Residential Peak Corps Market Study: An Application of Choice-Based Conjoint Analysis Using Hierarchical Bayes Estimation

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ABSTRACT

Sacramento Municipal Utility District (SMUD) undertook to redesign its residential air conditioning load management (Peak Corps) program as a result of the current critical energy crisis in California coupled with a dramatic loss of participants during the summer of 2000. Management wanted to know how to best structure the program operations and incentives to meet both customer and company needs. A two-part survey of current and former participants was conducted to assess customer satisfaction, attitudes and motivations. The first part was a simple telephone interview to determine satisfaction level, sources of dissatisfaction, and participant characteristics. The second part was a choice-based conjoint mail/telephone exercise to identify the trade-offs customers make among program incentives and cycling intensities, and to identify and characterize any distinct participant segments.

This paper presents results of the survey, showing how results of choice-based conjoint can differ markedly from simple self-reports. In addition, it includes a discussion of the use of a relatively new method of analyzing conjoint data known as Hierarchical Bayes estimation. As opposed to traditional conjoint analysis, this method allows for the estimation of individual values of program attributes, which can then be aggregated in any number of ways to identify how different customer groups value program attributes. This paper goes on to describe how the results of the survey were used to redesign the Peak Corps program to meet customer, system operations and financial management needs.

Introduction

In the early stages of the ongoing California energy situation, Sacramento Municipal Utility District faced the need to redesign its residential air conditioning load management program, called the Peak Corps. In reaction to both the duration and frequency of air conditioner cycling that was linked to energy emergencies during summer 2000, a substantial number of customers left the program. SMUD needed to quickly clarify customers' reasons for leaving, determine how many remaining participants were on the verge of leaving and identify the program design that would keep and attract participants.

In addition to retaining and attracting customers, the ultimate design also needed to address the potentially divergent requirements of SMUD's system control and financial operations during a supply-shortage crisis. In order to implement needed load reductions during shortages and emergencies, system operators want the ability to cycle Peak Corps customers at varying levels. In order to minimize program costs, financial managers only want to pay for load reductions that are actually realized.

To identify customer needs, SMUD surveyed current and former Peak Corps participants using a relatively new methodology to analyze customer motivations for joining or leaving the Peak Corps. The following describes the process undertaken to identify customer needs and to develop a program that balances those needs with the interests of SMUD.

Background

The Peak Corps program at SMUD is currently operated as a means of shedding customer load during emergency conditions where system voltage or capacity shortages are threatened or imminent. The program has approximately 105,000 residential customers enrolled, representing 20% of SMUD's residential customer base and 40% of target customers in single-family dwellings with central air conditioning.

Prior to 1998, the program was operated as a traditional load management program to reduce summer peak load, displacing purchase of electricity on the then fairly expensive spot market. Beginning in 1989, customers could choose one of four cycling levels, or percent of each hour their air conditioner was cycled off (33%, 50%, 67% and 100%), and were paid an incentive during the summer season according to their chosen level and their monthly electricity usage. Customers in new dwellings, customers on SMUD's low income rate and participants in SMUD's high efficiency air conditioner rebate program were automatically enrolled at the 50% cycling level. Participants could migrate to other cycling levels or opt out of the program at any time.

In 1998, when deregulation in California was just underway with supplies seemingly high and prices low, SMUD revised the Peak Corps program for use to sustain system reliability. Customers were notified that the program would be used rarely and only in emergencies, and that all participants would be cycled at the same cycling duration and level, which could range from 25% to 100%. The incentive was reduced to a flat rate of $10 per season for all participants, down from a range of $8 to $80 per season depending upon electricity consumption and chosen cycling level, and automatic enrollments were discontinued.

The cycling of air conditioners was in fact minimal in 1998, and did not take place at all in 1999. During the summer of 2000, however, the situation changed dramatically as a result of the critical shortage of electricity in California. In response to requests from the California Independent System Operator (ISO), SMUD cycled Peak Corps customers' air conditioning a total of six times during the season. The first occurrence of cycling on June 15th provided a maximum load reduction of about 200 megawatts. Unfortunately, cycling on that day was fairly severe, lasting almost six hours with many hours at full shed. Primarily as a result of this event, more than 6,000 participants opted out of the program, representing an attrition rate exceeding 5%, or one-third of all program attrition since its inception in 1977.

Study Objectives

Because it was clear that California's energy problem would not be solved soon, SMUD decided to revamp the program once again to retain and attract customers while maintaining the operational flexibility and ease of response of the emergency program and minimizing program costs. To assist in program redesign, SMUD contracted with The Response Center to conduct a market study of residential Peak Corps participants.

The purposes of the study were to:

- Assess participant awareness, satisfaction and attitudes towards the Peak Corps,
- Identify the motivations and reasons for participating in or for leaving the program, and
- Investigate alternative program structures and incentive levels to determine the relative importance of program attributes.

The following research questions guided the evaluation and defined the objectives.

- How do participants regard the current program? How satisfied are they with it?
- How important is each program attribute in customers' decisions to participate?
- What trade-offs do customers make among the different program attributes?
- What is the effect on retention or attraction to the program from a change in incentive payment or other program attribute?
- What relationships exist among program attributes, attitudes and demographics?
- What is the optimum combination of attributes to offer to obtain maximum participation at the least cost?

The answers to these questions were used in program planning to decide how to:

- Structure the incentive and the program to retain the greatest number of current participants and attract new participants,
- Define the program operations to both provide customer needs and obtain the greatest flexibility, and
- Characterize and promote the program to achieve the greatest acceptance, understanding and credibility.

Methodology

Customers were interviewed using two methods to obtain answers to the research questions. First, telephone interviews were conducted with 1,001 participants—778 current program participants and 223 former participants who left the program during the summer of 2000. The two samples were randomly drawn from separate customer lists with phone numbers. Contact was made with 1,297 current and 365 former participants from 3,848 and 626 numbers dialed, respectively.

Participants were asked questions regarding their awareness of and satisfaction with the program and reasons for dissatisfaction, their preferences for various program changes, their air conditioning operating practices, actions taken to reduce electricity usage, and demographic and household characteristics. Responses were compared to the results of similar surveys conducted before the substantive program changes that took place in 1998. (SMUD 1994; SMUD 1995) Analysis of the telephone survey consisted of simple cross-tabulations of frequencies using chi-square tests, and comparisons of means using t-tests. Reported results, including those from prior surveys, are all significant within a 95% confidence interval at accuracies of ±6.6% or better.

Second, during the course of the telephone interview, current program participants were solicited to participate in a separate mail survey with a series of choice tasks with different program attributes. All current program survey respondents were solicited, and those who agreed to participate in this phase of the study were mailed a package containing one of two versions of eleven choice tasks, instructions for completing the survey, and a $5 bill as incentive to review the choices and make selections. These respondents were then called again and asked to indicate their selections on each of the choice tasks. Of the 778 current program respondents, 692 agreed to participate in the second phase of the survey, and completed packages were obtained from 365 respondents.

Choice-Based Conjoint Analysis

Conjoint analysis allows marketers to assign specific values to the range of options or product attributes buyers consider when making purchase decisions. Given that a primary objective of the study was to investigate the attractiveness of alternative programs, it was decided that conjoint analysis was the best approach. As a trade-off technique, the superiority of conjoint analysis over self-stated

importance questions has been well documented. By forcing respondents to make trade-offs between desired options, it better simulates real world decision-making.

In this study we used a form of conjoint analysis called discrete choice. In a discrete choice framework, conjoint respondents make choices between different bundles of attributes (products, or in this case, program designs) rather than just rating or ranking them. Discrete choice also allows the respondent to choose a "None" option if the particular set of choices presented is not at all appealing. This makes the choice task more realistic as this process duplicates the options available in the marketplace.

The specific objectives of the discrete choice analysis were to determine:

- The relative importance of each attribute,
- The relative importance of each level within each attribute, and
- The relative attractiveness of various hypothetical configurations.

For the purposes of this study, five program attributes and three levels within each attribute were chosen, as shown in Table 1 below. While trying to meet the objectives of the study, care was also taken to ensure that the number of levels within each attribute was similar, as there is evidence in the conjoint literature to indicate that larger numbers of levels may artificially inflate attribute importance. (Wittink, et al. 1992) Since all the attributes were quantitative, it was possible to choose equal numbers of levels that were both meaningful and covered the range of program feasibility.

Table 1. Peak Corps Program Attributes and Attribute Levels

Program Attribute	Attribute Level
Maximum Cycling Level: Maximum number of minutes out of every hour that the air conditioner is turned off	20 minutes per hour 40 minutes per hour 60 minutes per hour
Fixed Seasonal Payment: Amount of the payment per season paid in four installments on the electric bill	$10 per season $5 per season $0 per season
Maximum Hours Cycled per Day: Maximum number of hours that cycling can occur per day of cycling	2 hours per day 4 hours per day 6 hours per day
Payment per Cycling Day: Amount of the payment for each cycling day credited to the monthly electric bill	$5 per day $3 per day $1 per day
Maximum Days Cycled per Month: Maximum number of cycling days that cycling can occur per month	4 days per month 6 days per month 8 days per month

After finalizing the attributes and levels, it was decided that eleven choice tasks would be provided to each respondent. Each choice task was comprised of three product alternatives and a "None" option. Hence, for each task a respondent could choose one of the three alternatives they liked best, or choose the "None" option if none of the three were attractive enough. Two versions of the choice tasks were generated such that half the respondents rated one version and the other half rated the other version. With three program alternatives per task and three levels per attribute, all three levels of each attribute were included within each choice task without redundancy.

The first choice task from each version was used as a holdout task, which was repeated later in the package. Holdout tasks are used to check on the scaling of utility scores and as predictive validity checks on the model. Using the same holdout task twice in the package provides a test of individual response reliability.[1] Sawtooth Software's Choice-Based Conjoint (CBC) system was used to generate task options, as well as to analyze responses.

Hierarchical Bayes Estimation

The traditional way of analyzing discrete choice conjoint data is either at the aggregate level or at a group level. The problem with aggregate level analysis is that individual heterogeneity is not taken into account, and hence the results may not be accurate. This problem is mitigated to some extent by using various methods of group level analysis, but these methods all make a priori assumptions about the data, and perform well only when these assumptions hold true.

Theoretically, the best way of analyzing choice data is at the individual level letting the data drive the individual models, and then aggregating estimates to the desired group levels. However, the development of such models usually requires collection of a great deal of information about individual choices. Hierarchical Bayes is a method of estimating individual choice models from only a few choices by an individual. It does this by developing a two-level model—the higher level assumes a normal distribution of individual choice parameters while the lower level assumes an individual model governs choice probabilities. Through an iterative process of sampling from upper level data (information from other individuals, i.e., population data) and updating individual estimates based on the joint probabilities of individual and population choices, the model estimates both individual parameters and the mean and covariances of the distribution of parameters.[2] (Sawtooth Software 2000) This process requires thousands of iterations to make all the individual model estimates. Until recently, such intensive computation was not possible. With the improvement in computer processing speeds and the recent introduction of Hierarchical Bayes estimation software by Sawtooth Software[3], the process has become much easier.

For this study we used Hierarchical Bayes to estimate economic utility scores at the individual level. Utility scores in conjoint analysis are a measure of the relative attraction of the various levels of product attributes. The importance of product attributes is calculated from the range of the utility scores assigned to the levels within each attribute for each individual, and these utility and importance scores are comparable across individuals. The results of the individual utility and importance scores we calculated were then aggregated to provide average utility and importance scores for the entire sample and for selected segments or groups of customers we were interested in.

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[1] Testing response reliability with holdouts is relatively straightforward, but there are some shortcomings with using holdouts for validity testing. See Johnson 1997b and Orme et al. 1997 for a discussion of the use of holdout tasks to measure validity and reliability.

[2] Hierarchical Bayes as an important improvement over traditional aggregate models is discussed in Huber 1998 and Orme 2000. Ten to twelve choice tasks are as a rule considered to be sufficient to obtain valid results from HB. HB estimates tend to smooth individual differences because of the reliance on upper level data. The fewer the number of tasks, the greater the reliance on the upper level model and therefore the greater is the smoothing. This provides relative stability in estimates even with a few tasks; however, fewer tasks limit the ability to detect group differences. The number of tasks required depends upon the number of alternatives or product concepts provided per task (more alternatives provide greater information and therefore fewer tasks are required) as well as the number of attributes and levels per product concept (more attributes and levels result in greater noise and therefore more tasks are required). See Sawtooth Software 2000, 14-15 for a discussion of the effect of the number of tasks on robustness of estimates.

[3] Sawtooth Software's technical report describing their methodology (Sawtooth Software 2000) and other technical papers on conjoint analysis can be found on their website at http://www.sawtoothsoftware.com/techpap.shtml.

Findings

Telephone survey responses were summarized and compared with responses from previous surveys of Peak Corps participants. In addition, responses from the telephone survey were combined with individual conjoint estimates to test for differences in program preferences among groups of participants.

Results of Telephone Survey

Responses to the telephone survey indicate that there has been substantial erosion of satisfaction with Peak Corps since the 1998 program change. Comparison of results of this study to a similar study conducted prior to the program changes shows that:[4]

- In 1994, 97% of participants were satisfied with the program (71% *very* satisfied), and only 3% were dissatisfied. (SMUD 1994)
- In 2000, 62% were satisfied, 18% undecided and 19% dissatisfied, half of these *very* dissatisfied.
- 40% of dissatisfied participants, or 8,000+ current customers, were considering leaving. In addition, one-fourth of all current participants said they were somewhat or very unlikely to participate in 2001 if the program structure and operation remained the same as in 2000.

The primary reasons for dissatisfaction were:

- The discomfort experienced during cycling—52% of current dissatisfied participants and 64% of former participants complained about the indoor temperature or the duration of cycling. In addition, 24% of former program participants and 5% of current participants who are considering leaving the Peak Corps program cited health concerns for children or the elderly related to the heat as the reason for leaving.
- The low incentive—41% of current dissatisfied and 25% of former participants cited the low incentive level as a reason for dissatisfaction.
- The program not being operated as promised—19% of current dissatisfied and 15% of former participants mentioned the "honesty of the program" or the "program not as advertised" as reasons for dissatisfaction.

Reasons for dissatisfaction were directly related to prior cycling option. Participants who were formerly on the 33% option were much more likely to cite discomfort as the source of dissatisfaction, whereas participants formerly on the 100% option were much more likely to cite the incentive level as the source of dissatisfaction.

When asked to choose among four proposed changes to the program, the vast majority of current participants preferred an increase in the incentive (61%) to a decrease in the minutes cycled per hour (16%), or to a limit on the number of hours cycled per day (14%), or to a limit on the number of cycling days per season (8%).

Although 90% of participants were aware of the electricity shortages in California, 12% of current participants and 22% of former participants did not believe the program was operated only in emergencies.

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[4] Where respondents could cite more than one reason, totals exceed 100%.

Questions regarding the operation of air conditioners revealed that:

- 71% of current and 65% of former participants keep their air conditioners at 78°F or greater during peak hours on summer weekdays. Former 100% cycling level customers are twice as likely (11% vs. 5.5%) as the other groups to have their air conditioner turned off during those times. This is because those customers chose the highest cycling level with the highest incentive payment, knowing their typical air conditioning use is low.
- In most cases (77% of current and 85% of former participants), someone is home during peak hours.
- When air conditioners are completely turned off on hot days, 70% of participants become uncomfortable within three hours—33% within the first hour, another 23% within the second hour, and 14% within the third hour.

Eighty percent of all participants have changed their behavior to reduce their electricity bills (turned off lights, turned up thermostat in summer, etc.). However, current participants are much more likely than former participants (49% vs. 28%) to have made changes in their dwellings (installed double-pane windows, purchased high-efficiency appliances, added insulation, etc.).

Generally, Peak Corps participants own (86%) their single family dwelling (90%), in which they have lived an average of 10 years of its average 25-year life. A high proportion have college degrees (56%), and they have a higher than average annual income ($60,000).

Results of Conjoint Analysis

Conjoint analysis produces aggregated utility scores, which add to zero within each attribute. These utility scores are raw measures of the aggregate relative values of the levels within each program attribute. The utilities for each of the three levels within the five Peak Corps program attributes are shown in the table below.

Table 2. Utility Scores of Peak Corps Program Attributes

Program Attribute	Attribute Level	Utility
Maximum Cycling Level	20 minutes per hour	123.91
	40 minutes per hour	-22.55
	60 minutes per hour	-101.36
Fixed Seasonal Payment	$10 per season	41.93
	$5 per season	7.31
	$0 per season	-49.23
Maximum Hours Used per Day	2 hours per day	20.03
	4 hours per day	-1.62
	6 hours per day	-18.41
Payment per Cycling Day	$5 per day	27.34
	$3 per day	8.37
	$1 per day	-35.71
Maximum Days Used per Month	4 days per month	7.52
	6 days per month	5.81
	8 days per month	-13.33

The range of utility scores indicates the relative importance of the attributes—the greater the range, the more important the attribute, since importance scores are calculated for each attribute as a percentage of the ranges. The resulting importance scores of each of the program attributes are shown in Table 3 below.

Table 3. Importance Scores of Peak Corps Program Attributes

Program Attribute	Importance
Maximum Cycling Level	48.46
Fixed Seasonal Payment	19.22
Payment per Cycling Day	15.29
Maximum Hours Used per Day	9.75
Maximum Days Used per Month	7.28

Based on the importance scores, the attributes can be split into three groups. The first group contains only Maximum Cycling Level. The difference in scores between cycling level and the other attributes shows that cycling level is far and away the most important attribute. The second group, containing the monetary attributes Fixed Seasonal Payment and Payment Per Cycling Day, is of moderate importance. The third group is comprised of the usage attributes, Maximum Hours Used Per Day and Maximum Days Used Per Month, and is the least important.

To compare different options, program bundles can be created by combining one level of each attribute. The total utility of each program can be calculated by adding up the utility scores of each level. Programs can then be compared on their total utility scores to see which combination is more attractive to customers. Comparison of two possible combinations of attribute levels is shown in Table 4.

Table 4. Comparison of Two Hypothetical Peak Corps Program Configurations

Program Attribute	Program A		Program B	
	Level	Utility	Level	Utility
Maximum Cycling Level	40	-22.55	20	123.91
Maximum Hours Used per Day	4	-1.62	4	-1.62
Maximum Days Used per Month	6	5.81	6	5.81
Payment per Cycling Day	$5	27.34	$1	-35.71
Fixed Seasonal Payment	$10	41.93	$0	-49.23
Total Utility		**50.91**		**43.16**

The large importance associated with Maximum Cycling Level indicates that there is a lot of inter-changeability associated with the other attributes. For example, if a cycling level of 40 minutes per hour is used, the other usage levels would need to be reduced while the incentive levels would need to be increased, to maintain the total utility score at the same level. On the other hand, if a cycling level of 20 minutes per hour is used, then higher usage and lower incentive levels can be implemented. If other usage levels are held constant, as in the example, the disproportionate effect that decreasing or increasing the cycling level has on the required incentive payments can be seen—changing the cycling level by one attribute level (from 40 to 20 minutes per hour) requires a change of two attribute levels in the incentives (from $5 to $1 and from $10 to $0) to maintain approximately the same overall utility.

Conjoint Compared to Self-Stated Importance

Comparing the results of the conjoint analysis with the self-stated responses provides some interesting contrasts. When presented with changes to particular attributes in the program, a vast majority of participants (61%) indicated that they would like to see increases in the incentive. Decreasing the cycling time is a distant second (16%) preference.

This is in stark contrast to the conjoint results where the most important attribute was cycling level with monetary incentives a somewhat distant second. Of course, as no amounts were mentioned in the self-stated survey it is hard to make a direct comparison. One of the benefits of a discrete choice study over simple self-reports is that it does, in fact, clearly specify attribute levels, and by forcing choices measures the implicit values people ascribe to those levels. A presumption of the method is that ordinarily people are not very good at analyzing their own preferences and purchase behaviors, and thus self-reports can be very misleading.

Analysis by Segments

Since utility scores are available at the individual level it is possible to aggregate them to any group level to examine differences between groups. Four such comparisons were made using the following variables:

- Prior cycling level of respondent (33%, 50/67%, 100%),
- Satisfaction with Peak Corps program (Satisfied, Neutral/Dissatisfied),
- Size of electric bill (Small, Medium, Large), and
- Agreement with the idea that SMUD only uses the Peak Corps program for emergencies (Agree, Neutral/Disagree).

The only variable where any difference was seen was Prior Cycling Level. Participants who were cycled at the highest cycling level, expectedly, place somewhat lower importance on the cycling level and a somewhat higher importance on monetary compensation. Essentially, customers trade-off cycling level, or comfort, for monetary compensation, and those customers willing to experience greater discomfort require higher compensation. However, the amount of extra compensation required for the same incremental increase in discomfort varies by former selected cycling level—customers who (prior to 1998) elected to be cycled at 100% have a higher tolerance for heat (or are not home to experience it) than those who elected to be cycled at 33%. This same relationship was indicated by self-reports of preferred program changes. None of the other comparisons showed any noticeable differences between groups, indicating that these factors did not differentiate between customers.[5]

Holdout Choices

Since each version of the questionnaire had its first choice task included as a holdout task, it is possible to compare results in a test-retest framework to measure respondent reliability, or the attention respondents paid to the tasks. The test-retest reliabilities for the two versions are, respectively, 0.70 and 0.66. While these values are high, they are not high enough to confidently say that respondents consistently applied the same choice rules from task to task. What this means for the results of the study is that the smaller differences found among utilities may not appear if the survey were replicated (even with the same individuals). However, the larger differences found are still likely to appear.

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[5] The fact that few differences among groups were found may also be due in part to the relatively small number of choice tasks, since fewer choice tasks increases the smoothing effect, as discussed earlier.

Inclusion of the "None" Option

Discrete choice conjoint tasks can be constructed with or without the use of a "None" option. In general, the use of the "None" option is recommended because it more realistically simulates real world decision making by giving the respondent the option of not making a purchase if the available products are not attractive, or in the case of the Peak Corps program, choosing not to participate.

One of the objectives of this study was to identify the effect on retention or attraction to the program of a change in incentive or other attribute. Towards this end, it was felt that inclusion of the "None" option would help. However, it appears that the proportion of respondents choosing the "None" option is much higher than those who are actually leaving the Peak Corps program. A possible explanation for this is simply inertia. Customers who are already enrolled in the program are less likely to leave, even if they are somewhat unhappy. But those who are not yet enrolled, when presented with the same set of options, are more likely to not enroll. Since this study was conducted among current participants of the program, the "None" option likely yields an overestimate of attrition.

Program Revisions

The information gleaned from the telephone and conjoint surveys was used to redesign the program in several ways, as outlined below.

Participants were offered a choice of cycling level. Customers clearly had strong and differing preferences for the length of time they were willing to be cycled. However, being able to cycle customers at varying cycling levels from 25% to 100% under the new program provided a great deal of operational flexibility that was not available under the old program, where customers were cycled only at their chosen strategy. To retain this flexibility while still providing customer choice, it was decided customers would be offered a choice of *maximum* cycling level. In this way, all customers could be cycled simultaneously anywhere from 25% to their selected maximum to achieve the needed load reduction.

The old cycling levels of 33%, 67% and 100% did not exactly match the new levels (which occurred in 10% increments), nor the levels offered in the conjoint study (45%, 65% and 100%). Because 94% of current participants had been participants under the old program prior to 1998, and therefore know what to expect during cycling at the old levels, the choices of new cycling levels offered matched the old levels as closely as possible. Under the new program, current participants default to the following cycling levels unless they specify otherwise:

- 45% maximum level (former 33% participants),
- 65% maximum level (former 50% and 65% participants, and new participants since 1998), and
- 100% maximum level (former 100% participants).

The incentive was increased and revised to a partial pay-per-use structure. Study results indicated that the incentive level was second in importance to choice of cycling level, and that participants value a fixed seasonal credit only slightly higher than a payment for each day cycling is used. To accommodate these preferences, a dual incentive was developed which incorporated differences in selected maximum cycling strategies: a flat seasonal incentive of $10, $15 and $20, depending upon maximum cycling level chosen, plus an additional incentive for each day cycled. This per-use payment also varies depending upon maximum cycling level chosen, from $1, $2 and $3 for the 45%, 65% and 100% cycling levels respectively. Assuming a cycling frequency of eight days per season,

which was the average frequency under the pre-1998 program, the payment per season ranges from $18 to $44.

The number of hours and days customers can be cycled were limited. Although the hours and days of cycling are the least important program attributes, their combined importance is about 17% of total program importance. Also, most participants become uncomfortable after two to three hours without air conditioning. For these reasons, cycling was limited to four hours per day at the selected maximum cycling level during low to mid-level emergencies. At less than the maximum cycling level, or during extreme emergencies, cycling hours per day is unlimited. In addition, a maximum of sixteen days per season of cycling, exclusive of imminent blackouts, was imposed as being a reasonable number from the standpoint of both operational need and customer tolerance.

The ability to shed customers up to 100% in extreme emergencies was retained. Because the Peak Corps is an emergency program, SMUD needs to retain the ability to fully shed all participants for any length of time in the event of a severe, or stage three, emergency with imminent blackouts. Since stage three emergencies cannot be predicted, participants will continue to be paid based on their selected maximum cycling level per cycling day, regardless of the degree of emergency or level they are actually cycled.

Eligibility to participate in the program was restricted. Customers expressed concern that participation adversely affects the health of the elderly and the young. For this reason, anyone who has health problems that may be exacerbated by exposure to heat is discouraged from participating. To underscore this point, participation is prohibited for residences that are certified caregivers, such as day care or elderly care providers.

A high profile was adopted in explaining the new program to current and prospective participants. Because many customers expressed the belief that the program was not operated as promised or only in emergencies, the marketing message to participants focussed on regaining their trust and in educating them regarding program operation during the current supply crisis. It makes very clear how the program will be operated in conjunction with California ISO declared emergencies, and highlights the importance of the program as a large part of SMUD's short-term solution to the crisis.

Conclusions

The energy emergencies in California continue at an unprecedented rate. Telephone survey results indicate that Peak Corps customers have been unhappy with the operation of the program and the incentives provided for program operation during these emergencies. Conjoint survey results indicate that customers want first, a choice of cycling level and second, an increase in incentive. Conjoint analysis also indicates that generally a change in cycling intensity results in a proportionately much larger change in incentive required for customers to remain on the program, and this disproportionate change differs among groups of customers. In practical terms, this means that offering customers a choice in cycling level goes a long way towards reducing required incentive payments.

The recommended program being implemented in the summer of 2001 balances the customer needs of choice and higher incentives with SMUD financial management's need for performance payments and system operation's need for dispatch flexibility. It offers customers a choice of maximum cycling level tied to two-part incentives—a flat payment for participation and a per-use payment for performance—and it offers system operators the ability to cycle at any level up to the chosen maximum, and to 100% during extreme emergencies.

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