includes customers living in climate zone 1, and consequently includes more customers with lower monthly summer electric bills on average, then these findings are consistent with previous findings that show a preference for basic controls among those with lower electricity usage. These differences aside, all three utilities had the highest preference for the moderate control option.

PG&E customers also responded somewhat more negatively to a controls device that was programmed by the utility with no override option for the user, though clearly this option was negatively received by most customers.

Table 9.7 – Variations in Utilites by Utility Provider

Utility	Basic Control	Extensive Control	System Programming Utility programs/activates- you cannot override
SCE	.10	-.51	-.51
PG&E	.28	-.62	-.67
SDG&E	.11	-.50	-.55
Total	.18	-.56	-.58

Table 9.8 shows how households where no one is home on summer weekday afternoons differ in how they assign value to the extensiveness of appliance controls, monthly system cost and system programming and control. The differences suggest that households where no one is home during these time periods are less resistant to extensive controls, less resistant to paying more ($15 per month) for moderate controls, and respond more favorably to utility programming of their control devices with no user option for overriding the settings.

These findings make sense given that households where no one is home during summer weekday afternoons might want to maximize their conservation/savings through the use of extensive controls and would not worry about overriding the system since there is no one home anyway. These customers may also be willing to pay more ($15) than other households since there is no one home to make the appropriate energy saving adjustments. Despite these differences, both those with and without people home during weekday afternoons prefer to purchase moderate controls at a base price of $7.50 per month.

Table 9.8 – Variation in Utilities by Number at Home on Summer Weekday Afternoons

Number Home Summer Weekday Afternoons	Extensive Controls	Monthly Cost (Moderate Controls) $7.50	Monthly Cost (Moderate Controls) $15	System Programming – Customer Programs	System Programming Utility programs/activates-customer cannot override
None	-.25	.38	-.33	.15	.07
One	-.66	.58	-.50	.76	-.67
Two or more	-.54	.54	-.47	.67	-.58
Total	-.56	.55	-.47	.68	-.58

The next several tables describe the few demographic differences found in terms how customers value the appliance control features. In looking at these differences, it is found that:

- Hispanic customers and those in the 35-64 age group attach more value to the percentage savings that an appliance control could yield, even after the contribution of higher electricity bills to this higher value has been taken into consideration.

  - Recall that, in the presentation of these products, customers were shown potential savings in terms of actual dollars saved rather than percentages. These were calculated by applying the percentage savings against each customer's approximate summer electric bill. In the analysis of this information, we are able to separate out the contribution of the "dollar-metric" component of the utility for each savings level from the contribution of the percentage savings component. Analysis found that, in many cases, customers with higher electricity bills tend to prefer a savings level more than an equivalent customer with a lower electricity bill, a finding that, in and of itself, is not that surprising. It is for this reason that our analysis here focuses on customer response to the percentage savings only.

- Preferences for basic, moderate, and extensive controls also vary among ethnic and age groups. There is a stronger preference for a basic control system among Hispanics, whereas Whites and those 65+ have a stronger preference for a moderate control. While not necessarily preferring an extensive control, those ages 18-34 have a less of a negative reaction to extensive controls.

- <u>There is a stronger preference among those 35+ for a control that the customer can program.</u> Related to this, those aged 18-34 are less negative (though still negative) towards a system that would be programmed and activated by the utility without overrides. This particular finding may be symptomatic of a comfort level among the younger age group with technology generally and faith that it will work as it is supposed to.

Table 9.9 – Variation in Utilities by Ethnicity

Ethnicity	Bill Impact – 15% savings	Basic Control	Moderate Control	System Programming Utility programs to customer specifications
White	.22	.10	.44	-.43
Hispanic	.28	.38	.23	-.31
Total	.24	.18	.38	-.39

Table 9.10 – Variation in Utilities by Age

Age	Bill Impact – 15% savings	Moderate Control	Extensive Control	System Programming Customer programs	System Programming Utility programs/activates-customer cannot override
18-34	.20	.33	-.46	.56	-.42
35-64	.26	.39	-.60	.70	-.62
65+	.22	.45	-.58	.79	-.69
Total	.24	.38	-.56	.68	-.58

Differences were also found in terms of preferences for a basic control among those self-reportedly living in urban, suburban and rural areas. Those living in rural areas expressed a much stronger preference for a basic appliance control than those in urban areas.

Table 9.11 – Variation in Utilities by Location of Home

Location of Home	Basic Controls
Urban	.07
Suburban	.21
Rural	.35
Total	.18

Detailed Findings: Estimating Market Potential – Appliance Controls

Up to this point, the discussion has revolved around customer preference for or value of various features or components of an appliance control system. This section will now move beyond this investigation of the various pieces of such a system to gain an understanding of how preferences for these various pieces would work together in a whole product and how it might translate into share of preference for a given product. Specifically, this section will investigate:

- Several different appliance control options and how changes in these options affects customer acceptance
- Sensitivity of customer acceptance to changes in the specific features that might be offered in an appliance control system
- Estimates of anticipated customer response for each of the example appliance control systems against the alternative of no appliance control system.
- Likely customer response assuming perfect awareness, 70%, 50%, and 30% customer awareness.

The reader will note that the discussion here on estimating market potential for the appliance control systems under consideration will be a good deal more simplified than parallel discussion in previous sections for the time-differentiated pricing programs. There are two reasons for this. First, as noted in the methodology section, no inertia or risk avoidance factors were applied to the forecasts of anticipated customer response to the control options. These adjustments were deemed unnecessary because of respondents' greater familiarity with making these types of product adoption decisions. Second, the analysis proceeded on the assumption that, at most, each utility would offer only one control product in the marketplace. Thus, this discussion will take up the expected customer response for scenarios in which only one such product is offered. Last, the analysis assumed that customers would not be required to use such a system, so the default or starting "condition" in every scenario is one in which the customer does not currently have an appliance control system (that is, all scenarios assume that customers must "opt-in" to installing a control system).

The Example Appliance Controls Products Used in this Section

The remainder of this discussion will focus on the ten specific offering scenarios displayed in Table 10.1. For the purposes of this report, we have identified these ten for discussion on the basis that they represent a reasonable range (from basic to extensive) of products that the utilities may consider offering. In addition, an option has been included to represent, as closely as possible, the Gulf Power Model.

The products included here in this report are intended only as examples of the types of results that can be calculated for each product. There are numerous other options that could be constructed from the features and levels tested in this research (in fact, there are 2,304 different products that could be constructed from the features explicitly tested in this design, and even more if we interpolate beyond the explicit savings values, etc. tested in the design). The reader may wish to build their own products using the market simulator that accompanies this report.

Table 10.1 – Base Appliance Control Options for Market Share Analysis

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10 (Gulf Power Model)
How Extensive Controls are (Basic, Moderate, Extensive)	Basic Control	Basic Control	Basic Control	Moderate Control	Moderate Control	Moderate Control	Moderate Control	Extensive Control	Extensive Control	Extensive Control
Monthly Cost ($0.0 to $22.50)	$2.50	$2.50	$0	$7.50	$7.50	$7.50	$7.50	$17.50	$17.50	$15.00
Bill impact (Total) (2.5% savings to 15% savings)	8.75% savings	8.75% savings	10% savings	15% savings	15% savings	8.75% savings	8.75% savings	8.75% savings	8.75% savings	12% savings
System Prog./Control (customer or utility programs/Customer or utility specs/Can or cannot override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer *cannot* override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override

To begin then, we will explore the preferences customers express when they have the option to either purchase a basic appliance control system, or not purchase anything at all. In this case (and in all the scenarios to be investigated), we assume that customers are given the option of one appliance control system to purchase (that is, there are not several options from which they have to choose) and that it is not a required acquisition for the rate plan that they've signed up for.

Before beginning our examination of market response to each of the basic control options, it is worth repeating how such results should be interpreted. As previously noted in our discussion of market response to the TD rate options, the share of preference results obtained here should not be interpreted as direct estimates of likely market share. That is to say, if option 1 received a 50% share of preference, that would not mean that 50% of all customers would choose that option in a "live" marketplace. There are many other external factors that can constrain customers from making choices based on their stated preferences that cannot be accounted for here and that may impact market share.

The discrete choice analysis is based on the assumption that all potential customers were aware of, fully informed about, and had access to the relevant options. To account for different levels of awareness of the systems once introduced customer share of preference estimates are provided that have been adjusted for different assumptions regarding awareness. More specifically, estimates have been calculated for "high" awareness (70%), "moderate awarness" (50%) and "low" awareness (30%).

Note again, however, that the analysis of share preference for the appliance control systems does not consider customer inertia or risk aversion that were incorporated into the previous discussion for the various TD rates investigated. These adjustments were considered unnecessary because customers typically have more experience with purchasing these types of products and would not be excessively influenced by inertia or risk avoidance.

We will begin by investigating the share of preference for a basic control system that the utility programs with a customer override that can generate 8.75% savings for $2.50 per month. In this initial scenario, when the basic control option 1 is offered, it achieves a 13% share of preference, with 87% opting not to acquire an appliance control system. Share decreases accordingly as awareness decreases.

The basic control system in option 2 is nearly identical to option 1, except that the customer is allowed to program the system. Our initial examination of the utilities for the potential programming features revealed a strong preference for this option over all others, so we would expect the share of preference to increase with this change in the system. And, in fact, it does. By changing this feature in this way share is increased fifteen percentage points, going from 13% to 28% (assuming perfect awareness).

The basic control system in option 3 looks at the impact on share of preference when making it more appealing in terms of the monthly cost and potential bill savings (making it free and increasing savings potential from 8.75% to 10%) but including a fairly unappealing programming feature – allowing the utility to program the system without the option for a customer override. Though financially more attractive than option 2, share of preference is significantly lower without the option to override the utility's programmed settings, with share dropping from 28% to 17%. However, option 3 is slightly more appealing than option 1, with the improvement in the financial aspects of the system being enough to overcome the loss of the customer override.

Table 10.2 – Simple Share of Preference: Basic Control Options vs. No Control

	Option 1	Option 2	Option 3
How Extensive Controls are (Basic, Moderate, Extensive)	Basic Control	Basic Control	Basic Control
Monthly Cost ($0.0 to $22.50)	$2.50	$2.50	$0
Bill impact (Total) (2.5% savings to 15% savings)	8.75% savings	8.75% savings	10% savings
System Prog./Control (customer or utility programs/Customer or utility specs/Can or cannot override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer *cannot* override
Share of Preference (Total Population) (Against the alternative of no appliance controls)	**13%**	**28%**	**17%**
Share of Preference Adjusted for Awareness (Total Population) (Against the alternative of no appliance controls)			
70%	9%	20%	12%
50%	7%	14%	9%
30%	4%	8%	5%
Share of Preference (CAC Owners Only – Represent 51% of Pop.) (Against the alternative of no appliance controls)	**14%**	**30%**	**18%**
Share of Preference Adjusted for Awareness (CAC Owners Only – Represent 51% of Pop.) (Against the alternative of no appliance controls)			
70%	10%	21%	13%
50%	7%	15%	9%
30%	4%	9%	5%

If we were to look only at the portion of the population that owns and pays for central air conditioning, the results are much the same, with the share of preference for this subset of the population for options 1-3 varying no more than one or two percentage points. Those results are reported in the second to last row of Table 10.2. Bear in mind, however, that the percentage of customers with Central AC is 51%, which means that the percentage of all customers who would choose to purchase an appliance control system would be reduced by about half from what is reported in Table 10.2 if it were only made available to these customers.

In looking at the moderate control options, we would expect share of preference to be much higher overall as our earlier investigation of the utility or value assigned to moderate controls was much higher than for either basic or extensive controls. And, in fact, that is exactly what we find in Table 10.3.

The share of preference for these four options ranges from 40-59% assuming perfect awareness of these options in the marketplace. Less than perfect awareness will of course reduce these figures accordingly as reported in Table 10.3.

For moderate control option 4, which includes programming by the utility, but with customer override and a potential for 15% monthly savings at a monthly cost of $7.50, achieves a 45% share of preference against the option of purchasing nothing at all. If we were then to change only the method of system programming and control for this system to a customer programmed option (option 5), share of preference would increase from 45% to 59%.

Now, what if we considered these same two options, but reduced the potential savings from 15% monthly to 8.75% monthly? Options 6 and 7 look at just that. Option 6 (which is really option 4 with a reduced monthly savings) loses only 5% share of preference with this reduction in monthly savings. Similarly, option 7 (which is option 5 with reduced monthly savings) loses only 4% share.

Table 10.3 – Simple Share of Preference: Moderate Control Options vs. No Control

	Option 4	Option 5	Option 6	Option 7
How Extensive Controls are (Basic, Moderate, Extensive)	Moderate Control	Moderate Control	Moderate Control	Moderate Control
Monthly Cost ($0.0 to $22.50)	$7.50	$7.50	$7.50	$7.50
Bill impact (Total) (2.5% savings to 15% savings)	15% savings	15% savings	8.75% savings	8.75% savings
System Prog./Control (customer or utility programs/Customer or utility specs/Can or cannot override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override	Customer programs to customer specs
Share of Preference (Total Population) (Against the alternative of no appliance controls)	**45%**	**59%**	**40%**	**55%**
Share of Preference Adjusted for Awareness (Total Population) (Against the alternative of no appliance controls)				
70%	32%	41%	28%	39%
50%	23%	30%	20%	28%
30%	14%	18%	12%	17%
Share of Preference (CAC Owners Only – Represent 51% of Pop.) (Against the alternative of no appliance controls)	**41%**	**58%**	**37%**	**54%**
Share of Preference Adjusted for Awareness (CAC Owners Only – Represent 51% of Pop.) (Against the alternative of no appliance controls)				
70%	29%	41%	26%	38%
50%	21%	29%	19%	27%
30%	12%	17%	11%	16%

When examining the subset of this population that owns central air conditioning we find very similar results, which are reported in the last row of Table 10.3. However, CAC owners only represent 51% of the population so the percentage of the total population would necessarily be reduced by about half if these systems were only made available to CAC owners.

The share of preference for each of the three extensive control options investigated for this report was the smallest for any of the ten options tested, in part because respondents more highly valued both basic and moderate control options.

The first option in Table 10.4 is an extensive control system with programming by the utility with customer override, 8.75% savings monthly and a monthly cost of $17.50. The share of preference the option achieves when customers have the option to purchase nothing at all is 8%. Unlike some of the other options presented here, modifying the product slightly to allow for the customer to program the system does not increase share of preference for this system at all.

The third option listed in Table 10.4 (option 10) was designed from the components tested in this research to resemble as closely as possible the Gulf Power appliance control system. The reader more familiar with the system offered by Gulf Power will realize that that system is actually offered free to the customer, while option 10 is listed as having a monthly charge of $15. Because the design only tested monthly charges of $15-$22.50 for an extensive control option, we are unable to estimate what impact offering this option free of charge would have on preference shares. Thus, we have run the simulation for this product as closely as possible to the Gulf Power system by using the cheapest monthly cost tested for an extensive control system - $15.

Table 10.4 – Simple Share of Preference: Extensive Control Options vs. No Control

	Option 8	**Option 9**	**Option 10 (Resembles Gulf Power Model)**
How Extensive Controls are (Basic, Moderate, Extensive)	Extensive Control	Extensive Control	Extensive Control
Monthly Cost ($0.0 to $22.50)	$17.50	$17.50	$15.00
Bill impact (Total) (2.5% savings to 15% savings)	8.75% savings	8.75% savings	12% savings
System Prog./Control (customer or utility programs/Customer or utility specs/Can or cannot override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override
Share of Preference (Total Population) (Against the alternative of no appliance controls)	**8%**	**8%**	**19%**
Share of Preference Adjusted for Awareness (Total Population) (Against the alternative of no appliance controls)			
70%	6%	6%	13%
50%	4%	4%	10%
30%	2%	2%	6%
Share of Preference (CAC Owners Only – Represent 51% of Pop.) (Against the alternative of no appliance controls)	**9%**	**9%**	**19%**
Share of Preference Adjusted for Awareness (CAC Owners Only – Represent 51% of Pop.) (Against the alternative of no appliance controls)			
70%	6%	6%	13%
50%	5%	5%	10%
30%	3%	3%	6%

The results for this option are slightly better than for options 8 and 9 with a 19% share of preference, but still significantly lower than the preference shares for any of the moderate control options.

The share of preference for these three options remain virtually unchanged when looking at the subset of the population with central air conditioning, with those results reported in the second to last row of Table 10.4. Again, CAC owners only represent 51% of the population so the percentage of the total population would necessarily be reduced by about half if these systems were only made available to CAC owners.

A summary of these results appears in Table 10.5. Across the ten product scenarios examined, a clear preference emerges for the systems with moderate controls. The systems receiving the largest share have been highlighted in Table 10.5.

Table 10.5 – Summary of Simple Share of Preference: All Options vs. No Control

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10 (Gulf Power Model
How Extensive Controls are (Basic, Moderate, Extensive)	Basic Control	Basic Control	Basic Control	Moderate Control	Moderate Control	Moderate Control	Moderate Control	Extensive Control	Extensive Control	Extensive Control
Monthly Cost ($0.0 to $22.50)	$2.50	$2.50	$0	$7.50	$7.50	$7.50	$7.50	$17.50	$17.50	$15.00
Bill impact (Total) (2.5% savings to 15% savings)	8.75% savings	8.75% savings	10% savings	15% savings	15% savings	8.75% savings	8.75% savings	8.75% savings	8.75% savings	12% savings
System Prog./Control (customer or utility programs/Customer or utility specs/Can or cannot override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer *cannot* override	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override	Customer programs to customer specs	Utility programs/ customer can override
Share of Preference (Total Population) (Against the alternative of no appliance controls)	**13%**	**28%**	**17%**	**45%**	**59%**	**40%**	**55%**	**8%**	**8%**	**19%**
Share of Preference Adjusted for Awareness (Total Population) (Against the alternative of no appliance controls) 70% / 50% / 30%	9% / 7% / 4%	20% / 14% / 8%	12% / 9% / 5%	32% / 23% / 14%	41% / 30% / 18%	28% / 20% / 12%	39% / 28% / 17%	6% / 4% / 2%	6% / 4% / 2%	13% / 10% / 6%
Share of Preference (CAC Owners Only – Represent 51% of Pop.) (Against the alternative of no appliance controls	**14%**	**30%**	**18%**	**41%**	**58%**	**37%**	**54%**	**9%**	**9%**	**19%**
Share of Preference Adjusted for Awareness (CAC Owners Only – Represent 51% of Pop.) (Against the alternative of no appliance controls) 70% / 50% / 30%	10% / 7% / 4%	21% / 15% / 9%	13% / 9% / 5%	29% / 21% / 12%	41% / 29% / 17%	26% / 19% / 11%	38% / 27% / 16%	6% / 5% / 3%	6% / 5% / 3%	13% / 10% / 6%

Sensitivity Analysis to Variations in Monthly Cost

Another way to investigate how customers might respond to modifications in the design of an appliance control system is to look systematically at the impact on the share of preference from changing one feature while holding the other features constant.

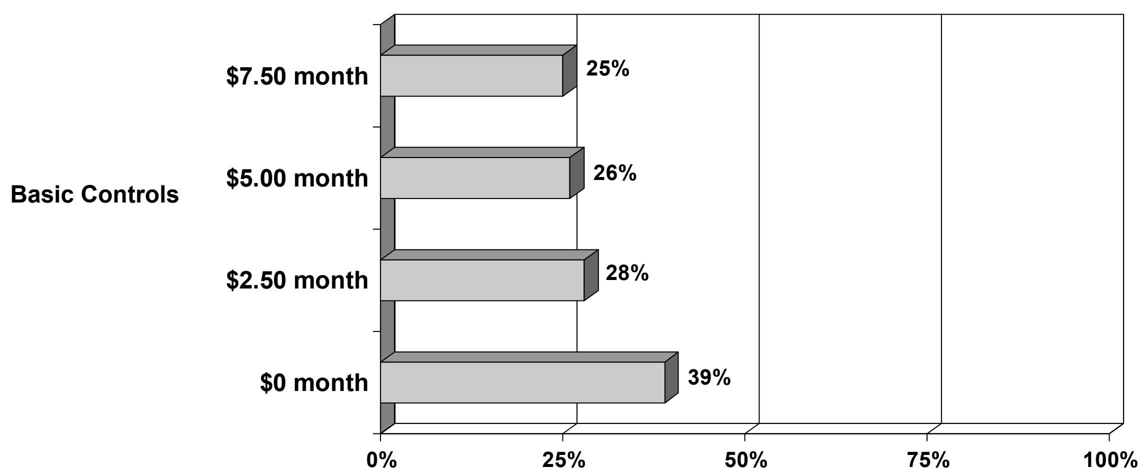
With this technique we can answer questions about how sensitive the share of preference for an appliance control system is to changes in the monthly cost of the system. All other things being equal, would we expect to see a large or small decrease in share if price was increased from $0 monthly to $2.50 monthly for a basic control system? Would we see more or less of a decrease in share if we increased the price from $2.50 to $5? The answer to these questions and more can be seen in Charts 10.1-10.3. In Charts 10.1–10.3 savings or bill impact has been held constant at 8.75%, and system programming and control is held constant at "customer programs to own specs" in order to look at the impact of a change in monthly cost on share of preference for a basic, moderate and extensive control system option.

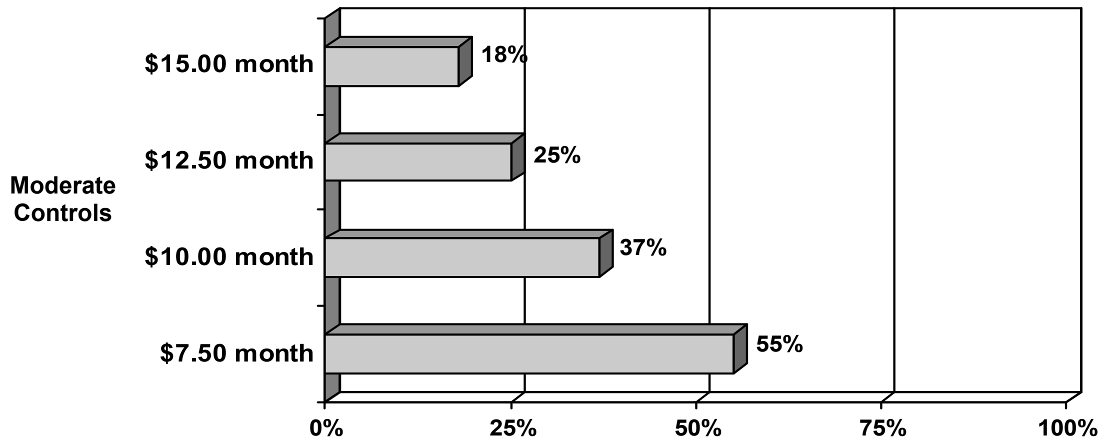
These charts reveal that there is less sensitivity to changes in price for the basic and extensive control systems than for moderate control systems. More specifically, the sensitivity analysis reveals:

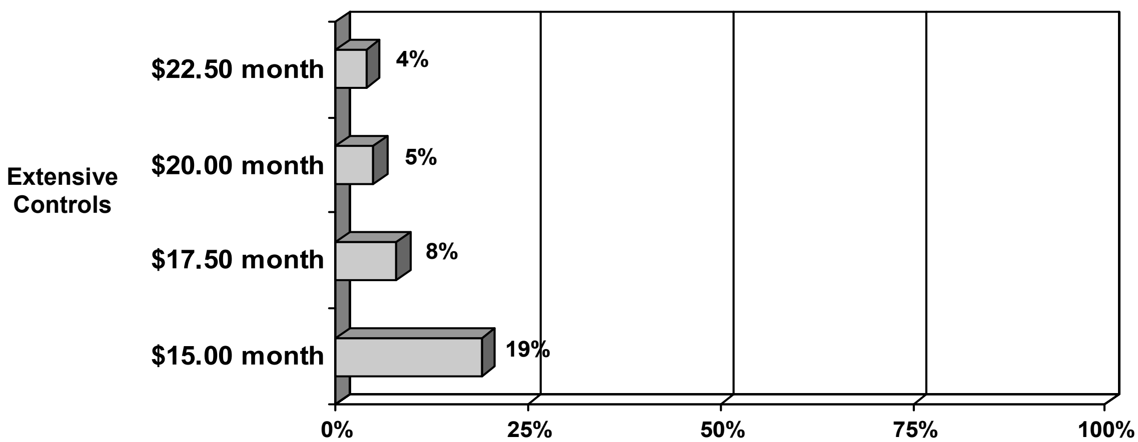
- For the basic and extensive control systems, customers appear to be most sensitive to price increases that are above and beyond the lowest monthly cost ($0 for Basic and $15 for Extensive) with demand dropping sharply as price is increased to the next level. Increases in price after that have little impact on share of preference.

- Share of preference drops steadily as price increases for the moderate control system. That is, while there is a fairly sizeable drop in share of preference when going from the lowest monthly cost ($7.50) to the next highest monthly cost ($10), preference shares continue to steadily decrease with each increase in monthly cost.

Charts 10.1 to 10.3 – Sensitivity to Differences in Price (Holding Bill Impact at 8.75% and Programming at Customer Programs to Own Specs)





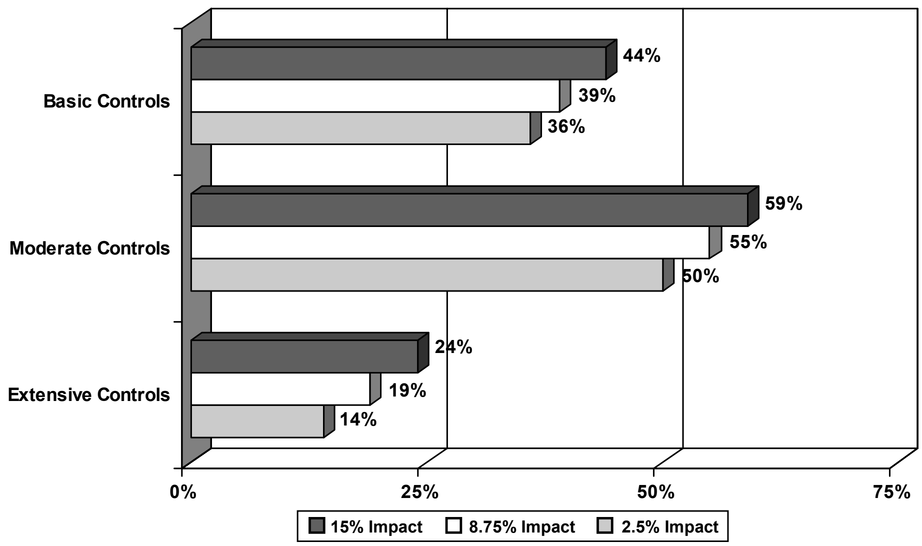


Now, by fixing price at the lowest level for each appliance control option (Basic=$0, Moderate=$7.50, and Extensive=$15) and programming at customer programmable, the impact of monthly savings on share of preference can be examined. Those results are presented in Chart 10.4 and reveal a similar pattern for the impact of increased savings across all three levels of appliance controls. There is a 4% to 5% decrease in share preference as the bill impact shifts to the next lower level.

The information presented in Chart 10.4 reveals that:

- <u>There is not a great deal of sensitivity to changes in savings levels, regardless of the type of appliance control system considered.</u> Share of preference for each type of appliance control system decreases by only a few percentage points as savings decreases.

Charts 10.4 – Sensitivity to Differences in Bill Impact (Holding Cost at Lowest Level and Programming at "Customer Programs")



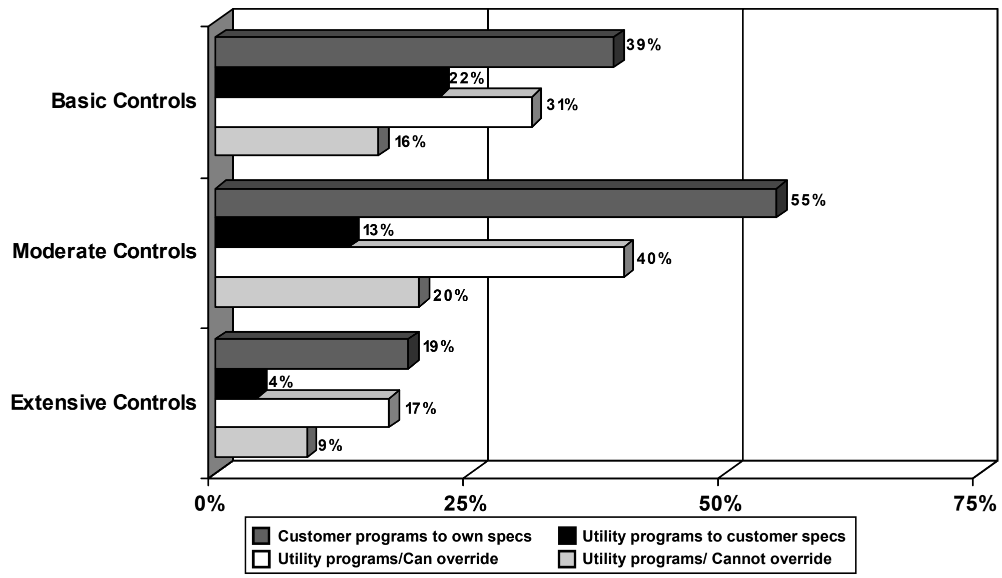
Finally, how much do changes in system programming and control impact share of preference? All other things being equal, would we expect to see a large or small increase or decrease in share if the type of programming used were changed from utility programmed with customer override to customer programmed?

For this analysis, cost for each product is held constant at the lowest amount for each type of appliance control while the savings potential is held constant at 8.75%. The results presented in Chart 10.5 reveal the following:

- Customers are very sensitive to changes in how the control systems are programmed and activated, with the biggest drops in share of preference occurring for the options in which the utility programs to the customer's specifications and for the option in which the utility programs the system and does not allow the customer to override the settings.

- Customers are most sensitive to changes in this feature for the moderate control options. In reviewing Chart 10.5, we see that for both the basic control and extensive control options there is approximately a 50% decrease in share of preference if the system programming is changed from customer-implemented to programming that the utility implements for the customer or programming done by the utility without override. However, for the moderate control options, this same change results in approximately a 65-75% decrease in share of preference.

Charts 10.5 – Sensitivity to Differences in Programming/Activation (Holding Cost at Lowest Level and Billing Impact at the mid-level 8.75%)



In Summary

The results generated from the simulations investigated here lead us to several conclusions.

- The system features with the biggest impact on share are the type of control system offered (basic, moderate, extensive) and the type of programming and activation offered. The biggest changes in share of preference can be seen when manipulating these two features, where the preferred features are a moderate appliance control that allows the customer to program and activate the system herself.

- The monthly fee and potential savings features have much less of an impact on customer preference for a particular system. So much so, in fact, that if the utilities decided to offer a system at a price other than the lowest price tested, then they might as well offer it at the highest price tested. Furthermore, little share is lost by offering lower monthly savings.

- Based on these findings, it is not surprising that options 4-7 achieved the largest share of preference, achieving 40-55% share. Even more interesting, however, is how little share is lost when the percentage savings the customer could expect is cut nearly in half (from 15% to 8.75% for identical products), with share falling only in the range of 4-5%, even given this significant reduction in savings.
    - Taking awareness into account, however, will necessarily reduce the share of preference here, depending on whether one assumes high, moderate or low levels of awareness of these systems.

- The shares reported here would also be reduced by approximately half if it was determined these systems were only relevant for CAC owners.

- Results here further suggest that both basic and extensive control options similar to the ones tested here would achieve a much smaller share of preference than a similar moderate option.

Notes on the Use of the Simulator

Accompanying this report is a simulator which will allow the user to simulate up to three different alternative appliance control systems. The final version of the simulator (labeled as Version 2.2) was the one used to calculate the share of preference estimates described here.

The simulator is quite similar in form to the one created to explore the various pricing rate designs. There are three columns for specifying up to three different alternative systems, labeled alternative A, B, and C. Alternative A is automatically included in each simulation. Alternatives B and C will only be included if the box below each of the two columns, which reads "include in simulation" is checked.

The type of control option (basic, moderate, or extensive) is chosen from a drop down menu. To specify the monthly cost and bill impact, type in any number within the valid range stipulated in the upper left hand corner of the "simulator" sheet. If invalid numbers are entered in for monthly cost or bill impact, the product will be ignored in the simulations, returning a 0% share of preference. The type of activation and control for the system can be chosen from a drop down menu.

Unlike the rate design simulator, the appliance controls simulator will not include options to calibrate for risk or inertia. Once the "run simulation" button is hit, the program will automatically take the user to the results page. The top of the screen lists each of the options simulated and the share of preference for each and for none, or the percentage of customers that would not purchase. On the bottom portion of the screen, the simulator shows the share of preference for each alternative and none broken out by seven different subgroups. The user can then click on the "simulator" tab at the bottom of the screen to specify a new simulation.

Likely Takers by Select Appliance Control Options

Gaining a better understanding of the types of customers most likely to purchase a given appliance control system will be very helpful as program planners develop their marketing efforts for these products. Profiling those most likely to purchase a control option can be helpful in terms of understanding both who to target as well as how to target these potential customers. For example, are those most interested in these appliance control systems more likely to have been in their present home for less than 5 years, suggesting a newly constructed home? Are likely takers more or less likely to own or rent their home?

This section of the report profiles the likely takers for each of the options evaluated. For this analysis a "likely taker" has been identified at the top 10% of customers with the highest utility scores for a given product.

Likely Takers – Moderate Control Options

There were some fairly interesting and consistent patterns identified in terms of the similarities and differences among the likely takers for the four moderate control options tested in this report. The profiles for three of these four products have been provided in Tables 10.6–10.8 for illustration purposes.

Overall, the key similarities among those most interested in the moderate appliance control options included the following:

- Those most interested in moderate control options tend to live in smaller, two person households and they tend to be non-Hispanic.
- The moderate appliance control options tend to capture the interest of those who would otherwise have little interest in appliance control systems generally.

There were also some interesting differences found between the most likely takers of a moderate control system that allows for customer programming versus utility programming with a customer override.

The likely takers of moderate control systems that can be programmed by the customer have the following characteristics:

- They tend to be customers with high electricity use. Those with high electricity use not only have more end uses that could be potentially curbed or controlled, but more end uses that they may wish not to control at any given moment. For that reason, these customers may wish to keep their electricity use as much as possible under their own control.
- Those with higher electricity use also tend to be more attracted to the higher potential savings offered by a moderate, customer programmable system.
- This moderate control option seems to be more attractive to those who have been in their home 5 or more years and to those aged 65+ at the 15% savings level.

The likely takers of moderate control systems that are programmed by the utility, but have a customer override have the following characteristics:

- Unlike the moderate control option that allows the customer to program the system, this option does not appear to differentially capture high electricity use customers. In fact, those with low, medium and high overall electricity use are just as likely to be interested in this option.
- This option appears to be more appealing to customers aged 35-64.

Table 10.6 – Most Likely Takers – Option 5 (Moderate, $7.50, 15% Bill Impact, Customer programs, 59% Share of Preference)

	Indexed Values
Electricity Usage by Climate Zone	
Zone 3, High Usage	161
Presence of Room and Central AC by Climate Zone	
AC, Zone 3	139
Number of Refrigerators/Freezers	
2+	144
Household Type	
Single Family Household	119
Household Size	
2	139
Number of Years in Home	
5 Years or More	123
Action Taken During 2001 Crisis	
No Action Taken	159
Age	
65+	176

Table 10.7 – Most Likely Takers – Option 7 (Moderate, $7.50, 8.75% Bill Impact, Customer programs; 55% Share of Preference)

	Indexed Values
Household Size	
2	149
Presence of AC	
Electricity Usage by Climate Zone	
Zone 2, Medium	156
Number of Refrigerators/Freezers	
2+	139
Years in Home	
5 or More Years	123

Table 10.8 – Most Likely Takers – Option 6 (Moderate, $7.50, 8.75% Bill Impact, Utility programs/ Customer Override, 40% Share of Preference)

	Indexed Values
Electricity Usage	
Low	169
Electricity Use by Climate Zone	
Zone 2, Low Usage	229
Household Size	
2	138
Home Location	
Urban	129
Age	
35 – 64	117
Education Level	
College Degree or Higher	150

Likely Takers – Basic Control Options

There were some interesting patterns identified among the likely takers for the three basic control options tested in this report. For illustration purposes a profile of the likely takers for basic control option 2 has been provided in Table 10.9.

Likely takers of the basic control options tended to be:

- Hispanic
- Living in households with a medium level of electricity use ($40 - $100 monthly bills, approximately).
- Living in rural or non-urban areas.
- Aged 35-64 when the basic control system is programmed by the utility with a customer override.

Table 10.9 – Most Likely Takers – Option 2 (Basic, $2.50, 8.75% Bill Impact, Customer programs, 28% Share of Preference)

	Indexed Values
Electricity Use	
Medium	133
Presence of Room AC	
No	115
Home Location	
Rural	168
Ethnicity	
Hispanic	180

Likely Takers – Extensive Control Options

The group of customers deemed most likely takers for the extensive control options were fairly small and not particularly distinct. Across the three extensive control options tested, it was found that these likely takers tended to be:

- Non-white, non-Hispanic
- Living in urban areas

A profile of the extensive control options tested which received the highest share of preference is listed below in Table 10.10.

Table 10.10 – Most Likely Takers – Option 10 (Gulf Power Model, Extensive, $15.00, 12% Bill Impact, Utility programs/ Customer Override, 19%))

	Indexed Values
Ethnicity	
Other/Non-White	163
Home Location	
Urban	144
Action Taken Since 2001 Crisis	
As Much As / More Than During 2001 Crisis	135

Summary

Clearly, the majority of customers prefer a moderate control system with either customer or utility programming with override. However, the types of customers interested in moderate and basic control options are different enough to suggest the possibility of offering both a moderate and basic control option to the marketplace. Offering both could increase market share by capturing households on both ends of the electricity use spectrum as well as Hispanic households. Of course the expense of offering two options will need to be weighed against the benefit of targeting this smaller subset of the population with moderate electricity use that already has less impact on load.

APPENDIX

Telephone and Online Screener

Online Base Questionnaire

Discrete Choice Electricity Pricing Questionnaire

Discrete Choice Design – Electricity Pricing

Discrete Choice Appliance Controls Questionnaire

Discrete Choice Design – Appliance Controls

Weighting Matrix

Memo – Validity of Survey Research Conducted with Online Research Panels