Statewide Pricing Pilot – Track B Evaluation of Community-Based Enhanced Information Treatment

Final Report

Prepared by San Francisco Community Power in cooperation with M.Cubed[1]
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1. Executive Summary

The Track B pilot provides a separate, but related to Track A, examination of residential responses to critical peak prices and education/information about the benefits of changing the timing of electricity use. Track B specifically addresses the following questions:

- Because of their unique situation, are San Francisco pilot participants more responsive to information/education than the (Richmond) control group or Track A participants?
- What is the relative effect of information vs. price signals on Track B participants? Does it differ from Track A?
- What factors influenced Track B participants to respond as they do?

Track B was implemented by San Francisco Community Power (SF Power) in cooperation with Pacific Gas and Electric Company (PG&E) in San Francisco's Bayview-Hunters Point and Dogpatch neighborhoods. Two older, inefficient power plants are located in this area. A City of Richmond community, which has a number of environmental hazards, including oil refineries, was used as a study "control." Both areas are in Track A's Zone 1, with similar demographic, economic, and energy use characteristics.

One San Francisco group received the Track A critical peak pricing (CPP-F) rate and community-based information/education; while the other received only community-based information/education (i.e., no price signals). The Richmond control group received the CPP-F rate and the same information provided to comparable Track A participants.

The experiment did not include a standard-rate control group in Richmond, as was the case for Track A, thereby reducing the ability to conduct analyses across all treatment groups. Likewise, by implementing the pilot in a temperate climate, participants' ability to respond to price or education/information was limited by the lack of air conditioning and other extreme weather loads, particularly during the summer. As a result, this study is intended to determine whether *any* significant shifts in electricity use can be induced in the study setting using the pilot interventions – particularly during *winter* months, when households have greater use flexibility -- as well as to examine the potential of targeted, rather than broadcast, price- or educationally-based critical peak pricing programs to shift residential energy use.

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[1] Charles River Associates provided technical assistance in data analysis.

1.1. Key Findings

Without a directly comparable control group for which there was no rate or information treatment, it's difficult to separate the effects of the information treatment from those created by local conditions, such as general environmental awareness or neighborhood characteristics. However, the available evidence suggests the following:

- **Enhanced information alone did not induce participants to actively engage in shifting behavior. It did, however, seem to prompt noticeable long-term conservation, even among those receiving only information**. During the winter period, when San Francisco's loads are highest, enhanced information appeared to result in significantly greater reductions in both peak and daily loads when examining average usage patterns. Those receiving information only appeared to conserve, but did not shift usage from the peak period.
- **Community-based information/education apparently increased participants' responsiveness to the CPP price signal, at least when electricity use patterns allowed for some demand flexibility (i.e., during winter months)**. The San Francisco group receiving enhanced information and CPP-F rates exhibited noticeably lower electricity use during CPP periods as compared to the Richmond group that received the standard Track A price and information package in the summer 2003 and winter 2004. However, this impact declined sharply in the summer 2004, as did the Track B educational efforts, which implies that it may not extend over multiple seasons without a consistent and strong community-based education effort.
- **Track B's community-based enhanced education/information interventions appeared more effective than Track A in communicating key program elements**. For example, 38% of the Track B Info-Only participants exhibited a "high/medium-high" understanding of the program, compared to 29% or less for the Track A Info-Only; and a much smaller proportion of Track B info-only participants had a "low" program understanding than the Track A Info-only population.
- **Track B customers elected to stay on the CPP rate at significantly higher rates compared with the other SPP participant groups, including Track B Richmond customers**. Approximately 55% of Track A participants and of those in Richmond elected to remain on the CPP-F rate. The remainder roughly split equally between the standard and TOU rates. In contrast, 72% of San Francisco Track B customers apparently chose to remain on the CPP-F rate. Of those that switched in San Francisco, a majority selected the TOU rate.

1.2. Further Research

The Track B analysis is the first step in determining whether community-based information/education strategies may be effective in inducing changes in consumer demand in response to specific situations. Further analysis which could shed light on this topic include:

- Whether community-based enhanced information improves price responsiveness and reduces opt-out rates could be examined over the long-run. For example, San Francisco participants could be provided with additional information and ongoing education about the linkages between the timing of electricity use and the operations of locally polluting power plants (i.e., continue the process initiated in 2003), particularly targeted to the winter months, when participants' have a greater ability to respond. Analysis would then be conducted to determine whether this intervention or "treatment" had a significant effect on participation and response rates.

- In-depth focus groups of Richmond and San Francisco participants could employed to further probe participants' experience with the tariff , including investigating further the affect of price versus information on their behavior; as well as exploring the effectiveness of the education/information effort (e.g., what elements worked best – the community approach; environmental context; or information content/frequency). The geographic proximity of these two groups and the ability to control for significant (e.g., demographic) differences between them makes this an attractive end-of-summer project.
- Whether Track B provided a cost-effective approach to achieving changes in electricity use patterns over the long-term.

Finally, in conducting further analyses and developing business cases based on this and the other SPP reports it's important to be mindful of Track B's ancillary benefits as compared with other implementation models. For example, by employing local residents to help implement the pilot the study contributed, in a small way, to assisting with economic development in a hard-pressed community. Likewise, by reinforcing the community benefits associated with better household energy management the pilot helped to encourage community cohesiveness, and civic engagement.

2.0 Track B's Background and Relationship to Track A

In July 2002 the California Public Utility Commission (CPUC or Commission) initiated Rulemaking 02-06-001, to examine the role demand-response and related programs could usefully play in helping to ensure electric system reliability, and whether these programs could provide other benefits to utilities, ratepayers, and society-at-large. By undertaking the Rulemaking the Commission signaled its interest in creating programs that will serve to manage the timing and level of electricity demand in a way that enhances electric system reliability; reduces power purchases, particularly on-peak; lowers consumer costs; and minimizes the environmental impacts associated with electricity use. As a result of the proceeding the Commission hopes to develop comprehensive policies to make electricity demand responsive to system supply conditions as they change over time.

The Commission established three working groups to evaluate potential demand-response programs. Working Group 3 (WG3) was charged with focusing on residential and commercial customers with demands less than 200 kW.[2] Early in the WG3 process Charles Rivers Associates (CRA) developed an analysis indicating that a wide range of potential benefits could be achieved through implementation of dynamic pricing within PG&E's service territory, with a low-end monetized benefits estimate of $561 million and a high-end of $2,637 million. However, the incremental metering and billing costs associated with the provision of dynamic pricing were estimated at roughly one billion dollars. Based on this analysis the potential net-benefits of dynamic pricing depend on meter and rate deployment strategies and costs, customer responsiveness, and the magnitude of avoided energy and capacity costs. CRA's analysis also indicated that conducting an experiment with a few thousand customers could significantly reduce the uncertainty in the net benefit estimates.

Based in part on this information, and after a series of workshops, which were attended by utility representatives, technology vendors, and a small number of consumer groups, on December 10, 2002 WG3 recommended that the state conduct a carefully designed pilot experiment examining different pricing, information, and educational "treatments" prior to making a decision on whether, and how best to, deploy a dynamic pricing program. The CPUC approved the experiment, called the Statewide Pricing Pilot (SPP), on March 14, 2003.[3]

2.1 Description of the SPP

The SPP has three primary objectives:

- Develop estimates of the average change in electricity demand, as well as associated demand curves, by time-of-use (TOU) period for dynamic tariffs, and derive the associated price elasticities of demand. This is addressed in the SPP Track A report for statewide impacts, and in this report for a specific setting which may have applications elsewhere.

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[2] WG 2 focuses on customers with demands greater than 200 kW, while WG 1 is tasked with providing policy guidance.

[3] D. 03-03-036, Interim Opinion in Phase 1 adopting pilot program for residential and small commercial customers.

- Determine customer preferences for tariff characteristics and responses to information/educational treatments. This is analyzed in the Momentum Report.
- Evaluate the effectiveness and customer perceptions of specific pilot characteristics and materials, including enrollment and education material, bill formats, web information, and tariff features.

Under the WG3 plan potential SPP participants were divided into four climate zones across the three utilities' service areas to assess whether responsiveness varies across geographic/climatic regions. A mix of price, information, and educational signals would be provided to energy users under three different approaches, with the resulting behaviors examined through real-time meters and surveys. These approaches are as follows:

- "Track A" tests residential customers' responsiveness to price signals that vary by TOU or during critical peak periods (CPP), the time when demand for power is particularly high. Track A was designed to be representative of the state's general population.
- "Track B" examines whether residential customers' responsiveness to price signals can be enhanced through the use of economic and environmental messages delivered by a community-based organization. Track B is geographically-specific to residential low-income customers located in San Francisco near operating power plants. This report focuses on the results of the Track B analysis.
- "Track C" evaluates the responsiveness of existing residential smart, or programmable, thermostat customers, who were enrolled under Assembly Bill (AB) 970, to TOU and CPP price signals.

The SPP involves roughly 2,000 residential and small commercial and industrial (C&I) customers[4] located in PG&E's, San Diego Gas & Electric Company's (SDG&E) and Southern California Edison Company's (SCE) service territories. Most customers enrolled in the pilot were either placed on experimental time-of-use or dynamic pricing tariffs, or given information about the importance of shifting the timing of electricity use to encourage a response. Other customers were selected to serve as control groups and were kept on their existing tariffs.

The tariffs being tested in the SPP include a TOU rate and two types of CPP rates. The TOU rate offers customers an on-peak price that is higher than the average price for the standard rate, and an off-peak price that is lower than the average price. The two CPP rates (CPP-F and CPP-V) include a substantially higher on-peak price (50 to 75 cents/kWh) for 15 "critical" days of the year, and a standard TOU on-peak price on all other days. CPP-F features the same fixed, on-peak period on both critical and non-critical days with day-ahead customer notification, while CPP-V features a variable-length on-peak period on critical days, and customers may be notified on the day of the critical peak event.[5] The rate-specific prices by time period varies across utilities and climate zones, as they are layered on top of the existing five-tier rate structure, which

[4] Small C&I customers are divided into two segments, those with billing demand less than 200 kW and those with billing demand between 20 kW and 200 kW.

[5] The peak period for TOU residential tariffs is from 2 pm to 7 pm on weekdays. The critical peak period for the CPP-F rate is also from 2 pm to 7 pm on CPP-event days.

also varies by utility and climate zone (due to differences in baseline quantities by climate zone).

2.2 Track B's Research Objectives

The Track B pilot provides a separate, but related to Track A, examination of residential responses to price and educational interventions. Specifically, Track B investigates the impact the following factors have on household response to enhanced information about and time-based pricing of electricity use: (1) proximity to locally-polluting electric generating facilities; (2) increased knowledge of the impact changes in the timing of electricity use may have on polluting air emissions associated with local electricity generation; and (3) the delivery of these messages by a community-based organization, with attendant energy management support. The study did not attempt to disentangle the relative influences of the second and third factors, but was designed to distinguish the proximity from the educational effect. As with Track A, Track B was structured to determine the extent to which responses are induced through price signals as opposed to information/education.

Track B's specific study objectives were to determine

(1) If a locally-based educationally-focused program can derive similar or greater benefits as a more traditional utility-implemented critical peak pricing program;[6] and

(2) If residential customers' responsiveness to price signals can be enhanced through the use of economic and environmental messages delivered by a community-based organization.

Track B analysis is also intended to assist in examining whether CPP can be an effective tool to reduce reliance on excessively polluting generation facilities on a broader regional scale.

The Commission authorized the Track B analysis in D.03-03-036 in proceeding R.02-06-001. Specifically, the Commission stated:

> The SPP will also provide data about the impact of information presented to participating customers, both general information and education about rates and other options available to the customer, and more specific and personalized information provided to the customer as input to the customer's ongoing usage decisions. In connection with the latter information type, the SPP will include a special feature suggested by SF Co-op, known as the "Track B pilot." One hundred electric customers residing in the Bay View, Hunters Point, and Potrero Hill districts of San Francisco (home to two aging power plants which generate above-average levels of air pollutants) will be randomly selected and provided with information about the economic and environmental consequences associated with peak power use, and informed of the potential to reduce reliance on a locally polluting power plant through adoption of the CPP-F tariff. These track B pilot participants will receive educational information regularly and periodically to reinforce this message, and will be contacted via various

[6] Comparisons between the costs associated with relying on community-based non-profit organizations; for-profit vendors; or the utility to implement information/education treatments could also be usefully developed to examine "business cases."

> communication means when the critical peak periods are occurring. The SPP will include a control group of 100 electric customers randomly selected from another Bay Area community [Richmond] situated near a known and publicized environmental hazard, with similar socio-economic and demographic characteristics, and similar climatic and other demand-driving conditions. The Track B pilot will provide data about how environmentally oriented information, provided to a population with heightened sensitivity about air quality issues, may increase responsiveness to CPP-F. (p. 10)

Track B specifically addresses the following questions, which restate the two research objectives above:

- Are SF pilot participants more responsive to information/education than the (Richmond) control group or Track A participants?
- What is the relative effect of information vs. price signals on Track B participants? Does it differ from Track A?
- What factors influenced Track B participants to respond as they do?

For the first two questions, this analysis provides useful information about comparisons within the Track B sample. Unfortunately, without a directly comparable control group for which there was no rate or information treatment, it is difficult to separate the effects of the information treatment from those created by local conditions, such as general environmental awareness or neighborhood characteristics.

Although already completed survey research can shed some light, fully addressing the third research objective will require additional analyses. For example, in Section 4.3 of the SPP Final Report, variables identifying average daily energy use, central air conditioner and spa ownership, electric cooking facilities, education and income, and housing characteristics were analyzed for their effects on Track A customers; this same analysis could be usefully conducted for Track B.[7] A statistical examination of post-pilot "opt-in" patterns would also be useful. Likewise, additional survey data – and in particular, in depth interviews or focus groups – could provide for a deeper understanding of participants' motivations.

2.3 Track B Experimental Design

The most important Track B design challenge was how to implement the pilot in such a way as to be able to isolate the information/education treatments in the subsequent regression analysis. Because the enhanced information would be provided by a community group on a neighborhood "broadcast" basis, the control group for the information treatment (i.e., those <u>not</u> receiving enhanced information) could not reside in the target area. Yet, to provide an adequate comparison the control group needed to have similar demographics, climate and exposure to environmental hazards. The West Richmond neighborhood near the Chevron refinery was identified as best meeting these requirements. Further details on the two study areas are provided below.

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[7] For example, a Chicago study found that low-income customers responded more strongly than high-income ones (Summit Blue Consulting, *Evaluation of the Energy-Smart Pricing Plan*, IDCEO Grant 02-19502, Final Report (Boulder, Colorado: Prepared for the Community Energy Cooperative, March, 2004)).

2.3.1 Relationship of Sample Design Cells

Table 2-1 shows the analytic relationship among the different sample cells in Track B. Note that the effect of the rate treatment can be measured between cells B01 (San Francisco-Info Only) and B02 (San Francisco-Price and Info), and the effect of the information treatment between cells B02 (San Francisco-Price and Info) and B03 (Richmond-Price Only). The study does not have a fully controlled cell against which the full effect of both treatments can be compared.

Table 2-1
Track B CPP-F Rate and Information Treatments

		Rate	
		Yes	**No**
Information Intervention	**Type of Treatment** **Yes**	**CELLID = B02** Location = San Francisco Reference = Treatment Values: CPP-F RATE =1, INFORMATION = 1.	**CELLID = B01** Location = San Francisco Reference = Rate Control Values: CPP-F RATE =0, INFORMATION = 1.
	No	**CELLID = B03** Location = Richmond, CA Reference = Information Control Values: CPP-F RATE =1, INFORMATION = 0.	**NA** There are no customers for this combination. Reference = Full Control Values: CPP-F RATE =0, INFORMATION = 0.

2.3.2 Issue of Comparison to "Control"

To distinguish the relative effects of the two different treatments requires that four cells be created, two for partial controls, one for each treatment, and one for control of both treatments. However, because of limited resources, Track B proceeded without the latter control cell. Likewise, given that Track A Zone 1 customers are expected to be less responsive than other customers, Track B was tasked with determining whether the information treatment would have *any* effect on customer response, rather than determining the precise magnitude of that response.

2.3.3 Description of Track B Participants and Target Populations

Track B's treatment group consists of households located in San Francisco's Bayview-Hunters Point (zip code 94124) and Potrero (census tracts 609, 226, and 227.03 within zip code 94107) communities. These two areas are adjacent, and contain both the Hunters Point and Potrero power plants.

In addition, a control group in the City of Richmond was established so that use patterns in the control group and the treatment group receiving the CPP-F tariff could be compared to allow inferences to be drawn about the impact of targeted information and education. Both the treatment and control groups have similar demographic and "environmental justice" characteristics, and provide a valid basis to compare responses as a means of isolating Track B treatment impacts. Comparison of electric use patterns between these two groups will allow price elasticity estimation in the presence of a targeted information and education program.

These estimates are not directly comparable with those obtained in Track A, where "enhanced" information was not used, due to the significant demographic differences between Track A and Track B populations. However, Track A did include an "information-only" cell, that allows at least partial comparison between that cell and the rate treatment cells akin to the comparison between cells B01 and B02.

Table 2-2 outlines Track B's two treatment groups and one control group. The table shows the initial enrollment and the subsequent number of activated meters and associated billing changes.

Table 2-2
Track B Sample Cells and Enrollments

	Role	Area	Information	Price	Enrollment	Meters Activated
B01	Info, No Price	San Francisco	Targeted	E-1 (Current)	63	48
B02	Info & Price	San Francisco	Targeted	CPP-F	126	106
B03	Price, A Info	Richmond	General	CPP-F	64	79

Targeted = Community focused environmental messages.

General = Information on the CPP-F pricing program only.

The treatment groups received information and educational materials, as well as a variety of communications (e.g., at events; via telephone) from a local community-based organization, San Francisco Community Power. The treatment "intervention" primarily focused on conveying information about the environmental and economic benefits of shifting electricity use off-peak, particularly on critical peak days (e.g., reduced use of the two power plants). The information interventions were provided at a somewhat uneven rate, with more information provided during the fall of 2003 and winter of 2004 than later during the summer of 2004. The first treatment group received the CPP-F rate, along with the targeted information and education program. The second treatment group remained on the standard rate and was provided with targeted information and education only.

The control area consisted of a portion of the City of Richmond (zip codes 94801 and 94804), located twelve miles north of Oakland, California. A Chevron refinery is located in this area, to which the local community has stated concerns about environmental impacts. Richmond was also the site of a proposed 500 megawatt power plant, which was to be located near the refinery. In 2001, strong community opposition stopped the proposal. The Richmond control group received the CPP-F price treatment and Track A information, but was not provided with a community-based information/education treatment.

The sections that follow provide comparison information between the Richmond and San Francisco groups, including economic and demographic data, and a description of the environmental hazards present in each of the communities. The purpose of this information is to enable the reader to understand the basic similarities between the areas – as well as a few significant differences – so as to be able to knowledgeably interpret pilot outcomes.

2.3.3.1 Characteristics of Study Area and Control Groups

The test and control geographic areas were carefully selected to provide comparability relative to four factors: (1) climate zone, (2) energy consumption patterns; (3) demographic characteristics; and (4) environmental hazards and associated community activism related to (perceived) environmental injustices located in the communities. Controlling for these factors will help isolate the influence of information, education and price treatments on the study's enrollees demand response behavior.

The following section compares and analyzes the treatment and control groups.

2.3.3.1.1 Climate Zone

Both the Richmond and Bayview-Hunters Point-Dogpatch neighborhoods are located in SPP Zone 1, a coastal climate zone. This zone is characterized by low seasonal and day/night time variation in temperatures compared to other climate zones, particularly the Central Valley. This climate pattern results in substantially lower levels of electricity use in the summer months for air conditioning, and lower levels for heating in the winter months. Much of the San Francisco Bay Area is in the coastal zone. The remaining Bay Area experiences less fog and thus requires somewhat less energy for heat but is similar to the coastal zone in other respects, including lower demand for summertime air conditioning relative to other climates zones.

2.3.3.1.2 Energy Consumption Patterns

Table 2-3 shows only slight differences in average daily use across the treatment, control, and coastal zone overall. Relative to the overall coastal climate zone, average daily consumption within the treatment and control groups are above-average for multi-family dwellings and slightly below average for single-family dwellings.

Table 2-3
Comparison of Energy Consumption Patterns
(May 2002 through October 2002)

KWh/day	Bayview/Hunters Point (Cells B01/B02)	Richmond (Cells B03)	Zone 1 Coastal
Multi-Family	9.46	8.27	8.06
Single-Family	12.99	11.57	13.62
Std Dev kWh/Day			
Multi-Family	5.94	4.64	5.95
Single-Family	7.01	6.34	8.87
Number of Households			
Multi-Family	4,154	8,138	396,791
Single-Family	6,311	13,631	533,828
Source: PG&E.			

For multifamily households, the variability in demand (standard deviation) is about the same or less in the treatment and control groups compared to the coastal zone overall. For single-family households, the difference in variability is somewhat lower in the treatment and control groups compared to the coastal zone overall. This reflects a lower incidence of very high electricity use households in the study group compared to the coastal zone.

For owner-occupied households, Table 2-4 shows little difference in heating type across treatment and control groups. [8] These households are also similar to the San Francisco Metropolitan Statistical Area.

Table 2-4
Comparison of Heating Type – Owner-Occupied

	Heat - Owner Occupied	Bayview/Hunters Point	Richmond	SF MSA
Percent	Gas	81.4%	80.0%	80.0%
	Electric	15.4%	17.1%	15.6%
	Other	3.1%	2.9%	4.5%
	Total	100.0%	100.0%	100.0%
Count	Gas	4,839	8,493	1,182,243
	Electric	917	1,813	230,247
	Other	187	304	66,199
	Total	5,943	10,610	1,478,689

For renter occupied households, Table 2-5 shows little difference in heating type across treatment and control groups. These households have a higher proportion of gas heating than the San Francisco Metropolitan Statistical Area.

Table 2-5
Comparison of Heating Types – Renter Occupied

	Heat – Renter Occupied	Bayview/Hunters Point	Richmond	SF MSA
Percent	Gas	69.6%	67.0%	59.5%
	Electric	23.4%	30.3%	35.4%
	Other	7.0%	2.7%	5.1%
	Total	100.0%	100.0%	100.0%
Count	Gas	4,214	8,184	641,882
	Electric	1,416	3,701	382,108
	Other	426	336	54,479
	Total	6,056	12,221	1,078,469

2.3.3.1.3 Demographics

The treatment and control groups are very similar across a number of important demographic indicators that differ from the larger population of the San Francisco Metropolitan Statistical Area (MSA). Table 2-6 below provides population statistics for the treatment and control groups, as well as the SF MSA.

[8] All figures included in the following tables are from the 2000 Census.

Table 2-6
Populations and Households

Population Size	Bayview/Hunters Point	Richmond	SF MSA
Population	39,145	67,676	7,039,362
Households	12,382	23,952	2,651,275
Population per Household	3.16	2.83	2.66

The treatment and control groups share similar language characteristics, and have a somewhat lower number of English-only speakers compared to the SF MSA, as shown in Table 2-7.

Table 2-7
Comparison of Language Characteristics

	Language	Bayview/Hunters Point	Richmond	SF MSA
Percent	18 to 64 Speak English Well	84%	85%	91%
	18 to 64 English Only	57%	60%	63%
	18 to 64 English Well + Others	27%	25%	28%
Count	18 to 64 Speak English Well	20,026	34,896	4,196,823
	18 to 64 English Only	13,560	24,651	2,897,934
	18 to 64 English Well + Others	6,466	10,245	1,298,889
	Population of 18 to 64	23,803	41,111	4,600,788

The treatment and control populations are similar in minority and ethnic makeup, yet very different from the San Francisco MSA, as listed in Table 2-8.

Table 2-8
Comparison of Race and Ethnicity

	Race & Ethnicity	Bayview/Hunters Point	Richmond	SF MSA
Percent	Black, non-Hispanic	43.3%	39.6%	7.0%
	White, non-Hispanic	11.4%	16.2%	50.4%
	Hispanic	15.9%	32.3%	19.7%
	Other	29.4%	11.9%	22.9%
Count	Black	16,968	26,803	490,655
	White	4,460	10,952	3,550,121
	Hispanic	6,221	21,889	1384506
	Other	11,496	8,032	1,614,080

The populations from which the treatment and control groups were drawn have lower household incomes compared to the San Francisco MSA, as shown in Table 2-9. In part, this is due to the higher number of individuals per household, which tends to dilute the median household income.[9] However, the per capita incomes for the two study areas are less than 60% of the MSA average.

Table 2-9
Comparison of Median Household Income

Median Household Income	Bayview/Hunters Point	Richmond	SF MSA
Per Household	$44,156	$38,675	$62,024

Home ownership is similar in the treatment and control groups, and significantly lower than in the San Francisco MSA, as shown in Table 2-10.

Table 2-10
Comparison of Home Ownership Patterns

	Own versus Rent	Bayview/Hunters Point	Richmond	SF MSA
Percent	Total	100.0%	100.0%	100.0%
	Own	49.5%	46.5%	57.8%
	Rent	50.5%	53.5%	42.2%
Count	Total	11,999	22,831	2,557,158
	Own	5,943	10,610	1,478,689
	Rent	6,056	12,221	1,078,469

The age of owner-occupied dwellings is similar in the treatment and control areas and much older than the San Francisco MSA, as shown in Table 2-11

Table 2-11
Age of Owner-Occupied Housing

	Year Built – Owner Occupied	Bayview/Hunters Point	Richmond	SF MSA
Percent	1970 & later	29%	22%	45%
	1969 & earlier	71%	78%	55%
	Total	100%	100%	100%
Count	1970 & later	1,706	2,300	663,520
	1969 & earlier	4,237	8,310	815,169
	Total	5,943	10,610	1,478,689

The age of renter-occupied dwellings is similar in the treatment and control areas and somewhat older than the San Francisco MSA, as shown in Table 2-12.

[9] Larger household sizes also creates potential problems with critical peak notification – more individuals are available to answer telephone calls, reducing the probability that the person responsible for managing electricity use in the house will receive the message.

Table 2-12
Age of Renter-Occupied Housing

	Year Built – Renter Occupied	Bayview/Hunters Point	Richmond	SF MSA
Percent	1970 & later	36.0%	34.1%	40.8%
	1969 & earlier	64.0%	65.9%	59.2%
	Total	100.0%	100.0%	100.0%
Count	1970 & later	2,181	4,170	439,537
	1969 & earlier	3,875	8,051	638,932
	Total	6,056	12,221	1,078,469

Finally, Table 2-13 shows very little difference in tenure across the three groups.

Table 2-13
Comparison of Tenure Length

Median Year Moved In	Bayview/Hunters Point	Richmond	SF MSA
Own	1987	1989	1990
Rent	1995	1997	1997

2.3.3.2 Community Environmental Concerns

Part of the pilot's premise is that community environmental concerns may heighten awareness of and willingness to take actions to reduce energy use. The Track B pilot location in southeast San Francisco was chosen in part due to the community's awareness of these issues. To discern the potential effect of using enhanced information provided by a community group, a community with similar concerns and demographics was needed as a control for the study. Richmond was chosen for this purpose. As discussed below, both communities face specific local environmental challenges and have active groups addressing those concerns.

2.3.3.2.1 San Francisco

San Francisco's Bayview, Hunters Point and Potrero neighborhoods are essentially "walled-in" by a freeway and two power plants. Highway 101, which is a main commuter artery carrying traffic from the Peninsula and East Bay, defines the western edge of Potrero. On the southeast, along side the bay, the Hunters Point Plant has been operating for more than three-quarters of a century. The almost equally aged Potrero Power Plant sits next to the bay at the northeast base of Potrero Hill. The plants are the first and second largest sources of polluting air emissions in the City.[10] No other power plants in the state with comparable emissions are located in such close proximity to a densely-populated area.

Other environmental hazards include:

- Vehicle noise and emissions: Highway 280 -- an increasingly popular alternative to Highway 101 for commuters from Burlingame, San Jose, and other southern cities -- cuts through Potrero and Bayview.

[10] San Francisco Department of the Environment and San Francisco Public Utility Commission. (Summer, 2002). *Electricity Resource Plan.* http://sfwater.org/detail.cfm/MSC_ID/64/MTO_ID/NULL/MC_ID/7/C_ID/1346/holdSession/1

- Diesel emissions: Significant truck traffic from Bayview's cement and other factories, as well as the Post Office and a bus depot and Muni marshalling yards in Potrero.
- Almost all of the City's sewage is sent to the southeast treatment facility located in Bayview.
- A number of hazardous waste sites, most predominately at the Hunters Point Shipyard, a former naval facility.

In part as a result of these environmental hazards, Bayview-Hunters Point may suffer from above-average rates of asthma, cancer, and other diseases.[11] A large number of "environmental justice" groups are active in the area, particularly in Bayview-Hunters Point, including the following

- Bayview Advocates for Health and Environmental Justice.
- Communities for a Better Environment.
- Greenaction for Health and Environmental Justice.
- Literacy for Environmental Justice.

2.3.3.2.2 Richmond

The Richmond control group is located west of Interstate 80 and south of the City of San Pablo. San Francisco Bay is to the south and west. The Richmond Parkway runs north/south through the 94801 zip code, and carries traffic between the Richmond / San Rafael Bridge and points north on Interstate 80. Interstate 580 runs east/west through both zip codes, and connects the bridge to points south on Interstate 80. The Chevron refinery also is located in the 94801 zip code.

Richmond has experienced a number of pollution-related problems associated with the presence of the Chevron refinery and other environmental threats.[12] Community groups and health officials in the area have responded by advocating for a number of initiatives, including the following:

- On July 9, 2001, Chevron agreed to pay $300,000 in fines for failing to meet air quality standards at its Richmond refinery, including infractions that contributed to a well-publicized explosion in 1999.[13]
- Contra Costa's asthma rate among children is 9 percent, according to a University of California, Los Angeles study. Sufferers are highly concentrated in Richmond, San Pablo and Bay Point, areas where neighborhoods border refineries and chemical plants.[14]

[11] Ibid.

[12] "Two gas leaks over 24 hours in Richmond" in *The San Francisco Chronicle*, (San Francisco, California, December 1, 2001). http://sfgate.com/cgi-bin/article.cgi?file=/chronicle/archive/2001/12/01/MN218859.DTL

[13] Sarkar, Pia. "Chevron Refinery fined $300,000" in *The San Francisco Chronicle*, (San Francisco, California, July 11, 2001) http://sfgate.com/cgi-bin/article.cgi?file=/chronicle/archive/2001/07/10/MN86561.DTL

[14] Johnson, Jason B. "Asthma epidemic sickens thousands" in *The San Francisco Chronicle*, (San Francisco, California, February 11, 2001) http://www.sfgate.com/cgi-

- In 2001, a 500 megawatt generating plant was proposed to be built near the Chevron refinery. In part as a result of grassroots community opposition, the proposal was voted down by the Richmond city council.[15]

Organizations active in environmental issues in Richmond include the following:

- Communities for a Better Environment.
- Richmond Greens.
- West County Toxics Coalition.

Both the Richmond and San Francisco target neighborhoods are the subject of a Bay Area Air Quality Management District research effort to examine localized, air-related environmental risks.[16]

2.3.4 Sample Design

Pilot enrollees were drawn from a sample of the population of households within the treatment and control areas. This "sampling approach" is a cost-effective alternative to measuring the entire population. The sample was stratified and randomly selected using statistical methods as shown in Tables 2-14 to 2-16.[17] The *SPP Impact Analysis*[18] describes the methodology used in greater detail, along with the full rationale for its use.

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bin/article.cgi?file=/chronicle/archive/2003/02/11/MN147858.DTL

[15] Sarkar, Pia. "Richmond power plant plan yanked. City manager reverses position" in *The San Francisco Chronicle*, (San Francisco, California, July 5, 2001) http://sfgate.com/cgi-bin/article.cgi?file=/chronicle/archive/2001/06/05/MNE166166.DTL

[16] Community Air Risk Evaluation initiative.

[17] This method will result in development of the necessary data to make reasonable inferences about the population with measurable accuracy. A less statistically robust approach would not provide measurable accuracy, and therefore provide no way to make inferences about the population. See William G. Cochran. Sampling Techniques, Third Edition (New York: John Wiley & Sons, 1977), pp. 1-2; Load Research Committee. Load Research Manual. (Birmingham, AL: Association of Edison Illuminating Companies, 1990). pp. 4-1 – 4-3.

[18] Charles River Associates, *Impact Evaluation of the Statewide Pricing Pilot, July 2003-December 2004*, Final Report (Oakland, California: Prepared for Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric Companies, March, 2004).

Table 2-14
Stratification – B01 Hunters Point Enhanced Information Only

Area	Residential Class	Usage	Population N_h	Average Daily Usage KWh/day	Standard Deviation S_h	Neyman Sample Allocation[19] n=63
BVHP	Multi-family	High	1,574	15.17	5.47	**13**
BVHP	Multi-family	Low	2,580	5.97	2.54	**10**
BVHP	Single-family	High	1,723	21.81	5.99	**15**
BVHP	Single-family	Low	4,588	9.68	3.74	**25**
Total			10,465			**63**

Table 2-15
Stratification – B02 Hunters Point Price and Enhanced Information

Area	Residential Class	Usage	Population N_h	Average Daily Usage	Standard Deviation S_h	Neyman Sample Allocation[20] n=63
BVHP	Multi-family	High	1,574	15.17	5.47	13
BVHP	Multi-family	Low	2,580	5.97	2.54	10
BVHP	Single-family	High	1,723	21.81	5.99	15
BVHP	Single-family	Low	4,588	9.68	3.74	25
Total			10,465			**63**

Table 2-16
Stratification – B03 Richmond Price Only and Track A Information[21]

Area	Residential Class	Usage	Population N_h	Average Daily Usage	Standard Deviation S_h	Proportional Sample Allocation[22] n=32
Richmond	Multi-family	High	2,311	13.95	4.23	**3**
Richmond	Multi-family	Low	5,827	6.02	2.25	**9**
Richmond	Single-family	High	2,685	21.30	5.69	**4**
Richmond	Single-family	Low	10,946	9.18	3.63	**16**
Total			21,769			**32**

The specific methodologies used to stratify and randomly select the sample includes the

[19] Neyman Sample Allocation = $n^* N_{h^*} S_h/(\Sigma N_{h^*} S_h)$

[20] Neyman Sample Allocation = $n^* N_{h^*} S_h/(\Sigma N_{h^*} S_h)$

[21] Richmond sampling frame was constructed by using zip codes 94804 and 94801. These zip codes include the boundaries of San Pablo, so some San Pablo sites may be included in the sampling frame.

[22] Proportional Sample Allocation = $n^* N_h/(\Sigma N_h)$

following:[23]

- Summer Average Daily Usage (ADU)[24] was used as the proxy variable for load.
- Dalenius-Hodges methodology was used to construct the optimal strata boundaries. The boundaries are 10kWh ADU for Multi-family households and 16 kWh ADU for Single-family households.
- Neyman Optimal Allocation Sampling was used to allocate the sample points among the strata for Hunter's Point.
- After attempting to use Neyman Optimal Allocation for Richmond, it was discovered that some cells had too few sample points. Neyman Optimal Allocation would not allow combining of cells, so proportional allocation was used for Richmond. Some cells in Richmond are small, but they can be combined together in any combination.

2.3.5 Rate Design Identical to Track A

Track B's rate design is identical to that used for the Track A CPP-F component. The rationale for this approach is discussed in detail in *SPP Impact Analysis*. Track B varies from Track A in two ways:

(1) Track B San Francisco participants were given enhanced information/education, to determine the effect of that added treatment on their responsiveness to the CPP-F rate schedule. These interventions consisted of providing the same materials as Track A, except modified to more closely align with community demographics and culture (e.g., *Welcome Package* examples that used African-American names and different family constellations) and included information about the linkage between peak energy use and polluting air emissions; as well as additional educational efforts, which consisted of two separate two-page flyers and three newsletters; and a community event. Track B interventions were also implemented by long-time community residents.

(2) The number of CPP Events was about half of that for Track A participants in the Summer 2003 phase, because the Track B project started later. Track B had two additional CPP events during the Winter 2004 phase beyond what Track A participants saw. The dates of those events and the times for the CPP signal are shown in Table 2-17.

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[23] These are the same methods used for Track A.

[24] Summer ADU = (May 2002 – October 2002 Billed Usage)/(May 2002 – October 2002 Billing Days) for all time periods.

Table 2-17 Critical Peak Pricing Event Summary					
Date	**Residential CPP-F (all PM)**				
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**	**Track B**
07/10/03	2-7	2-7	2-7	2-7	
07/17/03	2-7	2-7	2-7	2-7	
07/28/03		2-7	2-7	2-7	
08/08/03		2-7	2-7	2-7	
08/18/03	2-7	2-7	2-7	2-7	
08/27/03	2-7	2-7	2-7	2-7	
09/03/03	2-7	2-7	2-7	2-7	
09/12/03	2-7	2-7	2-7	2-7	**2-7**
09/18/03	2-7				**2-7**
09/22/03	2-7	2-7	2-7	2-7	
10/09/03	2-7	2-7	2-7	2-7	**2-7**
10/14/03	2-7	2-7	2-7	2-7	**2-7**
10/20/03	2-7	2-7	2-7	2-7	**2-7**
10/21/03					**2-7**
01/06/04	2-7	2-7	2-7	2-7	**2-7**
01/26/04	2-7	2-7	2-7	2-7	**2-7**
01/27/04					**2-7**
02/03/04	2-7	2-7	2-7	2-7	**2-7**
07/14/04	2-7	2-7	2-7	2-7	**2-7**
07/22/04	2-7	2-7	2-7	2-7	**2-7**
07/26/04	2-7	2-7	2-7	2-7	**2-7**
07/27/04	2-7	2-7	2-7	2-7	**2-7**
08/09/04	2-7	2-7	2-7	2-7	**2-7**
08/10/04	2-7	2-7	2-7	2-7	**2-7**
08/11/04	2-7	2-7	2-7	2-7	**2-7**
08/27/04	2-7	2-7	2-7	2-7	**2-7**
08/31/04	2-7	2-7	2-7	2-7	**2-7**
09/08/04	2-7	2-7	2-7	2-7	**2-7**
09/09/04	2-7	2-7	2-7	2-7	**2-7**
09/10/04	2-7	2-7	2-7	2-7	**2-7**

2.4 Customer Enrollment Process

2.4.1 Differences in Treatment between San Francisco versus Richmond and Track A

The key differences between Tracks A and B are the setting (e.g., low income, demographically diverse; adjacent to power-related hazards); the information and educational treatments (e.g., focusing on the linkage between electricity use and local polluting air emissions); and the delivery mechanism (e.g., a community-based organization). In addition, several exogenous events occurred which may have influenced participants' behavior during the study.[25] This section provides a discussion

[25] The same is true for Track A – exogenous events, such as rate increases, power plant siting

of these Track B pilot elements.

2.4.2 Information/Educational Treatments in San Francisco

Track B treatments were implemented by San Francisco Community Power. SF Power is a membership organization that provides its residential, business, church, and non-profit members with low- or no-cost energy efficiency services, as well as access to renewable technologies. SF Power was formed in the Fall, 2001, and at the time of the pilot launch had approximately 1,200 members. A survey implemented in the Fall, 2002 found that 20 percent of Potrero residents (94107 zip code) had heard of SF Power, while 10 percent of Bayview-Hunters point residents (94124 zip code) were aware of the organization. SF Power maintains offices in the community, and its employees are predominately residents or former residents of the area.

Table 2-18 indicates when notable information/education treatments were implemented in Track B. What these interventions consisted of is further discussed below.[26]

Table 2-18
Track B Education/Information Treatment Schedule

August-September, 2003	October, 2003	November, 2003	January, 2004	April, 2004	June, 2004	July, 2004
Welcome Package; Newsletter; Energy Kits	Flyer	Newsletter	Community event; Newsletter	Newsletter	Flyer	Welcome Package

- *Participant recruitment*: Modified Track A materials and implementation steps were used for Track B.[27] The basic "look" and structure of these materials remained the same, but were altered to include information about the generating patterns and associated emissions from the local power plants; and efficiency tips and household energy management case studies that more appropriately reflected the use patterns and cultural characteristics of the study area (e.g., most references to air conditioning were dropped; different energy use patterns and names and family structures were used as examples).

  Participants were recruited through a stepwise process, as follows: telephone calls were made to the sample list to notify potential participants that they would

cases, and utility news could influence statewide results.

[26] As with any project involving complex issues, multiple parties, and a tight schedule, actual implementation did not always follow the intended work plan. However, by and large the activities outlined herein reflect reality.

[27] SF Power does not necessarily endorse the Track A materials, and had some serious reservations about the graphics and lay-out. Likewise, the "look and feel" of these materials in general did not match with the community zeitgeist. It's possible that if more tailored materials had been employed pilot outcomes could be different.

soon receive a letter requesting their participation in the pilot. Call scripts[28] were short, and intended to reinforce the study's community and environmental importance. Letters were then posted, and if no response was received within five days follow-up calls were made to encourage the resident to enroll in the pilot, again with emphasis placed on the study's community and environmental benefits. Potential participants were called up to five times – and in some cases more – to try to enroll them in the pilot.

- *Meter installation*: Once a participant was enrolled in the pilot, they received a "Welcome Package" via mail, which more fully described the study and ways to engage in it.[29] Another series of calls were made to advise participants to expect the receipt of these documents, followed by installation of a new meter. Shortly thereafter, PG&E attempted to install the necessary meters, but had some difficulty due to a variety of factors, including an inability to arrange appointments; locked spaces; and in some cases the meter installers perceptions that the environment was unsafe (e.g., a group of men loitering). A process was established whereby SF Power assisted PG&E in making install appointments, which significantly increased the success rate, particularly for "difficult-to-access" households.
- *San Francisco Community Power membership*: Within sixty days of their enrollment in the pilot participants received an "energy kit" from SF Power, which included two compact florescent light bulbs (CFLs); weather stripping, high-pressure sink and shower faucets; toilet dye tab; and newsletter.[30] The newsletter contained offers for other low- or no-cost energy efficiency services the participant could gain access to, including rebates on electric heaters and refrigerators, as well as information on efforts to retire the locally-polluting power plants. Pilot participants received editions of SF Power's newsletter on November, 2003, January, 2004, and April, 2004
- *Participant care*: SF Power staff was available to answer participants' questions, either over the telephone or in person. In general, through-out the study period staff received no more than one or two pilot-specific inquiries each day, most of which focused on PG&E payment issues, billing problems, incentive payments, and meter install challenges. SF Power had a greater amount of interaction with participants relating to the energy efficiency measures being offered, as further described below. SF Power also received two to three calls in response to each critical peak period (CPP) event, mostly related to ways to respond to the notification. In general staff suggested that the participant turn all electrical appliances off, and avoid opening their refrigerator. Approximately 5 percent of the pilot participants did not speak English, and in these cases translators were

[28] All pilot materials, including call scripts, recruitment letters, and educational pieces, are provided in an appendix.

[29] A shortened version of the welcome package was also posted in July 2004. Track A participants also received welcome packages, though the Track B version was modified somewhat to reinforce the environmental benefits of shifting off-peak.

[30] All items were funded outside the Track B project budget.

used, but in general SF Power's response time was slow for non-English speakers.[31]

- *Audits and installs*: During the study period SF Power attempted to contact all San Francisco pilot participants to offer them a free household energy audit, and free installation of up to three indoor or outdoor occupancy sensors and up to ten CFLs.[32] As part of audit or install visits, participants were provided additional information on energy efficiency programs available through PG&E, SF Power and others. These same services were offered through non-pilot, more passive, channels to the Richmond Track B participants (e.g., all utility customers are eligible for energy efficiency rebate programs, and low income households can receive enhanced free services through Energy Partners).
- *Survey implementation*: In the early Fall, 2003, participants received PG&E's *Household Energy Survey* via mail. A similar procedure as the recruitment process was implemented to obtain the surveys, including pre-calls and post-calls. In some cases survey information was collected over the telephone. The study area initially received a modest return rate – approximately 60 percent. As a result, the recruitment process was repeated, including another posting of the survey, and follow-up telephone calls by SF Power, after which the return rate was pushed up to 90 percent.
- *Flyers:* In October, 2003 a two-sided flyer was posted to participants reminding them of the importance of shifting their electricity use during peak periods, and providing information on San Francisco's Winter-peaking patterns. A similar flyer, this time simply encouraging participants to continue their efforts to shift off-peak, was posted in June, 2004.
- *Community event*: On January 31, 2004 SF Power held a dinner and dance for all of its residential members, as a way of reinforcing the community context and importance of the pilot effort. Event invitations consisted of a postcard and a notice in the Winter flyer and Winter newsletter. Ninety members attended, of which 10 were pilot participants.
- *Website*: Pilot participants were given access to both the Emeter and SF Power websites. There were extensive discussions between Emeter, PG&E, and SF Power about customizing the Emeter website to more effectively focus on Track B design criteria (e.g., removing air conditioning tips; reducing the emphasis on PG&E and its programs), but in the end little was done to actually change the site.

2.4.3 Track B Exogenous Activities

Along with SF Power's educational activities, several other events occurred that could have influenced customer behavior. None of these activities were directed at changing customers' consumption patterns, but they may have raised pilot participants' awareness

[31] Spanish, Mandarin, and Cantonese were the predominant non-English languages spoken. Until Winter 2004 SF Power did not have staff members with these language skills, and as a result had to rely on temporary employees or volunteers, which usually engendered a week or more response delay. Whether and how to maintain staff with these skills is a necessary question to be answered if the program is expanded.

[32] This effort was funded outside the pilot budget.

of the role of their energy use in broader policy decisions:

- *PG&E mailer*: In late-Summer 2003 PG&E sent a letter to all households in the 94124 zip code encouraging them to join a coalition to advocate closure of the Hunters Point Power Plant by the end of 2005 through support of the proposed Jefferson-Martin transmission line.
- *New combustion turbines*: Throughout 2003 and early 2004 the City and County of San Francisco (CCSF) held a series of community meetings focusing on the siting of up to four 45 megawatt combustion turbines (CTs) in Southeast San Francisco. CCSF linked the successful siting of the CTs with the ultimate closure of the Hunters Point Plant, and proposed that at least three, if not four, be sited at or near the existing Potrero Power Plant. These outreach activities engendered noticeable participation by residents, some of whom were pilot participants. SF Power also attended many of the meetings, and provided formal and informal presentations at a number of them.
- *Media coverage of PG&E*: The *San Francisco Chronicle*, as well as other media outlets, published frequent stories about PG&E, most of which cast a negative light on the utility. Story topics included the bankruptcy, and emerging from it; a Christmas-time electrical outage in San Francisco; and PG&E employee bonuses.
- *Local election*: San Francisco held a mayoral race, which resulted in a run-off election. Closure of the Hunters Point Plant was a notable topic in the campaign, particularly in the 94124 zip code.
- *Bill rebates*: PG&E customers received bill rebates in October 2003 related to over-collection on previous Department of Water Resources Power Purchase Agreements. These rebates averaged about $40 per residential customer.

3. Track B Data Development

3.1 Track B Database Similar to Track A

The residential impact analysis and demand modeling relied on a variety of data from the following broad categories:

- Energy consumption and peak demand
- CPP event information
- Weather
- Price
- Survey information on appliance holdings and socio-demographic information
- Miscellaneous information (e.g., sample characteristics, etc.).

The data development and management approaches for Tracks A and B were identical, so as to maintain comparability in the analyses. The specific data used from each of these broad categories is described in *SPP Impact Analysis*.[33]

[33] Charles River Associates (2005), op. cit.

The primary load data consists of 96 values for each day representing integrated demand at 15-minute intervals. Off-peak period energy consumption for all weekdays covers the time period from midnight until 2 pm and from 7 pm until midnight. Peak-period energy use on all weekdays consists of the period from 2 pm to 7 pm for CPP-F customers.

For purposes of the analysis, the interval data was aggregated to energy consumption by rate period by summing over the corresponding 15-minute intervals. In other words, the observations consisted of the sum of all consumption during the same 15-minute interval of each weekday (or separately, each weekend), so that a single 24-hour "period" was represented. This approach serves to create an "average" use level for each day-type (i.e., pre-treatment, CPP, and non-CPP), and reduces the problem of serial correlation in the data when observations from successive days are included.

Diagnostics on the Track B data indicated that, at least for the summer 2003 period, missing data problems were consistent with those found in Track A. As a result, these data were treated in the same fashion in the Track A analysis.

3.2 Price Data

The estimation of demand models requires development of price data. Given the complexity of electricity tariffs, a key estimation issue is how best to represent the price of electricity. As part of the Statewide Pilot, extensive research was conducted to identify the "best" set of prices to be used as the baseline for current rates.[34] The decision was made to use the Tier 3 rate for the Track A analysis, as this is the rate that a plurality of customers "see" as their marginal electricity prices across a range of climate zones.[35] The Track B analysis also uses this tier, and additional analysis indicated that the results were insensitive to whether Tier 1 or Tier 2 prices were used instead. Table 3-1 summarizes the average prices used for each pricing period in the study.

[34] This analysis is discussed at length in Appendix 15 of Charles River Associates (2005), op. cit.

[35] The rate tiers for residential rates vary as a proportion of "baseline" usage. Baseline usage is determined by climate zone from data on residential usage within each of those zones. The tiers are at 100% of baseline and below, 101% to 130% of baseline, 131% to 200% of baseline, 201% to 300% of baseline, and greater than 300%.

Table 3-1
Average Prices For Residential CPP-F Tariff
($/kWh)

Season	Customer Segment	Day Type	Rate Period	High Ratio	Low Ratio	Average
Summer (03/04)	Info Only	All	All	0.13		
	Price Only & Price/Info	CPP	Peak	0.68	0.50	0.59
			Off-peak	0.07	0.11	0.09
			Daily	0.24	0.21	0.23
		Weekend	Daily	0.07	0.11	0.09
Winter	Info Only	All	All	0.13		
	Price Only & Price/Info	CPP	Peak	0.53	0.69	0.61
			Off-peak	0.10	0.11	0.11
			Daily	0.20	0.25	0.23
		Weekend	Daily	0.10	0.11	0.10

3.3 Event Data

Event data links CPP events to CPP treatment customers. Specifically, event data indicates whether or not a CPP-F customer will be billed at critical peak rates for a CPP event. A customer is not billed at the CPP rate if the auto-dialer that is used to make the call to the customer registers a "ST" code, which means "signal in transit." This indicates that a call was made but could not be completed. On average, between two and three percent of customers were not billed for a CPP event because the call did not get through to the occupant.

3.4 Survey Data

Data on household characteristics was gathered through a mail survey conducted among both treatment and control customers. Given the essential nature of the survey information to the impact and demand analysis, every effort was made to maximize survey response. Multiple mailings and telephone follow-up calls were made and respondents were paid $25 for completing the survey. Toward the end of the data collection process, in some cases, site visits were made to collect information on non-respondents. Table 3-2 summarizes the response rate by cell.[36]

[36] Response rate in this instance is defined as the percent of customers for whom load data exists that responded to the survey. This is different from the actual response rate to the survey. For various reasons, (e.g., delays in meter installations; timing differences between when surveys were mailed and when customers enrolled into or left the treatment group, etc.) surveys were sent to some customers who, it was later determined, did not actually participate in the SPP either as a control or treatment customer.

Table 3-2 Load Data and Survey Response By Cell					
		In Load Dataset	In Survey Data	In Both Load and Survey Data	
CELLID	Cell Description	Count	Count	Count	Percent of Customers in Load
B01	Track B, CPP-F InfoOnly, Hunters Pt.	70	59	51	72.9%
B02	Track B, CPP-F, Hunters Pt.	139	141	117	84.2%
B03	Track B, CPP-F, Richmond	80	73	73	91.3%
Total	Total for Tracks A, B, & C	2,019	2,016	1,821	90.2%

The customer characteristics survey gathered a variety of information, including data on:

- Appliance holdings
- Appliance usage patterns
- Housing type, age, size and tenure
- Socio-demographic information (e.g., persons per household, education level, language spoken and income)
- Satisfaction with utility performance
- Opinions about the environment.

Table 3-3 contains mean values for selected survey variables, weighted to represent the control group population as a whole. The survey vendor recorded the response to each question option as a binary variable. The survey data was typically recoded in order to produce variables that could be used in the analysis.

Variable	San Francisco B01	San Francisco B02	Richmond B03	Track A Zone 1 Control	Track A State Control
Persons per Household	3.16	3.48	2.36	3.21	3.18
# of Bedrooms	2.61	2.69	2.25	2.76	2.94
Central air conditioning	0[37]	0.04	0.04	0.06	0.42
Median Income	$44,156	$44,156	$38,675	$78,653	$68,251
Electric clothes dryer	0.34	0.38	0.50	0.33	0.36
Electric cook top	0.24	0.19	0.34	0.34	0.36
Electric spa	0.06	0.05	0.01	0.01	0.06
Electric water heater	0.10	0.08	0.14	0.09	0.09
Home business	0.06	0.03	0.01	0.04	0.03
Own home	0.59	0.62	0.49	0.71	0.67
College Education	0.41	0.31	0.44	0.56	0.43
Satisfied with Utility	2.59	2.70	2.76	2.95	2.98
Single family dwelling	0.43	0.53	0.57	0.65	0.68
Square footage	1,759	1,500	1306	1,542	1,537
Swimming pool	0	0	0.01	0.01	0.08
Home computer use	0.45	0.44	0.40	0.62	0.53
# of freezers	0.20	0.31	0.16	0.16	0.21
# of dishwashers	0.61	0.42	0.26	0.66	0.62
# of households with room a/c	0.05	0.05	0.04	0.03	0.16
# of water pumps	0.06	0.03	0.03	0.02	0.08
# of water beds	0	0	0	0.00	0.01

Table 3-3
Selected Characteristics of SPP Track B Customers vs. Track A Controls

Several differences are worth noting in the Table, both within the Track B population and in comparison between tracks. Both the Information-Only and CPP-F San Francisco groups have roughly the same number of persons per household, while the Richmond group exhibits substantially smaller household sizes than either San Francisco or the other Tracks. Median household incomes for San Francisco and Richmond are 56% and 49% respectively of the Track A Zone 1 median. The proportion of single-family dwellings is smaller in San Francisco versus the other areas. The percentage who own their home is lower in Richmond relative to the other areas. Dishwasher use also is much lower in Richmond. Home computer use in Track B is lower than Track A,

[37] While Cell B01, San Francisco Information-Only, shows no air conditioners, it does show a positive value for “Central Air Conditioning Operation.” These conflicting results have not been reconciled, but may be a miscoding between central and room air conditioners.

averaging in the low 40% range versus over 60% for Zone 1. The air conditioner saturation is much greater state wide (42%) compared to less than 6% for Track A Zone 1 and Track B. Satisfaction with the utility (PG&E) is somewhat lower in Track B areas relative to Track A.

Each of these characteristics could impact study outcomes. For example, larger household sizes could reduce the effectiveness of CPP programs, as there is a lower probability that an individual interested in and able to manage household energy use will be reached by a given call (e.g., the call may be answered by a youth, or extended family member). Likewise, as indicated in Track A, income levels appear to be linked to CPP responsiveness. And appliance saturation characteristics importantly impacts families' ability to flexibly manage their energy use.

3.5 Weather Data

Weather is an important determinant of energy use and a key explanatory variable in the regression models. Consequently, weather data was gathered from stations close by Richmond and San Francisco.

4 Comparison of Energy Usage across Track B Participants

Before examining the model results it's important to review average electricity use within each Track B cell by time period. This information provides an indication of expected patterns to be further analyzed. The tables below show average B01, B02 and B03 use in the Summer 2003, Winter 2004 and Summer 2004. The tables compare use on CPP event days versus non-CPP event days, because differences in those periods are the SPP study's primary focus. However, this analysis does not account fully for underlying differences between the study cells, and these results should not be used to estimate potential impacts. For example, differences in weather could explain much of the variation between the two groups, but are not accounted for in this analysis. This information can best be used to provide insight into possible changes in use patterns, as well as to identify differences that may be worth further study.

Table 4-1 examines how one of the most important factors in determining energy demand -- cooling and heating degree days -- differs between the CPP and non-CPP days. As expected in Track B, because it is in Zone 1, the differences in cooling degree days (CDD) are relatively small between days with normal peak prices and critical peak prices—generally less than 2 degrees Fahrenheit.[38] At that temperature change level, it is unlikely that the residential cooling load increased in any perceptible way, particularly given the very low air conditioning saturation rate. On the other hand, the heating degrees (HDD) differences between high and low price days in the winter are fairly large and consistent across the three cells. On CPP days, this may have lead to a significant increase in electric heating load, particularly with the higher electric heating saturation shown in Tables 2-4 and 2-5 above.

[38] A comparison of Track B to Track A Zone 1 climate data shows that the heating and cooling degree days are quite similar, generally varying by less than one degree during peak periods.

Table 4-1 CPP vs. Non CPP Cooling or Heating Degree Day Average Differences			
Cell	**Summer 2003** *CDD*	**Winter 2004** *HDD*	**Summer 2004** *CDD*
B01-San Francisco Enhanced Info Only	0.8	3.8	0.5
B02-San Francisco Price & Enhanced Info	0.7	3.8	0.5
B03–Richmond Price and "A" Information	1.8	4.2	0.9

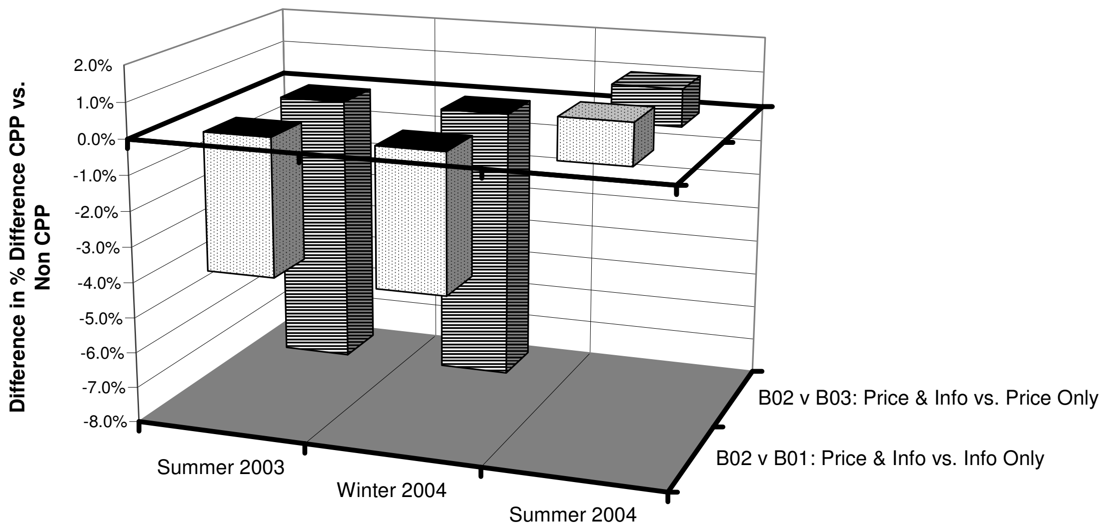
In general, peak energy use on CPP days was the same or less than non-CPP days during the Summer periods. This probably reflects the small cooling degree day differences shown in Table 4-1. On the other hand, CPP peak use was substantially larger in the Winter, probably reflecting the increase in heating degrees on those days.

Table 4-2 and Figure 4-1 show how average peak use varied among the cells between CPP and non-CPP event days, with the change in the CPP period measured against non-CPP use. In Summer 2003, San Francisco Price and Info (B02) participants demonstrated the largest average reduction among the three groups, and in Winter 2004 showed the smallest increase among the different cells. This is consistent with expectations that the combined price signal and enhanced information intervention would have a larger impact than price or information alone. The Price and Info (B02) treatment exhibited identical larger gains as compared with the Info-Only and Price-Only treatments in the Summer 2003 and Winter 2004.

However, San Francisco Price and Info lagged behind the other two cells in Summer 2004. Why this decline in responsiveness appears to have occurred is not readily apparent. It may have occurred because the information/education efforts in San Francisco diminished in Summer 2004. Interestingly, B01 in San Francisco, which received only the enhanced information intervention, showed a larger difference in use on CPP days than the Richmond group in the first two periods, and about the same in the third. Based on this comparison, the enhanced information intervention appears to have a similar effect as the price signal in similarly situated communities based on the analytic approach.

Table 4-2 Differences in CPP vs. Non CPP Peak Period Average Usage			
	Summer 2003	**Winter 2004**	**Summer 2004**
B02 v B01: Price & Info vs. Info Only	-3.9%	-3.9%	1.1%
B02 v B03: Price & Info vs. Price Only	-7.7%	-7.7%	1.1%

Figure 4-1
Differences in CPP vs. Non CPP Peak Period Average Usage



It is also important to examine the degree to which energy consumption generally shifted from peak to off-peak. One measure of this relationship is the ratio of peak to off-peak use. A negative value shows that on CPP days the ratio of peak to off peak use was lower than on non-CPP days, implying more use was reduced on-peak and/or increased off-peak.

Table 4-3 and Figure 4-2 compare the peak/off-peak use ratios for the study's two analytic relationships. A negative value indicates that peak use was lower in the B02 Price & Info cell than the "control" treatment. As with the peak use differences shown in Table 4-2, the San Francisco Price and Info groups demonstrated a greater response in the first two seasons, but it also indicates more response in the Summer 2004 period than for the San Francisco Info-Only group. However, the former's response is still less than that for Richmond Price-Only group in that latter season. The Info-Only doesn't show as much response compared to Price-Only by this measure. This result implies that B01 Info-Only customers exhibited less dynamic behavior than the other groups (e.g., did not increase their off-peak use as much as Price-Only customers, but decreased on-peak use). Instead, the actions the B01 participants took appear to have centered around conservation, rather than shifting. This makes sense – with no economic incentive to shift usage to a lower-priced period because they received a constant price, in general Info-Only participants appeared to have taken the easier route of reducing their electricity use to the extent possible, without any further behavioral changes.

Table 4-3 Differences in CPP vs. Non CPP Peak/Off Peak Ratio	Summer 2003	Winter 2004	Summer 2004
B02 v B01: Price & Info vs. Info Only	-4.2%	-1.7%	-2.0%
B02 v B03: Price & Info vs. Price Only	-2.2%	-1.1%	2.6%

Figure 4-2
Differences in CPP vs. Non CPP Peak/Off Peak Ratios

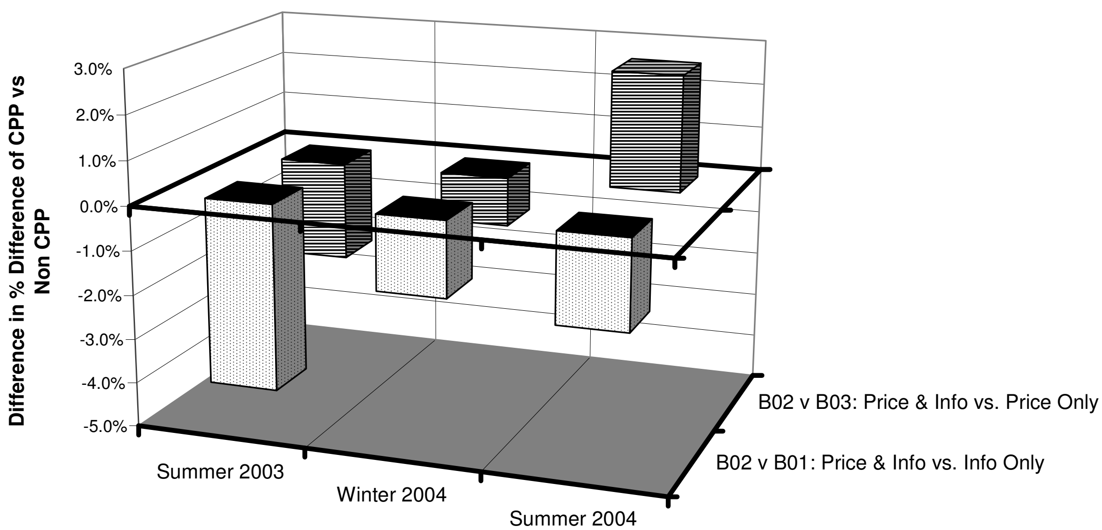
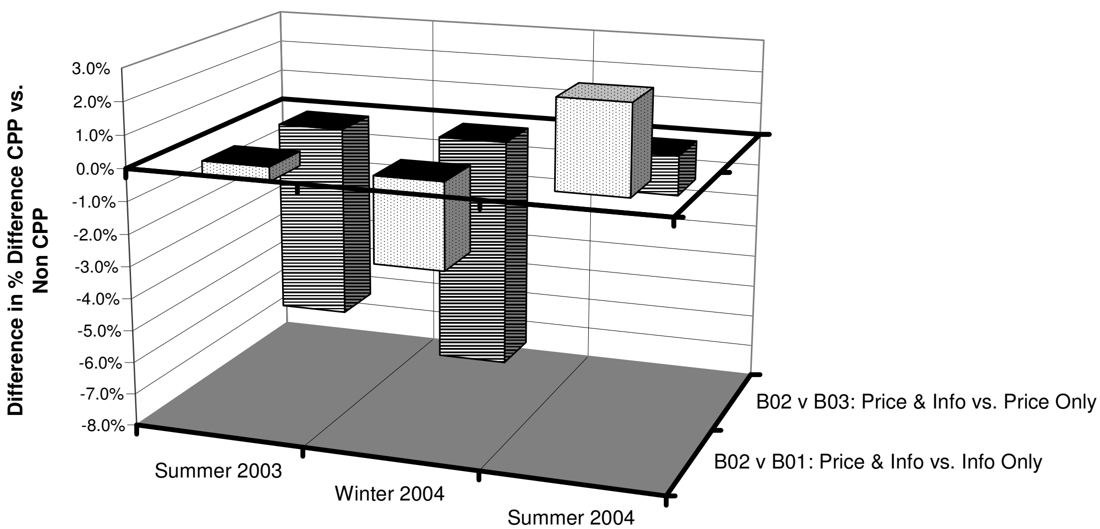


Table 4-4 and Figure 4-3 confirm that San Francisco Info-Only (B01) customers did not increase their off-peak consumption as much as Richmond Price-Only (B03) customers on CPP days. Info-Only customers decreased their daily average use in the summers on CPP days while Price-Only customers increased theirs, and Info-Only winter consumption did not increase as much as for Price-Only. Again, San Francisco Price and Info customers (B02) were the most frugal in the first two seasons, but lagged behind Info-Only in the Summer 2004. The Price and Info customers showed a larger difference over the Price-Only customers than over the Info-Only customers, again indicating that enhanced information may have as strong or a stronger effect than price without enhanced information.

Table 4-4 Differences in CPP vs. Non CPP Daily Average Usage	Summer 2003	Winter 2004	Summer 2004
B02 v B01: Price & Info vs. Info Only	-0.5%	-2.7%	2.7%
B02 v B03: Price & Info vs. Price Only	-6.1%	-7.2%	-1.2%

Figure 4-3
Differences in CPP vs. Non CPP Daily Average Usage



5 Model Specification for Regression Analysis

To re-state Track B's research objectives, the questions to be addressed are:

(1) Can a locally-based educationally-focused program induce similar beneficial (i.e., conservation; shifting) behavioral changes as a more traditional utility-implemented critical peak pricing program; and

(2) Can residential customers' responsiveness to price signals be enhanced through the use of economic and environmental messages delivered by a community-based organization.

Based on the comparison of energy use patterns discussed in Section 4, provision of enhanced information appears to induce additional conservation activity and to enhance price response. The next step in the analysis is to apply the modeling approach used in analyzing the Track A results to further examine Track B outcomes.

The Track B analysis employed a similar methodology as that used for the Track A residential analysis (i.e., the constant-elasticity-substitution (CES) specifications has been estimated).[39] There is, of course, an important difference between Tracks A and B. Some Track B San Francisco customers received a community-based information/education treatment in addition to the standard CPP-F rate treatment. Other San Francisco Track B participants just received a community-based information/education treatment without the rate treatment, and Track B customers in Richmond received only a rate treatment with no enhanced information.

These differences resulted in a number of generally modest methodological adjustments. For instance, for Track A CPP-F Rate customers, the price elasticity estimates are not conditional on customers receiving community-based information/education treatments. However, for a Track B CPP-F Rate customer receiving enhanced information in San Francisco (B02), price elasticities are estimated conditional on a community-based information/education treatment when using B01 participants receiving only enhanced information in San Francisco as a control group. And, the effect of an information/education treatment on price elasticity is estimated *given* a rate treatment when using B02 as a control group.

As in Track A, the participants were segmented into four groups, based on use levels (i.e., high; low), and type of residence (i.e., single; multi-family). Some of these groups were over-sampled relative to population norms, but to preserve the observations and associate information, the observations were weighted to match population norms.

As discussed in the *SPP Impact Analysis,* the analysis was structured around the constant elasticity of substitution (CES) demand system. The CES demand system consists of two equations. The first equation models the ratio of peak to off-peak quantities, expressed in logs, as a function of the ratio of peak to off-peak prices, also expressed in logs, and other terms,. The second equation models daily electricity consumption, expressed in logs, as a function of the daily price of electricity, also expressed in logs. The two equations constitute a system for predicting electricity consumption by period. By taking the shares of energy use by period that are predicted by the first equation and multiplying them by predictions of daily energy use from the second equation, one can generate estimates of the quantity levels for peak and off-peak energy use given specific peak and off-peak prices and other determining factors (i.e., the impacts of the CPP prices on demand).

Treatment customers in cells B02 (San Francisco CPP-f) and B03 (Richmond) faced a different price for each time period. Treatment customers in cells B01 and B02 received an additional information/education intervention during the Treatment period.

5.1 Addressing Issues of Heteroskedasticity and Autocorrelation

Due to issues of heteroskedasticity and autocorrelation found in the original analytic method, the SPP data was analyzed using a "first differences" regression method.[40] The SPP data set consists of observations on a cross section of customers that are observed over time and constitutes what is known in the literature as a panel data set. Given its panel nature, we have used the "fixed effects" estimation procedure to derive the model parameters. This procedure assigns a binary variable to each customer that represents

[39] The methodology is described in detail in Charles River Associates (2005), *op. cit.* Section 3.1.

[40] *Ibid.*

the unique and unexplainable lifestyle of each customer.[41]

5.2 Model Specification

The model has been developed using the constant-elasticity-substitution (CES) demand system used to analyze Track A and C results.[42] The CES specification also consists of two equations, one that estimates the tradeoff between peak and off-peak period energy use and another that estimates the responsiveness of daily energy use to daily price. Own- and cross-price elasticities of demand can be calculated from the elasticity of substitution and the daily price elasticity as follows:[43]

The own price elasticity of demand for peak period energy use shown in Equation 1 is:

$$(1) \qquad \eta_p = Q_{op}\sigma + \eta_d[w_p P_p \div (w_p P_p + w_{op} P_{op})],$$

where

$w_p = Q_p \div (Q_p + Q_{op})$ and

$w_{op} = Q_{op} \div (Q_p + Q_{op})$.

The cross-price elasticity of demand for peak period energy use given a change in off-peak prices = $\eta_{p,op} = -Q_{op}\sigma + \eta_d[w_{op}P_{op} \div (w_p P_p + w_{op} P_{op})]$. When B01 is used a control for B02, Equation 2 is specified as follows:

$$(2) \qquad \ln(Q_p/Q_{op}) = \alpha + \sum\beta_i d_i + \sigma \ln(P_p/P_{op}) + \delta(CDH_p - CDH_{op}) + \varepsilon$$

where

Q_p = average daily energy use per hour in the peak period

Q_{op} = average daily energy use per hour in the off-peak period

P_p = average price during the peak period

P_{op} = average price during the off-peak period

$CDH_p - CHD_{op}$ = the difference in cooling degree hours per hour during the peak and off-peak periods[44]

d_n = a binary variable equal to 1 for the n^{th} customer, 0 otherwise

σ = the elasticity of substitution between peak and off-peak energy use

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[41] See the discussion in James H. Stock and Mark W. Watson, *Introduction to Econometrics*, Addison Wesley, 2003.

[42] Other structural models that were examined included the log-log formulation, the quadratic and the Generalized Leontief demand system. See Appendix 7 of Charles River Associates (2005) *op. cit* for further discussion.

[43] A derivation of the formulas used to predict impacts by rate period based on the CES specification is provided in Appendix 8 of Charles River Associates (2005) *op. cit*.

[44] The difference in cooling degree hours was used in the CES specification rather than the ratio of cooling degree hours in the two time periods because, in some climate zones, the value for off-peak cooling degree hours equals 0. In these cases, calculating the ratio would involve dividing by zero.

ε = regression error term.

Equation 3 in the CES model estimates daily energy use as a function of daily average price and cooling degree hours. The daily model is specified as follows:

$$(3) \qquad \ln(Q_d) = \alpha + \sum\beta_1 d_1 + \eta_d \ln(P_d) + \delta(CDH_d) + \varepsilon$$

where

Q_d = average daily energy use per hour

P_d = average daily price (e.g., a usage weighted average of the peak and off-peak prices for the day)

CDH_d = cooling degree hours per hour

d_n = a binary variable equal to 1 for the n^{th} customer, 0 otherwise

η_d = the price elasticity of demand for daily energy

ε = regression error term.

Again, when using B03 as a control for B02, the specification will be the same as above with the addition of an Information Treatment dummy variable interacted with the price terms to capture any change in the price elasticities produced by the additional information/education treatment that B02 receives but B03 does not. However, since there is only one price term in both the CES trade-off and Daily regressions, there is only one information treatment interaction term added.

6 Track B Demand Models and Elasticity Estimates

The estimates of daily elasticity and elasticity of substitution for the CES specification are summarized in the tables below. Results are shown for the analyses of the Summer 2003 and 2004 periods combined, and the Winter 2004 period. As discussed in the *SPP Impact Evaluation*, the values from the Track A analysis did not vary significantly, so we expect a similar pattern in Track B. In addition, the analysis on customer characteristics similar to that in Section 4.3 in the *SPP Impact Evaluation* has not been conducted. Of particular interest for Track B would be changes in responsiveness related to household size, type and income measures.

The Track B design allows for the estimation of two types of treatments. One involves comparing the impact of the CPP-F rate, conditional on both the treatment and control groups receiving an extended community-based information treatment. The other involves comparing the impact of the information treatment, conditional on both groups getting the CPP-F rate. The first comparison can be made by running a regression on the B01 and B02 cells, both of which are located in Bayview-Hunters Point. The second comparison can be made in two ways: (a) running a regression on the B02 and B03 cells; or (b) running a regression on all three cells.

6.1 Summers of 2003 and 2004 Results

All three comparisons have been performed for the 2003 and 2004 summer data. Data for the two summers has also been pooled and tested for the annual persistence of impacts. The model indicated in Table 6-1 includes two equations, one for measuring the elasticity of substitution and one for measuring the daily price elasticity. Each equation includes an intercept, price and a weather term. A model with the same structure as the one indicated in Table 6-1 was tested as well that included a binary variable for the presence of information that takes on a value of "one" for cells B01 and B02 and "zero" for cell B03.

Table 6-1
Summers of 2003 and 2004
Daily Price Elasticity and Elasticity of Substitution Estimates using CES Specification
(Significant estimates are in Bold, SE & t-stats in parentheses)

Model	Elasticity	2003	2004	2003-2004 Pooled (2004 Dummy) 2003 Coefficient	2003-2004 Pooled (2004 Dummy) 2004 Dummy	2003-2004 Pooled
B02 v. B01 **Price Effect**	**Substitution**	**-0.026** (0.011) (-2.40)	-0.008 (0.008) (-1.01)	**-0.026** (0.011) (-2.38)	0.017 (0.014) (1.27)	**-0.015** (0.007) (-2.28)
	Daily Elasticity	**-0.044** (0.016) (-2.71)	-0.008 (0.013) (-0.62)	**-0.044** (0.016) (-2.72)	*0.036* (0.021) (1.70)	**-0.020** (0.010) (-2.00)
B02 v. B03 Info Effect	**Substitution**	**-0.027** (0.010) (-2.81)	**-0.022** (0.009) (-2.35)	**-0.027** (0.009) (-3.02)	0.005 (0.013) (0.38)	**-0.026** (0.007) (-4.06)
	Daily Elasticity	*-0.022* (0.014) (-1.61)	*-0.017* (0.010) (-1.66)	-0.022 (0.012) (-1.81)	0.0048 (0.017) (0.29)	**-0.017** (0.008) (-2.10)
B02 v. B01 v. B03 Pooled	**Substitution**	**-0.022** (0.008) (-2.56)	**-0.017** (0.007) (-2.32)	**-0.022** (0.008) (-2.72)	0.005 (0.011) (0.44)	**-0.021** (0.006) (-3.73)
	Daily Elasticity	**-0.027** (0.013) (-2.10)	-0.016 (0.010) (-1.58)	**-0.027** (0.012) (-2.30)	0.011 (0.016) (0.73)	**-0.018** (0.008) (-2.30)

The Table 6-1 results provide a set of mixed findings. For the measurement of the price effect only for San Francisco customers shown in the B02 v. B01 model comparing price-only to enhanced information-only customers, the elasticities of substitution and daily energy use are significant and about the same magnitude as those for Track A Zone 1 in 2003 (which are -.039 for substitution and -.041 for daily use on CPP days), but then drop to insignificance in 2004. The pooled data set across the two summers shows a response level equal to about half that of the pooled Track A Zone 1 results.[45]

For the B02 v. B03 model, which measures the enhanced information effect (i.e., both groups received a price and the same rate, but B02 in San Francisco also received enhanced information) the interpretation of the results is not clear. While the effect being measured is the response to price, the difference between the two cells is the information treatment. Unfortunately, an information treatment that was specific only to the CPP days could not be specified. As a result, collinearity is created with the price parameter itself,[46] and it is not clearly distinguishable whether the specified parameter is

[45] Charles River Associates (2005) *op. cit.*, Table 4-10.

[46] The only way to address this issue may be to construct an hourly price model that adds the

measuring a price-only or price plus information effect. Because the pooled data includes changes over time as well as across cells, the influence of the two effects cannot be easily separated given the inability to specify an appropriate dummy variable. Further confounding these results are the clear differences found in the comparison of CPP versus non-CPP day use patterns discussed in Section 4.

When comparing the two models, B02 v B01 to B02 v B03, the inclusion of the information effect in the “control” for one model (B02 v B01) and the price effect in the “control” for the other model (B02 v B03) may obscure the price effects we are attempting to measure with the price parameter. The regression model measures the differences both across time and between the two cells. In the case of the B02 v B01 model, the B01 customers may be responding to some degree to the CPP signal, but not sufficiently to show up as a statistically significant effect. Nevertheless, the price effect in the B02 v B01 results would be muted by this underlying, unaccounted for response. Similarly, the B02 v B03 price response may be overestimated because the B02 response is enhanced by the price effect but necessarily statistically measurable (at least with the parameters we could specify.) Since we cannot measure the magnitude of this information influence, we cannot estimate the magnitude of the potential biases in these estimates.

In the B02 v B03 model, the elasticity of substitution is significant in both summers. However, the magnitudes of the substitution elasticities are not statistically different from those in the price-only model. The daily use elasticity is not significant, except in the pooled model, although the daily use elasticities are marginally significant in the B02-only model focused on the San Francisco Price and Info cell, particularly in the summer of 2004, while they are not at all in the B03-only model for Richmond Price-Only customers.

The three-way model, B02 v B01 v B03, provides significant results for the elasticity of substitution through both seasons, for the daily use elasticity in 2003 and the pooled summer seasons. The dummy variable measuring if 2004 differs from 2003 is not significant in any model, although it approaches significance in the first model where the 2004 results fell to insignificance. Not shown are the weather effect parameter estimates. For the B02 v B01 model, the parameters are not statistically significant in the pooled data sets, but they are for both the B02 v B03 and three-way models, though the parameters are not large in absolute terms. Weekend use effects from prices are significantly larger in all models, reflecting more elastic use patterns.

Based on the Table 6-1 results, enhanced information appears to have some incremental effect on price response, but the actual magnitude is difficult to determine. If it had no effect, then under one interpretation of the model design the parameters estimated for the B02 v B03 information effect model should have been statistically indistinguishable from zero. For daily energy use, this appears to be true—enhanced information does not induce overall energy conservation. However, the elasticity of substitution effect (shifting usage off the peak) is significant in both years, indicating that

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information treatment on the days on which the CPP is called. The method used in this analysis presumed an information treatment on every day, and thus was overwhelmed by the vast majority of days on which the CPP price was not in effect, and participants were not responding directly to additional prompts. An additional problem is the lack of a true control group located in Richmond in which neither price nor added information interventions were provided. The presence of that control group may have allowed us to discern whether the difference between the price plus information versus price-only cells was information driven.

the peak period response was improved by the interventions. The B02 v B01 price-effect-only model shows statistically significant results for 2003 in both substitution and daily use elasticities, but these effects diminish in 2004.

An issue that influences the interpretation of these results is the apparent decline in the substitution elasticity in B02 during Summer 2004. This effect explains at least in part the reduction in the substitution elasticity in the B02 v B01 model. However, three other confounding outcomes occurred:

1. The daily use elasticity did not change significantly from 2003 to 2004 in B02, the price and info cell, and in fact became more robust;
2. The daily price elasticity in the B02 v B01 model dropped to near zero even though the B02 elasticity remained strong; and
3. The relationship between B02, the price and info-only cell, and B03, the price-only cell, remains robust as measured in the B02 v B03 model, which should not be the case if B02 dropped off alone.

The diminished response between the summers of 2003 to 2004 by the B02 group is not an isolated event in the SPP study. In three other cases, the decline in response between 2003 and 2004 was significant:

- In the Track A Information-Only treatment, during Summer 2003 respondents showed changes in daily energy use and in Climate Zone 3 also had a significant substitution elasticity.[47] Those parameter estimates became insignificant for Summer 2004.
- In the residential TOU-Only treatment, the substitution elasticity is significant for Summer 2003, but not for Summer 2004.[48] The daily use elasticities are significant through both seasons.
- In the residential CPP-V Track C analysis, the substitution elasticity falls by nearly 50% from Summer 2003 to Summer 2004, and the daily use elasticity falls by about 25% between the two seasons.[49]

In no cells did responsiveness increase in any significant way between 2003 and 2004. There may be another undetected factor that exists across these studies which causes these effects, leaving open the question of why the B02 results differ between Summer 2003 and Summer 2004. One likely difference for Track B could be that the enhanced information treatments were applied much less often in the spring and summer of 2004 in San Francisco.

An information treatment model was estimated to determine if the interventions had a statistically significant effect, but the models added the information dummy to all periods rather than just during the CPP periods. Even though the model was not specified to capture the expected precise effect, the information dummy on the elasticity of substitution was significant at the 90% confidence level for the Summer of 2003. This is at least partially consistent with results shown in Table 6-1.

[47] Charles River Associates (2005), *op. cit.*, Section 4.6.

[48] Charles River Associates (2005), *op. cit.*, Section 5.1.

[49] Charles River Associates (2005), *op. cit.*, Section 6.2.

6.2 Winter 2004 Results

Table 6-2 summarizes the results of the Winter 2004 analysis. The parameter estimates are more robust for this season than for the summer estimates. The elasticity of substitution responses are slightly less than for the summer analysis, but the daily use elasticities are significantly larger in absolute terms. This result is consistent with the winter "peaking" nature of San Francisco's (and Richmond's) loads. The elasticity parameters are roughly equivalent to those for Track A during the winter period. The weather and weekend use parameters are significant in all three models. The results seem to indicate that general energy conservation is more likely to be undertaken during the winter rather than load shifting in response to the price signals.

Unlike the summer models both sets of price effects are significant in the winter. Also of interest is that, despite being misspecified, resulting in the information treatment being swamped by non-CPP day actions, the information dummies on substitution and daily use are significant for the "inner" winter months of December through February. This means that the enhanced information effect when coupled with CPP prices did lead to significant reduction in load in the winter months relative to the enhanced information only treatment. It is notable that pilot participants were provided with the most education/information treatments in the Winter 2004. The effort was reduced in Summer 2004. Changes in customer responsiveness appears to have coincided with changes in enhanced information provision.

Table 6-2
Winter 2004
Daily Price Elasticity and Elasticity of Substitution Estimates using CES Specification
(Significant estimates are in Bold, SE & t-stats in parentheses)

Model	Elasticity	Parameters
B02 v. B01 Price Effect	**Substitution**	**-0.01907** (0.0085) (-2.25)
	Daily Elasticity	**-0.06250** (0.0139) (-4.51)
B02 v. B03 Info Effect	**Substitution**	**-0.02149** (0.0077) (-2.80)
	Daily Elasticity	**-0.03044** (0.0133) (-2.58)
B02 v. B01 v. B03 Pooled Effects	**Substitution**	**-0.01857** (0.0070) (-2.65)
	Daily Elasticity	**-0.04076** (0.0111) (-3.66)

6.3 Impact Analysis

The elasticity parameters developed above can be combined to estimate the expected impacts on peak load and daily average energy consumption. The impact estimates are dependent on (1) the expected initial energy consumption level; and (2) the initial and CPP price levels. The initial energy consumption levels are based on the average use for the specific period in the Track B analysis. The initial price is the computed average price for the Track A control group. The CPP prices are those used in the experiment to elicit the demand responses. It is important to remember that this latter set of prices were chosen arbitrarily in the experiment to gain sufficient information, and may not reflect actual economic costs and values, and thus may not be adopted by the Commission.

For the summer period, demand responded in the expected manner in each time period. Overall the B02 v B03 (price and info vs. price) model showed slightly larger responses during CPP periods in the summer. The average on-peak impact was 3.3% lower on CPP days in the B02 v B01 (price and info vs. info) model that measured the price effect and 4.7% lower on CPP days in the B02 v B03 model that measured the information effect. Daily average use fell about 1% in the first model and 0.76% in the second. On non-CPP days, which was subjected to TOU pricing, on peak use fell by 1% in the peak periods in the B02 v B01 model, and 1.82% in the B02 v B03 model. The daily average use on non-CPP days was basically unchanged in both models.

The summer Track B impact is about 25% to 35% of the Track A impacts, and about half of the Track A Zone 1 impacts. However, this difference is explained by several factors. First, the average peak use in Track A is about 250% greater (1.28 versus 0.51), which means that Track A customers are starting from a higher energy use level. The performance of the Track B customers is better compared to those in Track A Zone 1 who have more similar energy use patterns. Second, average Track B customer incomes are about one-third lower than that for Track A Zone 1 customers. This difference is explored further below, and analysis indicates that once adjusted for income, the impacts are of similar magnitude.

For the winter period, the relationships are reversed between the two models, with the B02 v B01 showing a larger overall response than the B02 v B03. Winter peak use on CPP days falls 6.3% in the B02 v B01 model compared to 4.7% in the B02 v B03 model. Off peak and daily use fell by more than 3% in the B02 v B01 model as well, while off-peak use fell less than 1% in the B02 v B03 model and daily use by 1.7%. The overall conservation effect appeared relatively stronger in the B02 v B01 model as the daily use reduction is more than twice that in the B02 v B03 model at 0.5%.

In comparison to Track A, the Track B winter peak impacts are larger, both overall and in Zone 1. This effect occurred despite average use being lower in Track B and the income difference discussed above.

One note: the overall CPP peak period price elasticities in Track B range from –0.008 to -0.015. The implied "inner summer" full arc elasticity for Track A is -0.041.[50] These values are consistent with others derived in the literature.

[50] This "elasticity" is calculated from the starting point price rather than from the average of the high and low prices as that any subsequent policy analysis will begin with a status quo price at the lower end.

Model	Day Type	Rate Period	Starting Value kWh/hr	Impact kWh/hr	% Impact
Summer B02 v B01	CPP	P	0.514	-0.017	**-3.27%**
		OP	0.499	-0.002	**-0.38%**
		Daily	0.502	-0.005	**-1.00%**
	Non-CPP	P	0.518	-0.005	**-1.00%**
		OP	0.506	0.002	**0.39%**
		Daily	0.509	0.000	**0.10%**
Summer B02 v B03	CPP	P	0.447	-0.021	**-4.74%**
		OP	0.483	0.001	**0.21%**
		Daily	0.475	-0.004	**-0.76%**
	Non-CPP	P	0.445	-0.008	**-1.82%**
		OP	0.466	0.003	**0.57%**
		Daily	0.462	0.000	**0.09%**
Winter B02 v B01	CPP	P	0.679	-0.043	**-6.28%**
		OP	0.595	-0.018	**-3.02%**
		Daily	0.612	-0.023	**-3.78%**
	Non-CPP	P	0.650	-0.010	**-1.57%**
		OP	0.579	-0.001	**-0.21%**
		Daily	0.593	-0.003	**-0.52%**
Winter B02 v B03	CPP	P	0.650	-0.030	**-4.68%**
		OP	0.623	-0.006	**-0.92%**
		Daily	0.628	-0.011	**-1.73%**
	Non-CPP	P	0.622	-0.009	**-1.42%**
		OP	0.600	0.001	**0.12%**
		Daily	0.604	-0.001	**-0.21%**

Table 6-3
Track B Analysis, Residential CPP-F Rate
Impact Estimates for Summer and Winter
(2003 and 2004 Summer Combined, Pooled Data)

6.4 Comparison of Information-Only Treatments between Track A and Track B

Both Track A and Track B included treatments in which participants received only information about the cause and incidence of CPP events, and the round benefits of reducing use during these events. The two tracks differed in two important ways, though. First, Track B B01 information-only customers received the same community-based enhanced information interventions that B02 price and information customers received. And second, Track B customers were in Climate Zone 1 while the Track A customers were located in Zones 2 and 3.[51] While the differences in climate zones almost certainly influenced the outcomes, the data may shed light on whether the application of enhanced information has any additional effect. Table 6-4 shows the results of the Track B information-only analysis. As with Track A, a measurable effect on daily energy use occurs in Summer 2003, but diminishes to statistical insignificance in the subsequent seasons. One difference is that in Summer 2004, the Track B parameters are negative for both elasticities versus positive for Track A. Nevertheless, these differences are not statistically significant.

As with the diminished response of San Francisco price and info customers in the price and information group (B02), the fall off in information-only (B01) response may be in part explained by the decreased number of information treatments in the spring and summer of 2004. However, the response becomes statistically insignificant in the winter period, when information interventions were fairly frequent.

Table 6-4
Track B Information Only (B01) CPP-Day Notification Dummy Variable Parameters

	Substitution Equation	Daily Energy Use Equation
Summer 2003	-0.00187 (0.0206)	**-0.02555** (0.0116)
Winter 2004	0.025268 (0.0323)	0.02429 (0.0192)
Summer 2004	-0.00161 (0.0183)	-0.00564 (0.0110)

6.5 Impact of Weather on Price Response

Track B differs from Track A in that it is contained entirely within Climate Zone 1. Only 6 percent of the Track A Zone 1 participants have a central air conditioner (CAC), and within Track B, less than 4 percent have CAC. The weather interaction term in the regression models is based on cooling degree-hours per day (CDD), which implies that customers may take actions to cool their residences when the temperature increases, most likely by switching on air conditioning or fans. However, given the low proportion of CAC in Track B homes, one would expect a negligible impact on consumer behavior (other than the use of fans). While the parameter estimates in many of the models were statistically significant, particularly for the winter period, the magnitude of the parameters was not large in absolute terms, usually being less than 0.006, which is small relative to the elasticity estimates of –0.02 to –0.04.

6.6 Impact of Income on Price Response

Analyses of the interaction of the price term with other socio-economic, appliance and housing data was conducted in the *SPP Impact Analysis* on Track A. For Track B, this may be particularly important with respect to income given that the income elasticity for the elasticity of substitution in the Track A analysis is 0.66 and for the daily use elasticity is 0.51. In other words, a doubling in income increases the elasticity of substitution by 66% and the daily use elasticity by 51%. The average income in Track B is about

[51] The results of the Track A Information-Only treatment are discussed in Charles River Associates (2005), *op. cit.*, Section 4.6.

$50,000 compared to $78,000 for Track A Zone 1.

Further analysis indicates that income was not affecting demand directly in the standard manner assumed in economic analysis (i.e., as income increases, the relative value of a commodity priced at the same level decreases, and demand responsiveness similarly declines). Instead, the inclusion of income appears to create a proxy parameter for goods and services that are purchased with higher incomes, and which require increasing amounts of energy. The use of these goods and services, such as appliances or even larger living space, are more discretionary and consumers are more willing to reduce their energy use in the face of higher prices. The result is that increased income appears to create *greater* demand response, although it is actually factors correlated with income that are creating this effect.

Table 6-5 summarizes how the addition of an income parameter affects the impact estimates. The elasticities are shown for two cases:

1) Using the observed incomes in the Track B sample, and

2) Using the observed incomes in the Track A Zone 1 sample.

The difference is the amount attributable to increasing income. The parameter estimates for the second case represent the more likely outcome if the experiment had been conducted in Track A Zone 1. The pooled average elasticities for the summers of 2003 and 2004 was used for these estimates.

Table 6-5 Track B Analysis, Residential CPP-F Rate Comparison of Income Effects vs. Track A Zone 1 Impact Estimates for Summer and Winter (2003 and 2004 Summer Combined, Pooled Data)					
Treatment Cell	Day Type	Rate Period	% Impact w/Track B Income	% Impact w/Track A Zone 1 Income	Income Proxy Elasticity
Summer, B02 v B01	CPP	P	**-4.10%**	**-4.96%**	**0.794**
		OP	-0.09%	0.68%	-5.114
		Daily	**-0.94%**	**-0.52%**	**0.361**
	Non-CPP	P	-1.43%	-2.09%	0.958
		OP	0.50%	0.63%	0.818
		Daily	0.09%	0.05%	0.360
Summer, B02 v B03	CPP	P	**-4.74%**	**-8.54%**	**1.182**
		OP	0.00%	0.45%	-82.628
		Daily	**-0.93%**	**-1.31%**	**0.922**
	Non-CPP	P	-1.72%	-3.37%	1.282
		OP	0.57%	1.05%	1.194
		Daily	0.11%	0.16%	0.924
Winter, B02 v B01	CPP	P	**-5.15%**	**-7.29%**	**0.934**
		OP	-4.99%	-4.20%	0.556
		Daily	**-5.02%**	**-4.91%**	**0.645**
	Non-CPP	P	-0.75%	-1.69%	1.489
		OP	-0.68%	-0.38%	0.370
		Daily	-0.69%	-0.68%	0.645
Winter, B02 v B03	CPP	P	**-6.28%**	**-8.79%**	**0.924**
		OP	-1.90%	-1.09%	0.380
		Daily	**-2.84%**	**-2.75%**	**0.639**
	Non-CPP	P	-1.78%	-2.86%	1.061
		OP	0.04%	0.35%	6.132
		Daily	-0.35%	-0.34%	0.638

The elasticity of response to the income proxy also is shown in the last column of Table 6-5. This measures how much the response elasticity changes with a proportionate change in income. A negative value indicates that responsiveness decreases. A value greater than one indicates that the responsiveness elasticity increases proportionately faster than income. In most cases, the income proxy elasticity is near one for the peak period impacts. The daily average income elasticities are generally less than one, but still quite large as well. This responsiveness indicates that the substitution elasticities are highly sensitive to income levels and/or the factors associated with higher income. Further research is required in both Track A (which has a similar effect) and Track B to determine for what underlying characteristics the income parameters is a proxy that increases responsiveness so significantly.

7 Customer Survey Results

In August 2004 San Francisco Community Power fielded a survey to examine Track B participants' attitudes and actions related to the Track B pilot, electricity conservation and off-peak shifting.[52] The survey includes responses from 77 individuals, broken down by cell as shown in Table 7-1.

Table 7-1
Track B Summer 2004 Survey Participation
Discovery Research/Momentum Survey Population

	Participants	Surveyed
B01-SF Info Only	65	19/16
B02-SF CPP-F/Info	122	34/35
B03-Richmond CPP-F Only	64	24/21

In general the survey results were similar to those found in the Track A end-of-pilot survey, with the exception that the Richmond, and especially the San Francisco, group identified environmental and community factors as contributing to their decision to participate in and respond to the pilot.[53] All three Track B groups – San Francisco information-only, San Francisco CPP-F, and Richmond CPP-F – understood how the pilot worked, and supported its continued availability throughout the state. Richmond participants' primary motivation to participate in the pilot was financial (e.g., lower utility bills; incentive payment); while the San Francisco groups had a greater diversity of motivations, including financial and environmental. These survey findings may imply that incentive payments could be replaced with environmental-oriented messages as a means to motivate household participation and behavioral changes.

Key findings are as follows:

- *Track B participants exhibited greater satisfaction with the program than Track A participants*. Fifty-four percent of Track B CPP-F participants rated their satisfaction at "9" or "10," with "10" being the highest, and 60 percent of Track B info-only participants felt this way, compared with 44 percent or less of Track A participants, including those in Richmond.
- *Track B's community-based enhanced education/information interventions appeared to be more effective than the Track A approach in inculcating an understanding of the pilot program and key characteristics, as shown in Table 7-2*.[54] For example, according in part on the Momentum survey, 77% of the San

[52] The survey was fielded by Discovery Research, Inc.

[53] Momentum, *Statewide Pricing Pilot: End-of-Pilot Customer Assessment*, December 2004.

[54]The Momentum study found that Track B participants demonstrated "appreciably lower levels of accuracy and understanding than the other [Tracks]." (page 8). However, the margin of error based on a 90 percent confidence interval ranges from 10 to 18 percent for the Momentum study – and is even higher for individual questions – with slightly better margins for the Discovery Research survey. As a result, both survey results need to be interpreted with caution.

Francisco Track B CPP-F participants exhibited a “high/medium-high” understanding of the program, compared to 63% of the Richmond Track B participants; and a much smaller proportion of Track B info-only participants had a “low” understanding of the program than the Track A Info-only population.

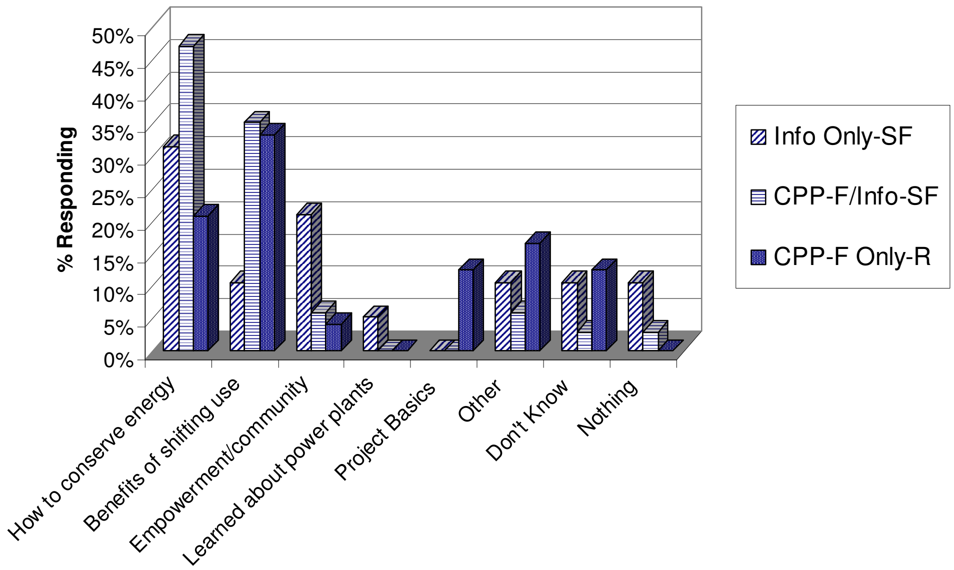
Table 7-2

When on certain days/hours of the year is the price you are charged for each kilowatt hour of electricity used the highest?

	Track A	**CPP-F/Info-SF**	**CPP-F Only-R**
Don't Know	12%	15%	0%
2 to 7 PM/Weekday Afternoon	**60%**	**45%**	**77%**
Evening/Morning		0%	8%
Evenings		5%	0%
Super Peak		**15%**	**8%**
Holidays		5%	0%
Night		5%	8%
Winter/Evening		10%	0%

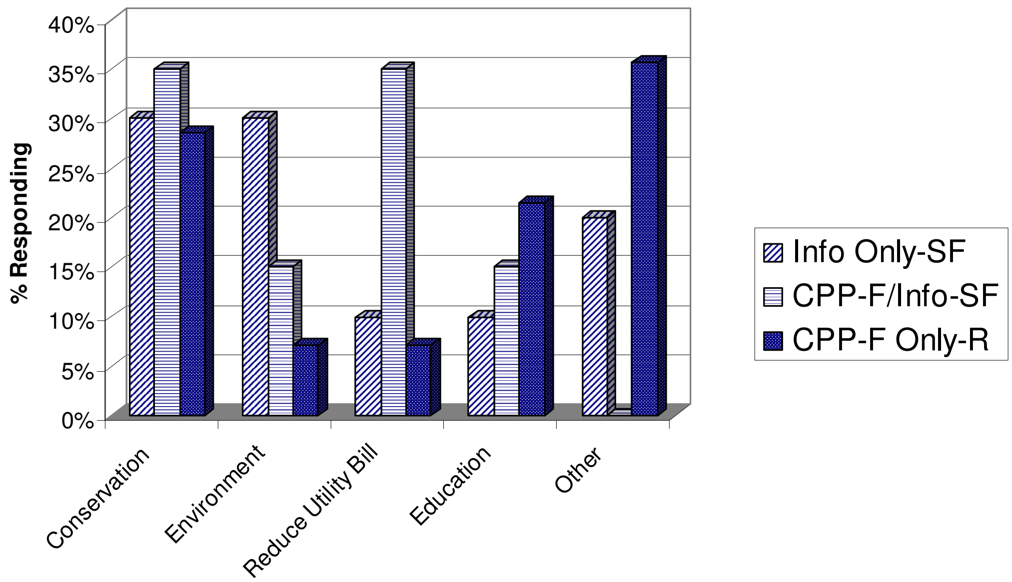
- *Both the Richmond and San Francisco CPP-F groups understood that the most effective way to reduce their bill would be to shift their use off-peak*. Among the San Francisco rate group, 76% thought they could lower their bills by shifting their use; 71% in Richmond answered in this way; and even 42% of the San Francisco information group thought this.
- *Similarly to Track A participants, more than 90% of San Francisco and Richmond customers claim that would have signed-up for the pilot even without an appreciation payment; and both believe that the program “should definitely be offered” to other customers (3.75 in San Francisco and 3.5 in Richmond on a scale of 1 to 4)*. One of the main factors both groups identified as a program benefit was becoming more educated about the linkage between electricity use and bill impacts. These findings were consistent in both the Discovery Research and Momentum surveys.
- *All three groups identified conservation tips and the benefits of shifting energy use as the primary things they learned from the study, as shown in Figure 7-1.* The San Francisco information-only cohort also believed that information about the relationship between energy use, polluting air emissions, and community empowerment was a significant benefit.

Figure 1
What were the main things you learned from the study materials?



- *Each of the groups reported somewhat different motivations for participating in the pilot, as shown in Figure 7-2.* Richmond participants were predominately interested in lowering their utility bills, though they also expressed interest in receiving energy efficiency education, improving reliability, and helping the community. The San Francisco information-only group was motivated by their support for energy conservation, concern for the environment, and the desire to reduce their utility bill. San Francisco CPP-F participants wanted to reduce their utility bill, help the environment, and support conservation. These findings were consistent in both the Discovery Research and Momentum surveys.

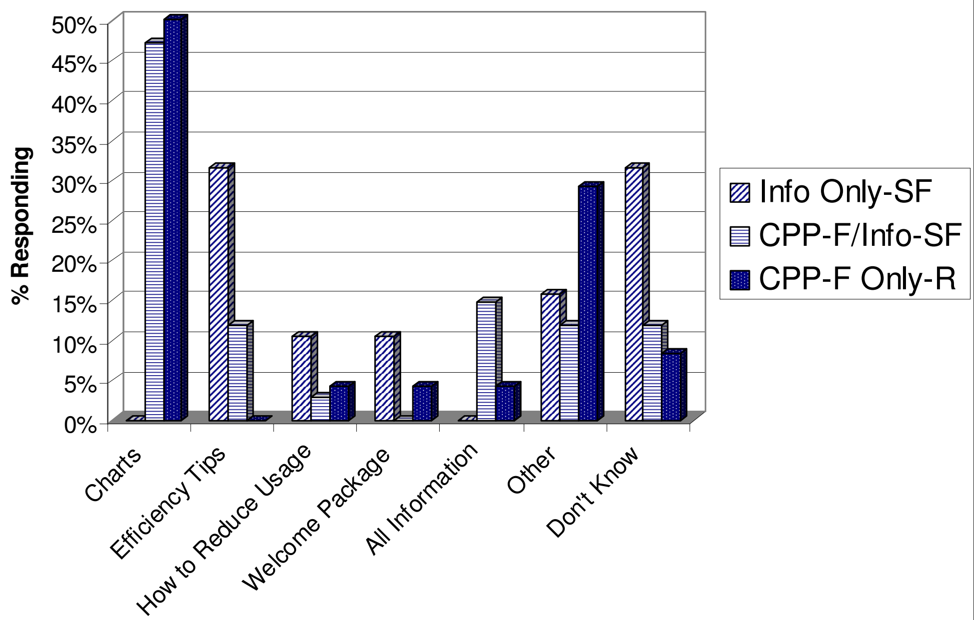
Figure 2
Most important reason for participating



- *Both groups engaged in energy efficiency behaviors, though the enhanced access to free compact fluorescents from SF Power appeared to increase adoption of these devices in comparison with Richmond, where free CFLs were likewise available through ongoing energy efficiency programs, but much less aggressively offered.* Likewise, both groups reported a variety of shifting tactics during peak periods, including switching off appliances and changing the timing of laundry and dish-washing.

- *Both San Francisco and Richmond groups felt that the materials were effective in conveying useful information about the pilot*. Of all the pilot materials and services, San Francisco and Richmond CPP-F participants thought the bill and rate comparison charts were most useful, while San Francisco information-only participants believed the energy tips were most useful, as shown in Figure 7-3. This makes intuitive sense, in that the charts enabled CPP-F participants to effectively participate in the pilot, while the energy tips were one of the only value-added items provided to the information-only households.

Figure 3
What was most useful?



8 SPP Decommissioning Process

At the end of the initial SPP, participants were given a choice to continue on the CPP rate or to switch one of another rate offered by the utility. For PG&E, the standard residential rate is Schedule E-1, and the time-of-use schedule is E-7. PG&E also is offering two new "Shift and Save" rates, included in the E-3 rate schedule, which are similar to the CPP-F rate. If a customer did not respond to the utility's query about whether they wanted to remain on the pilot rate or switch to another option they were automatically continued on the current CPP-F rate.

Table 8-1 shows what rate schedules customers were placed on after the end of the SPP study in PG&E's service territory. Results are shown for Cells A05 to A08, B03 and B02. The first five cells were given the standard Track A information, including Cell B03. Cell B02 was given enhanced information interventions through efforts by SF Power. For the Track A participants, including B03, 54.4% stayed on the CPP-F rate. The remainder roughly split half and half between the standard and TOU rates. In contrast, more Track B customers apparently chose to remain on the CPP-F rate, with 72.3% remaining on that rate going forward.[55] Of the others that switched in Track B, a majority chose the TOU rate. Whether the Track B customers did so because they were more satisfied, more motivated, or simply by default is a bit difficult to discern because the non-response rate was somewhat higher than for the other cells. However, this non-response may indicate that choosing to be on the CPP-F rate going forward was readily acceptable for this group.

[55] A two-sample t-test indicates that these sample means differ at the 99.98% confidence level.

Table 8-1
Comparison of Post-SPP Rate Choices in PG&E

Cell	Rate	No.	Standard	TOU	CPP-F	No Response
A05	CPP-F	48	20.8%	25.0%	54.2%	*43.8%*
A06	CPP-F	80	10.0%	32.5%	57.5%	*42.5%*
A07	CPP-F	50	24.0%	24.0%	52.0%	*40.0%*
A08	CPP-F	66	30.3%	15.2%	54.5%	*27.3%*
B03	CPP-F	61	23.0%	24.6%	52.5%	*32.8%*
Track A	**CPP-F**	**305**	**21.0%**	**24.6%**	**54.4%**	***37.0%***
B02	**CPP-F**	**119**	**9.2%**	**18.5%**	**72.3%**	***64.7%***

9 Conclusions and Findings

The Track B analysis is the first step in determining whether community-based information/education strategies may be effective in inducing changes in consumer demand in response to specific situations. The surprising result is that the estimated magnitude of the demand response to information/education is about the same as for the response to the CPP-F rate without enhanced information within Track B. One conclusion from this analysis may be that enhanced information interventions by themselves do not induce significant demand responses, but that they do encourage greater response when combined with price signals.

Unfortunately, without a directly comparable control group for which there was no rate or information treatment, it is difficult to separate the effects of the information treatment from those created by local conditions, such as general environmental awareness or neighborhood characteristics. That said, the enhanced information treatment alone did not appear to induce participants to actively engage in shifting behavior, though it did induce noticeable long-term conservation. However, the community-based information/education effort did increase the responsiveness of participants who also received a CPP price signal, at least during periods when electricity use patterns allowed for some demand flexibility. This suggests that a community-based enhanced information approach could play a valuable role in future CPP programs focusing on residential customers.

It is important to note that several barriers, in addition to the mild climate in which the pilot took place, may have acted to dampen the ability of the interventions to effectively shift demand.[56] For example, the larger household sizes for the San Francisco population relative to both Richmond and Track A almost certainly lowered the

[56] As previously discussed, there was also a great deal of "noise" in the study area related to energy issues and the locally polluting power plants, which could have influenced participants' behavior as much as the enhanced information treatments. Some of these conflicting messages could be reduced through active collaboration between utilities, municipalities, and non-profit organizations on environmentally-related energy issues.

probability that a CPP call would actually reach a participant who had the knowledge and ability to change the home's electricity use patterns. In addition, low income populations, as reflected in the fact that household income was about half of the Zone 1 median, are notorious for being subjected to a variety of stresses that can reduce their ability to respond to lower-priority activities. And the CARE program, which provides a 20 percent reduction in low income households' electricity bills, may have muted the economic incentive for participants' to actively engage in the program. In this respect, any future programs focusing on low income areas would be more effective if they incorporated the CPP tariff more seamlessly with existing energy subsidies.[57]

The reduction found in off peak use in San Francisco relative to Richmond appears to have dampened the apparent responsiveness in the former community because of the manner in which price elasticities were measured. However, this does indicate that longer term conservation measures may be more likely to be adopted with community-based information programs.

Importantly, participants were generally satisfied with the pilot, and particularly appreciated the tailored education they received about better managing their energy use. Given the intensive statewide efforts to educate the public about electricity use over the past several years, this outcome suggests that a tailored, community-based approach to energy education could provide noticeable additional benefits in terms of conservation.

Although already completed survey research sheds some light, fully addressing the third research objective will require additional analyses. For example, in Section 4.3 of the SPP Final Report, variables identifying average daily energy use, central air conditioner and spa ownership, electric cooking facilities, education and income, and housing characteristics were analyzed for their effects on Track A customers; this same analysis could be usefully conducted for Track B.[58] Additional analysis which could also shed light on the topic including the following:

- During the initial winter period, SF Power implemented the majority of its community outreach and education, with a substantial decline in these interventions thereafter. Impacts may not have diminished if the information treatments had been delivered on a steady basis over the entire analysis period. The implications of the intensity of the enhanced information treatment could be measured by segmenting the winter period further by these events.
- Whether enhanced information influences increased demand elasticity and reduced opt-out rates could be examined over the long-run. For example, the San Francisco participants could be provided with additional information and ongoing education about the linkages between the timing of electricity use and the operations of locally polluting power plants (i.e., continue the process initiated

[57] For example, a "CARE-Plus" tariff could be developed that incorporates the structure of TOU and CPP prices with a 20 percent discount that is contingent on the ratepayer's active participation in managing their electricity use, accounting for the other barriers identified above.

[58] For example, a Chicago study found that low-income customers responded more strongly than high-income ones (Summit Blue Consulting, *Evaluation of the Energy-Smart Pricing Plan*, IDCEO Grant 02-19502, Final Report (Boulder, Colorado: Prepared for the Community Energy Cooperative, March, 2004)). The findings from this study are discussed and contrasted with the Track A and B findings in the *SPP Impact Study*.

in 2003), particularly targeted to the winter months, when participants' have a greater ability to respond. Analysis would then be conducted to determine whether this intervention or "treatment" had a significant effect on participation and response rates.

- In-depth focus groups of Richmond and San Francisco participants could be conducted at the end of 2005. The purpose of these conversations would be to further probe participants' experience with the tariff , including investigating further the affect of price versus information on their behavior; as well as exploring the effectiveness of the education/information effort. The geographic proximity of these two groups and the ability to control for any significant (e.g., demographic) differences between them makes this an attractive project.

Finally, in conducting further analyses and developing business cases based on this and the other SPP reports it is important to be mindful of the ancillary benefits of the Track B approach, as well as its cost-effectiveness as compared with other implementation models. For example, by employing local residents to help implement the pilot the study contributed, in a small way, to assisting with economic development in a hard-pressed community. Likewise, by reinforcing the community benefits associated with better household energy management the pilot helped to encourage community cohesiveness, and, in a small measure, civic engagement.