FINAL REPORT

Prepared For:

Working Group 3

California's Statewide Pricing Pilot: Commercial & Industrial Analysis Update

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Date: 6/28/06

TABLE OF CONTENTS

EXECUTIVE SUMMARY

California's statewide pricing pilot (SPP) was designed to test the impact of several time-varying rate structures on the electricity usage patterns of residential and small commercial and industrial (C&I) customers. A critical peak pricing (CPP) tariff was offered to a sample of C&I customers in Southern California Edison's service territory with demands below 200 kW. The sample was segmented into two size strata, customers with demands below 20 kW (referred to here as the LT20 segment) and customers with demands between 20 and 200 kW (referred to as the GT20 segment).

With the CPP rate, on most weekdays, a peak-period price was in effect between noon and 6 pm. On critical peak days, a significantly higher peak-period price was in effect for up to five hours, all of which fell within the noon to 6 pm time period. While the tariff allowed the critical peak period to be any length up to 5 hours, during the experiment, the critical peak period was either 2 or 5 hours long. Prices changed over the two summers during which the treatment was tested (2004 and 2005). The average standard price for LT20 customers across the two summers was roughly $0.17/kWh and the average critical peak price was almost $1.00/kWh. For GT20 customers, the standard average price was $0.16/kWh and the critical peak price was roughly $0.60/kWh.

All customers in this treatment group were offered free installation of a smart thermostat that would automatically adjust their air conditioning setting when critical peak prices were in effect. Roughly one third of LT20 customers accepted the technology and about 60 percent of GT20 customers accepted it.

Preliminary analysis of the demand response associated with the CPP rate for C&I customers based on data from 2004 is summarized in a report entitled *Impact Evaluation of the California Statewide Pricing Pilot*, dated March 16, 2005 (hereafter referred to as the March 16th Report). This report updates and extends that analysis by examining the following four questions:

1. Does demand response differ across the two summers of 2004 and 2005?
2. How much do peak-period demand impacts vary across customers who do and don't have enabling technology?
3. Does demand response vary across days in a multi-day CPP event sequence?
4. Does price responsiveness vary across two-hour and five-hour critical peak events?

When examining whether demand response varied between 2004 and 2005, there are two relevant samples of interest. One sample consists of customers that were in the experiment during ***both*** summers (in other words, this sample excludes customers if they participated in 2004 but not in 2005, and vice versa). We refer to this as the ***common*** database. Using this database allows us to determine whether the same group of customers responded differently across the two summers. The second sample of interest consists of all customers who participated in ***each*** summer (that is, customers are included if they participated in 2004, 2005 or both 2004 and 2005). We refer to this as the ***pooled*** database. While there was not a large turnover in the sample, there were, in some instances, differences between customers who left and those that replaced them. Thus, using the pooled database allows us to determine whether price responsiveness varies across the population of customers that participated in each summer. These results may better represent how price responsiveness varies over time given "normal" turnover in customer participation.

Key findings regarding the difference in price response across years based on the common database (e.g., customers who participated in both summer periods) include:

- The average elasticity of substitution across the two summers was -0.0434 for LT20 customers and -0.0458 for GT20 customers.
- There was no statistically significant difference in price responsiveness in 2004 and 2005 for customers who participated in both summers.
- The average reduction in peak-period energy use on critical days for LT20 customers was 6.59 percent based on the average critical peak price across the two summers. The average reduction for GT20 customers was 5.47 percent.

Key findings based on the pooled database (e.g., all customers participating either in 2004, 2005 or both summers) include:

- The average elasticity of substitution across the two summers was -0.0316 for LT20 customers and -0.0578 for GT20 customers.
- There was no statistically significant difference in price responsiveness between the two summers for the LT20 pooled population. However, for the GT20 segment, there was a statistically significant drop in price responsiveness between the two summers. For this customer segment, the elasticity of substitution was roughly twice as large in 2004 as in 2005.
- The average reduction in peak-period energy use on critical days for the LT20 segment (based on the same average prices as above) was 4.83 percent, while the average reduction for GT20 customers was 6.75 percent.

The enabling technology offered to customers during the experiment had a significant impact on demand response for both the small and medium customer segments.[1] Specifically:

- LT20 customers were not price responsive at all on normal weekdays nor were customers without enabling technology price responsive on critical days. On the other hand, LT20 customers with enabling technology displayed a significant level of

[1] All of the remaining results reported in this section are based on the pooled database.

price responsiveness[2] on critical days, with an elasticity of substitution equal to -0.0892.[3]

- LT20 customers with enabling technology reduced peak-period energy use on critical days by more than 13 percent, based on average prices across the two summers.
- GT20 customers displayed a modest level of price responsiveness on normal weekdays, with an elasticity of substitution equal to -0.0493. There is no statistically significant difference in price response on normal weekdays and critical days for GT20 customers without enabling technology.
- On critical days, GT20 customers with enabling technology were roughly twice as price responsive as customers without technology.
- Based on average prices across the two summers, the average reduction in peak-period energy use on critical days for GT20 customers without enabling technology was 4.93 percent. For GT20 customers with enabling technology, the average reduction was 9.57 percent.

Figures ES-1 and ES-2 summarize the impact estimates by customer segment under various assumptions about the distribution of technology among the population. The impacts labeled "SPP Average Tech" shown in the figures are based on the percent of customers who took the technology in the SPP for each customer segment (e.g., roughly one-third for LT20 customers and 60 percent for GT20 customers).[4]

Figures ES-3 and ES-4 show how peak-period impacts on critical days would vary with changes in the critical peak price.[5] As seen in the figures, the percent decrease in peak-period energy use falls as prices increase, since it becomes harder and harder to reduce or shift load beyond a certain level. The horizontal curve along the x-axis in Figure ES-3 indicates the complete lack of demand response for LT20 customers in the absence of

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[2] Even though the demand response is enhanced by the enabling technology, we still characterize this as price responsiveness as customers ultimately have control over the device. For example, customers can override the automatic setback if they wish. Furthermore, the choice to accept or not accept the enabling technology is a reflection of a customer's desire and willingness to respond to the time-varying price signal.

[3] Page 116 of the March 16th Report indicates that an attempt was made to test for the impact of technology using only the 2004 data, and the interaction terms were not statistically significant. In light of the finding reported above, we examined the issue once again using only the 2004 data and obtained results similar to those shown here, namely that technology makes a significant difference and that LT20 customers are not price responsive at all in the absence of enabling technology. It would appear that the earlier analysis was incorrect.

[4] When comparing impacts across customer segments in Figures ES-1 and ES-2, it is important to note that the values are calculated at the average prices in the SPP for each segment, which are quite different, as indicated in the figure titles. When calculated using the same prices, the impacts for customers with enabling technology are similar across the two segments, as seen in Figures ES-3 and ES-4.

[5] It is important to note that these impacts are not based on a revenue-neutral change in price, simply a change in the critical peak price with everything else being held constant. Revenue neutral price changes would produce slightly larger peak-period reductions because they would have even greater changes in the peak-to-off-peak price ratio than do the price ratios underlying the impacts shown in the figures.

enabling technology. GT20 customers display a reasonable level of demand response even in the absence of enabling technology. Demand response is similar for both customer segments at the same price points in the presence of enabling technology.

Figure ES-1
% Reduction In Peak-Period Energy Use
(Average SPP Price: $0.97/kWh for LT20; $0.59/kWh for GT20)

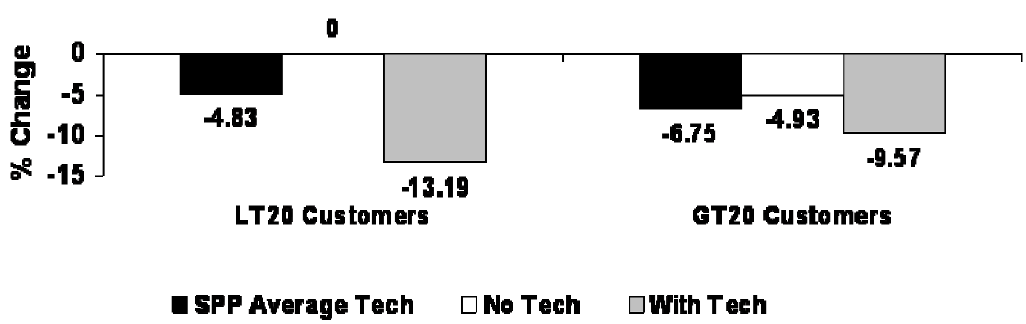


Figure ES-2
Change In Peak-Period Energy Use
(Average SPP Price: $0.97/kWh for LT20; $0.59/kWh for GT20)

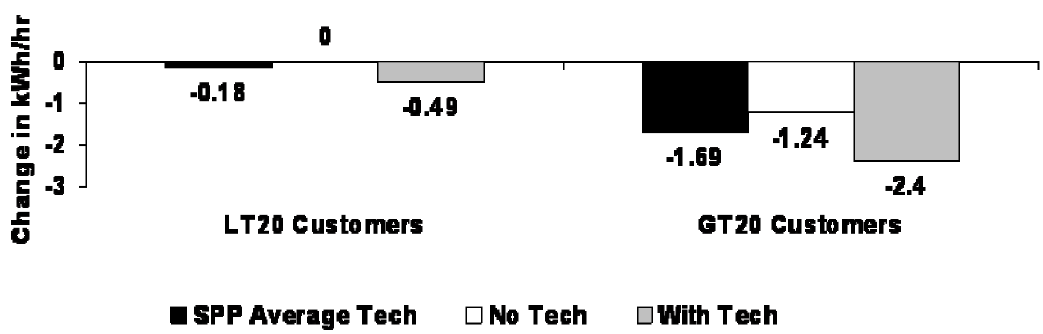


Figure ES-3
% Reduction in Peak-Period Energy Use on Critical Days: LT20
(Based on Elasticities From Pooled Database)

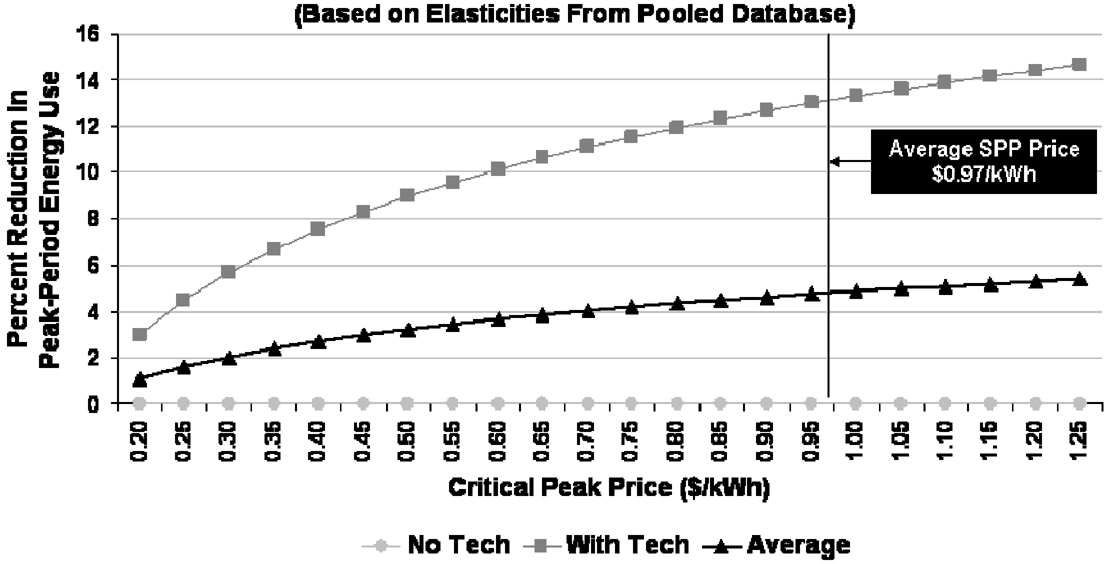
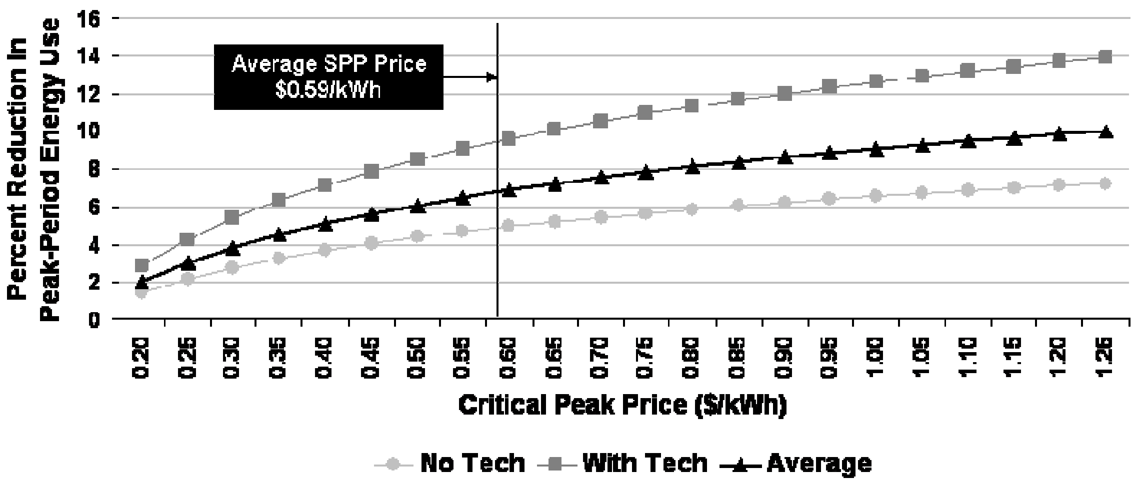


Figure ES-4
% Reduction in Peak-Period Energy Use on Critical Days: GT20
(Based on Elasticities From Pooled Database)



Our analysis also examined how LT20 and GT20 customers behaved across the first, second and third days of a multi-day critical event.

- LT20 customers displayed a modest level of price responsiveness on stand-alone critical days (e.g., critical days that were not followed immediately by another event) or on the first day of a multi-day event cycle. However, there is no evidence of price responsiveness on the second or third days of a multi-day event cycle. The difference between price responsiveness across these three day types was statistically significant at the 99 percent confidence level.[6]

- GT20 customers, on the other hand, displayed no statistically significant difference in price responsiveness across the first, second and third days of a multi-day critical event.

With respect to differences in price responsiveness between two-hour and five-hour critical events, we found:

- There is no statistically significant difference in price responsiveness between two-hour and five-hour critical events for LT20 customers.
- For GT20 customers, there is a statistically significant difference, with responsiveness being much greater with two-hour events than with five-hour events. The elasticity of substitution for five-hour critical events is -0.0287, whereas it equals -0.0800 for two-hour events.

[6] An examination of data on thermostat overrides for one multi-day event showed that roughly 50 percent of LT20 customers overrode the technology on the third day which explains, in large part, the variation in price response across the days for this group.

1. INTRODUCTION

California's statewide pricing pilot (SPP) was designed to test the impact of several time-varying rate structures on the electricity usage patterns of residential and small commercial and industrial customers. Pricing treatments went into effect in June 2003. Impact estimates for the 2003 and 2004 summer periods for all treatments and customer segments were presented in a report entitled *Impact Evaluation of the California Statewide Pricing Pilot*, dated March 16, 2005 (hereafter referred to as the March 16th report).

As described in Section 7 of the March 16th report, pricing treatments did not go into effect until the summer of 2004 for one of the primary C&I treatment groups, Track A CPP-V. Consequently, it was not possible to compare whether or not peak-period impacts would persist over two summers. As such, the CPUC decided to extend the experiment for another summer for this group of customers in order to measure persistence over time. This report summarizes the analysis of that issue as well as related issues, such as persistence over multiple critical peak days, that could not be examined with just the 2004 data.

The Track A sample was recruited from the general C&I population of customers with peak demands below 200 kW after screening out customers below a minimum usage threshold (to increase the likelihood that customers had air conditioning) and also screening out customers that did not live in a two-way paging area. The sample was segmented into two size strata, customers with demands below 20 kW (referred to here as the LT20 segment) and customers with demands between 20 and 200 kW (referred to as the GT20 segment). All customers were located in the Southern California Edison (SCE) service territory. A more detailed description of the sampling plan, recruitment process and other relevant facts can be found in the March 16th report.

The CPP-V rate is a critical peak pricing tariff with the following characteristics. The summer rate period was in effect for the four months starting on the first Sunday in June through the first Sunday in October in both 2004 and 2005. On most weekdays, a peak-period price was in effect between noon and 6 pm. On critical days, a significantly higher peak-period price was in effect for up to five hours, all of which fell within the noon to 6 pm time period. While the tariff allowed the critical peak period to be any length up to 5 hours, during the experiment, the critical peak period was either 2 or 5 hours long.

All customers in this treatment group were offered free installation of a smart thermostat that would automatically adjust their air conditioning setting when critical peak prices were in effect. A summary of the number of customers who took this offer is contained in Section 2.[7]

[7] Starting in late 2004, customers were also offered additional enabling technology that would automatically control additional end use equipment. 21 customers eventually accepted the offer and this technology was signaled on selected CPP days in 2005. This Additional Control Technology (ACT) addendum to the main pilot was not a statistically rigorous test and we did not attempt to estimate the impact of this treatment. A summary of the marketing effort, implementation challenges and an estimate of the impact of the additional technology for one CPP day for a subset of customers is contained in the final ACT report: *Additional Control Technologies (ACT) for Small/Medium Commercial Customers*, Lockheed Martin Aspen, April 2006.

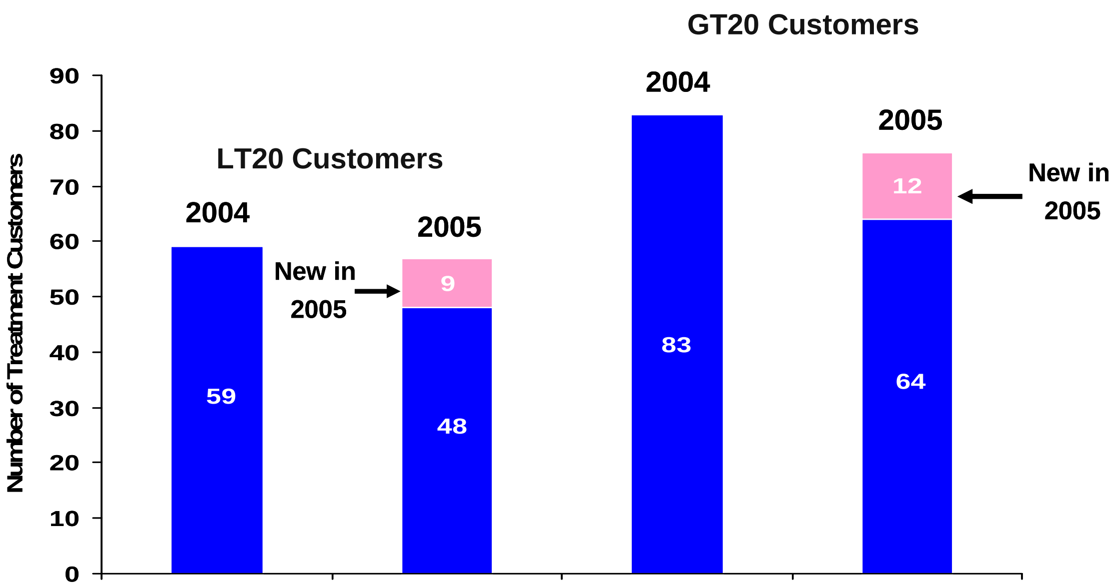
1.1. Report Organization

The remainder of this report is organized as follows. Section 2 summarizes the evolution of the sample and treatments over the two summers. Specifically, it examines the extent and nature of turnover in the sample, shows the number of customers that accepted the enabling technology offer, shows how prices changed across the two summers, and summarizes the length and timing of CPP events. Section 3 contains the results of our analysis on the issues of persistence across the two summers, persistence across multiple CPP days, the difference in impacts across customers with and without enabling technology and the difference in impacts across critical events of varying length.

2. EVOLUTION OF SAMPLE AND TREATMENT

The number of treatment customers and the composition of the treatment groups changed somewhat between the 2004 and 2005 summer periods. Figure 2-1 shows the total number of treatment customers that were in the experiment in each summer as well as the number of new customers that were added in 2005 in order to replace those that left the experiment after the initial summer. As seen, for the LT20 segment, there were 59 treatment customers in 2004 and 57 in 2005. The 2005 sample had 9 customers that were not present during the summer of 2004. Put another way, 11 of the 59 LT20 customers, or roughly 19 percent, that participated in 2004 did not participate in 2005 and 84 percent of the 2005 sample were also present in 2004. For the GT20 segment, 19 of the 83 participants during 2004, or 23 percent, dropped out of the experiment and 12 new customers were added in 2005 as replacements for most of those that left. Thus, 84 percent (64 out of 76) of the 2005 sample also participated in the experiment in 2004.

Figure 2-1
Change in C&I Sample Over Time



In some cases, the customers who left and joined the pilot between the two summers were quite different. For LT20 customers:

- Average daily energy use on critical days for the 11 customers who left during or after the 2004 summer was only 64 percent as large as the average for those who stayed
- Although these 11 customers used less energy, they used significantly more energy during the peak period. The ratio of average hourly energy use during the peak period to average use during the off-peak period for customers who left equaled 2.5, whereas the ratio for customers who stayed was only 2.0

- Average daily energy use on critical days for the nine LT20 customers who were recruited to replace those who left was also one-third smaller than for those who stayed (so the replacements appear to have been selected from the appropriate sample strata)
- However, these replacement customers had a much lower ratio of peak-to-off-peak average energy use than did those who they replaced (1.75 versus 2.5).

In short, LT20 customers who left the pilot after the first summer were smaller and "peakier" than those who did not leave. They were replaced by similarly small customers but the replacement customers used less energy on-peak than the average participant in the experiment.

Unlike for the LT20 segment, the differences between customers who left and those who stayed or joined were much smaller for the GT20 segment. Specifically:

- Those who left after the first summer had daily energy use on critical days that was about 10 percent greater than those who stayed, but the ratio of energy use in the peak and off-peak periods was nearly identical for the two groups.
- Replacement customers in 2005 were also larger than the average of those who stayed for both summers (about 23 percent greater energy use on critical days) but the ratio of peak-to-off-peak energy use was roughly the same for both groups.

All Track A, CPP-V treatment customers were offered, free of charge, a smart thermostat that could be programmed to automatically respond to critical peak price signals. Roughly one third of LT20 customers and less than two-thirds of GT20 customers took advantage of this offer. These percentages were essentially the same across both summer periods. For the LT20 customer segment, 19 of 59 customers (32 percent) took the technology in 2004 and 20 of 57 customers (35 percent) took the technology in 2005. For the GT20 customer segment, 49 out of 83 customers (59 percent) took the technology in 2004 and 45 out of 76 (also 59 percent) took it 2005.

Prices also changed across the two summers as experimental prices were modified along with changes in Edison's standard tariffs. Tables 2-1 and 2-2 show the average prices in each rate period that were in effect in 2004 and 2005, respectively, and Table 2-3 contains the average prices across the two summers.

The average control group price for LT20 customers was $0.17/kWh in 2004 and $0.18/kWh in 2005. A comparison of prices shows some significant differences across treatment groups (e.g., high and low ratio)[8], rate periods, day types, and years. On average, across the two summers, LT20 customers paid nearly $1/kWh during the peak period on critical days. However, this average masks significant variation. In 2004, the average critical peak price for LT20 customers was $0.77/kWh whereas the price equaled $1.17/kWh during the summer of 2005. High ratio LT20 customers in 2005 paid $1.38/kWh during the critical period. That is, the price ratio for these customers in 2005 was nearly 20 to 1 on critical peak days.

[8] Multiple price ratios were included for each tariff so that demand curves and price elasticities could be estimated. All of the tariffs were revenue neutral on an annual basis but not within the rate season. High price ratio customers had lower daily prices than did low ratio customers and high ratio summer customers had lower ratios in the winter.

Table 2-1
Average 2004 Summer Prices
For Track A CPP-V Customers
($/kWh)

Customer Segment	Day Type	Rate Period	High Ratio	Low Ratio	Average
LT20 Control	All	All	0.17		
LT20 Treatment	Critical	Peak	0.88	0.66	0.77
		Off-Peak	0.09	0.15	0.12
		Daily	0.30	0.29	0.29
	Normal Weekday	Peak	0.18	0.23	0.20
		Off-Peak	0.09	0.15	0.12
		Daily	0.12	0.18	0.15
GT20 Control	All	All	0.15		
GT20 Treatment	Critical	Peak	0.69	0.56	0.62
		Off-Peak	0.09	0.13	0.11
		Daily	0.23	0.23	0.23
	Normal Weekday	Peak	0.17	0.20	0.19
		Off-Peak	0.08	0.13	0.11
		Daily	0.12	0.16	0.14

Table 2-2
Average 2005 Summer Prices
For Track A CPP-V Customers
($/kWh)

Customer Segment	Day Type	Rate Period	High Ratio	Low Ratio	Average
LT20 Control	All	All	0.18		
LT20 Treatment	Critical	Peak	1.38	0.98	1.17
		Off-Peak	0.07	0.16	0.12
		Daily	0.41	0.38	0.39
	Normal Weekday	Peak	0.20	0.28	0.24
		Off-Peak	0.07	0.16	0.12
		Daily	0.12	0.20	0.16
GT20 Control	All	All	0.17		
GT20 Treatment	Critical	Peak	0.60	0.50	0.55
		Off-Peak	0.11	0.15	0.13
		Daily	0.23	0.23	0.23
	Normal Weekday	Peak	0.18	0.20	0.19
		Off-Peak	0.11	0.15	0.13
		Daily	0.14	0.17	0.16

Table 2-3 Average 2004/2005 Summer Prices For Track A CPP-V Customers ($/kWh)					
Customer Segment	Day Type	Rate Period	High Ratio	Low Ratio	Average
LT20 Control	All	All	0.17		
LT20 Treatment	Critical	Peak	1.12	0.82	0.97
		Off-Peak	0.08	0.16	0.12
		Daily	0.35	0.33	0.34
	Normal Weekday	Peak	0.19	0.25	0.22
		Off-Peak	0.08	0.16	0.12
		Daily	0.12	0.19	0.16
GT20 Control	All	All	0.16		
GT20 Treatment	Critical	Peak	0.65	0.53	0.59
		Off-Peak	0.10	0.14	0.12
		Daily	0.23	0.23	0.23
	Normal Weekday	Peak	0.18	0.20	0.19
		Off-Peak	0.10	0.14	0.12
		Daily	0.13	0.16	0.15

Prices did not change as dramatically across the two summers for the GT20 customer segment as they did for the LT20 segment. The average price for GT20 control customers went up from $0.15/kWh in 2004 to $0.17/kWh in 2005.[9] However, the average critical peak price actually fell from $0.59/kWh to $0.55/kWh between 2004 and 2005. The highest price ratio on critical days for the GT20 group equaled roughly 7.7 (for the high ratio group in 2004) and the lowest equaled 3.3 (the low ratio group in 2005).

Table 2-4 summarizes the dates and characteristics of the critical peak price events that were called over the two summers. Twelve critical events were called in 2004 and 11 were called in 2005. The critical peak price was in effect for five hours on 8 critical days and for two hours on the remaining 15 critical days. Ten of the 23 critical days were either the second or third day of a multi-day critical event. Put another way, of the 23 critical days, only 6 were stand-alone days, 7 were the first day of a multi-day event cycle, 6 were the second day of a multi-day cycle and 4 were the third day of a cycle.

[9] The GT20 customer segment has both demand and energy charges. The average prices reported here incorporate the demand charges into the energy charge in the relevant rate period.

Table 2-4
Characteristics of Critical Event Days

Year	Month	Day	Start Time (pm)	End Time (pm)	Duration	Day Sequence
2004	July	14	1	6	5	1
		22	1	6	5	1
		26	3	5	2	1
		27	3	5	2	2
	August	9	1	6	5	1
		10	1	6	5	2
		11	4	6	2	3
		27	4	6	2	1
		31	1	6	5	1
	September	8	1	6	5	1
		9	4	6	2	2
		10	4	6	2	3
2005	July	12	2	4	2	1
		13	2	4	2	2
		14	1	6	5	3
		22	1	6	5	1
	August	26	2	4	2	1
	September	6	2	4	2	1
		7	2	4	2	2
		23	1	3	2	1
		27	2	4	2	1
		28	2	4	2	2
		29	2	4	2	3

3. PRICE RESPONSE AND LOAD IMPACT ESTIMATES

This section summarizes our analysis of four primary issues:

1. Does demand response differ across the two summers of 2004 and 2005?
2. How much do peak-period demand impacts vary across customers who do and don't have enabling technology?
3. Does demand response vary across days in a multi-day CPP event sequence?
4. Does price responsiveness vary across two-hour and five-hour critical peak events?

We begin with a brief discussion of methodology.

3.1. METHODOLOGY

Section 3.1 of the March 16th report describes the CES demand system that was used for the analysis described there. The same approach is used here to estimate changes in energy use by rate period. The two-equation system consists of one equation that relates the log of the ratio of peak-to-off-peak energy use to the log of the ratio of peak-to-off-peak prices and other determining factors such as weather. As discussed in Section 7 of the March 16th report, interaction terms that would allow price responsiveness to vary with air conditioning ownership and weather were not statistically significant. Thus, the basic share equation has independent variables consisting of the log of the price ratio, the difference in cooling degree hours per hour between the peak and off-peak periods, and a binary variable representing the weekend. The coefficient on the price term equals the elasticity of substitution.

The second equation in the CES demand system relates daily energy use to daily price and other relevant variables. As was indicated in the March 16th report, daily price did not prove to be statistically significant and was dropped from the specification. Thus, the daily equation simply relates the log of daily energy use to daily cooling degree hours and a binary variable representing the weekend.

The share equation and daily equation were estimated jointly using Zellner's Seemingly Unrelated Regression estimator and the first difference transformation to correct for autocorrelation.

When testing for differences across years, across days in a multi-day critical event, across customers with and without enabling technology or across critical events of varying length, binary variables representing the variable of interest interacting with the price term in the share equation are employed. If the coefficient on the interaction term is statistically significant, it means that the factor represented by the binary variable has a statistically significant impact on price responsiveness.

When examining whether demand response varied between 2004 and 2005, there are two relevant samples of interest. One sample consists of customers that were in the experiment during ***both*** summers (in other words, this sample excludes customers if they participated in 2004 but not in 2005, and vice versa). We refer to this as the ***common*** database. Using this database allows us to determine whether the same group of customers responded differently across the two summers. The second sample of interest consists of all customers who participated in ***each*** summer (that is, customers are included if they participated in 2004, 2005 or both 2004 and 2005). We refer to this as the ***pooled*** database. As discussed in Section 2, there was not a large turnover in the sample but there were, in some instances, differences between customers who left and those that replaced them. Thus, using the pooled database allows us to determine whether price responsiveness varies across the population of customers that participated in each summer and may be a better example of how price responsiveness might vary over time given "normal" turnover in customer participation.

3.2. Comparing 2004 and 2005 Price Responsiveness and Impacts

Table 3-1 contains the coefficients, standard errors and t-statistics for the variables relevant to addressing the issue of whether price responsiveness differs across the two summers.[10] The first row in the table contains estimates of the elasticity of substitution based on just the 2004 population. These are the same values that are contained in the March 16th report and are provided here for reference. As seen, the elasticity of substitution is statistically significant for both LT20 and GT20 customers and is larger for the GT20 segment than for the LT20 segment.

Table 3-1
Tests for Differences In the Elasticity of Substitution Across Years

Database	Variable	LT20 Customers			GT20 Customers		
		Coefficient	Standard Error	t-stat	Coefficient	Standard Error	t-stat
2004 Only	2004 Elasticity of Substitution	-0.0445	0.0144	-3.09	-0.0692	0.0083	-8.34
'04/'05 Common	2005 Elasticity of Substitution	-0.0376	0.0133	-2.83	-0.0356	0.0121	-2.94
	2004 Binary Interaction	-0.0149	0.0214	-0.70	-0.0174	0.0155	-1.12
	2004 Elasticity of Substitution	-0.0525	0.0168	-3.13	-0.0510	0.0097	-5.47
'04/'05 Pooled	2005 Elasticity of Substitution	-0.0270	0.0130	-2.08	-0.0368	0.0118	-3.12
	2004 Binary Interaction	-0.0171	0.0204	-0.84	-0.0334	0.0147	-2.27
	2004 Elasticity of Substitution	-0.0442	0.0157	-2.82	-0.0702	0.0088	-7.95
'04/'05 Pooled	'04/'05 Elasticity of Substitution	-0.0316	0.0100	-3.18	-0.0578	0.0071	-8.20
'04/'05 Common	'04/'05 Elasticity of Substitution	-0.0434	0.0104	-4.17	-0.0458	0.0076	-6.06

10 Printouts of the full regression equations are contained in the appendices.

The next two rows contain estimates of the elasticity of substitution for 2005 and the coefficient on the interaction term between the price ratio and the binary variable representing 2004 based on the common database. The sum of the two values represents the estimate of the elasticity of substitution for 2004. The primary thing to note is that, based on the sample of customers who participated in both summers, the difference in the elasticities across the two summers is not statistically significant, as evidenced by the t-statistic on the binary interaction term equal to -0.70 for the LT20 group and -1.12 for the GT20 group.[11] Thus, although the 2005 estimate for LT20 customers is about 28 percent less than the 2004 estimate, this difference is not statistically significant. Similarly, the 2005 estimate for GT20 customers is about 30 percent less than the 2004 value but, again, the difference is not statistically significant.

The next three rows in Table 3-1 have the same information as in the previous three rows but these estimates are based on the pooled database that includes all customers that participated in the pilot each summer rather than only those that participated in both summers. In this case, the difference across the summers is, once again, not statistically significant for the LT20 segment, as evidenced by the t-statistic on the binary variable interaction term equal to -0.84. However, with a t-statistic on the binary interaction term equal to -2.27, the difference across the summers for the GT20 segment is statistically significant. For these larger customers, the magnitude of the elasticity of substitution dropped by roughly 50 percent across the two summers, from a value of almost -0.070 in 2004 to a value of -0.037 in 2005.

The final two rows in Table 3-1 contain estimates of the elasticity of substitution averaged across the two summers for the common and pooled databases. For the LT20 segment, the value is greater based on the common customer database (-0.043) than it is based on the pooled database (-0.032). For the GT20 segment, the opposite is true, with the value for the common database (-0.046) being less than the value based on the pooled database (-0.058).

It is difficult to understand why the difference across the two summers is statistically significant for the GT20 segment based on the pooled database and not significant based on the common database. As discussed in Section 2, differences in the characteristics of customers who left after the summer of 2004 and their replacements are small for the GT20 segment whereas the differences for the LT20 segment were greater (replacement customers had much smaller peak-to-off-peak energy use than did the customers who left). If anything, one would have expected there to be a greater difference between the common and pooled results for the LT20 group than for the GT20 group.

Tables 3-2 through 3-4 contain estimates of the impact of the CPP-V rates on energy use by rate period and day type for each customer segment. Both percentage and absolute impacts (kWh/hr) are presented. We present estimates based on different combinations of elasticities, starting

[11] A t-statistic equal to 1.96 represents a variable that is statistically significant at the 95 percent confidence level.

values and prices so as not to prejudge which estimates readers might consider to be most useful for their purposes.[12]

Table 3-2 contains impact estimates based on elasticities, prices and starting values that are specific to each summer. Thus, the drop of 6.04 percent in peak-period energy use on critical days in 2004 compared with the 7.55 percent drop in 2005 reflects both a drop in the elasticity of substitution between 2004 and 2005 as well as a significant increase in prices for this segment between 2004 and 2005. The significant drop in the percentage impact for GT20 customers (from 9.08 percent to 4.32 percent) reflects both a drop in the elasticity of substitution as well as a decrease in prices.

Table 3-2
Impact Estimates Based on Summer-Specific Datasets[13]

Customer Segment	Day Type	Rate Period	Starting Value (kWh/hr)	Impact (kWh/hr)	S.E. of Impact	t-stat	Impact (%)	S.E. of % Impact
2004 Participants, 2004 Prices								
LT20	Critical	Peak	3.668	-0.221	0.070	-3.166	-6.04	0.019
		Off-peak	1.831	0.043	0.014	3.143	2.36	0.008
	Normal Weekday	Peak	3.243	-0.048	0.015	-3.106	-1.47	0.005
		Off-peak	1.718	0.016	0.005	3.106	0.92	0.003
GT20	Critical	Peak	24.657	-2.240	0.259	-8.649	-9.08	0.011
		Off-peak	15.277	0.460	0.054	8.552	3.01	0.004
	Normal Weekday	Peak	23.231	-0.560	0.067	-8.391	-2.41	0.003
		Off-peak	14.085	0.187	0.022	8.391	1.32	0.002
2005 Participants, 2005 Prices								
LT20	Critical	Peak	3.832	-0.289	0.094	-3.090	-7.55	0.024
		Off-peak	1.778	0.046	0.015	3.047	2.58	0.008
	Normal Weekday	Peak	3.432	-0.066	0.022	-3.008	-1.93	0.006
		Off-peak	1.691	0.022	0.007	3.008	1.31	0.004
GT20	Critical	Peak	25.547	-1.103	0.357	-3.087	-4.32	0.014
		Off-peak	14.484	0.168	0.055	3.067	1.16	0.004
	Normal Weekday	Peak	23.249	-0.212	0.070	-3.039	-0.91	0.003
		Off-peak	14.029	0.071	0.023	3.039	0.50	0.002

Table 3-3 contains impact estimates based on the pooled database. Each set of estimates has the same starting values and price elasticities. The elasticities represent the average value across the

[12] The impact estimates presented in these and subsequent tables are all based on an average peak-period length on critical days equal to 3.45 hours. This is the average for the 2004 summer. The average value across the two summers is roughly 3 hours. Impact estimates would increase slightly if the two year average of 3 were used. For example, based on the price-impact models, an impact estimate equal to 6.71 percent for medium customers would increase to 6.92 percent if the average peak-period was reduced from 3.45 to 3.0 hours.

[13] Both the elasticities and starting values are based on customers who participated in each summer (e.g., the 2004 values are based on all customers who participated in 2004, and the 2005 values are based on all customers who participated in 2005). Differences across the two summers reflect differences in elasticities, starting values and prices.

two summers (and equal the values in the second to last row in Table 3-1). The only underlying values that differ across the three sets of estimates are prices. Thus, the higher impacts in 2005 for the LT20 segment reflect the higher prices in 2005 compared with 2004, and the lower impacts in 2005 for the GT20 segment reflect the lower average prices in 2005 compared with 2004.

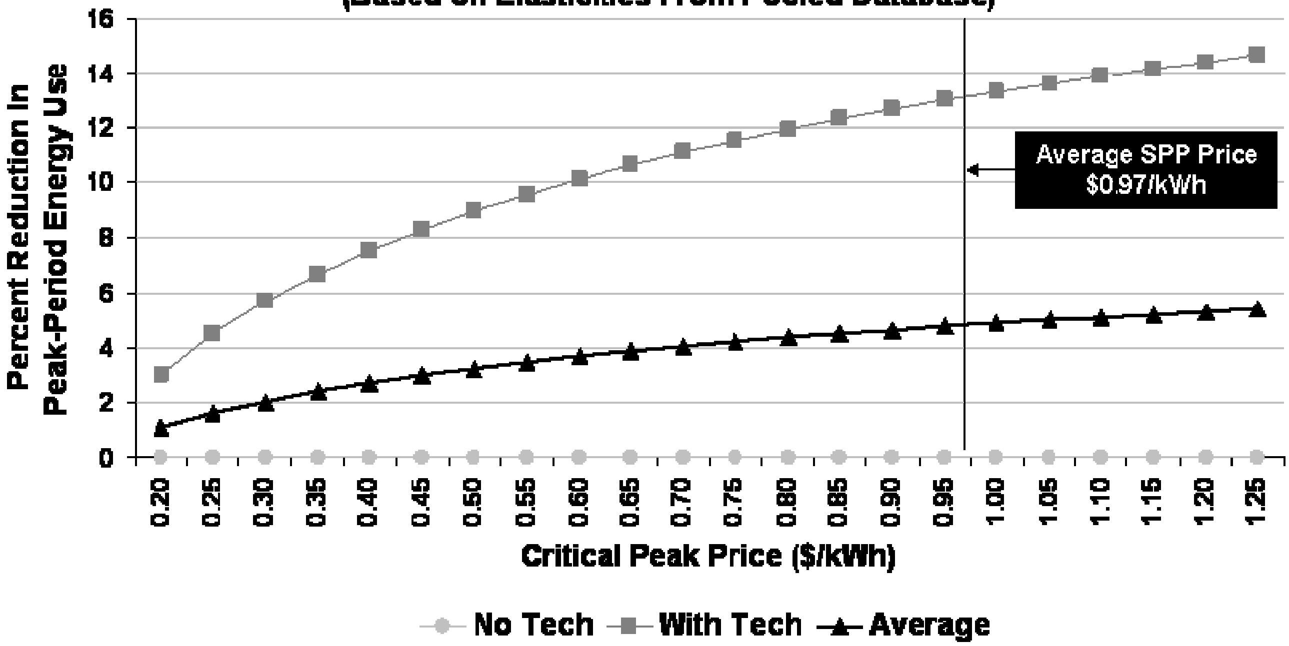
Table 3-3
Impact Estimates Based on Elasticities Estimated From the Pooled Database (All Participants In Pilot in Each Summer)[14]

Customer Segment	Day Type	Rate Period	Starting Value (kWh/hr)	Impact (kWh/hr)	S.E. of Impact	t-stat	Impact (%)	S.E. of % Impact
2004 & 2005 Participants, 2004 Prices								
LT20	Critical	Peak	3.748	-0.155	0.048	-3.222	-4.14	0.013
		Off-peak	1.805	0.030	0.009	3.206	1.67	0.005
	Normal Weekday	Peak	3.343	-0.034	0.011	-3.182	-1.03	0.003
		Off-peak	1.703	0.011	0.004	3.182	0.67	0.002
GT20	Critical	Peak	25.071	-1.800	0.221	-8.161	-7.18	0.009
		Off-peak	14.908	0.369	0.046	8.091	2.47	0.003
	Normal Weekday	Peak	23.212	-0.459	0.057	-7.977	-1.98	0.002
		Off-peak	14.047	0.153	0.019	7.977	1.09	0.001
2004 & 2005 Participants, 2005 Prices								
LT20	Critical	Peak	3.748	-0.209	0.064	-3.247	-5.57	0.017
		Off-peak	1.805	0.033	0.010	3.214	1.85	0.006
	Normal Weekday	Peak	3.343	-0.048	0.015	-3.184	-1.42	0.004
		Off-peak	1.703	0.016	0.005	3.184	0.93	0.003
GT20	Critical	Peak	25.071	-1.557	0.191	-8.151	-6.21	0.008
		Off-peak	14.908	0.241	0.030	8.069	1.62	0.002
	Normal Weekday	Peak	23.212	-0.304	0.038	-7.964	-1.31	0.002
		Off-peak	14.047	0.101	0.013	7.964	0.72	0.001
2004 & 2005 Participants, 2004/2005 Average Prices								
LT20	Critical	Peak	3.748	-0.181	0.056	-3.233	-4.83	0.015
		Off-peak	1.805	0.032	0.010	3.210	1.78	0.006
	Normal Weekday	Peak	3.343	-0.041	0.013	-3.183	-1.23	0.004
		Off-peak	1.703	0.014	0.004	3.183	0.81	0.003
GT20	Critical	Peak	25.071	-1.691	0.207	-8.158	-6.75	0.008
		Off-peak	14.908	0.309	0.038	8.082	2.07	0.003
	Normal Weekday	Peak	23.212	-0.376	0.047	-7.970	-1.62	0.002
		Off-peak	14.047	0.125	0.016	7.970	0.89	0.001

[14] Both the elasticities and starting values are based on all participants in the pilot, whether they participated only in 2004, only in 2005 or in both summers. Thus, differences across the time-periods (e.g., 2004, 2005 or 2004/2005) are due only to differences in prices, not to differences in elasticities or starting values.

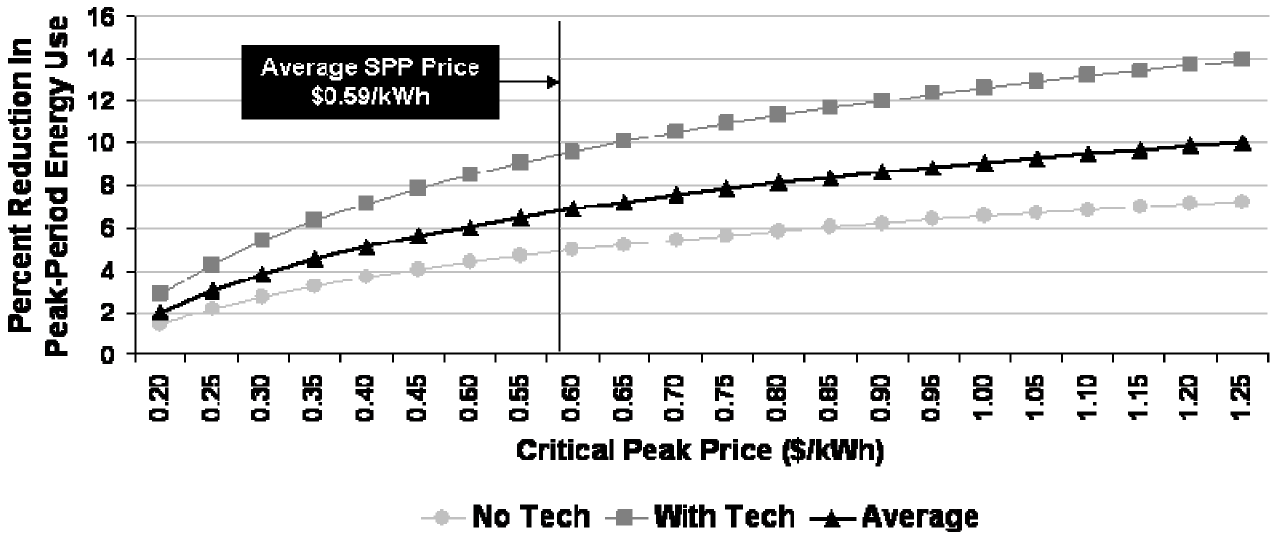
Figures 3-1 and 3-2 show how peak-period impacts on critical days would vary with changes in the critical peak price.[15] These estimates are based on the pooled database. As seen in the figures, the percent decrease in peak-period energy use falls as prices increase, since it becomes harder and harder to reduce or shift load beyond a certain level. The horizontal curve along the x-axis in Figure 3-1 indicates the complete lack of demand response for LT20 customers in the absence of enabling technology. GT20 customers display a reasonable level of demand response even in the absence of enabling technology. Demand response is similar for both customer segments at the same price points in the presence of enabling technology.

Figure 3-1
% Reduction in Peak-Period Energy Use on Critical Days: LT20
(Based on Elasticities From Pooled Database)



[15] It is important to note that these impacts are not based on a revenue-neutral change in price, simply a change in the critical peak price with everything else being held constant. Revenue neutral price changes would produce slightly larger peak-period reductions because they would have even greater changes in the peak-to-off-peak price ratio than do the price ratios underlying the impacts shown in the figures.

Figure 3-2
% Reduction in Peak-Period Energy Use on Critical Days: GT20
(Based on Elasticities From Pooled Database)



The impact estimates contained in Table 3-4 are based on the same starting values and prices as are the estimates in Table 3-3, but the elasticities underlying the impacts were estimated using the common database and equal those contained in the last row of Table 3-1. Thus, the impacts in Table 3-4 are greater for LT20 customers than are the impacts in Table 3-3 because the elasticity of substitution is greater using the common database than it is using the pooled database. The opposite is true for GT20 customers.

Table 3-4
Impact Estimates Based on Elasticities Estimated From the Common Database
(All Participants Present In Both Summers)[16]

Customer Segment	Day Type	Rate Period	Starting Value (kWh/hr)	Impact (kWh/hr)	S.E. of Impact	t-stat	Impact (%)	S.E. of % Impact
2004 & 2005 Participants, 2004 Prices								
LT20	Critical	Peak	3.748	-0.212	0.050	-4.256	-5.66	0.013
		Off-peak	1.805	0.041	0.010	4.227	2.28	0.005
	Normal Weekday	Peak	3.343	-0.047	0.011	-4.183	-1.41	0.003
		Off-peak	1.703	0.016	0.004	4.183	0.92	0.002
GT20	Critical	Peak	25.071	-1.460	0.236	-6.195	-5.82	0.009
		Off-peak	14.908	0.298	0.049	6.152	2.00	0.003
	Normal Weekday	Peak	23.212	-0.370	0.061	-6.082	-1.60	0.003
		Off-peak	14.047	0.123	0.020	6.082	0.88	0.001
2004 & 2005 Participants, 2005 Prices								
LT20	Critical	Peak	3.748	-0.284	0.066	-4.302	-7.58	0.018
		Off-peak	1.805	0.046	0.011	4.241	2.52	0.006
	Normal Weekday	Peak	3.343	-0.065	0.016	-4.187	-1.95	0.005
		Off-peak	1.703	0.022	0.005	4.187	1.28	0.003
GT20	Critical	Peak	25.071	-1.263	0.204	-6.189	-5.04	0.008
		Off-peak	14.908	0.195	0.032	6.139	1.31	0.002
	Normal Weekday	Peak	23.212	-0.246	0.040	-6.074	-1.06	0.002
		Off-peak	14.047	0.082	0.013	6.074	0.58	0.001
2004 & 2005 Participants, 2004/2005 Average Prices								
LT20	Critical	Peak	3.748	-0.247	0.058	-4.277	-6.59	0.015
		Off-peak	1.805	0.044	0.010	4.235	2.44	0.006
	Normal Weekday	Peak	3.343	-0.057	0.014	-4.185	-1.69	0.004
		Off-peak	1.703	0.019	0.005	4.185	1.11	0.003
GT20	Critical	Peak	25.071	-1.372	0.222	-6.193	-5.47	0.009
		Off-peak	14.908	0.250	0.041	6.146	1.68	0.003
	Normal Weekday	Peak	23.212	-0.303	0.050	-6.078	-1.31	0.002
		Off-peak	14.047	0.101	0.017	6.078	0.72	0.001

3.3. THE INFLUENCE OF ENABLING TECHNOLOGY

As discussed in Section 2, although all participating customers were offered, free of charge, a smart thermostat that would automatically adjust their air conditioning usage on critical peak days, not all customers took advantage of this offer. Roughly one-third of the LT20 customers accepted the technology offer and 59 percent of GT20 customers did so. Given that not all customers accepted the technology, it is possible to test for the effect of enabling technology on

16 The elasticities underlying the impact estimates in this table are based only on customers who participated in both summers. The starting values and prices are based on all customers who participated in 2004, 2005 or both summers. Thus, differences between the impact estimates in this table and those in Table 3-3 are due to differences in the elasticities between the pooled and common datasets.

demand response. The test was conducted by adding two binary variables interacting with the price term in the regression equation. One binary variable is equal to 1 on critical peak days for all customers, 0 otherwise. This variable measures the difference between price responsiveness for all customers on normal weekdays and for customers that do not have the technology on critical peak days. The second binary variable equals 1 on critical peak days for customers with enabling technology, 0 otherwise. This variable measures the difference in price responsiveness on critical peak days between customers with and without the enabling technology.

Table 3-5 contains estimates of the three relevant variables for LT20 and GT20 customers. It also shows what the elasticity of substitution equals for customers on normal weekdays and on critical days for customers with and without technology.

Table 3-5
Regression Results and Estimates of the Elasticity of Substitution For Participants With and Without Enabling Technology

Customer Segment	Variable	Coefficient	Standard Error	t-statistic
LT20	Price Ratio	0.0255	0.0208	1.23
	(Price Ratio)x (CPP day binary)	-0.0305	0.0182	-1.68
	(Price Ratio)x (CPP day-with-tech)	-0.0841	0.0181	-4.64
	EoS on normal weekdays	0.0255	0.0208	1.23
	EoS on critical days without tech	-0.0050	0.0113	-0.45
	EoS on critical days with tech	-0.0891	0.0163	-5.46
GT20	Price Ratio	-0.0493	0.0159	-3.10
	(Price Ratio)x (CPP day binary)	0.0081	0.0141	0.57
	(Price Ratio)x (CPP day-with-tech)	-0.0403	0.0120	-3.36
	EoS on normal weekdays	-0.0493	0.0159	-3.10
	EoS on critical days without tech	-0.0412	0.0086	-4.79
	EoS on critical days with tech	-0.0815	0.0101	-8.07

Looking first at the results for the LT20 customer segment, we see that the coefficient on the price ratio term by itself is positive and insignificant. This represents the elasticity of substitution for all customers (both with and without enabling technology) on normal weekdays. In other words, LT20 customers show no price responsiveness on normal weekdays. The variable labeled "(price ratio)x(CPP day binary)" represents the differential in the elasticity of substitution between all customers on normal weekdays and customers without enabling technology on critical days. The t-statistic of -1.68 indicates that this differential is not statistically significant at the 95 percent confidence level (but it is significant at the 90 percent confidence level). The sum of the coefficients in the first two rows of the table (shown in the fifth row in the table) equals -0.0050. This represents the elasticity of substitution for customers without enabling technology on critical days. The very small value and the low t-statistic indicates that LT20 customers without enabling technology are not price responsive on critical days. Finally, the variable labeled "(price ratio)x(CPP day-with-tech)" represents the difference in price responsiveness on critical days for customers with and without enabling technology. As seen, this variable is highly significant (with a t-statistic equal to -4.64) and has a value that is nearly three times as large as the coefficient without enabling technology. The sum of all three coefficients in the first three rows of Table 3-5, -0.0892, equals the elasticity of substitution on critical days for customers with enabling technology. The t-statistic, equal to -5.46, indicates that LT20 customers with enabling technology are highly price responsive.[17]

In summary, for LT20 customers on normal weekdays and for customers without enabling technology on critical days, there is no statistically significant price response. On critical days, customers with enabling technology are quite price-responsive, with an elasticity of substitution that is approximately equal to -0.09.[18]

Unlike the LT20 segment, GT20 customers display a reasonable level of price responsiveness on normal weekdays, with a statistically significant price coefficient equal to -0.0493. The differential between this value and the value on critical days for customers without enabling technology, equal to 0.0081, is not statistically significant. In other words, GT20 customers are equally responsive to time-varying price signals on normal weekdays and on critical days in the absence of enabling technology. The differential between customers with and without enabling technology on critical days equals -0.0403 and is highly significant. The elasticity of substitution for GT20 customers with enabling technology on critical days equals -0.0815, which is twice as large as the value for customers without enabling technology on critical days.

Table 3-6 contains impact estimates on critical days for customers with and without enabling technology. These estimates are based on average starting values for the pooled database and average prices across the two summers. For LT20 customers without technology, there was no statistically significant reduction in peak-period energy use on critical days. LT20 customers with enabling technology reduced peak-period energy use on critical days by more than 13 percent. It is important to note that customers with enabling technology have a relatively large increase in energy use in the off-peak period on critical days (4.92 percent).

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[17] Even though the demand response is enhanced by the enabling technology, we still characterize this as price responsiveness as customers ultimately have control over the device. For example, customers can override the automatic setback if they wish. Furthermore, the choice to accept or not accept the enabling technology is a reflection of a customer's desire and willingness to respond to the time-varying price signal.

[18] Page 116 of the March 16th Report indicates that an attempt was made to test for the impact of technology using only the 2004 data, and the interaction terms were not statistically significant. In light of the finding reported above, we examined the issue once again using only the 2004 data and obtained results similar to those shown here, namely that technology makes a significant difference and that LT20 customers are not price responsive at all in the absence of enabling technology. It would appear that the earlier analysis was incorrect.

For GT20 customers, the reduction in peak-period energy use on critical days for customers without enabling technology is 4.93 percent, whereas the reduction for customers with enabling technology is almost 10 percent. The absolute value of the reduction in energy use during the peak period by GT20 customers with enabling technology, -2.4 kWh/hr, is nearly five times larger than for LT20 customers, as the elasticities are comparable across the two segments but GT20 customers have much larger average energy use than do LT20 customers.

Table 3-6
Impact Estimates On Critical Days With and Without Enabling Technology
(2004/2005 Pooled Database/ 2004/2005 Average Prices)

Customer Segment	Technology	Rate Period	Starting Value	Impact (kWh/hr)	S.E. of Impact	t-stat	(%) Impact	S. E. of % Impact
LT20	No	Peak	3.748	-0.029	0.065	-0.447	-0.78%	0.017
		Offpeak	1.805	0.005	0.012	0.447	0.29%	0.006
	Yes	Peak	3.748	-0.494	0.086	-5.758	-13.19%	0.023
		Offpeak	1.805	0.089	0.016	5.639	4.92%	0.009
GT20	No	Peak	25.071	-1.236	0.253	-4.889	-4.93%	0.010
		Offpeak	14.908	0.225	0.046	4.856	1.51%	0.003
	Yes	Peak	25.071	-2.400	0.286	-8.399	-9.57%	0.011
		Offpeak	14.908	0.440	0.053	8.285	2.95%	0.004

3.4. DEMAND RESPONSIVENESS ACROSS CONTIGUOUS CRITICAL DAYS

Another important policy issue concerns whether or not price responsiveness is constant across the days of a multi-day critical event, as might occur during a heat wave. We tested for this by including three binary variables interacting with the price-ratio term in the substitution equation regressions. The first binary variable equals 1 on critical event days that were either stand-alone days (that is, days that were not followed by a second critical event the following day) or were the first day in a multi-day event. This interaction term measures the difference between price responsiveness on normal weekdays and price responsiveness on stand-alone or first days. The second binary variable equals 1 on all days that were the second-day of a multi-day event, 0 otherwise, and the third binary variable equals 1 on the third day of a multi-day event, 0 otherwise. Each of these interaction terms estimates the difference in price responsiveness on the critical day in question relative to normal weekdays.[19] As such, the elasticity of substitution for each day-type equals the sum of the price ratio coefficient and the binary variable interaction term coefficient for that day-type

[19] The regression also included interaction terms between the three binary variables and the weather variable. These variables control for differences in the ratio of peak-to-off-peak energy use that result from differences in weather patterns rather than price. For example, if temperatures remained high over a longer percent of the day on second days compared with first or stand-alone days, this would result in a drop in the usage ratio for air conditioned households that is not due to a price-driven reduction in peak period usage, but rather to a reduction in the share of peak period usage for that day because off-peak air conditioning use was higher due to the higher temperatures over the off-peak period.

Recall from section 2 that, of the 23 critical days across the two summers, 13 were either stand-alone days or occurred on the first day of a multi-day event, 6 occurred on the second day of a multi-day event and 4 occurred on the third day of a multi-day event. Complicating this analysis is the fact that the length of critical events was not constant across days and the percent of first, second and third days that were two-hour events rather than five-hour events varied. Specifically, of the 13 stand-alone/first-days, 7 (or 54 percent) were two-hour events. For second days, 4 out of 6 days, or 66 percent, were two-hour events and for third days, 3 out of 4, or 75 percent, were two-hour events. Consequently, it is difficult to separate out the individual effects of the length of the event and possible changes in behavior across days within a multi-day event cycle.

Table 3-7 contains the coefficients, standard errors and t-statistics associated with the price variables in the substitution equation. Consistent with earlier results for LT20 customers, we see that there is no demand-response on normal weekdays, as evidenced by the positive and statistically insignificant coefficient on the price-ratio term. On stand-alone days and on the first day of a multi-day event, customers are price-responsive. The coefficient on the day-one binary variable interaction term with price equals -0.0473 and the t-statistic equals -2.39. The sum of this variable and the stand-alone price term, -0.0229, equals the elasticity of substitution on day-one critical days. The next variable looks at the difference between the elasticity of substitution on normal weekdays and the value on the second day of a multi-day event. The value of 0.0201, with a t-statistic of 1.12, indicates that LT20 customers are not responsive to price on the second day of a multi-day event. This is also true on the third day of a multi-day event. A Chi-square test was conducted to see if the differences across the day-types were statistically significant. With a P-value equal to 0.014, the test confirms that the differences are significant at the 99 percent confidence level. In summary, LT20 customers show a very modest level of price responsiveness on single critical days or on the first day of a multi-day event, but that price responsiveness is absent on normal weekdays or on the second or third day of multi-day events.[20]

The results for GT20 customers are quite different than for LT20 customers. As seen in the table, these customers display a reasonable level of price responsiveness on normal weekdays and none of the binary variables representing critical-day types are statistically significant, indicating that price responsiveness does not vary across day types. The Chi-square test, with a P-value of 0.775, confirms that there is no statistically significant difference in price responsiveness across days within a multi-day event for GT20 customers.

[20] An examination of data on thermostat overrides for one multi-day event showed that roughly 50 percent of LT20 customers overrode the technology on the third day which explains, in large part, the variation in price response across the days for this group

Table 3-7 Regression Results Examining Variation in Price Responsiveness Across Days Within a Multi-Day Critical Event				
Customer Segment	**Variable**	**Coefficient**	**Standard Error**	**t-statistic**
LT20	**Price Ratio**	0.0244	0.0209	1.17
	(Price Ratio)x (Day-One)	-0.0473	0.0198	-2.39
	(Price Ratio)x (Day-Two)	0.0201	0.0179	1.12
	(Price Ratio)x (Day-Three)	-0.0266	0.0230	-1.16
GT20	**Price Ratio**	-0.0510	0.0159	-3.20
	(Price Ratio)x (Day-One)	-0.0023	0.0145	-0.16
	(Price Ratio)x (Day-Two)	-0.0008	0.0122	-0.06
	(Price Ratio)x (Day-Three)	-0.0115	0.0156	-0.73

3.5. COMPARING IMPACTS ACROSS CRITICAL EVENTS OF DIFFERENT LENGTHS

The final question we examine is whether demand response varies across critical events of different length. As previously discussed, all events were either two-hours or five-hours long. As with the other issues, differences are tested through the use of binary interaction terms with the price variable. In this instance, two binary variables are used. One variable equals 1 on critical days, 0 otherwise. The second variable equals 1 on critical days when the event is two hours long, 0 otherwise. Thus, the first variable examines the difference in price responsiveness on normal weekdays and on critical days for five-hour events. The second variable examines the difference in price responsiveness between two-hour and five-hour events.

Table 3-8 contains the regression results for the relevant variables. It also contains estimates of the elasticity of substitution for critical events of different length.

As before, for LT20 customers, there is no price responsiveness on normal weekdays and a modest level of price responsiveness on critical days with five-hour event periods. As evidenced by the entries in the third row, the difference in price responsiveness for two-hour and five-hour events is not statistically significant for this customer segment.

For GT20 customers, we see once again that there is no statistically significant difference in price responsiveness on normal weekdays and on critical days with five-hour events. However, we now see a very significant difference in price responsiveness between two-hour and five-hour events, with responsiveness being much larger for two-hour events. For this segment, the elasticity of substitution for five-hour critical events equals a modest -0.0287, whereas for two-hour events, the elasticity of substitution equals -0.0800.

Table 3-8
Regression Results Examining Variation in Price Responsiveness Across Two-Hour and Five-Hour Critical Events

Customer Segment	Variable	Coefficient	Standard Error	t-statistic
LT20	Price Ratio	0.0258	0.0208	1.24
	(Price Ratio)x (CPP day)	-0.0425	0.0197	-2.16
	(Price Ratio)x (CPP day-2-hr event)	-0.0193	0.0147	-1.32
	EoS on normal weekdays	0.0258	0.0208	1.24
	EoS on critical days with 5-hr events	-0.0167	0.0137	-1.22
	EoS on critical days with 2-hr events	-0.0361	0.0115	-3.13
GT20	Price Ratio	-0.0449	0.0159	-2.82
	(Price Ratio)x (CPP day)	0.0162	0.0143	1.14
	(Price Ratio)x (CPP day-2-hr event)	-0.0513	0.0101	-5.11
	EoS on normal weekdays	-0.0449	0.0159	-2.82
	EoS on critical days with 5-hr events	-0.0286	0.0092	-3.12
	EoS on critical days with 2-hr events	-0.0800	0.0084	-9.51