OG&E SMART STUDY TOGETHER IMPACT RESULTS

Final Report – Summer 2011

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EXECUTIVE SUMMARY

The primary goal of OG&E's Smart Study TOGETHER® is to assess the impact of multiple levels of enabling technology combined with different dynamic pricing rates on a customer's energy consumption. To achieve this goal and enable effective and efficient targeting, a randomized sample of 2,816 residential participant and control group customers and 465 small commercial (general service) customers in the area of Norman, OK, was selected in the spring and early summer of 2010 as Phase I. Another sample of 2,412 residential customers and 712 small commercial customers were recruited between the summer of 2010 and the summer of 2011 as Phase II. The ultimate goal is to determine if the demand reductions achieved through a combination of price response programs, in-home technology, and energy awareness will allow OG&E to delay capital investments in incremental fossil fuel generation prior to 2020.

This report focuses on the results for the summer of 2011 based on difference estimation and regression analysis.

Residential and Small Commercial customers were offered two rates as part of the Smart Study TOGETHER project. Based on their random assignment, participants were offered either a Time-of-Use rate with a Critical Price component (TOU-CP) or a Variable Peak Pricing rate with a Critical Price component (VPP-CP). Customers in the control group were left on their existing standard rates. OG&E tested four technology options, including a web portal, an in-home display (IHD), a programmable communicating thermostat (PCT), and a combination of all three. Before the summer of 2011, all customers were given access to the web portal.

A randomized study design was implemented with participant and control groups to estimate the load reduction associated with each of the eight rate-technology combinations. Customers were then recruited to participate in the study, and data were collected over the summer of 2011. The analysis also used pre-participant data for the summer of 2010 for the Phase II customers.

This report provides summary information about the results of the study, with load reductions in tabular and graphical form, accompanied by comments.

There were four recommendations from the Residential analysis:

- The most effective rate/technology combination going forward for residential customers is the VPP-CP with PCT. This provides the flexibility of multiple price levels, the highest load reduction on the hottest days, and the automated response enabling the customer to choose between the relative importance of cost and comfort.
- With the current rates in place, in order to maximize the load reduction on the system peak day, or on any day when capacity is constrained, OG&E should set the VPP price as High, and then call a Critical Price event starting at 4 p.m. This will provide more continuous load reduction across the entire on-peak period, particularly at the time of the usual system peak.
- In the long term, OG&E should investigate adding a "super-peak" period, probably from 4 p.m. to 6 p.m., with a higher price than the on-peak period. This would allow the automated response of the PCTs to spread the savings more evenly over the entire on-peak period.
- Efforts to engage those customers with PCTs in using the Web Portal could increase load response over time going forward, enhancing the effectiveness of the program.

Additional highlights of the residential findings include:

- In general, the automated response of the PCT and All 3 groups reduce load more than the information provided through the IHD and Web Portal. However, the IHD and Web Portal

load reductions are more constant throughout the on-peak period, whereas the PCT and All 3 groups tend to have a load reduction spike at the beginning, and savings that decay later in the period. Generally, there was a significant rebound effect at the end of the on-peak period for the PCT and All 3 groups.

- There were differences between the results for the Phase I and Phase II residential customers. There was some indication that the Phase I customers, who have more experience with the rate, are learning how to respond better, enhanced by the information provided by the Web Portal and IHD. While the PCT provides much more load reduction with its automated response, it did not show the same learning effect, probably since it is not likely as conducive to learning as the Web Portal and the IHD.
- The TOU-CP treatment shows significant load reductions for all technology groups on both non-event weekdays and event weekdays for the Phase I customers. For the Phase II customers, however, only the PCT and All 3 groups showed statistically significant load reductions based on the direct load comparisons.
- The VPP-CP treatment shows significant load reductions for all except the low price days for Phase I for all technologies, and for the same days for PCT and All 3 for Phase II, based on the direct load comparisons. Based on the prices that were set during the study period, there was a positive relationship between price and load reduction.
- As temperature increases, with all else held constant, on-peak energy savings increases in nearly all cases.
- When events are called during the on-peak periods on any weekdays for the TOU-CP or on days that are not already critical price days for the VPP-CP, there is a secondary load drop at the start of the event. This fact will enable OG&E to maximize savings at the time of system peak, which occurs around 5 p.m.

Highlights of the Small Commercial analysis include:

- The Small Commercial customers are much more variable in load shape, magnitude, and response to price than the Residential customers, making the estimation and characterization of impacts more challenging. There are significant differences between the load shapes of Small Commercial customers in each of the rate/technology groups, so it is challenging to separate the effect of these differences from the effects of the rates and technologies.
- As with the residential, the automated response of the PCT and All 3 groups reduce load more than the information provided through the IHD and Web Portal.
- The Small Commercial customers respond with a greater load reduction during critical price events than on non-event weekdays. This could be due to the notice process, and customers giving more weight to something that is an "event".

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BACKGROUND

1.1 GOALS OF THE STUDY

The primary goal of OG&E's Smart Study TOGETHER is to asses the demand response achieved through various technologies and dynamic rate plans. The ultimate goal is to determine if the demand reductions achieved through this program will allow OG&E to delay capital investments in incremental generation resources. With a demand response of 1.3 kW per customer, and 20% residential and small commercial participation, OG&E hopes to gain roughly 210 MW of virtual generation that will contribute to this avoided generation.

The experiment is to determine the load reduction enabled by smart grid resulting from various combinations of dynamic rates and enabling technologies. OG&E is testing two rates, a time-of-use (TOU-CP) and a variable peak price (VPP-CP), both with a critical peak component for both residential and small commercial. The four technology options include a web portal, in-home display (IHD), programmable communicating thermostat (PCT), and a combination of all three. For the summer of 2011, all customers received access to the web portal, so the IHD and PCT groups have become IHD-Portal and PCT-Portal for the 2011 analysis. While estimating the average on-peak period load reduction is the most important goal of the study, we also estimate how much load has shifted to the off-peak period, and if there is an overall reduction in energy consumption.

This report includes both residential and commercial study results for the summer of 2011. The residential results are split based on the customers recruited before the summer of 2010, referred to as Phase I, and the customers recruited between summer of 2010 and summer of 2011, referred to as Phase II. Only the commercial customers recruited between summer 2010 and summer 2011 (Phase II) are analyzed here, since the initial sample of commercial customers recruited before summer of 2010 were not representative of the population and did not have a valid control group for comparison.

1.2 GUIDING PRINCIPLES

OG&E established ten guiding principles for the study. These principles were used throughout the planning, design, implementation, and analysis of the program.

- Demand Response (DR) results will be obtained through customer empowerment.
- OG&E will not utilize any direct control of customer equipment or appliances.
- Customers will be provided time differentiated pricing and be allowed to choose their balance between cost and comfort.
- Pricing (rates) will reflect true costs minimizing any subsidies within or across customer rate classes.
- It is anticipated that all future customer participation will be voluntary, thus participation in this research will also be voluntary.
- Enabling technology will be provided to customers at no cost.
- Customers will be encouraged to remain on the program for the entire length of the study and incentives may be required.
- A control group will be utilized to eliminate the impact of weather, economic conditions, fuel prices, and other non-controllable variables.

- The number of customers participating in both the study and the control group must be large enough to provide statistically significant results which can be applied to OG&E's entire customer base.
- The sample will include a cross-section of customers that correspond to the demographic makeup of OG&E's customer population, though not proportionally represented.

1.3 RATE OPTIONS

Residential customers were offered two rates as part of Smart Study TOGETHER. Based on their random assignment, participants were offered either a Time-of-Use rate with a Critical Price option (TOU-CP) or a Variable Peak Pricing rate with a Critical Price option (VPP-CP). Customers in the control group were left on their existing standard rates.

1.3.1 Critical Price Component

Each rate plan tested in this experiment includes a Critical Price component, or Price Overcall Provision. With a minimum of two hours notice, a critical price event can be issued to raise the price level to the critical price. A price overcall may occur at any time during the year for a period lasting not less than two hours and not more than eight hours. The maximum number of hours during any calendar year that can be designated by the Company as critical peak period hours is 120.

1.3.2 Time-of-Use with Critical Pricing

The TOU-CP uses the existing Residential and General Service TOU rate structure and includes the critical price component explained in section 1.3.1. During summer 2011, all the critical price events occurred on weekdays.

Table 1-1 TOU-CP Prices

Price Level	Residential TOU-CP Price	Commercial TOU-CP Price	Number of days in summer 2011 at each price level
Off-peak	4.2¢ per kWh	4.7¢ per kWh	36
On-Peak (weekdays)	23¢ per kWh	30¢ per kWh	86
Critical Events	46.0¢ per kWh	60.0¢ per kWh	7 (also included in the 86 weekdays)

1.3.3 Variable Peak Pricing

The VPP-CP was designed using the existing Residential TOU rate structure. The peak period price in the TOU rate is replaced with one of four variable prices explained in Table 1-2. A single price will apply to the entire five-hour on peak window each weekday. There are four defined price levels – Low, Standard, High, and Critical – to simplify communications of price level. The prices assigned to each price level are based on the underlying Standard and TOU tariffs. Low prices, at 4.5¢ per kWh, are similar to Off-peak energy prices, Standard prices equate to the standard tariff summer season tail-block price, and High and Critical prices reflect the peak period energy prices.

The VPP-CP also includes the critical price component explained in section 1.3.1.

The Day-Ahead On-Peak Prices for VPP-CP are communicated to the customer by 5:00 PM on the previous day via email, text message and/or voicemail. On-Peak Hours are from June 1 through September 30, beginning each day at 2:00 PM and ending at 7:00 PM, local time, excluding Saturdays, Sundays, Independence Day (as observed) and Labor Day. Off-Peak hours are defined as all hours that are not On-Peak hours. Table 1-2 shows the prices for the VPP-CP rate. Because the critical events fell on different day types, the event days are also included in the count of the number of days at the various price levels.

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Table 1-2 VPP-CP Prices

Price Level	Residential VPP-CP Price	Commercial VPP-CP Price	Number of days in summer 2011 at each price level
Low and off-peak	4.5¢ per kWh	5.0¢ per kWh	63
Standard	11.3¢ per kWh	10.0¢ per kWh	25
High	23.0¢ per kWh	30.0¢ per kWh	28
Critical	46.0¢ per kWh	60.0¢ per kWh	6
Critical Event	46.0¢ per kWh	60.0¢ per kWh	7 (included in the above)

1.4 TECHNOLOGY OPTIONS

OG&E is testing four technology options:

- Web portal- an energy information website providing customers with 15 minute interval data updated every 15 minutes, neighborhood comparisons, bill estimates, environmental impacts, as well as tips and tools to manage energy consumption.
- In-home display (IHD) - a countertop display providing customers with near real-time demand, estimated monthly cost and current price.
- Programmable communicating thermostat (PCT) - a customer controlled device with current pricing information which allows automation of comfort settings based on current energy prices.
- Combination of All 3- a combination of all three treatments: web portal, IHD and/or PCT

Customers that choose to participate in Smart Study TOGETHER were randomly assigned to one of the above technology configurations or to the control group.

1.5 SYSTEM LOAD CHARACTERISTICS

Because the pilot targets system peak reduction, it is important to consider the nature of the OG&E system load. The 2011 OG&E system peak of 6,509 MW occurred at the hour ending 4:00 PM on August 3. This summer system peak is much higher than the winter peak of 4,580 MW, which occurred on February 10 at the hour ending 8:00 AM.

Figure 4-1 below shows the system load shape for the 2011 system peak day. Note that the system load during the peak period is fairly flat, but does drop a bit late in the on-peak period. The system load during the two hours on either side of the peak is greater than 97% of the actual peak, and the hour before the peak is within 1% of the actual peak. This means that reducing just the specific hour of the system peak will not significantly reduce OG&E's capacity requirements – load must be reduced in all of the peak hours.

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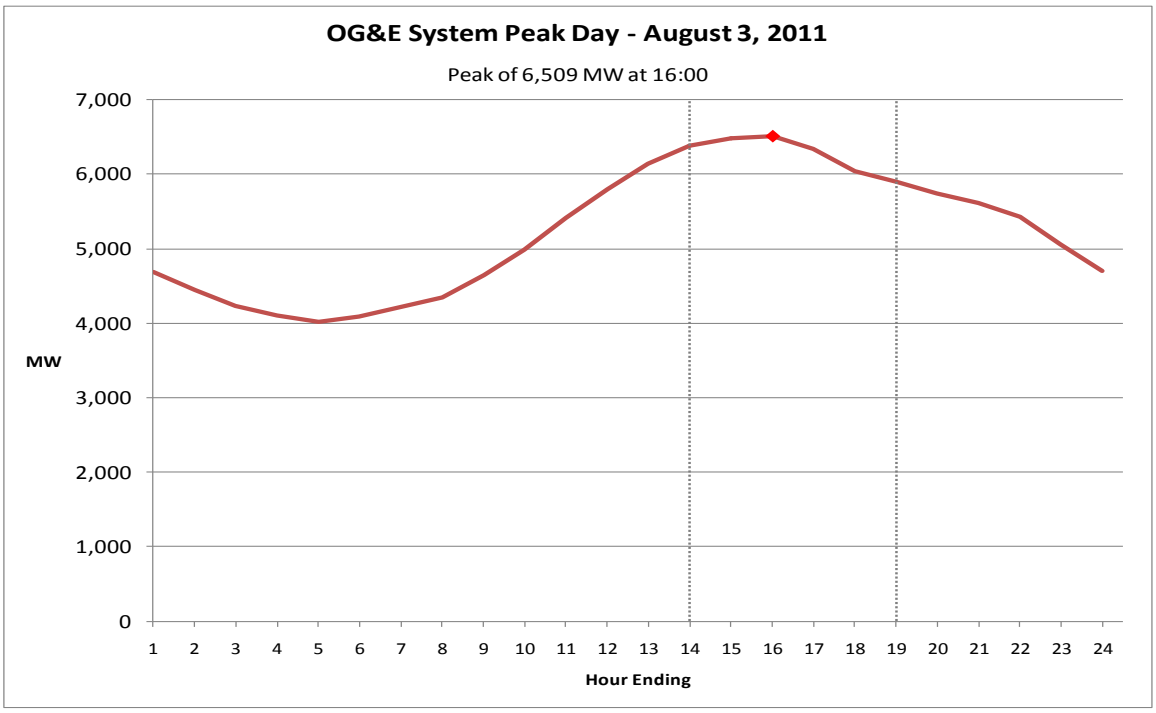

Figure 1-1 System Load on the summer peak day, August 3, 2011

Also important is the number of hours throughout the year that the system load is at or near the system peak. The best way to examine the nature of the relative magnitude of the system load throughout the year is a load duration curve. A load duration curve is a graph showing the system load for all 8,760 hours of the year, sorted from highest to lowest. Figure 1-2 shows a load duration curve for OG&E, based on the data available (through November) as of the writing of this report. Because the load duration curve drops off relatively quickly, load reduction in a few hours each year can reduce the capacity needs of the system significantly. In fact, the load exceeds 92% of the peak for less than 1% of the hours in the year.

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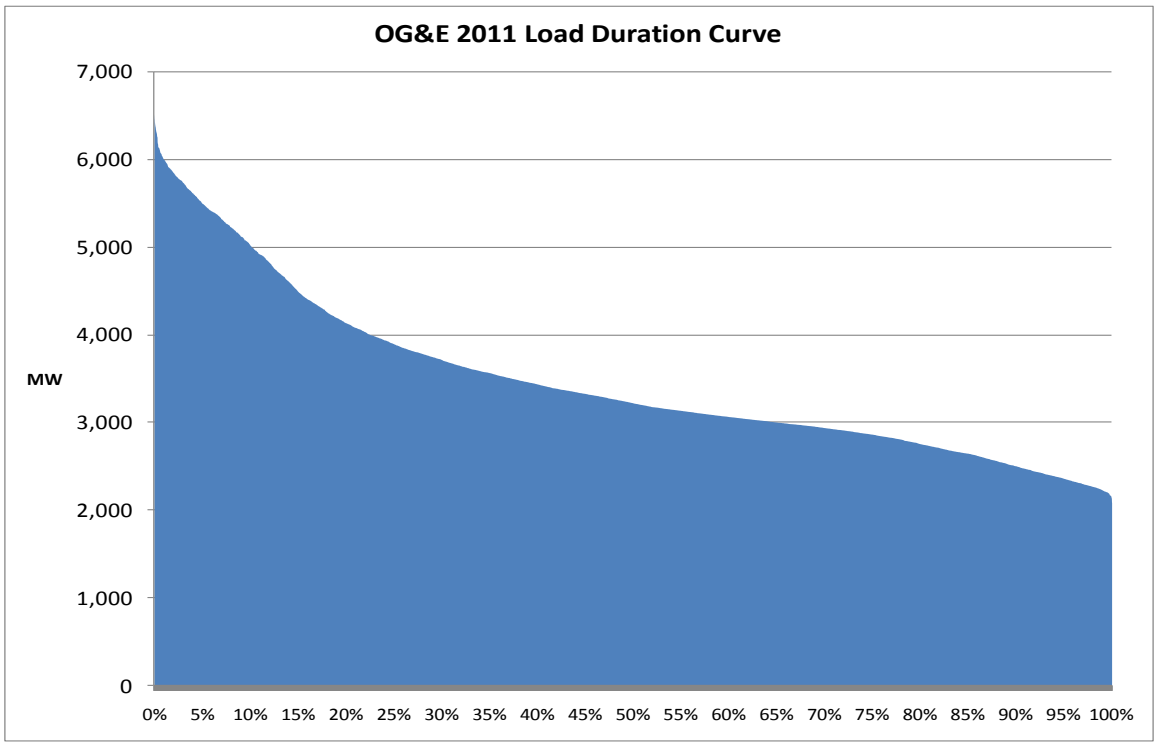

Figure 1-2 System Load Duration Curve for OG&E for January-November 2011

The nature of the OG&E system load is such that a technology-enabled pricing offering of the types offered in this pilot has the potential to reduce system capacity requirements significantly, potentially enough to eliminate the need for the two peaking units described above.

1.6 DEFINITIONS

We list some definitions of terms that are used throughout the report here as a reference.

- Cooling Degree Day (CDD) - the difference between the average of the high and low temperature for that day and a base temperature. For the regression model, we used a base of 70 degrees.
- Critical Price Event (CPE)- a provision of the VPP and TOU rate plans that sets the highest price (46 cents for residential, 60 cents for commercial) during a specified previously unscheduled time period (the event period.) This event replaces any previously applicable price message the customer had received for that time period.
- IHD – in-home display.
- PCT- programmable communicating thermostat.
- Phase I- participants in Smart Study Together who were recruited prior to June 1, 2010 and participated in both the summer 2010 study and the summer 2011 study
- Phase II- participants in Smart Study Together who were recruited after the conclusion of summer 2010 to participate in summer 2011 study. These customers also had interval data available for most or all of the summer of 2010, before they became participants.
- TOU-CP – Time-of-Use rate with a Critical Price component.
- VPP-CP – Variable Peak Pricing rate with a Critical Price component.

EXPERIMENTAL DESIGN

2.1 STUDY DESIGN

The experimental design for this study involved two stages. The first stage (Phase I participants) with analysis of summer 2010 summarized in a previous report, included participant and control group customers recruited in the spring of 2010. This first stage included both residential and commercial, however the commercial recruiting was insufficient to provide anything other than anecdotal results. Residential customers in Phase I also did not have any pre-participation interval data, since they went onto the new rates shortly after they received their smart meters.

The second stage (Phase II) includes both residential and commercial customers recruited after the summer of 2010, but before the summer of 2011. These customers have interval data for both the pre-participation period (summer of 2010, starting no later than July 1) and for the summer of 2011. This allows for the estimation of savings using a difference of differences approach, which corrects for pre-participation differences in the estimation of savings.

For the study, we collected interval data using smart meters from a sample of customers to estimate the load reduction resulting from various combinations of dynamic rates and enabling technologies. The two rates and four technology options described above result in eight combinations (referred to as treatments), with a separate sample of participating customers needed for each. For the analysis, we also need a control group of customers who are as similar as possible to those in each of the treatment (rate-technology combination) groups. We estimate the load reduction by comparing the load for the customers with each rate-technology combination with the load for customers in the control group. We make this comparison for several different day types, including average weekend days, average weekdays, event days, and average days for the various price levels for the VPP-CP rate. In addition to a direct comparison, we also use a statistical regression model, which quantifies the variability from all other known sources (appliances, building size, etc.) and removes that from the estimate of load impact. This allows us to estimate the load impact for different temperatures independent of price.

One important consideration was how to assign customers to the different rate-technology options and the control group. Because OG&E is planning to offer dynamic rates on a voluntary basis, it was most appropriate to recruit customers to volunteer to participate. However, since OG&E needs to determine the best option for rate and technology implementation, it was appropriate to randomize the assignment of customers to the 8 participant cells. This allows for direct and unbiased comparison of the rate-technology options. If customers were given a choice, then the results for, say, the IHD group would not apply to all customers, but only to those customers who would choose an IHD when the program is implemented. Also, it was critical to assign customers who volunteer randomly to the control group as well. This may seem strange, but the control group should include customers who are as much "like" those in the participant groups as possible. It was made clear to these customers that they were not on the rate, and would not receive any technology. Because the control group was to be compared with all eight of the participant groups separately, we decided to double its sample size to improve the precision of all estimates.

Two of the technologies, PCT and Web Portal, require specific customer qualifications. If a customer does not have central AC, they cannot be assigned to PCT. If a customer does not have internet access, they cannot be assigned to Web Portal. Because of this, all customers assigned to either of these groups were also given a secondary random assignment. During the initial contact, if a customer assigned to PCT reported that they did not have central AC, then they were given their secondary assignment. If a customer assigned to Web Portal reported that

they did not have internet access, then they were given their secondary assignment. This was asked before they were offered anything, so the customers never knew if they were receiving their original assignment or their secondary assignment. We considered the same approach for the All 3 technology group, but chose not to implement it. If in an eventual system-wide rollout, all three technologies were offered to all customers, there would be a mix of customers with and without central AC and with and without internet access. In those cases, the customers would receive those technologies which they qualified for, so we decided to emulate that with the study. In conclusion, the load reductions for the All 3 category reflect a mix of customers, most of which have all three, but some of which have only one or two of the three.

2.2 RANDOMIZATION

In order to implement a randomized design, all eligible customers were randomly preassigned to either one of the participant groups or the control group. This was done before recruiting started, so that then when customers called in or went online to join the study, the assignment was already determined. In order to optimize survey data collection and ensure consistent data, each interested customer first responded to a survey, and then was either told what their preassigned rate technology combination was, or if they were in the control group, they were told that they were not eligible to participate this year. As a result, we had survey data for all customers, both participant and control.

2.3 PRE-PARTICIPATION DATA

Because the meters for Phase I were installed in the spring and early summer of 2010, the analysis of customers in Phase I did not allow for the use of any pre-participation data. In a designed statistical experiment of this type, having data for both before the rate and technology start and after they are in place allows adjustment of the results for any pre-participation differences between the participant and control groups. This was used for Phase II, but was not possible with Phase I, since there was not interval data available for the Phase I customers before the smart meters were installed. This made the randomized assignments to participant and control even more important for this phase, since randomization is an effective way to ensure that pre-participation differences are minimized and groups of customers are similar. However, pre-participation data were available for Phase II, so the analysis of that phase includes correction for any pre-participation differences.

2.4 SUMMARY OF ANALYSIS METHODS AND DIFFERENCES BETWEEN PHASE I AND PHASE II

As described in the sections above, there are many similarities between Phase I and Phase II, but also some important differences. Any comparisons between the groups must include considerations of the following summary of the differences:

- Phase I customers were recruited in the spring of 2010, from the city of Norman. Phase II customers were recruited between the fall of 2010 and the spring of 2011, from a broader area that included Norman and areas around Oklahoma City.
- The rate/technology cells for Phase I were "capped," meaning that when the recruiting goals were met for a given rate/technology combination, no additional customers were allowed to enroll in that treatment. For Phase II, recruitment for all treatments was kept open for the same period of time. The marketing for Phase II was done based on the recruiting rates experienced in Phase I, so that when recruiting was completed, the number of customers in each cell was approximately the same.
- Phase I customers do not have any interval data available from before they went on the rates. Phase II customers have interval data available for both before and after they went on the new rates and received their technology.
- With the differencing estimation, Phase I customers are analyzed by calculating the difference between participant and control group loads. Phase II customers are analyzed by adjusting the difference between participant and control group loads by the

pre-participation differences between the two groups, using a difference of differences method.

- With the Regression estimation, the effect described in the previous bullet is mitigated somewhat in that both phases are analyzed together. Since both the participant groups and the control groups are combined, different time periods are used differently for the two phases. The baseline (non-participation) estimates are based on both summers for both control groups and on the first summer for the Phase II participants, since that was before they were recruited into the program. The savings estimates are based on both summers for the Phase I participants, and only the second summer for the Phase II participants.
- During the summer of 2011, Phase I customers are in the second summer of participation in the program. Phase II customers are in the first summer of participation in the program.
- Phase II includes commercial customers as a separately analyzed group, but Phase I includes only residential customers.

Any comparison between the 2010 and 2011 results for Phase I customers should also include consideration of the dramatic differences between the weather during the two summers. The summer of 2011 was much hotter than summer 2010. Summer 2011 also included seven event days, whereas 2010 had only two. Lastly, as described below under the section Data Editing and Exclusions, additional data filtering and editing were done for the data used in this report that were not done on the data used in the report based on the summer 2010. As part of the analysis for this report, we did perform consistent edits for both summers. Where we comment on how the results for the Phase I customers changed between the years, we are comparing the results based on the consistent data treatment.

After completing the difference analysis for the residential customers, we also performed a regression analysis, looking at how on-peak energy depended on many factors, some unrelated to participation, and others related to participation. Because this approach looks at price and participation separately from temperature, we were able to look at how price affects savings at different temperatures. The regression model has variables that explain how savings change based on cooling degree days (CDD) for different technologies and on differently-priced days. This allows us to determine how much of the increase in savings for higher-priced days is due to the price, and how much is due to the fact that higher-priced days tend to be hotter.

However, the regression model we used was based on on-peak energy, not on hourly demands. Modeling hourly demands is much more complex and introduces significant mathematical difficulty, so we chose the more tenable on-peak energy model. As a result, the model provides kWh savings, but does not tell us how those savings are distributed across the five hours of the on-peak period. In order to distribute the savings across the hours, we integrated the two methods. We used the savings shapes from the differencing methods for the appropriate day type (we chose the Phase II savings shapes, since those should be more robust, being corrected for pre-participation differences) to distribute the kWh savings from the regression model across the five on-peak hours.

We also separated the effect of central AC on savings for all but the PCT customers in the regression model. The model uses the information about whether the customer has Central AC or not to estimate both the baseline consumption and the savings, including the relationship between savings and CDD.

Because the event start and stop times varied across the events, and because the event savings depended on the price already set on that day, the relationships between energy, weather, and price for event days was far too complex to be estimated with a regression model based on the seven events called in 2011 and the two called in 2010. As a result, the estimation of the impact of events is only based on the differencing estimation.

2.5 PCT AND CENTRAL AIR CONDITIONING CONSIDERATIONS

The programmable communicating thermostat requires specific customer qualifications. A customer home must have central air conditioning in order to receive a PCT. Consequently, we can assume that anyone with a PCT has central AC. Given that the PCT group consists of customers with central AC only, a comparable control group is used. Direct load comparisons and savings estimates for the PCT group are calculated with a control group of customers with central AC. All load shapes, savings shapes, consumption and savings estimates in this report will reflect this when referring to the PCT group.

IMPLEMENTATION

3.1 RECRUITING

For Phase I, recruiting started early in 2010, with the target of recruiting 2,400 customers evenly distributed across the eight participant groups, as shown in Table 3-1 below. Phase II recruiting began in late 2010, and continued through June 1 of 2011. This table reflects the rate-technology options that were used for recruiting.

Table 3-1 Smart Study TOGETHER Residential Recruiting as Designed (same for both Phases)

	Control	TOU-CP	VPP-CP	Total
Control	480	-	-	480
Web Portal	-	240	240	480
IHD	-	240	240	480
PCT	-	240	240	480
All 3	-	240	240	480
Total	**480**	**960**	**960**	**2,400**

With the recruiting complete as of June 30, 2010, there were 2,667 residential customers recruited for the study. Since that time, there has been attrition, which has reduced the number of customers still in the study for the summer of 2011.

The Phase II commercial recruiting was done in parallel with the Phase II residential recruiting, with the target of recruiting 660 customers as shown in Table 3-2 below.

Table 3-2 Smart Study TOGETHER Commercial Recruiting As Designed (Phase II)

	Control	TOU-CP	VPP-CP	Total
Control	132	-	-	132
Web Portal	-	66	66	132
IHD	-	66	66	132
PCT	-	66	66	132
All 3	-	66	66	132
Total	**132**	**264**	**264**	**660**

The recruiting goals for each cell were further subdivided to target one third of each cell in each age segment, and one third to target each income segment.

3.2 RECRUITING LIMITS

The Study was designed to include approximately the same number of customers assigned to each rate/technology combination and age/income group. During the Phase I recruiting, this was accomplished by capping the number of customers recruited into each cell. The result of

this was that certain cells that filled up more quickly had more customers who signed up earlier in the recruiting period, and no customers who signed up late in the recruiting period. Other cells had relatively few customers who signed up early in the recruiting period, and a higher percentage of those who signed up later in the period. If there is a significant difference between the behavior of customers who sign up early in the period and those who sign up later in the period, then this would affect the impact estimates for the different rate/technology combinations and age/income segments.

In order to remove any potential effect from the capping of cells during recruiting, Phase II was set up to market to customers inversely to the recruiting rates seen in Phase I. So in those cells with higher recruiting rates, fewer customers received marketing materials. In those cells with low recruiting rates, all customers received marketing materials. This resulted in roughly comparable sample sizes across the cells, but also included the same time frame for recruiting across all cells.

3.3 DIFFERENCES BETWEEN ASSIGNMENTS AND ACTUAL INSTALLATIONS

As described above, customers were randomly preassigned to either the control group or to one of the eight rate-technology groups. These assignments determined the enabling technology or technologies that participants would receive, which would then be used to distinguish participant cohorts during the analysis. Customers in the control group were not to receive any enabling technologies. Participant group customers, on the other hand, would receive what was designated by their primary assignment, or if they did not qualify for that, then by their secondary assignment. Most of the time, installed technologies matched assigned technologies. In addition, for all customers in the control group, technology installations were handled properly. That is, no control group customers received enabling technologies. There were a few instances where the installed technologies for some participants did not match the assigned technologies. In these cases, we excluded the customers whose rate/technology combination was not compatible with the groups defined by the study, or reassigned those who matched another rate/technology group. This involved relatively few customers.

3.4 DATA EDITING AND EXCLUSIONS

It was not possible to include every participant we had interval data for in the analysis. Two main reasons prevented customers from being used. The first was related to rate and technology group classification. Some customers were put on the rate, but not given any technology, or were given a technology but not put on a TOU-CP or VPP-CP rate, and so were excluded from the analysis.

The second reason we excluded customers had to do with missing or erroneous usage data, including exceptionally high values and excessive zero values. For the analysis included in this report, we validated and edited the interval data more than in the last report. For those residential customers with abnormally high spikes in single intervals (on the order of tens of thousands of kW), the spikes were removed and were replaced using linear interpolation, connecting the point before and after the spike with a straight line. In one case, there was a series of very high intervals, and the day that included these intervals was removed from the analysis. Because of the volatility of commercial loads, we did not intend to edit the commercial interval data, but we discovered an enormous spike, going from 0.003 kW on either side of it to 22,500 kW at the peak. We edited these intervals using the same method described above, which simply meant replacing the spike value with 0.003 kW.

Because it is uncommon for any residential customer to have zero electricity consumption for any significant length of time, we looked at those customers with zero interval values more closely. We discovered that in some cases, when a meter was replaced, there were zero values for a partial day or more before data appeared for the customer. The zero intervals were changed to missing values, meaning that they were not included in any calculations, but the valid usage data for the rest of the day was used. In addition, for residential customers, we also changed zero intervals in the following way. If a record had more 50% of its intervals equal to zero, the entire record was excluded. In addition, if a record had more than three consecutive zeros (a zero load

for an entire hour), we set all zeros on that day to missing, but included the non-zero data in the record.

Because zero intervals for commercial establishments are much more common, we did not edit zero values for commercial customers other than when a meter was changed. An example of this is parking lots, which only use electricity for part of the day.

One additional, but important and perhaps obvious point is that when interval data was missing for customers, those intervals were not included in the analysis.

The regression analysis required survey data in order to quantify the energy use of the home. As a result, there were some customers that were excluded from this analysis because they had not completed the survey during enrollment.

3.5 SAMPLE SIZES USED FOR ANALYSIS

Using the actual technology assignments as described above, Table 3-3, Table 3-4, and Table 3-5 show the number of customers in each rate-technology group that were used in the analysis. The distribution of residential participants across rate categories for each technology group is roughly equivalent and is what we would expect based on the randomization of the preassignments. The distribution of commercial participants is skewed to include more Portal Only customers. We believe this is due to commercial customers' lower interest in the other enabling technologies, resulting in fewer agreeing to participate once they were contacted.

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Table 3-3 Smart Study TOGETHER Sample Sizes Used – Phase I Residential

	Control	TOU-CP	VPP-CP	Total
Control	488	-	-	488
Portal Only	-	255	261	516
IHD, Portal	-	217	210	427
PCT, Portal	-	191	200	391
All 3	-	218	218	436
Total	**488**	**881**	**889**	**2,258**

Table 3-4 Smart Study TOGETHER Sample Sizes Used – Phase II Residential

	Control	TOU-CP	VPP-CP	Total
Control	511	-	-	511
Portal Only	-	273	298	571
IHD, Portal	-	223	232	455
PCT, Portal	-	221	227	448
All 3	-	212	215	427
Total	**511**	**929**	**972**	**2,412**

Table 3-5 Smart Study TOGETHER Sample Sizes Used – Phase II Commercial

	Control	TOU-CP	VPP-CP	Total
Control	239	-	-	239

Portal Only	-	98	101	199
IHD, Portal	-	48	46	94
PCT, Portal	-	46	36	82
All 3	-	51	47	98
Total	**239**	**243**	**230**	**712**

Table 3-6 Smart Study TOGETHER Sample Sizes Used – Residential Regression Analysis

	Control	TOU-CP	VPP-CP	Total
Control	804	-	-	804
Portal Only	-	507	545	1,052
IHD, Portal	-	438	436	874
PCT, Portal	-	411	426	837
All 3	-	428	428	856
Total	**804**	**1,784**	**1,835**	**4,423**

3.6 EVENT AND NON-EVENT DAY SUMMARY

In 2011, there were 7 event days called, with varying lengths and varying advance notice times, shown below in Table 3-7. Four were called on days that had already been set as VPP High price days and one each on VPP Critical, Standard, and Low price days. Five of the seven event days had high temperatures over 100, with only one mild day with a high temperature of only 86.

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For the first two event days, the event period completely covers the on-peak period, but for the other 5, the day includes both critical event periods and "regular" on-peak periods.

Table 3-7 Smart Study TOGETHER 2011 Event Days Called

Date	Start Time	End Time	Notice	Original VPP Price Level	Daily Low	Daily High	70˚ Base CDD
7/8/2011	1:00 PM	7:00 PM	2 hours	High	79	99	19
7/15/2011	1:00 PM	9:00 PM	3 hours	High	76	103	19.5
8/8/2011	4:00 PM	6:00 PM	2 hours	Critical	79	107	23
8/24/2011	4:00 PM	6:00 PM	Day ahead	High	78	107	22.5
9/1/2011	3:00 PM	7:00 PM	2 hours	High	73	102	17.5
9/13/2011	1:00 PM	5:00 PM	Day ahead	Standard	73	101	17
9/27/2011	4:00 PM	6:00 PM	Day ahead	Low	56	86	1

The temperatures on the non-event days affected the impacts for those days as well. Table 3-8 shows the range of average daily temperature (the average of the high and the low for the day) for the non-event weekdays for the TOU and for each price level of the VPP.

Table 3-8 Smart Study TOGETHER Non-Event Days

	2010			2011			
Day Type	**Lowest Avg Temp**	**Average of All Days**	**Highest Avg Temp**	**Lowest Avg Temp**	**Average of All Days**	**Highest Avg Temp**	**Overall 2 Year Average**
TOU	61.5	80.9	91.5	57.5	83.1	95	82.0
VPP-CP Low Price	61.5	74.3	81	57.5	73.4	85	73.7
VPP-CP Standard Price	74.5	79.9	85.5	75	86.0	91.5	82.3
VPP-CP High Price	80.5	84.5	91.5	83.5	88.4	93.5	86.5
VPP-CP Critical Price	80.5	86.6	90.5	93	94.4	95	89.2

RESULTS

The estimation of the impact of Smart Study TOGETHER was done in two segments. First, the savings were estimated by day type and for event days for both the residential and the commercial customers using a differencing approach, where load shapes for participants were compared directly with load shapes for control group customers. Then we also used a regression modeling approach, where a statistical model was used to estimate how different factors influenced on-peak energy use, including variables related to participation. The coefficients of the participation variables were then used to estimate the impact of the different daily prices and technologies on on-peak energy use. In this section, we present the results from both analysis approaches.

The differencing estimation was completed as follows. Using the interval data collected for customers in the study, along with the actual assignments described above, the impacts for the summer of 2011 for the two phases were estimated in similar but slightly different ways. For Phase I participants, the savings for each day type were estimated as follows. We first calculated the average hourly load for each day type for each customer. Since these were based on actual measured data for the days, these were not statistical estimates and so had no uncertainty associated with them. Then for each rate-technology combination and for the control group, we calculated an average day type load shape for each demographic combination segment (age and income), and then weighted those segments based on the OG&E service territory proportions in each segment. This adjusted the relative representation of the different demographic segments to correspond to OG&E's service territory instead of to the roughly equivalent sample sizes from the sample design. We also calculated the associated variances and 90% confidence intervals for these estimates. The participant and control group load shapes in the graphs in this section are the result of these calculations.

We then calculated the savings as the difference between the control group load and the participant group load for each day type, for each rate-technology combination. We used the variances of the load shape estimates to calculate the 90% confidence intervals for the savings as well.

For Phase II participants, we also estimated the difference between the control group load and the participant group load for each day type and rate-technology combination for the summer of 2010, which was before the Phase II customers went on the rates and received the technologies. Then this "first difference" was subtracted from the control group load for each day type and rate-technology-segment combination during the summer of 2011 to create an adjusted control group load, with the segments then combined as described above. This calculation results in a control group load adjusted for the pre-existing differences between the participant and control groups. Because this adjustment differs across the rate/technology groups, the adjusted control group loads also differ. The last step of the process for Phase II is to calculate the savings as the difference between this adjusted control group and the participant group for each day type and rate-technology combination.

The commercial group for Phase II was treated the same way as the residential group, except that there was no segmentation for the commercial customers, so the step of combining segments was not needed.

The regression estimation was done only for the residential customers, and was run using the combined group of all Phase I and Phase II customers. For this analysis, the on-peak energy was calculated for each customer for each non-holiday weekday by summing the energy for each interval during the on-peak period. Both summers were included, and event days were excluded,

since on-peak energy use would be influenced by the events on those days. This on-peak energy was the dependent variable in the regression model. The model looks at on-peak energy as a function of numerous other variables, and estimates the coefficients of the variables in that function.

The variables included information from the survey, from weather databases, and information related to participation. Conceptually, information not related to participation went into the model to estimate the baseline on-peak energy use based on all customers (Phase I and Phase II participants and control groups), and the participation variables (in some cases interacted with weather data) estimate the program impacts. The number of Cooling Degree Days (CDD) for each day was used in the model, both with and without participation, so that the relationship between energy use and temperature as well as savings and temperature is quantified by the model.

Once the model was estimated, the savings for each price level and technology were estimated using the model coefficients based on several daily average temperatures. Where the savings differed between customers with and without Central AC, two savings estimates were calculated.

4.1 OVERALL RESULTS BY PHASE, RATE AND TECHNOLOGY

This section presents the results for each phase the entire rate-technology group, combining all demographic segments for residential. As described above, the residential demographic segments are weighted to reflect the overall mix of customers in OG&E's service territory.

4.1.1 Average Non-Event Day Impacts

We start with the impacts on non-event days. Table 4-1, Table 4-2, Table 4-3, and Table 4-4 below show, for on-peak and off-peak times, the kWh baseline consumption (from the adjusted control group), the associated kWh and percentage change in consumption, as well as the overall kWh change for each day type and each rate-technology combination, for Phase I Residential, Phase II Residential, Residential regression, and Phase II Commercial, respectively. Note that for Phase I, on a given day type, baseline consumption is different for the PCT group than it is for the other technology groups. This is as a result of the PCT group control group being comprised of customers with central AC only. For Phase II, for both residential and commercial, baseline consumption is different for every technology group as a result of the difference of differences adjustment to the control group. Note that throughout the report, we present consumption reductions as negative numbers, and increases as positive numbers. However, we report demand in terms of savings, so that positive savings means less energy consumed. Also note that there is no on-peak period on weekends, so all consumption is reported as off-peak.

The regression only estimates on-peak savings (which only apply to weekdays), and includes estimates at 6 different average temperature values. These average temperatures represent the average of the high and the low for each day, which is the value used for the calculation of CDD.

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Table 4-1 Non-Event Day Average Customer Consumption – Phase I Residential

	On-Peak Consumption			Off-Peak Consumption			Overall
	Baseline	Change	Percent	Baseline	Change	Percent	Change
TOU-CP Weekend Non-Event							
Portal Only				63.94	-2.43	-3.81%	-2.43
IHD, Portal				63.94	-6.44	-10.07%	-6.44
PCT, Portal				61.92	-0.68	-1.10%	-0.68
All 3				63.94	-2.92	-4.57%	-2.92
TOU-CP Weekday Non-Event							

Portal Only	17.31	-2.47	-14.27%	41.65	-0.78	-1.87%	-3.25
IHD, Portal	17.31	-3.51	-20.29%	41.65	-3.27	-7.84%	-6.78
PCT, Portal	16.78	-4.42	-26.33%	40.42	0.93	2.31%	-3.49
All 3	17.31	-4.76	-27.47%	41.65	-1.29	-3.10%	-6.05
VPP-CP Weekend Non-Event							
Portal Only				63.94	-2.50	-3.90%	-2.50
IHD, Portal				63.94	-4.71	-7.37%	-4.71
PCT, Portal				61.92	2.97	4.80%	2.97
All 3				63.94	-4.34	-6.78%	-4.34
VPP-CP Low Weekday Non-Event							
Portal Only	12.05	-1.08	-8.99%	28.55	-1.40	-4.90%	-2.48
IHD, Portal	12.05	-1.23	-10.24%	28.55	-1.84	-6.43%	-3.07
PCT, Portal	11.49	-0.17	-1.49%	27.36	1.65	6.04%	1.48
All 3	12.05	-1.20	-9.97%	28.55	-1.76	-6.15%	-2.96
VPP-CP Standard Weekday Non-Event							
Portal Only	18.99	-2.42	-12.75%	45.34	-0.73	-1.61%	-3.15
IHD, Portal	18.99	-2.42	-12.77%	45.34	-2.22	-4.91%	-4.65
PCT, Portal	18.43	-3.27	-17.73%	43.97	3.00	6.83%	-0.26
All 3	18.99	-4.91	-25.87%	45.34	-3.05	-6.72%	-7.96
VPP-CP High Weekday Non-Event							
Portal Only	20.33	-2.95	-14.52%	49.32	-0.37	-0.74%	-3.32
IHD, Portal	20.33	-3.06	-15.07%	49.32	-1.77	-3.58%	-4.83
PCT, Portal	19.81	-4.05	-20.43%	48.12	4.29	8.92%	0.24
All 3	20.33	-5.86	-28.81%	49.32	-1.85	-3.76%	-7.71
VPP-CP Critical Weekday Non-Event							
Portal Only	22.63	-3.15	-13.94%	56.35	1.74	3.09%	-1.41
IHD, Portal	22.63	-3.35	-14.82%	56.35	-0.80	-1.43%	-4.16
PCT, Portal	22.46	-5.06	-22.54%	55.63	6.91	12.42%	1.84
All 3	22.63	-6.75	-29.82%	56.35	-1.00	-1.78%	-7.75

For all non-event weekdays across all prices, the Phase I residential customers reduce consumption during on-peak times. For the VPP-CP groups, as expected, the consumption savings increases as the price level increases. The percentage savings increases as price increases in most cases, except for the change from the High to the Critical price days, which is roughly flat. This is because the Critical price days tend to be the hottest days, and so the baseline consumption increases by the same percentage as the actual usage. Except at the lowest VPP price, the PCT and All 3 groups, which automate the response through the use of the PCT, show the biggest savings in on-peak energy use.

The change in off-peak consumption is mixed. For the TOU-CP group, usage drops for all groups on weekends, when prices are lower. This is probably due to increased awareness of energy use, which tends to result in lower energy use. The same is true for all the VPP groups with the exception of the PCT group. The decrease in energy use is largest for those with IHDs, which may be enabling the customers to identify and eliminate behavior that results in wasteful energy use, regardless of when it occurs. Across the board for all prices, the PCT group has consistently the largest increase in off peak use. This is primarily driven by the rebound effect after the end of the on-peak period each day, when the price decreases and the PCT setpoint is reduced. The magnitude of the rebound effect also increases with price, and four three of the four VPP price levels, the net change for the day type is positive, meaning that the rebound increases energy more during off-peak times than the price signal reduces it during the on-peak period.

Table 4-2 Non-Event Day Average Customer Consumption – Phase II Residential

	On-Peak Consumption			Off-Peak Consumption			Overall
	Baseline	Change	Percent	Baseline	Change	Percent	Change
TOU-CP Weekend Non-Event							
Portal Only				58.53	-2.50	-4.28%	-2.50
IHD, Portal				57.98	-1.07	-1.84%	-1.07
PCT, Portal				59.57	-1.19	-2.00%	-1.19
All 3				61.68	-1.40	-2.27%	-1.40
TOU-CP Weekday Non-Event							
Portal Only	15.63	-1.41	-9.04%	38.04	-0.52	-1.37%	-1.93
IHD, Portal	15.62	-1.09	-7.00%	38.74	-0.29	-0.76%	-1.39
PCT, Portal	16.25	-4.18	-25.73%	39.36	0.89	2.27%	-3.29
All 3	16.43	-3.54	-21.52%	40.93	0.78	1.92%	-2.75
VPP-CP Weekend Non-Event							
Portal Only				60.62	-2.30	-3.80%	-2.30
IHD, Portal				58.20	-0.72	-1.24%	-0.72
PCT, Portal				61.74	0.98	1.59%	0.98
All 3				58.42	0.40	0.69%	0.40
VPP-CP Low Weekday Non-Event							
Portal Only	12.09	-1.06	-8.79%	28.87	-1.50	-5.19%	-2.56
IHD, Portal	11.07	-0.38	-3.46%	26.51	0.00	-0.01%	-0.38
PCT, Portal	11.94	-0.75	-6.31%	27.75	0.64	2.32%	-0.11
All 3	11.27	-0.49	-4.32%	26.41	0.08	0.29%	-0.41
VPP-CP Standard Weekday Non-Event							
Portal Only	17.78	-1.36	-7.64%	43.80	-1.10	-2.51%	-2.46
IHD, Portal	17.06	-1.30	-7.62%	41.67	-0.51	-1.21%	-1.81
PCT, Portal	17.98	-3.93	-21.85%	43.60	1.50	3.45%	-2.42

All 3	17.28	-3.19	-18.44%	41.83	0.69	1.66%	-2.49
VPP-CP High Weekday Non-Event							
Portal Only	18.82	-1.39	-7.38%	47.27	-0.22	-0.46%	-1.61
IHD, Portal	18.17	-1.19	-6.54%	44.99	0.08	0.17%	-1.11
PCT, Portal	19.27	-4.73	-24.53%	47.49	2.37	4.98%	-2.36
All 3	18.65	-4.02	-21.57%	46.09	1.41	3.05%	-2.62
VPP-CP Critical Weekday Non-Event							
Portal Only	20.92	-1.22	-5.83%	54.74	-0.36	-0.65%	-1.58
IHD, Portal	20.23	-1.24	-6.12%	51.63	1.11	2.14%	-0.13
PCT, Portal	21.14	-5.78	-27.33%	53.43	4.30	8.05%	-1.48
All 3	20.54	-5.51	-26.82%	52.55	2.53	4.81%	-2.98

The Phase II residential customers show similar patterns of energy consumption change, with a few differences. As with Phase I, the PCT and All 3 groups show the most savings for all but the lowest VPP price days, and the savings increases as the price increases for all groups. However, for Phase II, all except the Portal Only customers increased their off-peak consumption on most days. This increase was less than the decrease in on-peak consumption, so the net change was still negative overall.

Table 4-3 Non-Event Day Average On-Peak Consumption Change–Residential, based on Regression

	Average Daily Temperature					
	70˚	**75˚**	**80˚**	**85˚**	**90˚**	**95˚**
TOU-CP Weekday Non-Event						
Portal Only	-0.57	-1.09	-1.61	-2.13	-2.65	-3.17
IHD, Portal	-1.12	-1.54	-1.97	-2.40	-2.83	-3.26
PCT, Portal	-1.74	-2.64	-3.54	-4.43	-5.33	-6.23
All 3	-1.58	-2.41	-3.24	-4.07	-4.90	-5.73
VPP-CP Low Weekday Non-Event						
Portal Only	-0.88	-1.08	-1.28	-1.48		
IHD, Portal	-1.00	-1.15	-1.31	-1.46		
PCT, Portal	-0.91	-1.03	-1.15	-1.27		
All 3	-0.62	-0.92	-1.22	-1.52		
VPP-CP Standard Weekday Non-Event						
Portal Only		-0.64	-1.28	-1.92	-2.56	
IHD, Portal		-0.68	-1.36	-2.04	-2.73	
PCT, Portal		-1.32	-2.64	-3.96	-5.28	
All 3		-1.30	-2.60	-3.90	-5.20	
VPP-CP High Weekday Non-Event						

Portal Only			-0.70	-1.79	-2.54	-2.81
IHD, Portal			-0.73	-1.89	-2.71	-3.01
PCT, Portal			-1.92	-4.04	-5.46	-5.81
All 3			-1.95	-3.99	-5.40	-5.85
VPP-CP Critical Weekday Non-Event						
Portal Only			-2.43	-1.90	-1.70	-1.98
IHD, Portal			-2.75	-2.10	-1.87	-2.27
PCT, Portal			-3.96	-3.96	-4.65	-6.37
All 3			-3.92	-3.92	-4.62	-6.39

The regression results allow us to look at how the savings vary across different temperatures for each day type. This allows us to separate the effect of price from the effect of weather. Note that for all TOU technologies, the savings increase as the temperature increases. For the VPP, we only included estimates for each price level that were within the range of temperatures experienced during the study period for that price level. There were no critical price days with an average temperature less than 80, so it would be inappropriate to use the model to estimate the savings that we would see if a critical price were set for a 70 or 75 degree day. Looking at the savings, we see that on all but the lowest price VPP-CP days, the PCT and All 3 show much higher savings that the Portal and IHD. In nearly all cases, the savings increase as the temperature increases, except for the highest price days for the Portal and IHD, where the savings first dip, and then increase at the highest temperature.

The difference in savings at a given temperature across the different prices is more difficult to interpret. On the hottest days, the highest price has the highest savings for the PCT and All groups. However, for some temperatures (i.e. 90˚), the savings are greater at the High and Standard prices than they are at the Critical price. This is in part due to the complex relationship between energy use, temperature, thermostat setting, and the limited range of temperatures for each day type. This limited range means that the relationship of energy use to temperature is calculated based on the temperature range of days at each price level. As a result, the relative savings across temperatures at a given price reflect the nature of that relationship, but the relative savings between prices are not as reliable. If the range of temperatures for the different prices were greater, we could determine the nature of the relationships more effectively, but that is not possible since we are dealing with historical data. If we were to assume more structure in the relationship of price to usage, consistent estimates across prices might be more feasible, but that would necessarily depend on the appropriateness of the assumed structure, which may not be valid. Because the TOU involved only one on-peak price, and because the estimation was based on the full range of temperatures across all the weekdays in the study period, the TOU estimates are more consistent.

Table 4-4 Non-Event Day Average Customer Consumption – Phase II Small Commercial

	On-Peak Consumption			Off-Peak Consumption			Overall
	Baseline	Change	Percent	Baseline	Change	Percent	Change
TOU-CP Weekend Non-Event							
Portal Only				66.83	-1.12	-1.67%	-1.12
IHD, Portal				72.84	-5.08	-6.97%	-5.08
PCT, Portal				87.47	-9.92	-11.34%	-9.92

All 3				69.08	-2.31	-3.34%	-2.31
TOU-CP Weekday Non-Event							
Portal Only	26.52	-0.39	-1.47%	57.59	-0.39	-0.68%	-0.78
IHD, Portal	32.91	-3.95	-12.01%	65.87	-7.78	-11.81%	-11.73
PCT, Portal	34.75	-5.90	-16.97%	74.18	-12.22	-16.47%	-18.11
All 3	33.38	-2.86	-8.56%	65.45	-2.63	-4.01%	-5.48
VPP-CP Weekend Non-Event							
Portal Only				65.43	-3.18	-4.87%	-3.18
IHD, Portal				78.49	4.39	5.59%	4.39
PCT, Portal				53.03	-6.76	-12.75%	-6.76
All 3				97.33	-7.25	-7.45%	-7.25
VPP-CP Low Weekday Non-Event							
Portal Only	21.35	-1.34	-6.29%	47.82	-3.56	-7.45%	-4.90
IHD, Portal	24.52	0.25	1.02%	58.50	3.24	5.53%	3.49
PCT, Portal	18.44	-2.16	-11.73%	41.58	-4.70	-11.31%	-6.87
All 3	28.43	-2.50	-8.79%	67.23	-6.91	-10.29%	-9.41
VPP-CP Standard Weekday Non-Event							
Portal Only	27.24	-1.73	-6.36%	62.06	-4.08	-6.57%	-5.81
IHD, Portal	30.98	1.11	3.57%	73.24	5.34	7.29%	6.45
PCT, Portal	26.47	-5.40	-20.41%	58.17	-8.73	-15.01%	-14.13
All 3	35.80	-2.88	-8.05%	83.98	-1.90	-2.27%	-4.79
VPP-CP High Weekday Non-Event							
Portal Only	29.38	-2.37	-8.08%	67.64	-5.17	-7.65%	-7.55
IHD, Portal	34.04	-0.41	-1.22%	81.26	1.36	1.67%	0.94
PCT, Portal	27.42	-5.63	-20.52%	63.98	-8.13	-12.71%	-13.76
All 3	39.08	-4.55	-11.64%	93.82	-4.28	-4.57%	-8.83
VPP-CP Critical Weekday Non-Event							
Portal Only	31.74	-0.93	-2.93%	76.96	-2.17	-2.82%	-3.10
IHD, Portal	30.34	5.93	19.55%	73.23	17.24	23.55%	23.17
PCT, Portal	33.63	-10.17	-30.24%	80.56	-14.26	-17.70%	-24.43
All 3	42.29	-6.01	-14.21%	103.84	-6.61	-6.37%	-12.63

There was more variation in the savings for small commercial customers, most likely driven by both the fact that small commercial customer energy use is more variable and by the smaller sample sizes for the small commercial groups. The response to price is apparent in the PCT and All 3 groups, with the savings increasing as the price increases, but the VPP IHD group does not seem to be responding to price. In nearly all day types and periods, these customers increase their use.

Table 4-5 below shows average on-peak kW savings for each day type and each rate-technology combination, for residential customers in both phases. Table 4-6 shows the same savings based on the regression analysis for a range of average daily temperatures. Table 4-7 below shows the kW savings at the single hour that shows the maximum reduction for both residential phases. This is usually in the first hour of the period for the PCT and All 3 groups, when the load reduction due to the PCT is maximized. For the Web and IHD, the maximum demand tends to occur later in the on-peak period. Because the hour that the maximum reduction occurs in can differ for different groups, the baseline use can differ as well. Table 4-8 shows the maximum reduction based on the regression analysis. Table 4-9 below shows, for Phase II Small Commercial customers, average on-peak kW savings for each day type and each rate-technology combination as well as the kW savings at the single hour that shows the maximum reduction.

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We include on-peak demand reductions on the weekend days as well, even though the entire weekend days are off peak. We report this because there is some consistency in customer behavior across all days, resulting in weekend day demand reductions during what would be the usual on-peak hours on a weekday.

Not that when presenting demand, the values represent savings, so a positive value means less energy is used, and a negative value indicates more energy used.

Table 4-5 Non-Event Day Average Residential On-Peak Demand

	Phase I Average On-Peak Demand			Phase II Average On-Peak Demand		
	Baseline	**Reduction**	**Percent**	**Baseline**	**Reduction**	**Percent**
TOU-CP Weekend Non-Event						
Portal Only	3.83	0.24	6.40%	3.40	0.17	4.89%
IHD, Portal	3.83	0.50	13.18%	3.37	0.10	3.05%
PCT, Portal	3.71	0.14	3.76%	3.51	0.28	8.03%
All 3	3.83	0.25	6.52%	3.59	0.27	7.47%
TOU-CP Weekday Non-Event						
Portal Only	3.46	0.49	14.27%	3.13	0.28	9.04%
IHD, Portal	3.46	0.70	20.29%	3.12	0.22	7.00%
PCT, Portal	3.36	0.88	26.33%	3.25	0.84	25.73%
All 3	3.46	0.95	27.47%	3.29	0.71	21.52%
VPP-CP Weekend Non-Event						
Portal Only	3.83	0.26	6.82%	3.54	0.17	4.94%
IHD, Portal	3.83	0.36	9.33%	3.42	0.10	2.86%
PCT, Portal	3.71	-0.07	-1.89%	3.65	0.09	2.48%
All 3	3.83	0.38	9.82%	3.44	0.09	2.72%
VPP-CP Low Weekday Non-Event						
Portal Only	2.41	0.22	8.99%	2.42	0.21	8.79%
IHD, Portal	2.41	0.25	10.24%	2.21	0.08	3.46%

PCT, Portal	2.30	0.03	1.49%	2.39	0.15	6.31%
All 3	2.41	0.24	9.97%	2.25	0.10	4.32%
VPP-CP Standard Weekday Non-Event						
Portal Only	3.80	0.48	12.75%	3.56	0.27	7.64%
IHD, Portal	3.80	0.48	12.77%	3.41	0.26	7.62%
PCT, Portal	3.69	0.65	17.73%	3.60	0.79	21.85%
All 3	3.80	0.98	25.87%	3.46	0.64	18.44%
VPP-CP High Weekday Non-Event						
Portal Only	4.07	0.59	14.52%	3.76	0.28	7.38%
IHD, Portal	4.07	0.61	15.07%	3.63	0.24	6.54%
PCT, Portal	3.96	0.81	20.43%	3.85	0.95	24.53%
All 3	4.07	1.17	28.81%	3.73	0.80	21.57%
VPP-CP Critical Weekday Non-Event						
Portal Only	4.53	0.63	13.94%	4.18	0.24	5.83%
IHD, Portal	4.53	0.67	14.82%	4.05	0.25	6.12%
PCT, Portal	4.49	1.01	22.54%	4.23	1.16	27.33%
All 3	4.53	1.35	29.82%	4.11	1.10	26.82%

Table 4-5 is the easiest place to directly compare the savings for the Phase I and Phase II customers. The savings estimates are for the same time period, the summer of 2011, which was the first summer in the program for the Phase II customers, but the second summer in the program for the Phase I customers. While the baseline energy is higher for Phase I, indicating higher energy use before they went on the pilot, they also show higher savings for the Portal, IHD, and All 3 groups, but not for the PCT group, on all but the lowest price VPP days. This could be an indication that those customers who have more experience with the rate are learning how to respond better, but that the learning is enhanced by the information provided by the web portal and IHD, but that the PCT is not as conducive to learning and improving price responsiveness over time. Given the "set it and forget it" nature of the PCT, this is not surprising.

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Table 4-6 Non-Event Day Average Residential On-Peak Demand savings based on Regression

	Average Daily Temperature					
	70˚	**75˚**	**80˚**	**85˚**	**90˚**	**95˚**
TOU-CP Weekday Non-Event						
Portal Only	0.11	0.22	0.32	0.43	0.53	0.63
IHD, Portal	0.22	0.31	0.39	0.48	0.57	0.65
PCT, Portal	0.35	0.53	0.71	0.89	1.07	1.25

All 3	0.32	0.48	0.65	0.81	0.98	1.15
VPP-CP Low Weekday Non-Event						
Portal Only	0.18	0.22	0.26	0.30		
IHD, Portal	0.20	0.23	0.26	0.29		
PCT, Portal	0.18	0.21	0.23	0.25		
All 3	0.12	0.18	0.24	0.30		
VPP-CP Standard Weekday Non-Event						
Portal Only		0.13	0.26	0.38	0.51	
IHD, Portal		0.14	0.27	0.41	0.55	
PCT, Portal		0.26	0.53	0.79	1.06	
All 3		0.26	0.52	0.78	1.04	
VPP-CP High Weekday Non-Event						
Portal Only			0.14	0.36	0.51	0.56
IHD, Portal			0.15	0.38	0.54	0.60
PCT, Portal			0.38	0.81	1.09	1.16
All 3			0.39	0.80	1.08	1.17
VPP-CP Critical Weekday Non-Event						
Portal Only			0.49	0.38	0.34	0.40
IHD, Portal			0.55	0.42	0.37	0.45
PCT, Portal			0.79	0.79	0.93	1.27
All 3			0.78	0.78	0.92	1.28

Because the average demand savings are simply the consumption savings divided by the number of hours, the same patterns exist.

Table 4-7 Non-Event Day Average Residential On-Peak Demand at Maximum Reduction

	Phase I Demand at Maximum Reduction			Phase II Demand at Maximum Reduction		
	Baseline	**Reduction**	**Percent**	**Baseline**	**Reduction**	**Percent**
TOU-CP Weekend Non-Event						
Portal Only	3.97	0.27	6.70%	3.29	0.27	8.27%
IHD, Portal	3.97	0.52	13.21%	3.19	0.12	3.63%
PCT, Portal	3.46	0.18	5.12%	3.33	0.49	14.63%
All 3	3.77	0.27	7.20%	3.42	0.46	13.49%

TOU-CP Weekday Non-Event						
Portal Only	3.32	0.53	15.96%	2.83	0.30	10.70%
IHD, Portal	3.32	0.73	22.01%	2.83	0.23	8.12%
PCT, Portal	2.97	1.36	45.66%	2.91	1.25	42.98%
All 3	3.08	1.31	42.62%	2.93	1.09	37.00%
VPP-CP Weekend Non-Event						
Portal Only	3.77	0.29	7.63%	3.33	0.20	5.86%
IHD, Portal	3.77	0.38	10.17%	3.22	0.13	4.09%
PCT, Portal	3.46	-0.04	-1.27%	3.46	0.15	4.48%
All 3	3.93	0.38	9.78%	3.26	0.17	5.24%
VPP-CP Low Weekday Non-Event						
Portal Only	2.67	0.23	8.81%	2.65	0.28	10.53%
IHD, Portal	2.25	0.27	11.87%	1.93	0.09	4.82%
PCT, Portal	1.92	0.11	5.48%	2.06	0.27	13.12%
All 3	2.25	0.28	12.34%	1.96	0.20	10.00%
VPP-CP Standard Weekday Non-Event						
Portal Only	3.68	0.56	15.22%	3.73	0.30	7.91%
IHD, Portal	3.68	0.52	14.17%	3.46	0.28	8.14%
PCT, Portal	3.32	1.19	35.78%	3.35	1.38	41.38%
All 3	3.43	1.41	40.98%	3.20	1.09	34.07%
VPP-CP High Weekday Non-Event						
Portal Only	3.93	0.66	16.85%	3.99	0.32	7.96%
IHD, Portal	3.93	0.68	17.25%	3.70	0.26	6.90%
PCT, Portal	3.53	1.44	40.74%	3.53	1.65	46.55%
All 3	3.64	1.68	46.27%	3.38	1.32	39.01%
VPP-CP Critical Weekday Non-Event						
Portal Only	4.48	0.69	15.39%	4.32	0.29	6.83%
IHD, Portal	4.48	0.80	17.81%	3.84	0.27	7.09%
PCT, Portal	4.19	1.97	47.08%	4.02	1.97	49.09%
All 3	4.22	2.03	48.04%	3.91	1.77	45.17%

In the tables above, while the magnitudes are different, the general trends of how the savings changes over time are similar between the two phases.

Table 4-8 Non-Event Day Average Residential On-Peak Demand at Maximum Reduction savings based on Regression

	Average Daily Temperature					
	70˚	75˚	80˚	85˚	90˚	95˚
TOU-CP Weekday Non-Event						
Portal Only	0.12	0.23	0.34	0.46	0.57	0.68
IHD, Portal	0.23	0.33	0.42	0.51	0.60	0.69
PCT, Portal	0.52	0.79	1.06	1.33	1.59	1.86
All 3	0.49	0.74	1.00	1.25	1.51	1.76
VPP-CP Low Weekday Non-Event						
Portal Only	0.23	0.28	0.34	0.39		
IHD, Portal	0.24	0.28	0.32	0.36		
PCT, Portal	0.33	0.37	0.41	0.46		
All 3	0.25	0.37	0.49	0.61		
VPP-CP Standard Weekday Non-Event						
Portal Only		0.14	0.28	0.42	0.56	
IHD, Portal		0.15	0.30	0.44	0.59	
PCT, Portal		0.47	0.93	1.40	1.86	
All 3		0.44	0.89	1.33	1.78	
VPP-CP High Weekday Non-Event						
Portal Only			0.16	0.41	0.58	0.64
IHD, Portal			0.16	0.41	0.58	0.65
PCT, Portal			0.67	1.41	1.90	2.02
All 3			0.64	1.31	1.77	1.92
VPP-CP Critical Weekday Non-Event						
Portal Only			0.59	0.46	0.41	0.48
IHD, Portal			0.61	0.46	0.41	0.50
PCT, Portal			1.35	1.35	1.59	2.18
All 3			1.26	1.26	1.48	2.05

Note that as the temperature increases, the savings increases, again in all cases except the Portal and IHD for critical price days, where it dips before increasing.

Table 4-9 Non-Event Day Average Small Commercial On-Peak Demand

	Average On-Peak Demand			Demand at Maximum Reduction		
	Baseline	Reduction	Percent	Baseline	Reduction	Percent
TOU-CP Weekend Non-Event						
Portal Only	3.99	0.09	2.20%	4.19	0.16	3.79%
IHD, Portal	4.27	0.23	5.36%	4.48	0.35	7.91%
PCT, Portal	5.39	0.53	9.88%	6.15	0.69	11.28%
All 3	4.42	0.36	8.21%	4.70	0.45	9.50%
TOU-CP Weekday Non-Event						
Portal Only	5.30	0.08	1.47%	4.89	0.20	4.14%
IHD, Portal	6.58	0.79	12.01%	7.11	0.92	12.96%
PCT, Portal	6.95	1.18	16.97%	7.84	1.70	21.65%
All 3	6.68	0.57	8.56%	5.27	0.63	11.95%
VPP-CP Weekend Non-Event						
Portal Only	3.66	0.13	3.55%	3.49	0.23	6.61%
IHD, Portal	4.54	-0.04	-0.83%	4.63	0.13	2.70%
PCT, Portal	2.73	0.19	6.93%	2.84	0.26	9.05%
All 3	5.25	0.27	5.20%	5.46	0.38	6.97%
VPP-CP Low Weekday Non-Event						
Portal Only	4.27	0.27	6.29%	4.72	0.31	6.60%
IHD, Portal	4.90	-0.05	-1.02%	5.31	0.06	1.11%
PCT, Portal	3.69	0.43	11.73%	2.66	0.89	33.32%
All 3	5.69	0.50	8.79%	5.46	0.68	12.51%
VPP-CP Standard Weekday Non-Event						
Portal Only	5.45	0.35	6.36%	5.27	0.44	8.38%
IHD, Portal	6.20	-0.22	-3.57%	6.65	-0.14	-2.08%
PCT, Portal	5.29	1.08	20.41%	4.00	1.31	32.66%
All 3	7.16	0.58	8.05%	7.01	0.76	10.89%
VPP-CP High Weekday Non-Event						
Portal Only	5.88	0.47	8.08%	5.74	0.59	10.27%
IHD, Portal	6.81	0.08	1.22%	7.37	0.19	2.54%
PCT, Portal	5.48	1.13	20.52%	5.91	1.34	22.72%

All 3	7.82	0.91	11.64%	7.75	1.16	15.01%
VPP-CP Critical Weekday Non-Event						
Portal Only	6.35	0.19	2.93%	6.15	0.30	4.86%
IHD, Portal	6.07	-1.19	-19.55%	6.86	-0.96	-14.03%
PCT, Portal	6.73	2.03	30.24%	7.34	2.47	33.59%
All 3	8.46	1.20	14.21%	8.95	1.60	17.89%

Again, we see here that the PCT and All 3 groups are responding in general as expected, but the small commercial IHD group does not seem to be responding to price.

One important consideration to keep in mind is that the PCT group includes only those customers with central AC, since that was a requirement of having the PCT. For the All 3 group, there were many with central AC, but some without, since that group represents a more diverse population. Because of this, the savings for the PCT group are often slightly higher than the savings for the All 3 group. We believe that this is a result of the differences in the mix of customers, and does not reflect a fundamental difference between how customers are responding.

4.1.2 Non-Event Day Impact Graphs

The graphs below show the estimated load shapes for the control group and for each of the rate-technology groups for each day type for each rate. These graphs allow for a comparison of the different groups. We show the Phase I Residential graphs first, followed by the Phase II residential graphs, and then the Phase II Small Commercial graphs. Within each group, we start with the TOU-CP rate group and then show the VPP-CP rate group.

Figure 4-1 below shows the load shapes for the TOU-CP rate for an average of the non-event weekend days for Phase I Residential. On weekend days, the TOU-CP rate appears not to have any real effect on usage. The IHD group appears slightly lower, probably due to the increased awareness IHD customers have of their energy use. Note that prices for the TOU-CP customers are lower during the day on weekends than the standard rate, but this lower price does not result in an increase in energy use.

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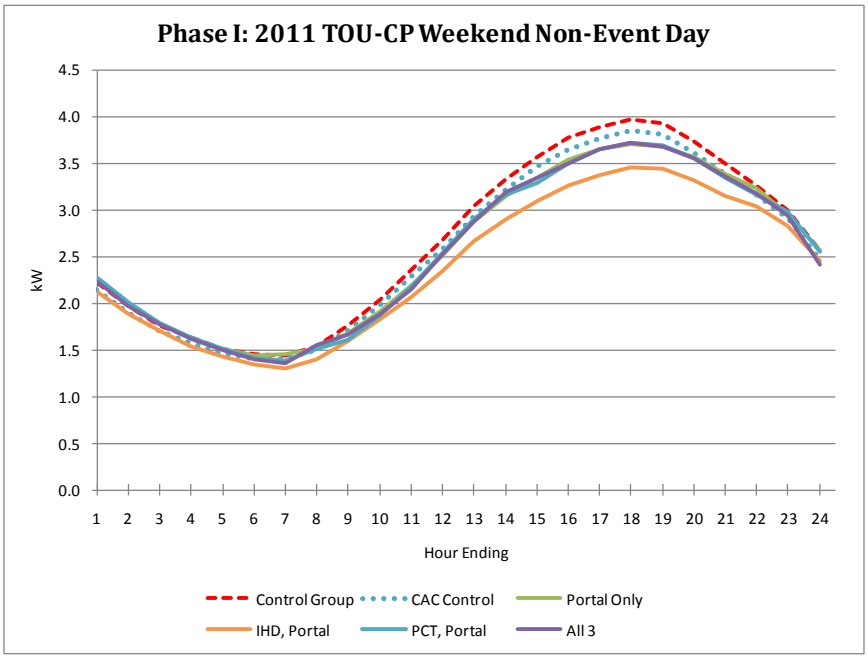

Figure 4-1 TOU-CP weekend non-event day – Phase I Residential

Figure 4-2 shows the load shapes for the average non-event weekday. The PCT and All 3 groups clearly show a bigger initial savings, when the PCTs raise their setpoints in response to the higher price, but that savings decays after the start of the peak period, since the indoor temperature rises to the new setpoint, and the central AC goes on again. The IHD and Web only groups are fairly similar to each other, with the IHD showing slightly more savings, which may be due to increased awareness of energy use, though it is not statistically significantly different.

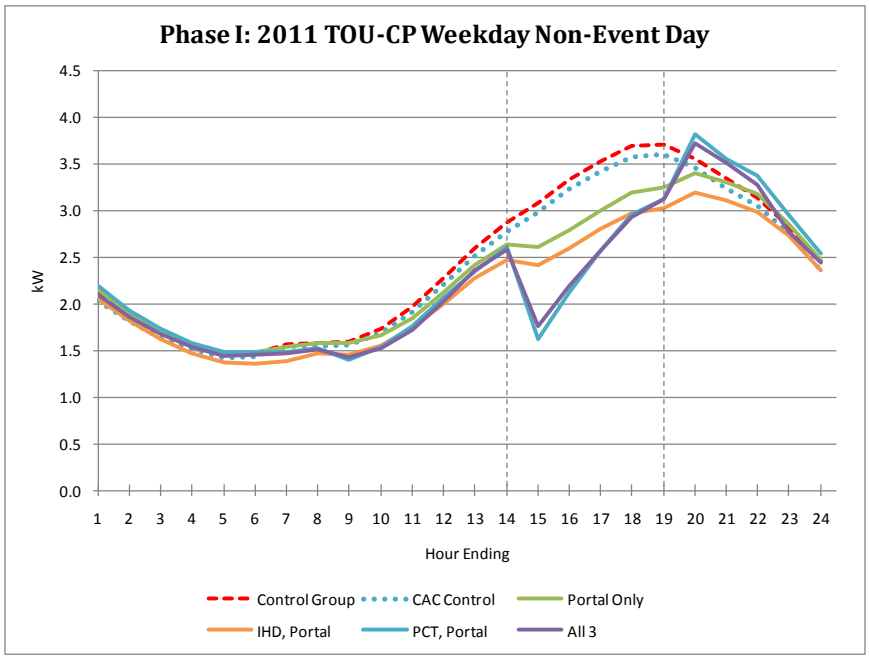

Figure 4-2 TOU-CP weekday non-event day – Phase I Residential

Figure 4-3 below shows the load shape for the VPP-CP group for an average weekend day. There are not any significant differences between the load shapes for the control group and any of the rate-technology groups.

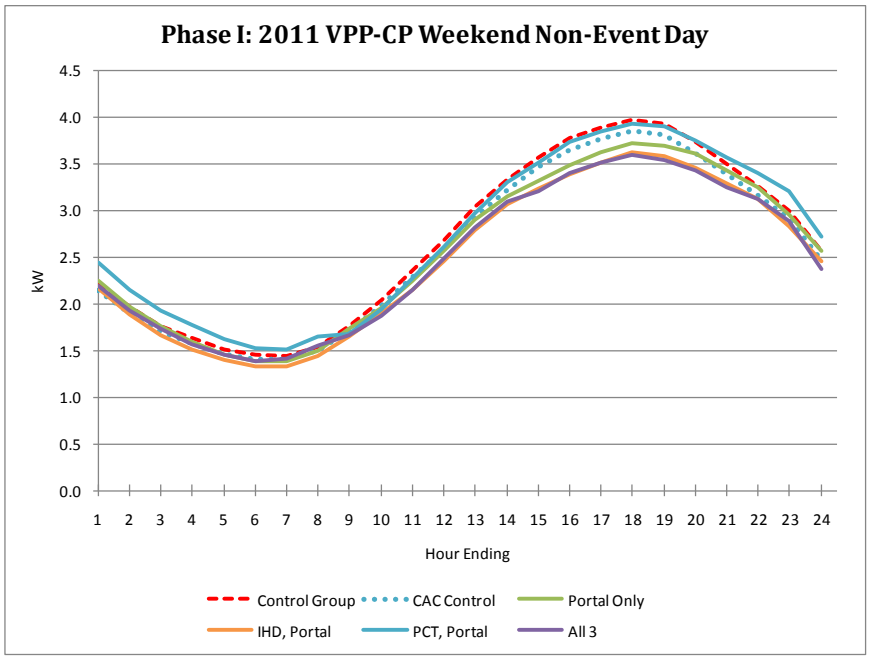

Figure 4-3 VPP-CP weekend non-event day, low price – Phase I Residential

Figure 4-4 shows the load shapes for the VPP-CP rate on low-priced weekdays. Note that even though the price during the peak period does not change, there appears to be a small load reduction for all rate-technology groups at the beginning of the peak period. The drop at the beginning of the peak period may reflect a change in behavior common to all weekdays, perhaps driven by programmable thermostats that may or may not be part of the program.

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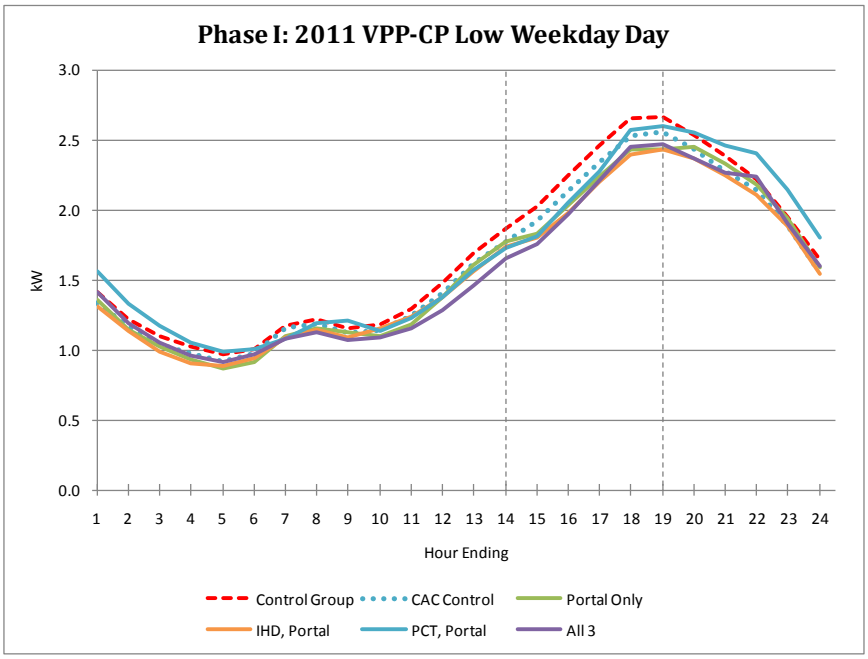

Figure 4-4 VPP-CP weekday non-event day, low price – Phase I Residential

Figure 4-5 shows the load shapes for the VPP-CP rate on standard-priced weekdays. There is a significant drop in the loads for the PCT and All 3 groups that is in response to the price increase, and a smaller drop in the IHD and Web groups. Note that there is also a sizeable "rebound effect" after the event for the PCT group, when the PCTs are reset back to a lower temperature, increasing energy use. For the PCT group, this effect lingers throughout the night, with slightly higher usage until the early morning hours. There does not appear to be any rebound effect for the IHD, All 3, and Web groups.

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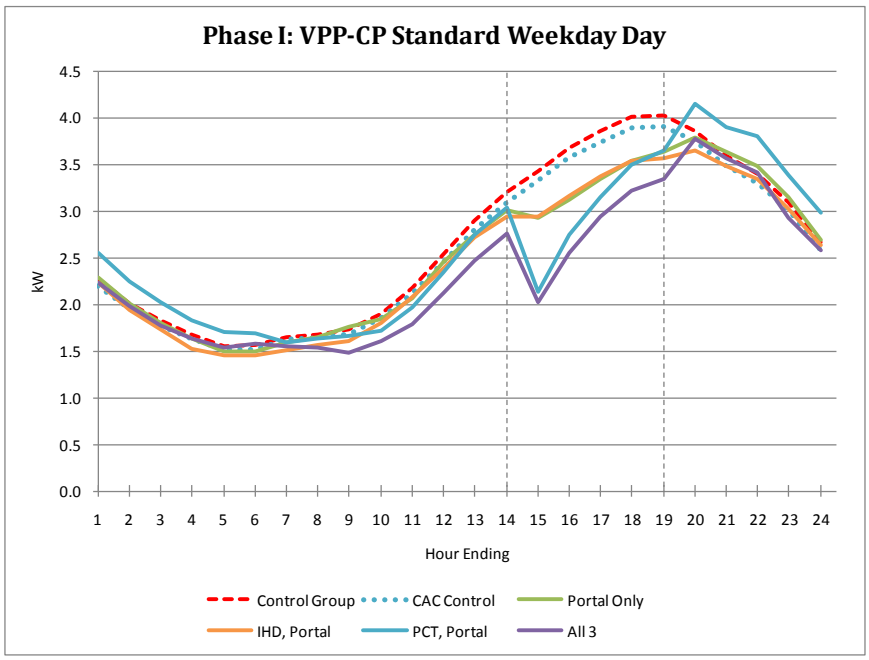

Figure 4-5 VPP-CP weekday non-event day, standard price – Phase I Residential

Figure 4-6 shows the load shapes for the VPP-CP rate on high-priced weekdays. The effects are similar to the standard-priced day, but with a slightly higher load, slightly higher savings, and slightly more rebound effect, driven by the combination of the higher temperatures on high-priced days and the higher price.

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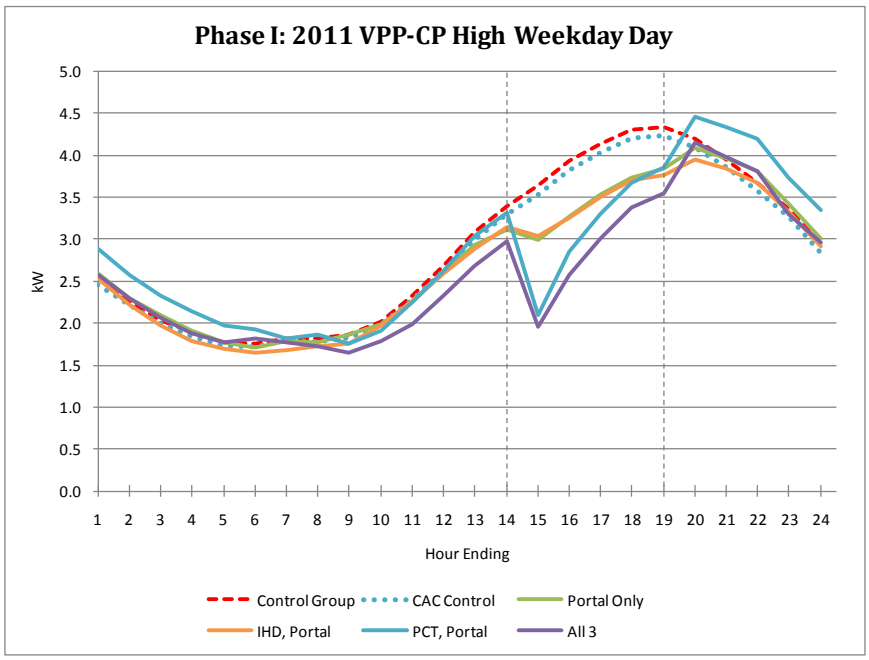

Figure 4-6 VPP-CP weekday non-event day, high price – Phase I Residential

Figure 4-7 shows the load shapes for the VPP-CP rate on critical-priced weekdays. The patterns of increased savings over the lower prices, peak savings for the PCT and All 3 groups early in the event, and a significant rebound effect continue here, with the highest savings of any non-event day for each rate-technology group.

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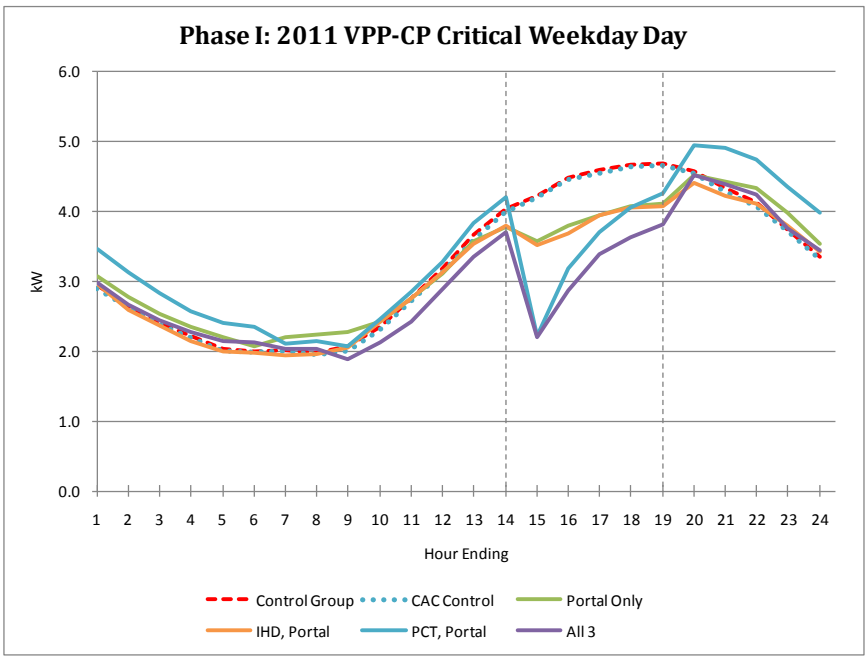

Figure 4-7 VPP-CP weekday non-event day, critical price – Phase I Residential

We now present the non-event graphs for the Phase II residential results.

Figure 4-8 below shows the load shapes for the TOU-CP rate for an average of the non-event weekend days. On weekend days, the TOU-CP rate customers appear to have a drop in usage at the beginning of what is the on-peak period on weekdays. This may reflect a change in behavior common to all days, perhaps driven by programmable thermostats. Note that prices for the TOU-CP customers are lower on weekends during the day than the standard rate, but this lower price does not result in an increase in energy use.

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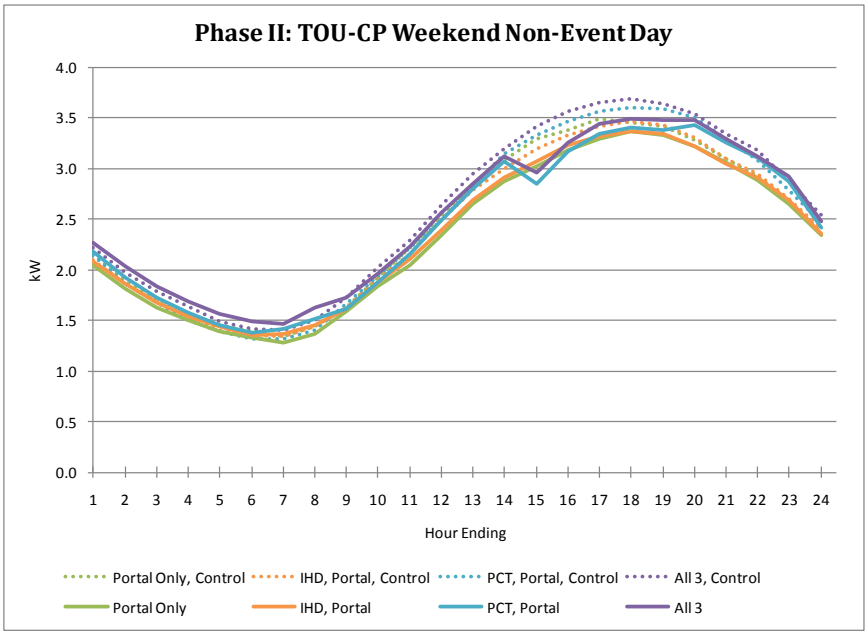

Figure 4-8 TOU-CP weekend non-event day – Phase II Residential

Figure 4-9 shows the load shapes for the average non-event weekday for TOU-CP. The load shapes for the participant groups are very similar to those for Phase I. The savings are slightly

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different because of the adjustments made to the control group from the pre-participation period.

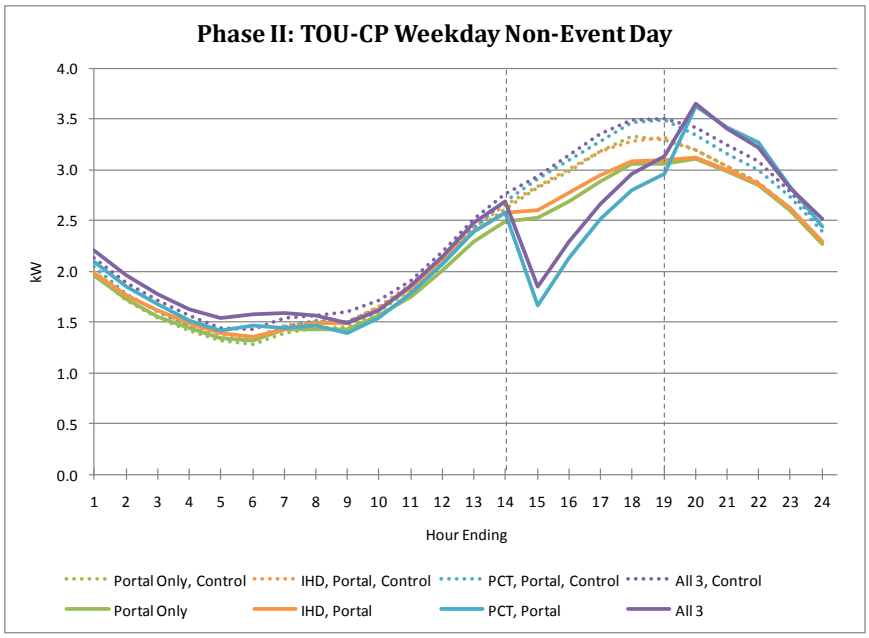

Figure 4-9 TOU-CP weekday non-event day – Phase II Residential

Figure 4-10 below shows the load shape for the VPP-CP group for an average weekend day. There are not any significant differences between the load shapes for the control group and any of the rate-technology groups.

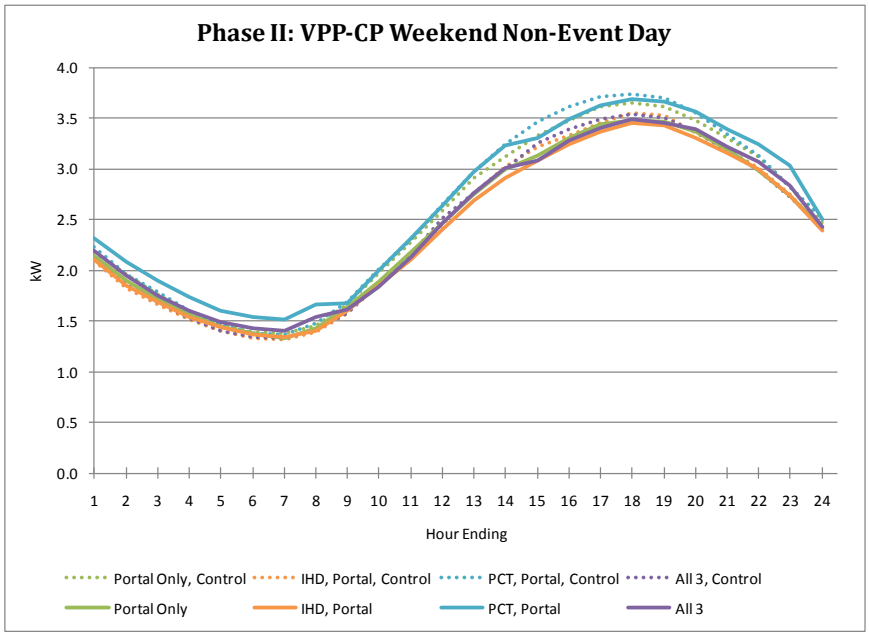

Figure 4-10 VPP-CP weekend non-event day, low price – Phase II Residential

Figure 4-11 shows the load shapes for the VPP-CP rate on low-priced weekdays. Like the Phase 1 customers, there do not appear to be any significant differences between the load shapes for the control group and any of the rate-technology groups, thought there is a slight drop in usage at the beginning of the peak period, probably representing a few customers who change their thermostat setpoint on all days.

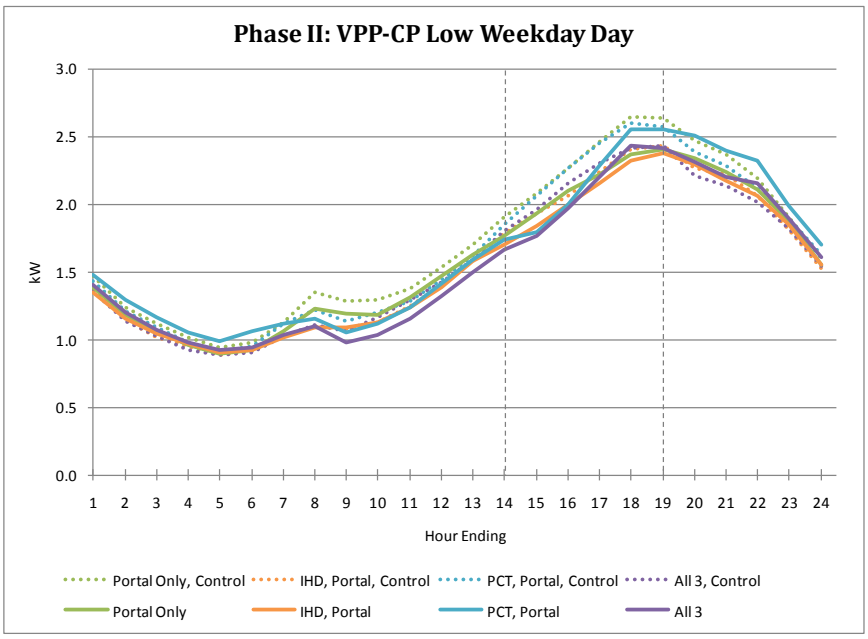

Figure 4-11 VPP-CP weekday non-event day, low price – Phase II Residential

Figure 4-12 shows the load shapes for the VPP-CP rate on standard-priced weekdays. The load shapes for the participant groups are very similar to those for Phase I. The savings are slightly different because of the adjustments made to the control group from the pre-participation period.

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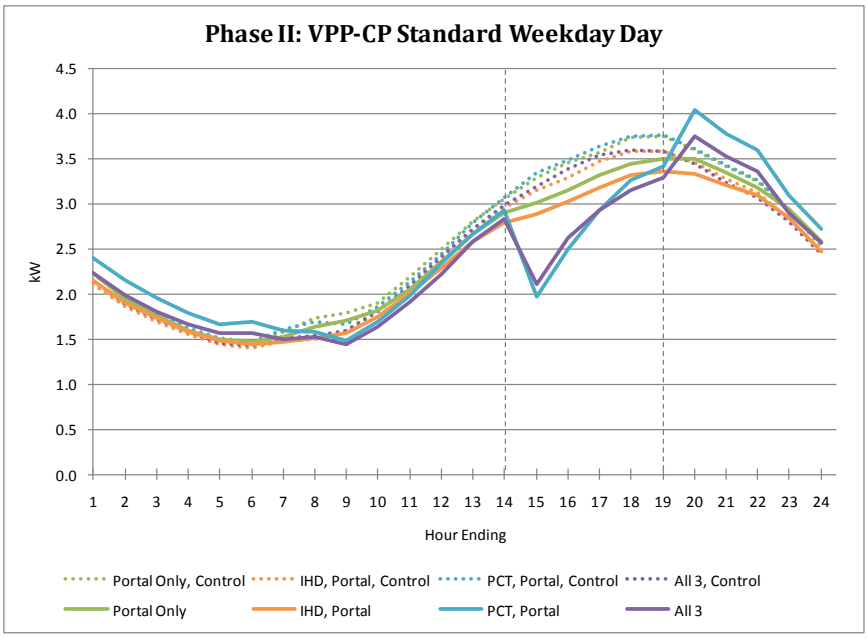

Figure 4-12 VPP-CP weekday non-event day, standard price – Phase II Residential

Figure 4-13 shows the load shapes for the VPP-CP rate on high-priced weekdays.

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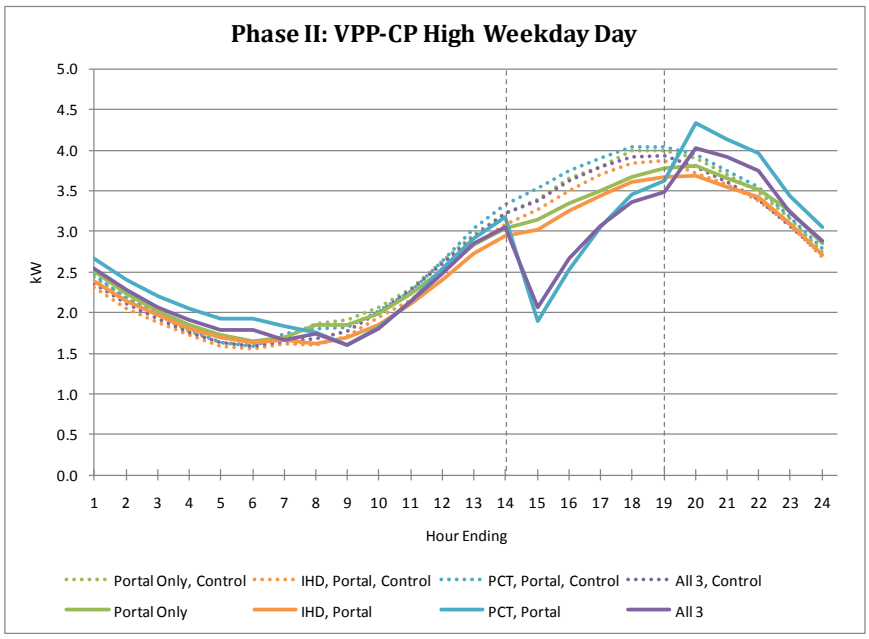

Figure 4-13 VPP-CP weekday non-event day, high price – Phase II Residential

Figure 4-14 shows the load shapes for the VPP-CP rate on critical-priced weekdays. The load shapes for the participant groups are very similar to those for Phase I. The savings are slightly different because of the adjustments made to the control group from the pre-participation period.

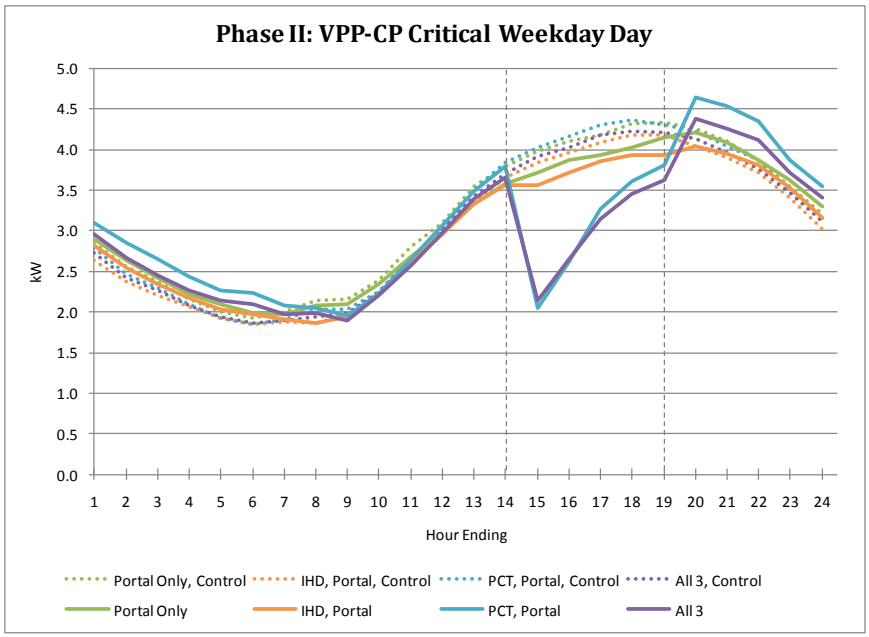

Figure 4-14 VPP-CP weekday non-event day, critical price – Phase II Residential

We now present the non-event graphs for the small commercial customers. Note that throughout this section, the control group lines for the different rate-technology groups are quite different. This reflects the fact that there are differences between the customers who accepted the offers in the different groups and the control group. Even though the control group was randomized, there is much more diversity among small commercial customers than among residential customers, particularly when you consider the overall magnitude of energy use. This is why the Phase II difference of differences approach is much more appropriate and provides

more stable estimates of savings than a direct comparison of loads for the small commercial groups.

However, this higher diversity means that there is more natural variation in customer energy use, so that what appear to be smaller changes in energy are generally just random variation.

Figure 4-15 below shows the load shapes for the TOU-CP rate for an average of the small commercial non-event weekend days. There does not appear to be any systematic changes in energy use on weekend days. While the PCT group load is somewhat smaller than its corresponding control group, this could indicate a reduction in usage resulting from increased energy awareness, but may also be natural variation.

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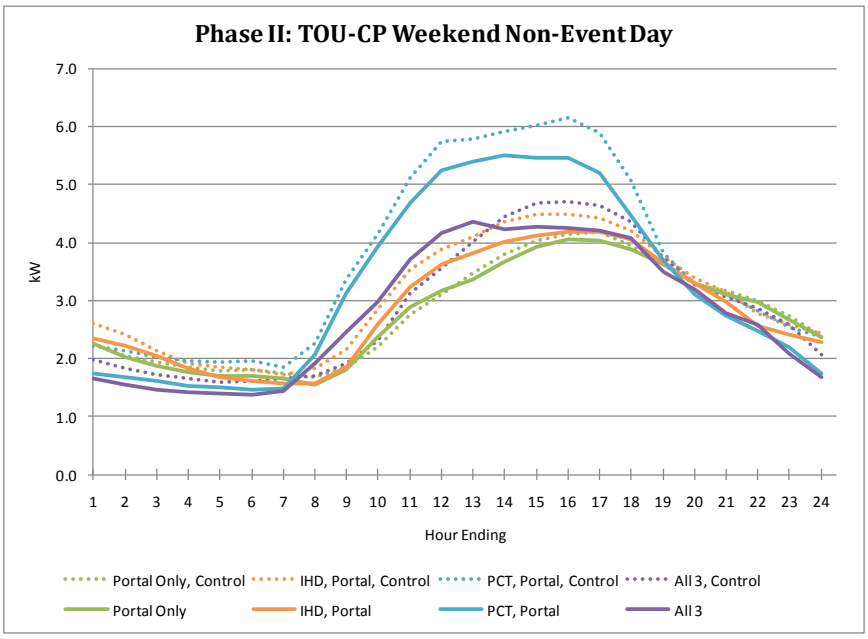

Figure 4-15 TOU-CP weekend non-event day – Phase II Small Commercial

Figure 4-16 shows the load shapes for the average Small Commercial TOU-CP non-event weekday. The PCT and All 3 groups show a noticeable drop in load at the beginning of the on-peak period, driven by the change in the thermostat setpoint in response to price. The Web portal group does not seem to show any response, with the two lines almost the same. The IHD group seems to be saving energy at all times, perhaps due to increased awareness.

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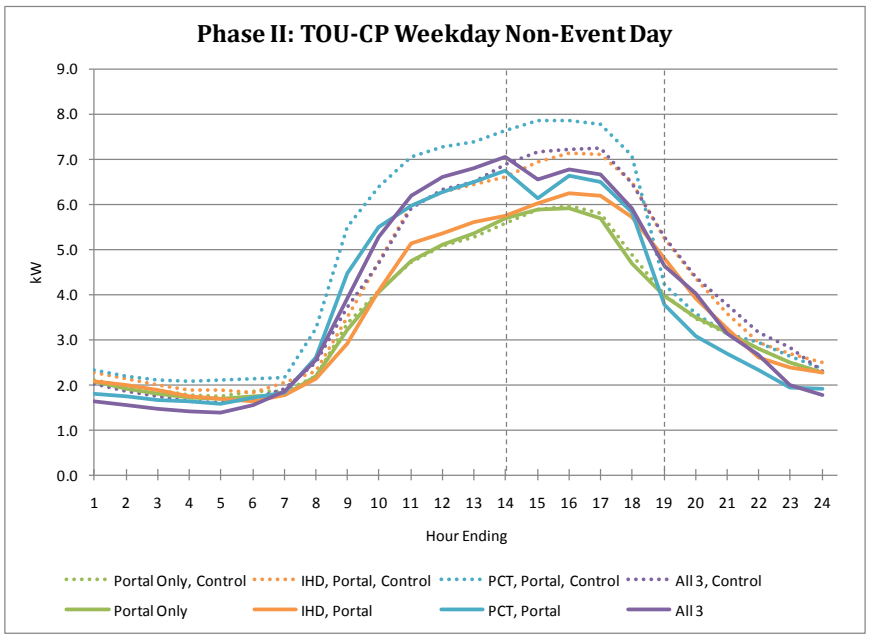

Figure 4-16 TOU-CP weekday non-event day – Phase II Small Commercial

Figure 4-17 below shows the load shape for the small commercial VPP-CP group for an average weekend day. There are not any significant differences between the load shapes for the control group and any of the rate-technology groups. This is a clear example of the differences between the rate-technology groups for the small commercial customers, and the importance of the difference of differences method for this group.

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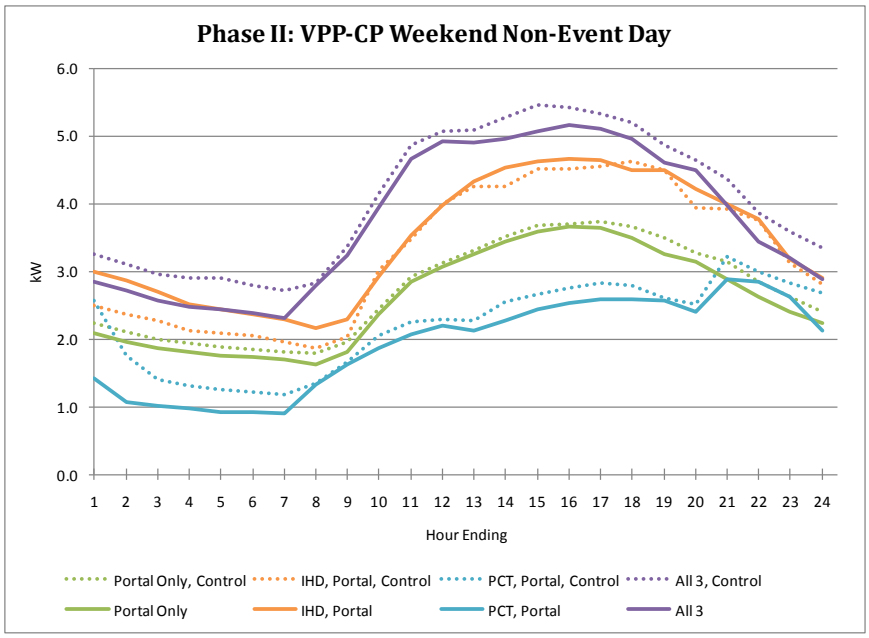

Figure 4-17 VPP-CP weekend non-event day, low price – Phase II Small Commercial

Figure 4-18 shows the load shapes for the VPP-CP rate on low-priced weekdays. . There appears to be a small decrease in energy use during the day and slightly more savings during the on-peak period.

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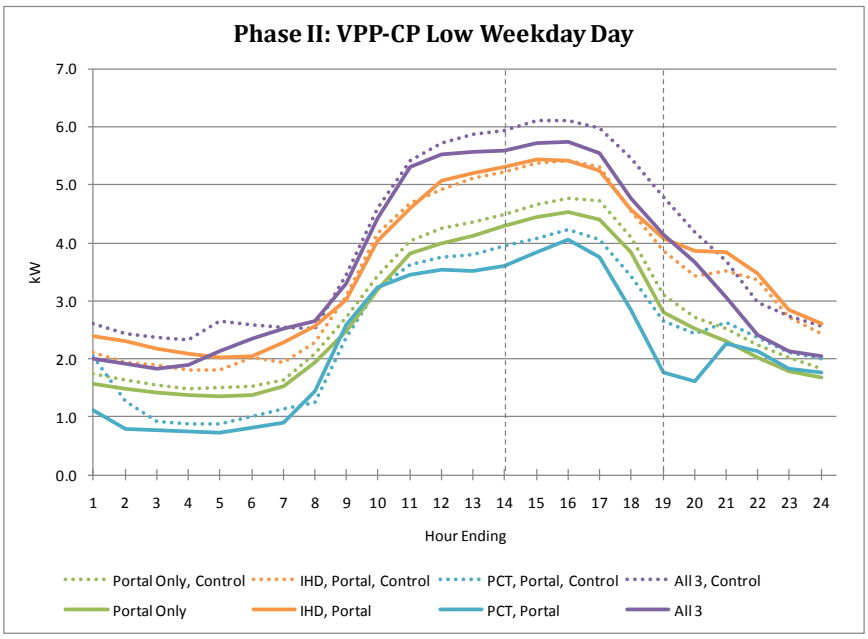

Figure 4-18 VPP-CP weekday non-event day, low price – Phase II Small Commercial

Figure 4-19 shows the load shapes for the VPP-CP rate on standard-priced weekdays. Like the low price day, there appears to be a small decrease in energy use during the day and slightly more savings during the on-peak period. However, there does not appear to be any significant change in usage for the IHD or Portal groups.

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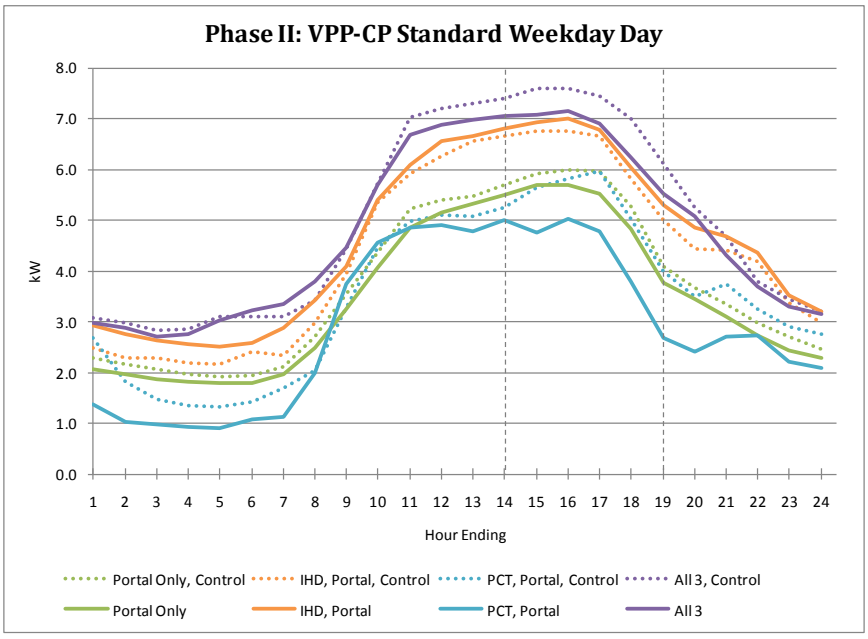

Figure 4-19 VPP-CP weekday non-event day, standard price – Phase II Small Commercial

Figure 4-20 shows the load shapes for the VPP-CP rate on high-priced weekdays. Again, there are more savings for the All 3 and PCT groups during the on-peak period, including a more noticeable drop at the beginning of the on-peak period. The Portal group seems to be responding a bit more to the higher prices as well.

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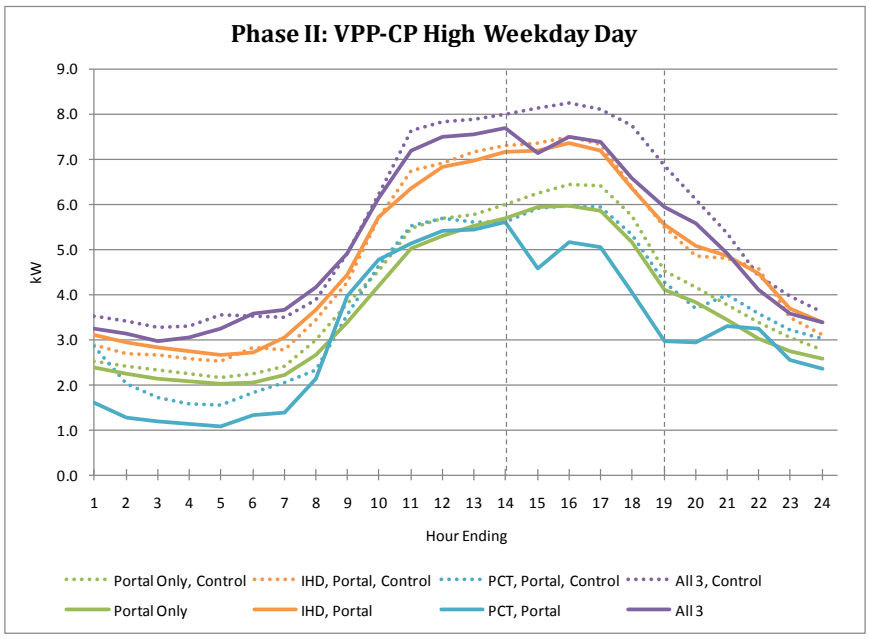

Figure 4-20 VPP-CP weekday non-event day, high price – Phase II Small Commercial

Figure 4-21 shows the load shapes for the VPP-CP rate on critical-priced weekdays. The PCT and All 3 groups show more savings on the Critical price days than on the lower price days. However, the IHD group shows increased usage and the Portal shows no change in usage in response to the price. The increase in the IHD group may be because of the higher temperatures that occurred on the critical price days, though that increase was present in the control group as well.

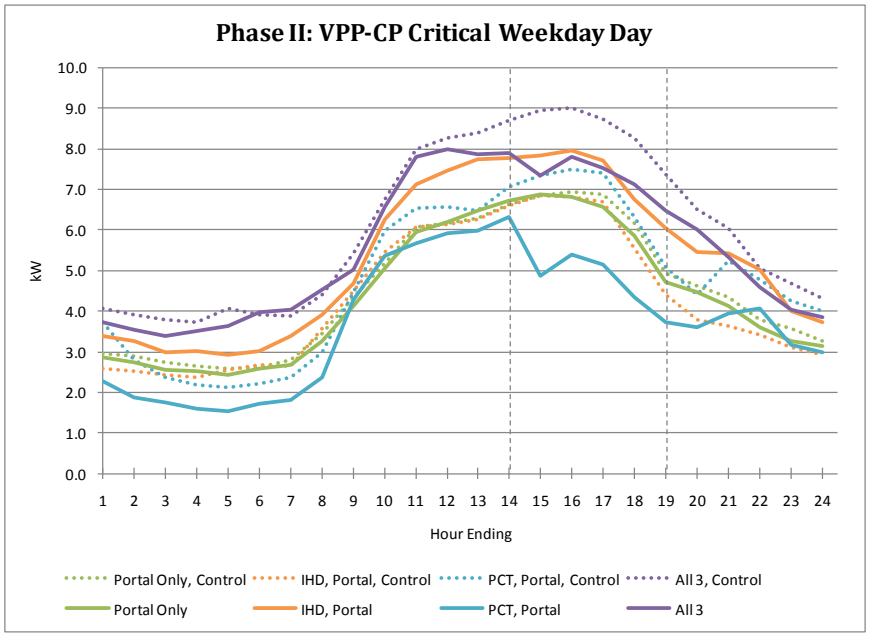

Figure 4-21 VPP-CP weekday non-event day, critical price – Phase II Small Commercial

We now present the estimated savings load shapes based on the regression model. As described above in the Experimental Design section, the regression model estimates the on-peak kWh savings for TOU-CP customers and at each price level for the VPP-CP rate as a function of temperature. The temperature used in the model is the average of the high and low for the day. The estimated on-peak kWh savings for each temperature and price are spread across the five on-peak hours based on the distribution of the savings across those hours from the Phase II

difference of differences estimates for the appropriate price and day type. So the shape of the savings reflects the earlier estimate, but the magnitude reflects the regression estimate.

For the TOU-CP rate, we include three savings load shapes, one for the coolest non-event weekday of the study period, one for the hottest non-event weekday, and one for the average non-event weekday across both summers. For each price level for the VPP-CP rate, we include a graph for the coolest day during the study period for that price level, the hottest day at that price level, and the average of all the days at that price level. This prevents us from inappropriately estimating savings for a price level for a day that is outside what was included in the estimation of the savings regression model. For instance, we can't estimate what the savings would be on a day with an average temperature of 95° at a low price, since the warmest low price day was only 85°.

While the study period did include some days that were very cool, with average temperatures less than 70°, we use 70° as the minimum here since it is the base for the CDD calculations. The results of the model assume that the savings at average temperatures below 70° are the same as the savings for 70°. During summer, there tend to be few days with an average temperature less than 70° and these days are of less interest since the system load tends to be low.

For each graph, we only include estimated savings for the five hours of the on-peak period. We set the savings at hour 14 to zero, though this is done for reference purposes – it does not reflect an estimate of the savings during that hour. The regression model was only used to estimate the on-peak energy savings.

Figure 4-22 shows the savings estimate based on the regression model for the TOU-CP customers on a mild day, with an average temperature of 70°. The actual coolest day during the study period had an average temperature of 57.5°, but as discussed above, we use 70° as the practical minimum.

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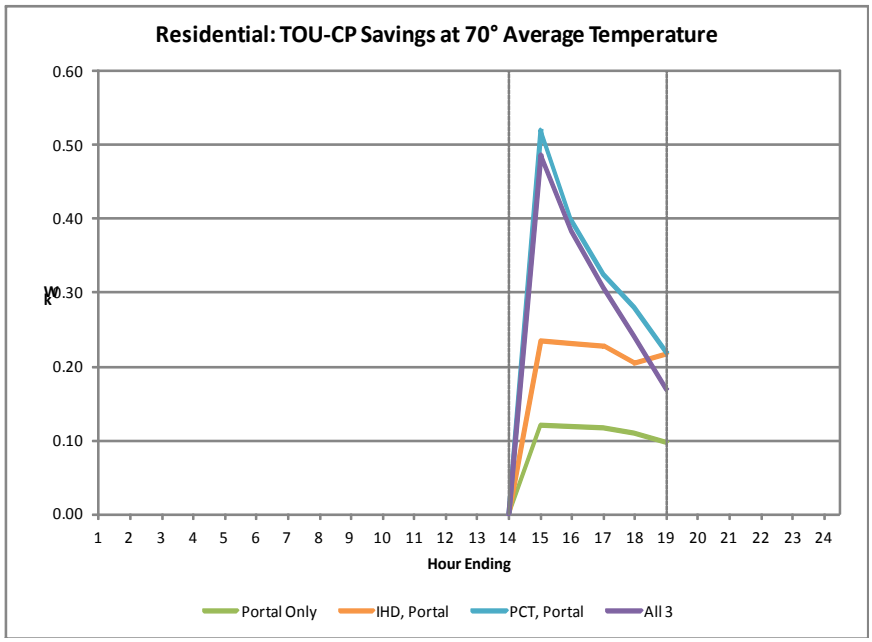

Figure 4-22 TOU-CP weekday non-event day at 70° – Regression On-Peak Savings

Figure 4-23 shows the savings estimate based on the regression model for the TOU-CP customers on a mild day, with an average temperature of 82°, the mean average temperature for all the non-event weekdays in the study period.

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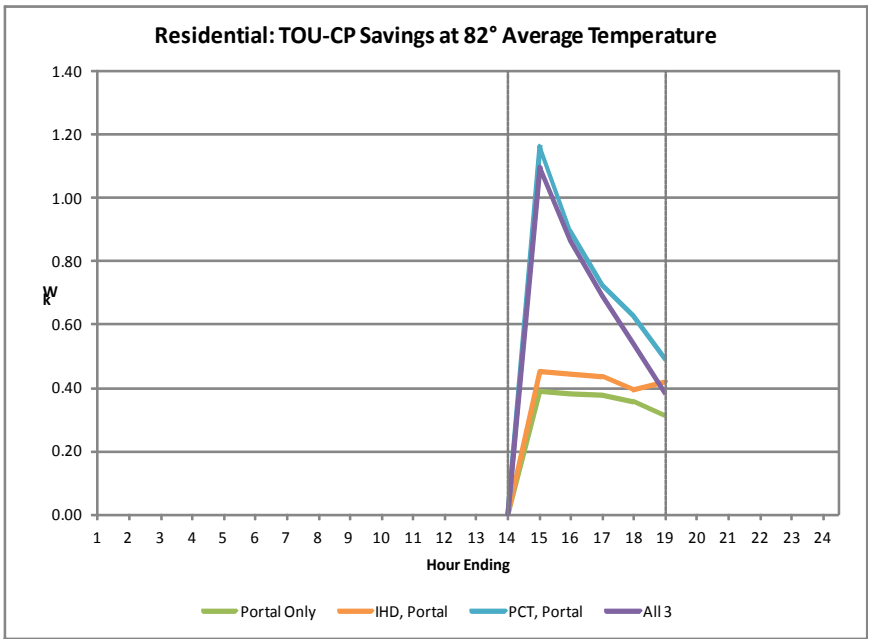

Figure 4-23 TOU-CP weekday non-event day at 82° – Regression On-Peak Savings

Figure 4-24 shows the savings estimate based on the regression model for the TOU-CP customers on a hot day with an average temperature of 95°, the highest average temperature for all the non-event weekdays in the study period.

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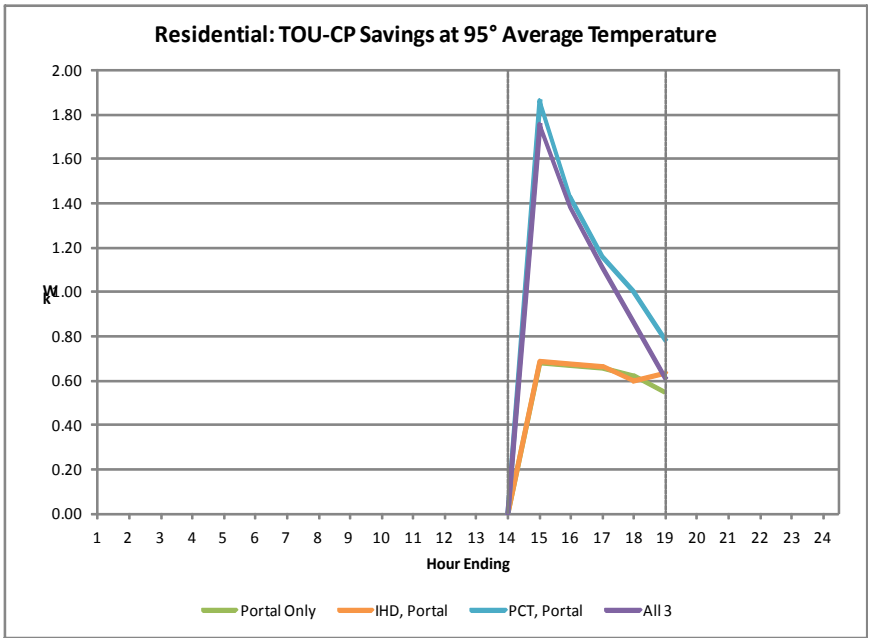

Figure 4-24 TOU-CP weekday non-event day at 95° – Regression On-Peak Savings

Figure 4-25 shows the savings estimate based on the regression model for the VPP-CP customers on a low price day that is very mild, with an average temperature of 70° or less. The coolest low price day had an average temperature of 57.5°, but as described above, we use 70° as a practical minimum.

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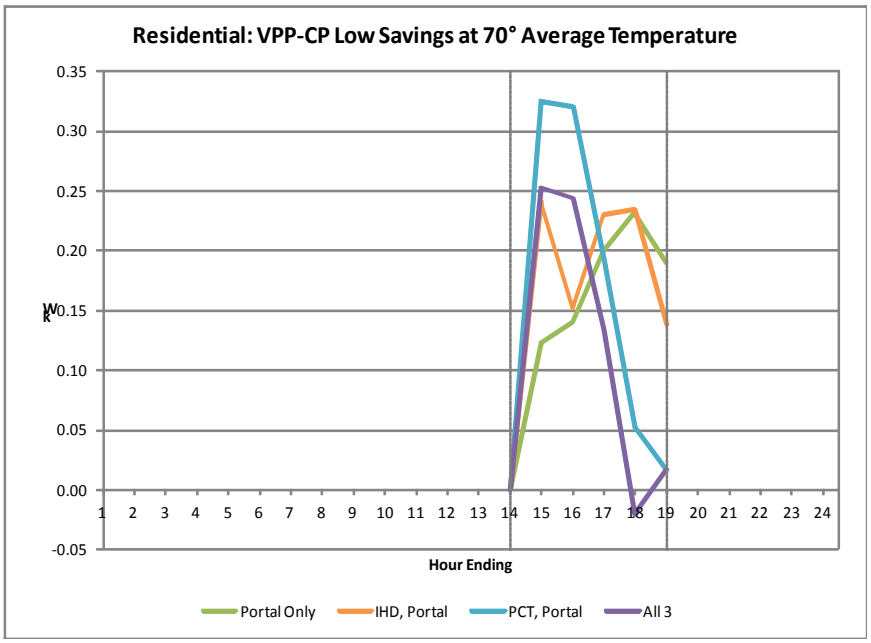

Figure 4-25 VPP-CP weekday non-event day, low price at 70° – Regression On-Peak Savings

Figure 4-26 shows the savings estimate based on the regression model for the VPP-CP customers on an average low price day, with an average temperature of 73.7°, the mean average temperature for all the low price non-event weekdays in the study period.

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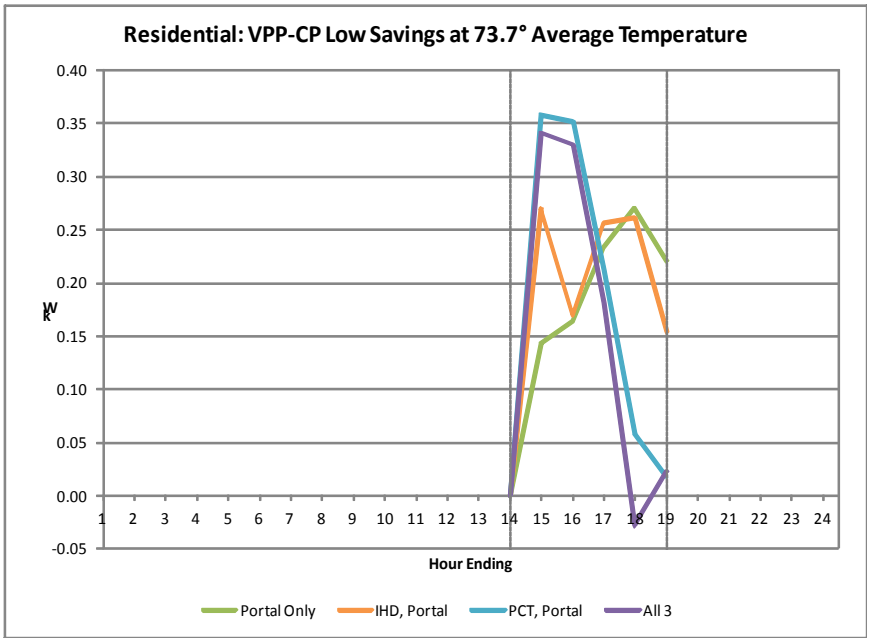

Figure 4-26 VPP-CP weekday non-event day, low price at 73.7° – Regression On-Peak Savings

Figure 4-27 shows the savings estimate based on the regression model for the TOU-CP customers on a relatively warm low price day, with an average temperature of 85°, the highest average temperature for all the low price non-event weekdays in the study period.

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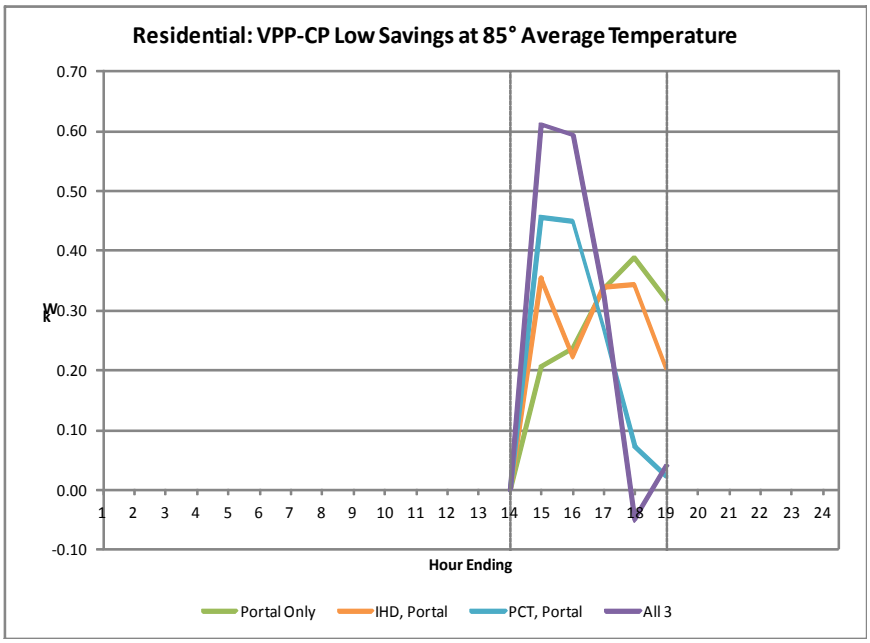

Figure 4-27 VPP-CP weekday non-event day, low price at 85° – Regression On-Peak Savings

Figure 4-28 shows the savings estimate based on the regression model for the VPP-CP customers on the mildest standard price day during the study period, which had an average temperature of 74.5°.

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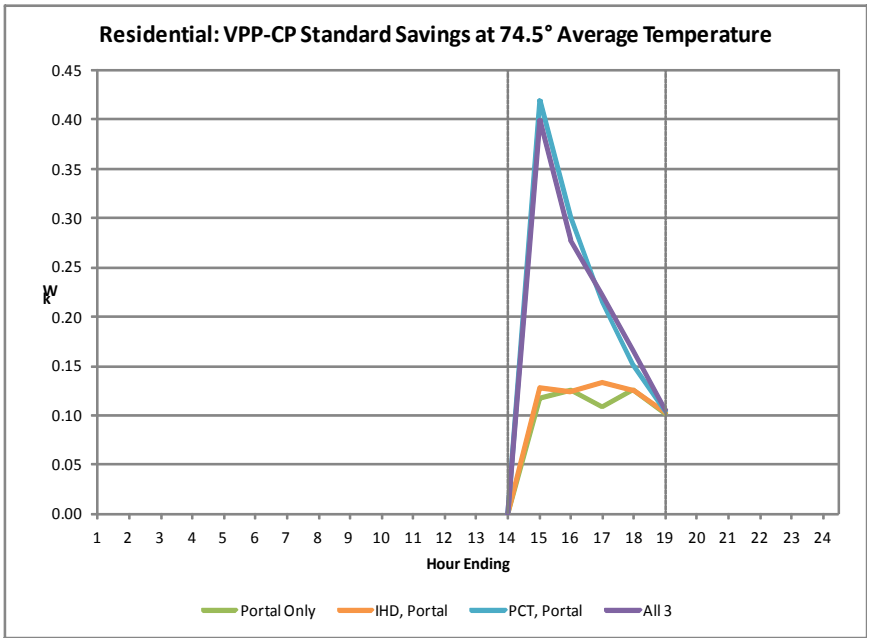

Figure 4-28 VPP-CP weekday non-event day, standard price at 74.5° – Regression On-Peak Savings

Figure 4-29 shows the savings estimate based on the regression model for the VPP-CP customers on an average standard price day, with an average temperature of 82.3°, the mean average temperature for all the standard price non-event weekdays in the study period.

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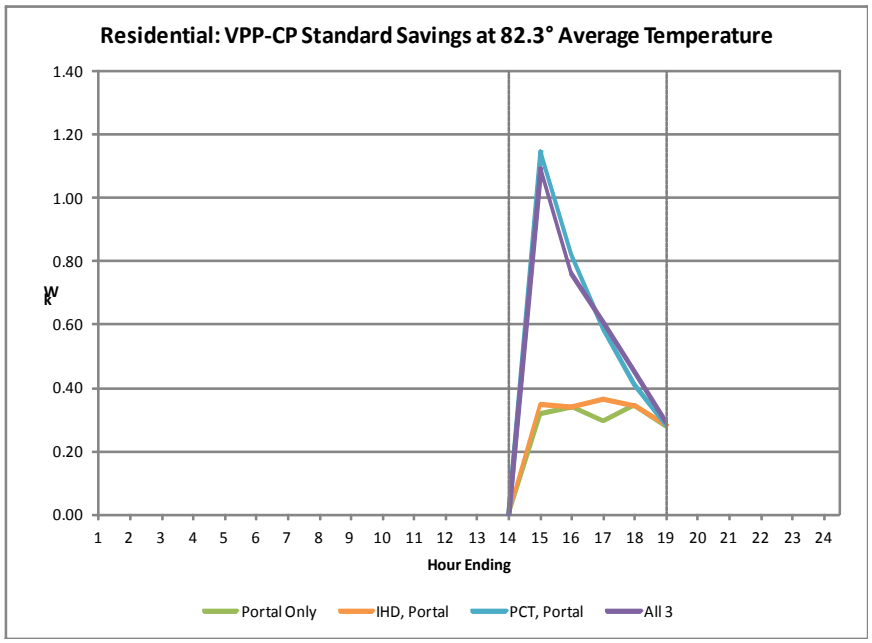

Figure 4-29 VPP-CP weekday non-event day, standard price at 82.3° – Regression On-Peak Savings

Figure 4-30 shows the savings estimate based on the regression model for the TOU-CP customers on a relatively warm standard price day, with an average temperature of 91.5°, the highest average temperature for all the standard price non-event weekdays in the study period.

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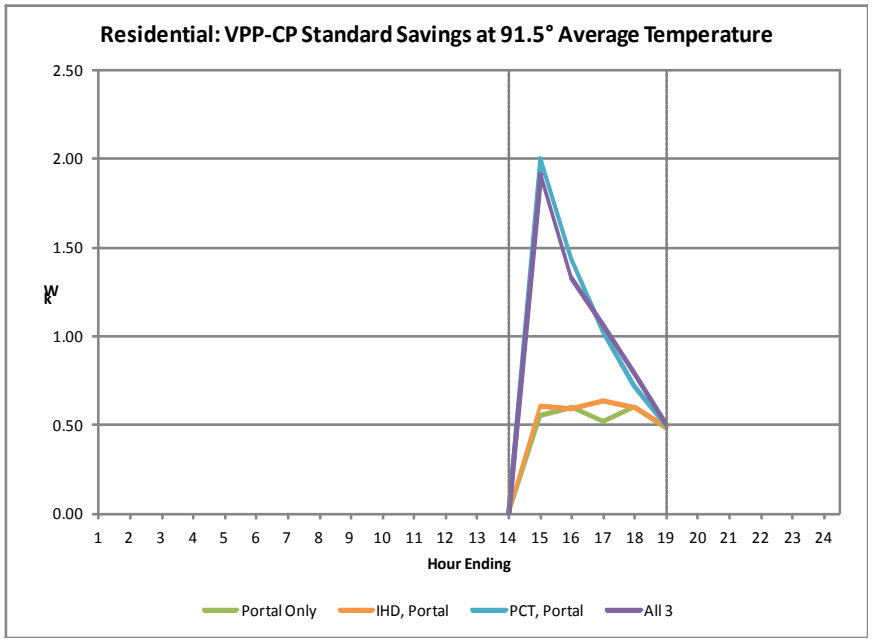

Figure 4-30 VPP-CP weekday non-event day, standard price at 91.5° – Regression On-Peak Savings

Figure 4-31 shows the savings estimate based on the regression model for the VPP-CP customers on the mildest high price day during the study period, which had an average temperature of 80.5°,.

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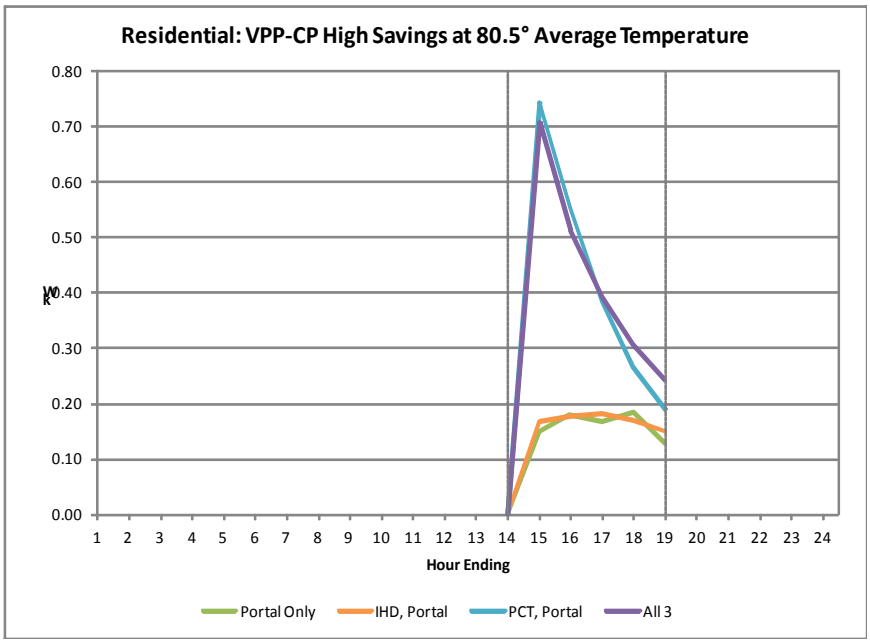

Figure 4-31 VPP-CP weekday non-event day, high price at 80.5˚ – Regression On-Peak Savings

Figure 4-32 shows the savings estimate based on the regression model for the VPP-CP customers on an average high price day, with an average temperature of 86.5°, the mean average temperature for all the high price non-event weekdays in the study period.

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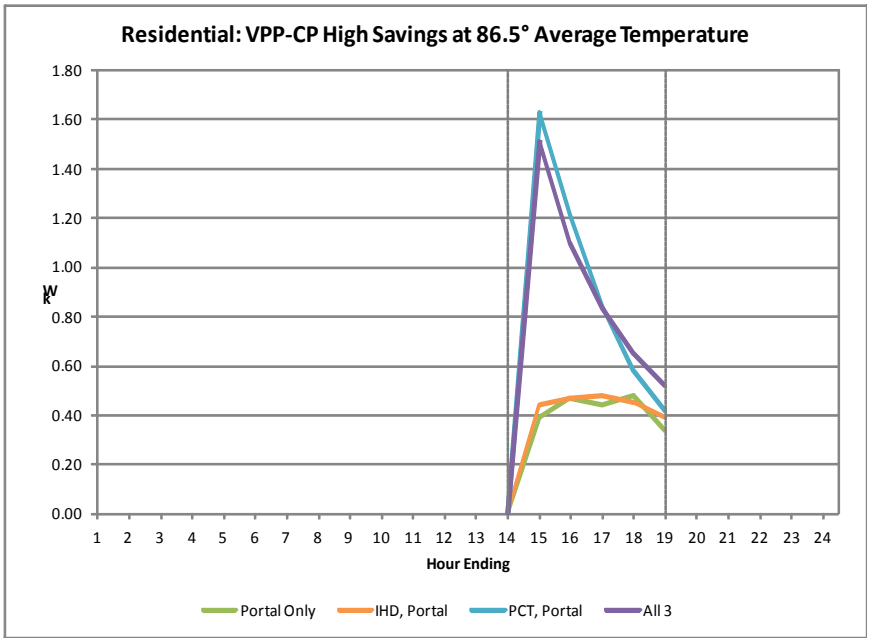

Figure 4-32 VPP-CP weekday non-event day, high price at 86.5˚ – Regression On-Peak Savings

Figure 4-33 shows the savings estimate based on the regression model for the TOU-CP customers on a relatively warm high price day, with an average temperature of 93.5°, the highest average temperature for all the high price non-event weekdays in the study period.

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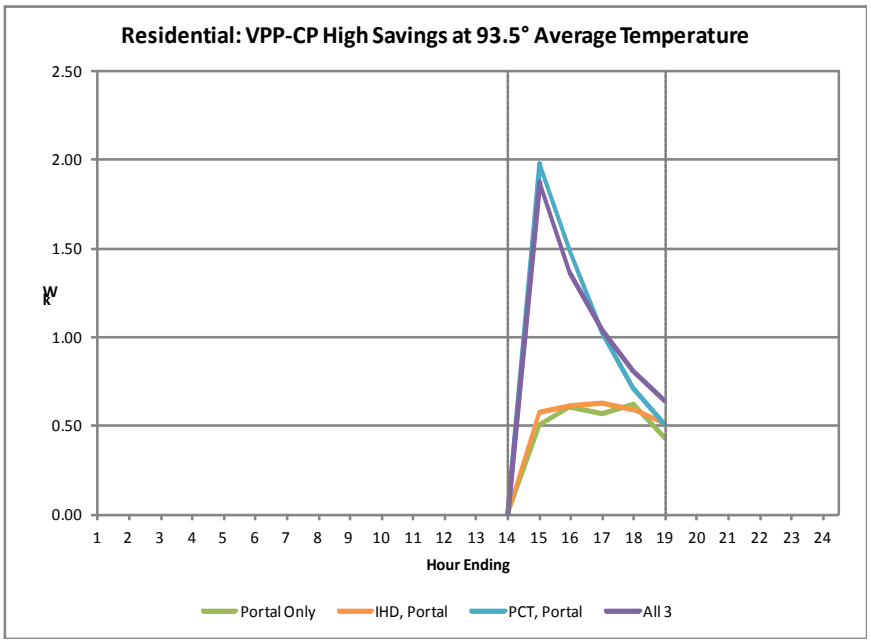

Figure 4-33 VPP-CP weekday non-event day, high price at 93.5° – Regression On-Peak Savings

Figure 4-34 shows the savings estimate based on the regression model for the VPP-CP customers on the mildest critical price day during the study period, which had an average temperature of 80.5°.

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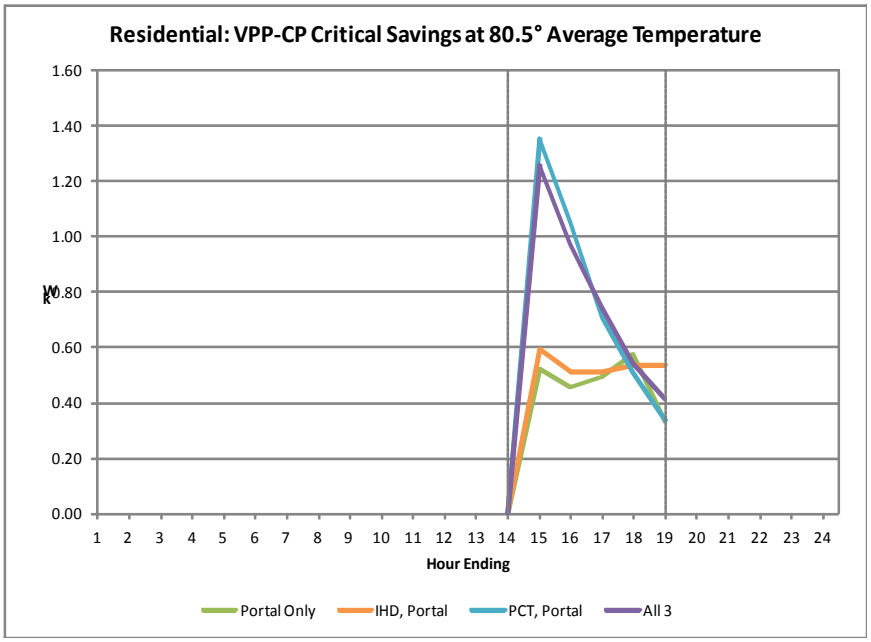

Figure 4-34 VPP-CP weekday non-event day, critical price at 80.5° – Regression On-Peak Savings

Figure 4-35 shows the savings estimate based on the regression model for the VPP-CP customers on an average critical price day, with an average temperature of 89.2°, the mean average temperature for all the critical price non-event weekdays in the study period.

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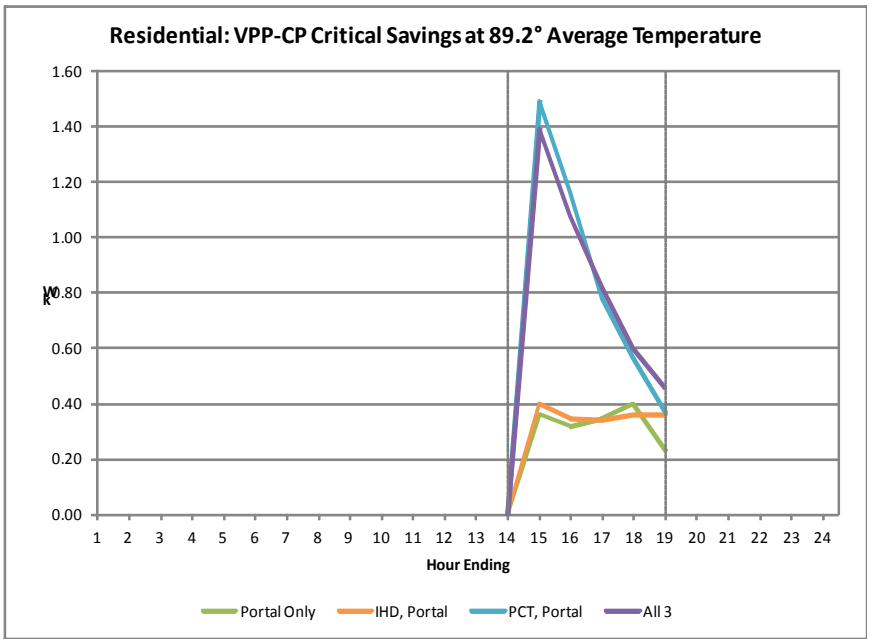

Figure 4-35 VPP-CP weekday non-event day, critical price at 89.2° – Regression On-Peak Savings

Figure 4-36 shows the savings estimate based on the regression model for the TOU-CP customers on a relatively warm critical price day, with an average temperature of 95°, the highest average temperature for all the critical price non-event weekdays in the study period.

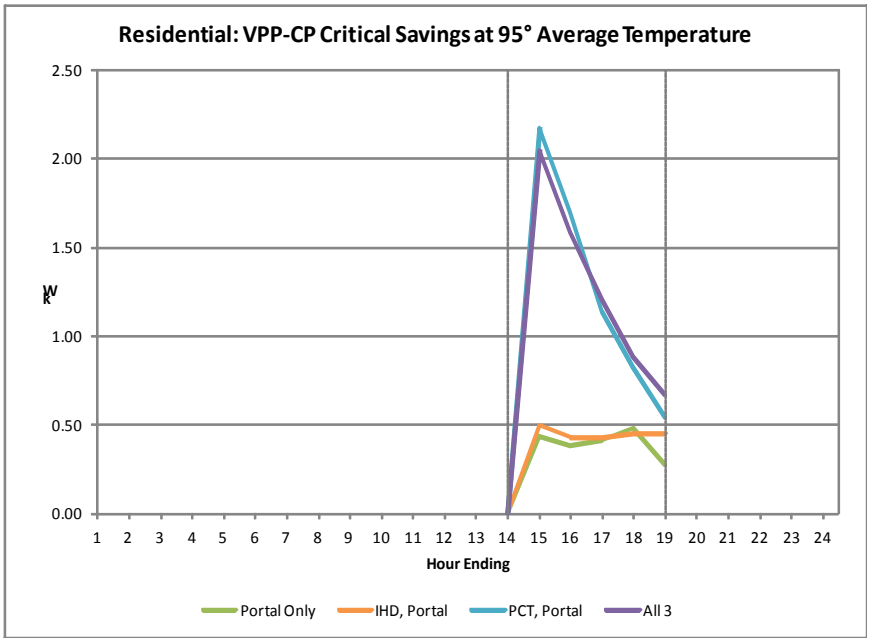

Figure 4-36 VPP-CP weekday non-event day, critical price at 95° – Regression On-Peak Savings

4.1.3 Event Day Impacts

Table 4-10 and Table 4-11 below show average critical peak, on-peak, and off-peak baseline consumption and change for each day type and each rate-technology combination for each event day for the Phase I Residential customers. For those event days where the event period included the entire on-peak period, there was no on-peak consumption. Note that, on a given

day type, baseline consumption is different for the PCT group than it is for the other technology groups. This is as a result of the PCT group control group being comprised of customers with central AC only.

Table 4-10 Event Day Average Critical and On-Peak Consumption – Phase I Residential

	Critical Peak Consumption			On-Peak Consumption		
	Baseline	**Change**	**Percent**	**Baseline**	**Change**	**Percent**
TOU-CP July 08, 2011 Event						
Portal Only	25.00	-4.78	-19.12%			
IHD, Portal	25.00	-6.10	-24.40%			
PCT, Portal	24.25	-8.14	-33.55%			
All 3	25.00	-8.01	-32.02%			
VPP-CP July 08, 2011 Event						
Portal Only	25.00	-4.32	-17.29%			
IHD, Portal	25.00	-5.09	-20.36%			
PCT, Portal	24.25	-6.86	-28.29%			
All 3	25.00	-9.03	-36.12%			
TOU-CP July 15, 2011 Event						
Portal Only	35.35	-5.14	-14.53%			
IHD, Portal	35.35	-8.40	-23.75%			
PCT, Portal	34.58	-9.35	-27.02%			
All 3	35.35	-9.55	-27.01%			
VPP-CP July 15, 2011 Event						
Portal Only	35.35	-5.69	-16.09%			
IHD, Portal	35.35	-6.13	-17.35%			
PCT, Portal	34.58	-6.97	-20.17%			
All 3	35.35	-9.25	-26.16%			
TOU-CP August 08, 2011 Event						
Portal Only	9.27	-1.64	-17.72%	13.34	-2.02	-15.16%
IHD, Portal	9.27	-1.69	-18.27%	13.34	-2.29	-17.19%
PCT, Portal	9.11	-2.85	-31.25%	13.19	-4.03	-30.57%
All 3	9.27	-3.03	-32.70%	13.34	-4.18	-31.36%
VPP-CP August 08, 2011 Event						
Portal Only	9.27	-1.38	-14.90%	13.34	-1.88	-14.06%
IHD, Portal	9.27	-1.58	-17.08%	13.34	-2.27	-17.04%
PCT, Portal	9.11	-1.64	-18.01%	13.19	-3.83	-29.03%
All 3	9.27	-2.42	-26.07%	13.34	-4.56	-34.19%

TOU-CP August 24, 2011 Event						
Portal Only	9.18	-1.45	-15.77%	12.85	-1.86	-14.44%
IHD, Portal	9.18	-2.04	-22.23%	12.85	-2.45	-19.07%
PCT, Portal	9.09	-2.97	-32.63%	12.75	-3.88	-30.46%
All 3	9.18	-3.02	-32.90%	12.85	-4.02	-31.29%
VPP-CP August 24, 2011 Event						
Portal Only	9.18	-1.35	-14.72%	12.85	-1.86	-14.50%
IHD, Portal	9.18	-1.74	-18.95%	12.85	-1.97	-15.30%
PCT, Portal	9.09	-2.65	-29.17%	12.75	-3.55	-27.85%
All 3	9.18	-3.03	-33.01%	12.85	-3.86	-30.08%
TOU-CP September 01, 2011 Event						
Portal Only	16.46	-2.43	-14.79%	3.66	-0.56	-15.19%
IHD, Portal	16.46	-3.54	-21.49%	3.66	-0.80	-21.81%
PCT, Portal	16.32	-5.61	-34.39%	3.60	-1.65	-45.82%
All 3	16.46	-4.89	-29.73%	3.66	-1.74	-47.47%
VPP-CP September 01, 2011 Event						
Portal Only	16.46	-2.87	-17.43%	3.66	-0.74	-20.13%
IHD, Portal	16.46	-2.72	-16.54%	3.66	-0.59	-16.25%
PCT, Portal	16.32	-4.55	-27.90%	3.60	-1.59	-44.24%
All 3	16.46	-5.46	-33.14%	3.66	-1.74	-47.59%
TOU-CP September 13, 2011 Event						
Portal Only	13.47	-2.51	-18.64%	7.70	-0.95	-12.34%
IHD, Portal	13.47	-3.29	-24.43%	7.70	-1.22	-15.80%
PCT, Portal	13.34	-5.82	-43.60%	7.61	-1.06	-13.92%
All 3	13.47	-5.39	-40.05%	7.70	-1.28	-16.57%
VPP-CP September 13, 2011 Event						
Portal Only	13.47	-2.35	-17.47%	7.70	-0.58	-7.56%
IHD, Portal	13.47	-2.37	-17.58%	7.70	-0.80	-10.42%
PCT, Portal	13.34	-5.46	-40.96%	7.61	-0.23	-3.07%
All 3	13.47	-5.00	-37.09%	7.70	-0.79	-10.22%
TOU-CP September 27, 2011 Event						
Portal Only	4.30	-0.58	-13.51%	5.51	-0.73	-13.20%
IHD, Portal	4.30	-1.13	-26.21%	5.51	-1.15	-20.89%
PCT, Portal	4.29	-1.52	-35.51%	5.44	-1.45	-26.57%
All 3	4.30	-1.16	-26.88%	5.51	-1.41	-25.66%
VPP-CP September 27, 2011 Event						

Portal Only	4.30	-0.59	-13.69%	5.51	-0.50	-9.00%
IHD, Portal	4.30	-0.68	-15.81%	5.51	-0.27	-4.96%
PCT, Portal	4.29	-1.49	-34.64%	5.44	0.01	0.19%
All 3	4.30	-1.57	-36.44%	5.51	0.21	3.79%

Table 4-11 Event Day Average Off-Peak and Overall Consumption – Phase I Residential

	Off-Peak Consumption			Overall
	Baseline	Change	Percent	Change
TOU-CP July 08, 2011 Event				
Portal Only	48.81	-1.86	-3.81%	-6.64
IHD, Portal	48.81	-3.86	-7.91%	-9.96
PCT, Portal	47.34	1.89	4.00%	-6.24
All 3	48.81	-0.70	-1.43%	-8.70
VPP-CP July 08, 2011 Event				
Portal Only	48.81	-1.12	-2.30%	-5.44
IHD, Portal	48.81	-2.22	-4.55%	-7.31
PCT, Portal	47.34	5.01	10.59%	-1.85
All 3	48.81	-1.56	-3.20%	-10.59
TOU-CP July 15, 2011 Event				
Portal Only	40.50	-0.18	-0.44%	-5.32
IHD, Portal	40.50	-1.83	-4.51%	-10.22
PCT, Portal	39.58	2.65	6.69%	-6.70
All 3	40.50	-0.31	-0.77%	-9.86
VPP-CP July 15, 2011 Event				
Portal Only	40.50	0.72	1.77%	-4.97
IHD, Portal	40.50	-0.73	-1.80%	-6.86
PCT, Portal	39.58	4.59	11.61%	-2.38
All 3	40.50	-0.15	-0.37%	-9.40
TOU-CP August 08, 2011 Event				
Portal Only	54.31	-1.16	-2.13%	-4.82
IHD, Portal	54.31	-4.14	-7.62%	-8.12
PCT, Portal	53.69	1.18	2.20%	-5.70
All 3	54.31	-2.15	-3.95%	-9.36
VPP-CP August 08, 2011 Event				
Portal Only	54.31	1.11	2.05%	-2.14
IHD, Portal	54.31	-1.52	-2.81%	-5.38

PCT, Portal	53.69	5.09	9.48%	-0.38
All 3	54.31	-1.92	-3.54%	-8.90
TOU-CP August 24, 2011 Event				
Portal Only	52.21	0.65	1.25%	-2.65
IHD, Portal	52.21	-1.99	-3.80%	-6.48
PCT, Portal	51.37	2.53	4.93%	-4.32
All 3	52.21	0.34	0.66%	-6.69
VPP-CP August 24, 2011 Event				
Portal Only	52.21	0.06	0.11%	-3.16
IHD, Portal	52.21	-0.42	-0.80%	-4.12
PCT, Portal	51.37	6.11	11.89%	-0.09
All 3	52.21	0.40	0.76%	-6.50
TOU-CP September 01, 2011 Event				
Portal Only	46.57	0.45	0.97%	-2.54
IHD, Portal	46.57	-2.38	-5.10%	-6.71
PCT, Portal	45.97	2.50	5.44%	-4.76
All 3	46.57	1.51	3.24%	-5.12
VPP-CP September 01, 2011 Event				
Portal Only	46.57	1.12	2.40%	-2.49
IHD, Portal	46.57	-0.49	-1.06%	-3.81
PCT, Portal	45.97	6.24	13.58%	0.10
All 3	46.57	0.81	1.75%	-6.38
TOU-CP September 13, 2011 Event				
Portal Only	36.25	0.66	1.81%	-2.80
IHD, Portal	36.25	-0.79	-2.17%	-5.30
PCT, Portal	35.90	1.68	4.67%	-5.20
All 3	36.25	1.69	4.65%	-4.99
VPP-CP September 13, 2011 Event				
Portal Only	36.25	1.22	3.36%	-1.72
IHD, Portal	36.25	-0.39	-1.07%	-3.56
PCT, Portal	35.90	4.94	13.76%	-0.76
All 3	36.25	2.00	5.51%	-3.79
TOU-CP September 27, 2011 Event				
Portal Only	21.62	0.65	3.00%	-0.66
IHD, Portal	21.62	-0.82	-3.78%	-3.10
PCT, Portal	21.30	0.72	3.36%	-2.25

All 3	21.62	0.40	1.86%	-2.17
VPP-CP September 27, 2011 Event				
Portal Only	21.62	-0.93	-4.30%	-2.01
IHD, Portal	21.62	-0.47	-2.17%	-1.42
PCT, Portal	21.30	2.25	10.55%	0.77
All 3	21.62	0.80	3.70%	-0.56

For all phases and groups, for the event days, the timing and duration of the event relative to the on-peak period, the price that was in place for the on-peak period before the event was called, and the temperature on the day of the event all have a dramatic impact on the savings during the event and for the remainder of the day.

Table 4-12 and Table 4-13 below show average critical peak, on-peak, and off-peak baseline consumption and change for each day type and each rate-technology combination for each event day for the Phase II residential customers.

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Table 4-12 Event Day Average Critical and On-Peak Consumption – Phase II Residential

	Critical Consumption			On-Peak Consumption		
	Baseline	**Change**	**Percent**	**Baseline**	**Change**	**Percent**
TOU-CP July 08, 2011 Event						
Portal Only	22.37	-2.51	-11.21%			
IHD, Portal	21.14	-1.33	-6.31%			
PCT, Portal	22.61	-6.77	-29.95%			
All 3	23.09	-5.49	-23.76%			
VPP-CP July 08, 2011 Event						
Portal Only	23.21	-2.38	-10.24%			
IHD, Portal	21.81	-2.12	-9.72%			
PCT, Portal	23.51	-8.50	-36.14%			
All 3	22.24	-6.36	-28.60%			
TOU-CP July 15, 2011 Event						
Portal Only	31.39	-2.37	-7.55%			
IHD, Portal	31.25	-2.44	-7.81%			
PCT, Portal	31.99	-6.52	-20.38%			
All 3	33.35	-5.97	-17.89%			
VPP-CP July 15, 2011 Event						
Portal Only	32.83	-2.17	-6.61%			
IHD, Portal	31.18	-2.74	-8.79%			
PCT, Portal	32.69	-6.97	-21.31%			
All 3	32.06	-7.41	-23.11%			

TOU-CP August 08, 2011 Event						
Portal Only	8.58	-1.10	-12.85%	12.28	-1.29	-10.49%
IHD, Portal	8.04	-0.80	-9.92%	11.73	-0.84	-7.15%
PCT, Portal	8.46	-2.76	-32.67%	12.28	-3.28	-26.72%
All 3	8.81	-2.74	-31.05%	12.39	-3.14	-25.36%
VPP-CP August 08, 2011 Event						
Portal Only	8.78	-0.92	-10.52%	12.75	-1.33	-10.40%
IHD, Portal	8.20	-0.54	-6.60%	11.89	-1.04	-8.72%
PCT, Portal	8.65	-1.78	-20.55%	12.29	-3.65	-29.73%
All 3	8.27	-1.70	-20.59%	12.10	-3.75	-31.03%
TOU-CP August 24, 2011 Event						
Portal Only	8.12	-0.83	-10.28%	11.51	-1.19	-10.34%
IHD, Portal	7.99	-0.67	-8.37%	11.41	-0.78	-6.80%
PCT, Portal	8.47	-2.77	-32.75%	11.48	-3.02	-26.34%
All 3	8.73	-2.24	-25.67%	11.86	-2.54	-21.39%
VPP-CP August 24, 2011 Event						
Portal Only	8.44	-0.88	-10.39%	12.03	-1.03	-8.53%
IHD, Portal	7.95	-0.50	-6.28%	11.30	-0.62	-5.47%
PCT, Portal	8.52	-2.52	-29.53%	12.12	-3.52	-29.03%
All 3	8.52	-2.62	-30.78%	11.67	-3.07	-26.26%
TOU-CP September 01, 2011 Event						
Portal Only	14.90	-1.82	-12.20%	3.39	-0.49	-14.33%
IHD, Portal	14.55	-1.15	-7.91%	3.25	-0.02	-0.52%
PCT, Portal	16.01	-5.27	-32.88%	3.57	-1.71	-47.99%
All 3	15.95	-4.27	-26.78%	3.55	-1.42	-39.98%
VPP-CP September 01, 2011 Event						
Portal Only	15.60	-1.98	-12.67%	3.62	-0.40	-11.17%
IHD, Portal	15.14	-1.87	-12.32%	3.41	-0.42	-12.24%
PCT, Portal	15.83	-4.54	-28.69%	3.57	-1.65	-46.30%
All 3	15.45	-4.36	-28.25%	3.51	-1.51	-42.99%
TOU-CP September 13, 2011 Event						
Portal Only	12.76	-2.04	-15.97%	6.69	-0.39	-5.76%
IHD, Portal	12.54	-1.43	-11.44%	7.06	-0.71	-10.03%
PCT, Portal	12.49	-4.92	-39.40%	7.30	-1.44	-19.69%
All 3	13.36	-4.47	-33.48%	7.53	-1.00	-13.24%
VPP-CP September 13, 2011 Event						

Portal Only	14.07	-2.60	-18.45%	7.64	-0.93	-12.16%
IHD, Portal	12.48	-1.35	-10.85%	6.94	-0.55	-7.86%
PCT, Portal	13.13	-4.73	-36.05%	7.32	-0.33	-4.45%
All 3	13.29	-5.24	-39.40%	7.20	-0.57	-7.85%
TOU-CP September 27, 2011 Event						
Portal Only	4.38	-0.63	-14.37%	5.42	-0.63	-11.60%
IHD, Portal	4.33	-0.48	-11.13%	5.62	-0.47	-8.31%
PCT, Portal	4.68	-1.89	-40.45%	6.20	-2.21	-35.72%
All 3	4.94	-1.71	-34.72%	6.04	-1.43	-23.71%
VPP-CP September 27, 2011 Event						
Portal Only	4.94	-1.07	-21.64%	6.27	-0.74	-11.84%
IHD, Portal	4.48	-0.77	-17.17%	5.88	-0.74	-12.60%
PCT, Portal	4.96	-2.04	-41.24%	6.24	-0.31	-5.04%
All 3	4.68	-1.82	-38.94%	5.85	-0.14	-2.36%

Table 4-13 Event Day Average Off-Peak and Overall Consumption – Phase II Residential

	Off-Peak Consumption			Overall
	Baseline	Change	Percent	Change
TOU-CP July 08, 2011 Event				
Portal Only	44.90	-0.81	-1.81%	-3.32
IHD, Portal	45.29	-0.23	-0.51%	-1.57
PCT, Portal	45.51	1.80	3.95%	-4.97
All 3	47.19	2.40	5.10%	-3.08
VPP-CP July 08, 2011 Event				
Portal Only	48.16	-1.79	-3.71%	-4.16
IHD, Portal	44.59	0.39	0.88%	-1.73
PCT, Portal	47.07	1.28	2.71%	-7.22
All 3	45.92	-0.04	-0.08%	-6.40
TOU-CP July 15, 2011 Event				
Portal Only	37.37	0.13	0.34%	-2.24
IHD, Portal	38.60	-0.93	-2.41%	-3.37
PCT, Portal	38.89	0.86	2.22%	-5.66
All 3	41.30	0.12	0.29%	-5.85
VPP-CP July 15, 2011 Event				
Portal Only	40.67	-0.92	-2.26%	-3.09
IHD, Portal	37.16	0.49	1.31%	-2.26

PCT, Portal	38.51	4.02	10.43%	-2.95
All 3	37.83	1.18	3.11%	-6.23
TOU-CP August 08, 2011 Event				
Portal Only	47.74	0.65	1.37%	-1.74
IHD, Portal	49.48	-1.13	-2.28%	-2.76
PCT, Portal	50.22	-0.26	-0.52%	-6.31
All 3	52.44	0.82	1.57%	-5.06
VPP-CP August 08, 2011 Event				
Portal Only	50.49	-0.22	-0.44%	-2.47
IHD, Portal	48.62	0.03	0.06%	-1.55
PCT, Portal	49.15	4.73	9.62%	-0.70
All 3	49.27	1.83	3.72%	-3.63
TOU-CP August 24, 2011 Event				
Portal Only	47.48	1.17	2.46%	-0.86
IHD, Portal	48.81	-0.20	-0.42%	-1.65
PCT, Portal	49.57	0.91	1.85%	-4.88
All 3	52.43	1.47	2.80%	-3.31
VPP-CP August 24, 2011 Event				
Portal Only	51.39	-0.38	-0.74%	-2.28
IHD, Portal	47.44	1.00	2.12%	-0.11
PCT, Portal	49.20	5.64	11.46%	-0.40
All 3	48.06	3.08	6.40%	-2.61
TOU-CP September 01, 2011 Event				
Portal Only	42.61	0.77	1.81%	-1.53
IHD, Portal	44.05	0.10	0.23%	-1.07
PCT, Portal	46.38	0.35	0.75%	-6.63
All 3	47.56	1.81	3.81%	-3.88
VPP-CP September 01, 2011 Event				
Portal Only	46.44	-0.47	-1.01%	-2.85
IHD, Portal	43.59	0.06	0.14%	-2.22
PCT, Portal	44.36	4.81	10.85%	-1.38
All 3	44.64	2.35	5.27%	-3.52
TOU-CP September 13, 2011 Event				
Portal Only	33.03	1.00	3.04%	-1.42
IHD, Portal	34.41	-0.14	-0.40%	-2.28
PCT, Portal	33.67	2.93	8.71%	-3.42

All 3	36.08	3.63	10.05%	-1.84
VPP-CP September 13, 2011 Event				
Portal Only	36.53	-0.85	-2.34%	-4.38
IHD, Portal	33.88	0.62	1.82%	-1.28
PCT, Portal	34.95	4.29	12.27%	-0.77
All 3	33.65	3.33	9.89%	-2.47
TOU-CP September 27, 2011 Event				
Portal Only	20.75	0.38	1.82%	-0.88
IHD, Portal	21.90	-0.97	-4.41%	-1.91
PCT, Portal	22.40	-1.63	-7.30%	-5.74
All 3	24.15	-0.52	-2.13%	-3.66
VPP-CP September 27, 2011 Event				
Portal Only	24.23	-2.91	-12.03%	-4.73
IHD, Portal	22.12	-1.12	-5.06%	-2.63
PCT, Portal	23.71	0.78	3.27%	-1.58
All 3	21.73	0.32	1.47%	-1.64

As stated above, for all phases and groups, for the event days, the timing and duration of the event relative to the on-peak period, the price that was in place for the on-peak period before the event was called, and the temperature on the day of the event all have a dramatic impact on the savings during the event and for the remainder of the day.

Table 4-14 and Table 4-15 below show average critical peak, on-peak, and off-peak baseline consumption and change for each day type and each rate-technology combination for each event day for the Phase II Small Commercial customers.

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Table 4-14 Event Day Average Critical and On-Peak Consumption – Phase II Small Commercial

	Critical Consumption			On-Peak Consumption		
	Baseline	**Change**	**Percent**	**Baseline**	**Change**	**Percent**
TOU-CP July 08, 2011 Event						
Portal Only	35.73	1.14	3.20%			
IHD, Portal	43.40	-4.57	-10.53%			
PCT, Portal	44.18	-5.06	-11.46%			
All 3	43.35	-2.69	-6.21%			
VPP-CP July 08, 2011 Event						
Portal Only	33.95	-0.76	-2.25%			
IHD, Portal	40.48	-2.80	-6.93%			
PCT, Portal	30.65	-7.27	-23.71%			
All 3	46.24	-1.32	-2.85%			

TOU-CP July 15, 2011 Event						
Portal Only	46.59	0.40	0.86%			
IHD, Portal	55.60	-5.69	-10.23%			
PCT, Portal	56.07	-6.72	-11.98%			
All 3	55.19	-5.60	-10.14%			
VPP-CP July 15, 2011 Event						
Portal Only	45.01	-0.63	-1.40%			
IHD, Portal	54.02	-2.38	-4.40%			
PCT, Portal	41.90	-10.42	-24.86%			
All 3	60.72	-2.25	-3.70%			
TOU-CP August 08, 2011 Event						
Portal Only	13.76	-1.72	-12.53%	20.33	-2.00	-9.85%
IHD, Portal	16.66	-2.73	-16.38%	24.01	-4.57	-19.03%
PCT, Portal	17.76	-4.49	-25.31%	24.03	-4.70	-19.56%
All 3	16.64	-0.96	-5.75%	23.78	-2.37	-9.97%
VPP-CP August 08, 2011 Event						
Portal Only	13.53	-1.46	-10.79%	19.24	-1.99	-10.37%
IHD, Portal	15.22	-0.48	-3.14%	22.85	-1.68	-7.37%
PCT, Portal	12.51	-2.08	-16.61%	18.58	-5.02	-27.02%
All 3	17.43	-2.25	-12.92%	25.44	-2.99	-11.74%
TOU-CP August 24, 2011 Event						
Portal Only	13.77	-0.61	-4.42%	20.01	-0.78	-3.89%
IHD, Portal	16.67	-2.73	-16.40%	23.69	-3.04	-12.84%
PCT, Portal	17.79	-4.27	-24.03%	23.73	-4.28	-18.05%
All 3	16.65	-3.18	-19.10%	23.47	-3.02	-12.87%
VPP-CP August 24, 2011 Event						
Portal Only	13.55	-1.12	-8.27%	18.92	-0.75	-3.98%
IHD, Portal	15.24	-0.48	-3.15%	22.53	0.40	1.77%
PCT, Portal	12.55	-3.75	-29.87%	18.28	-4.46	-24.42%
All 3	17.45	-4.19	-24.03%	25.13	-5.26	-20.92%
TOU-CP September 01, 2011 Event						
Portal Only	24.66	-1.50	-6.10%	7.02	-0.40	-5.69%
IHD, Portal	30.29	-5.52	-18.23%	7.97	-1.44	-18.11%
PCT, Portal	30.52	-5.77	-18.89%	8.65	-1.22	-14.11%
All 3	29.80	-2.78	-9.32%	8.21	-0.55	-6.66%
VPP-CP September 01, 2011 Event						

Portal Only	23.89	-1.96	-8.22%	6.48	-0.32	-4.98%
IHD, Portal	28.03	-0.68	-2.43%	7.63	0.19	2.54%
PCT, Portal	22.24	-2.94	-13.22%	6.23	-1.06	-17.01%
All 3	31.94	-4.13	-12.94%	8.54	-1.24	-14.58%
TOU-CP September 13, 2011 Event						
Portal Only	26.16	-3.51	-13.43%	9.63	-0.87	-8.98%
IHD, Portal	30.60	-1.91	-6.25%	12.87	-1.72	-13.39%
PCT, Portal	33.16	-9.68	-29.18%	11.68	-2.97	-25.42%
All 3	31.20	-0.98	-3.14%	12.22	-1.82	-14.88%
VPP-CP September 13, 2011 Event						
Portal Only	24.43	-0.50	-2.04%	9.59	-1.22	-12.73%
IHD, Portal	28.74	0.11	0.37%	11.81	-1.21	-10.21%
PCT, Portal	22.72	-5.42	-23.84%	8.58	-1.63	-19.00%
All 3	32.41	-5.44	-16.78%	13.90	-2.60	-18.73%
TOU-CP September 27, 2011 Event						
Portal Only	9.56	-1.75	-18.29%	13.76	-1.85	-13.47%
IHD, Portal	12.46	-2.93	-23.54%	17.44	-5.24	-30.03%
PCT, Portal	13.00	-3.04	-23.40%	16.62	-3.49	-21.03%
All 3	12.44	-2.05	-16.50%	17.22	-1.06	-6.14%
VPP-CP September 27, 2011 Event						
Portal Only	9.33	-1.32	-14.19%	12.68	-1.02	-8.06%
IHD, Portal	11.02	-1.56	-14.17%	16.28	-1.43	-8.81%
PCT, Portal	7.75	-2.05	-26.39%	11.17	-1.62	-14.47%
All 3	13.24	-4.74	-35.83%	18.88	-4.30	-22.79%

Table 4-15 Event Day Average Off-Peak and Overall Consumption – Phase II Small Commercial

	Off-Peak Consumption			Overall
	Baseline	Change	Percent	Change
TOU-CP July 08, 2011 Event				
Portal Only	61.48	-0.70	-1.14%	0.44
IHD, Portal	68.10	-0.27	-0.39%	-4.84
PCT, Portal	76.91	-14.20	-18.46%	-19.26
All 3	65.79	-2.17	-3.30%	-4.86
VPP-CP July 08, 2011 Event				
Portal Only	61.93	-3.12	-5.04%	-3.88

IHD, Portal	74.58	2.12	2.84%	-0.69
PCT, Portal	58.27	-5.25	-9.01%	-12.52
All 3	86.18	5.13	5.95%	3.81
TOU-CP July 15, 2011 Event				
Portal Only	55.66	0.57	1.03%	0.98
IHD, Portal	60.94	-6.84	-11.22%	-12.52
PCT, Portal	71.04	-11.55	-16.26%	-18.27
All 3	58.99	2.89	4.89%	-2.71
VPP-CP July 15, 2011 Event				
Portal Only	55.92	-2.17	-3.89%	-2.80
IHD, Portal	66.06	-0.43	-0.66%	-2.81
PCT, Portal	53.05	-0.24	-0.46%	-10.66
All 3	76.74	-1.69	-2.21%	-3.94
TOU-CP August 08, 2011 Event				
Portal Only	72.83	-2.14	-2.94%	-5.87
IHD, Portal	80.54	-13.99	-17.37%	-21.29
PCT, Portal	90.78	-12.13	-13.36%	-21.32
All 3	78.43	-5.11	-6.52%	-8.44
VPP-CP August 08, 2011 Event				
Portal Only	72.82	-3.86	-5.30%	-7.31
IHD, Portal	86.69	-0.29	-0.33%	-2.45
PCT, Portal	69.30	-8.41	-12.13%	-15.51
All 3	99.25	-7.97	-8.03%	-13.21
TOU-CP August 24, 2011 Event				
Portal Only	72.06	0.29	0.40%	-1.10
IHD, Portal	79.78	-5.62	-7.04%	-11.39
PCT, Portal	90.23	-12.76	-14.15%	-21.32
All 3	77.66	-2.67	-3.43%	-8.87
VPP-CP August 24, 2011 Event				
Portal Only	72.06	-0.85	-1.18%	-2.72
IHD, Portal	85.93	6.25	7.27%	6.17
PCT, Portal	68.75	-10.97	-15.96%	-19.18
All 3	98.48	-7.70	-7.82%	-17.15
TOU-CP September 01, 2011 Event				
Portal Only	68.24	-1.02	-1.49%	-2.92
IHD, Portal	75.95	-9.84	-12.95%	-16.81

PCT, Portal	85.82	-16.68	-19.43%	-23.66
All 3	73.83	-1.02	-1.38%	-4.35
VPP-CP September 01, 2011 Event				
Portal Only	68.23	-5.94	-8.71%	-8.23
IHD, Portal	82.10	-0.04	-0.04%	-0.52
PCT, Portal	64.34	-6.83	-10.61%	-10.83
All 3	94.66	-1.33	-1.40%	-6.71
TOU-CP September 13, 2011 Event				
Portal Only	53.23	-4.12	-7.73%	-8.50
IHD, Portal	59.84	-6.84	-11.43%	-10.48
PCT, Portal	67.94	-14.12	-20.78%	-26.76
All 3	57.53	-1.56	-2.71%	-4.36
VPP-CP September 13, 2011 Event				
Portal Only	53.68	-2.68	-4.99%	-4.40
IHD, Portal	66.32	2.82	4.26%	1.73
PCT, Portal	49.30	-4.60	-9.33%	-11.65
All 3	77.93	-6.16	-7.91%	-14.20
TOU-CP September 27, 2011 Event				
Portal Only	42.36	-5.41	-12.77%	-9.01
IHD, Portal	50.07	-12.65	-25.26%	-20.82
PCT, Portal	56.60	-16.41	-28.99%	-22.95
All 3	47.96	-0.25	-0.53%	-3.36
VPP-CP September 27, 2011 Event				
Portal Only	42.35	0.03	0.07%	-2.31
IHD, Portal	56.22	1.17	2.08%	-1.83
PCT, Portal	35.13	-3.93	-11.18%	-7.59
All 3	68.78	-15.10	-21.95%	-24.14

As stated above, for all phases and groups, for the event days, the timing and duration of the event relative to the on-peak period, the price that was in place for the on-peak period before the event was called, and the temperature on the day of the event all have a dramatic impact on the savings during the event and for the remainder of the day.

Table 4-16 below shows average on-peak kW savings for each event day and each rate-technology combination, for residential customers in both phases. Table 4-17 below shows the kW savings at the single hour that shows the maximum reduction for both residential phases. This is usually in the first hour of the period for the PCT and All 3 groups, when the load reduction due to the PCT is maximized. For the Web and IHD, the maximum demand tends to occur later in the on-peak period. Because the hour that the maximum reduction occurs in can differ for different groups, the baseline use can differ as well. Table 4-18 below shows, for Phase II Small Commercial customers, average on-peak kW savings for each event day and each rate-

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technology combination as well as the kW savings at the single hour that shows the maximum reduction.

Not that when presenting demand, the values represent savings, so a positive value means less energy is used, and a negative value indicates more energy used.

Table 4-16 Event Day Average Residential On-Peak Demand

	Phase I Average On-Peak Demand			Phase II Average On-Peak Demand		
	Baseline	**Reduction**	**Percent**	**Baseline**	**Reduction**	**Percent**
TOU-CP July 08, 2011 Event						
Portal Only	4.17	0.80	19.12%	3.73	0.42	11.21%
IHD, Portal	4.17	1.02	24.40%	3.52	0.22	6.31%
PCT, Portal	4.04	1.36	33.55%	3.77	1.13	29.95%
All 3	4.17	1.33	32.02%	3.85	0.91	23.76%
VPP-CP July 08, 2011 Event						
Portal Only	4.17	0.72	17.29%	3.87	0.40	10.24%
IHD, Portal	4.17	0.85	20.36%	3.63	0.35	9.72%
PCT, Portal	4.04	1.14	28.29%	3.92	1.42	36.14%
All 3	4.17	1.51	36.12%	3.71	1.06	28.60%
TOU-CP July 15, 2011 Event						
Portal Only	4.42	0.64	14.53%	3.92	0.30	7.55%
IHD, Portal	4.42	1.05	23.75%	3.91	0.30	7.81%
PCT, Portal	4.32	1.17	27.02%	4.00	0.82	20.38%
All 3	4.42	1.19	27.01%	4.17	0.75	17.89%
VPP-CP July 15, 2011 Event						
Portal Only	4.42	0.71	16.09%	4.10	0.27	6.61%
IHD, Portal	4.42	0.77	17.35%	3.90	0.34	8.79%
PCT, Portal	4.32	0.87	20.17%	4.09	0.87	21.31%
All 3	4.42	1.16	26.16%	4.01	0.93	23.11%
TOU-CP August 08, 2011 Event						
Portal Only	4.63	0.82	17.72%	4.29	0.55	12.85%
IHD, Portal	4.63	0.85	18.27%	4.02	0.40	9.92%
PCT, Portal	4.55	1.42	31.25%	4.23	1.38	32.67%
All 3	4.63	1.52	32.70%	4.41	1.37	31.05%
VPP-CP August 08, 2011 Event						

Portal Only	4.63	0.69	14.90%	4.39	0.46	10.52%
IHD, Portal	4.63	0.79	17.08%	4.10	0.27	6.60%
PCT, Portal	4.55	0.82	18.01%	4.32	0.89	20.55%
All 3	4.63	1.21	26.07%	4.14	0.85	20.59%
TOU-CP August 24, 2011 Event						
Portal Only	4.59	0.72	15.77%	4.06	0.42	10.28%
IHD, Portal	4.59	1.02	22.23%	3.99	0.33	8.37%
PCT, Portal	4.54	1.48	32.63%	4.23	1.39	32.75%
All 3	4.59	1.51	32.90%	4.37	1.12	25.67%
VPP-CP August 24, 2011 Event						
Portal Only	4.59	0.68	14.72%	4.22	0.44	10.39%
IHD, Portal	4.59	0.87	18.95%	3.98	0.25	6.28%
PCT, Portal	4.54	1.33	29.17%	4.26	1.26	29.53%
All 3	4.59	1.52	33.01%	4.26	1.31	30.78%
TOU-CP September 01, 2011 Event						
Portal Only	4.11	0.61	14.79%	3.73	0.45	12.20%
IHD, Portal	4.11	0.88	21.49%	3.64	0.29	7.91%
PCT, Portal	4.08	1.40	34.39%	4.00	1.32	32.88%
All 3	4.11	1.22	29.73%	3.99	1.07	26.78%
VPP-CP September 01, 2011 Event						
Portal Only	4.11	0.72	17.43%	3.90	0.49	12.67%
IHD, Portal	4.11	0.68	16.54%	3.79	0.47	12.32%
PCT, Portal	4.08	1.14	27.90%	3.96	1.14	28.69%
All 3	4.11	1.36	33.14%	3.86	1.09	28.25%
TOU-CP September 13, 2011 Event						
Portal Only	3.37	0.63	18.64%	3.19	0.51	15.97%
IHD, Portal	3.37	0.82	24.43%	3.14	0.36	11.44%
PCT, Portal	3.33	1.45	43.60%	3.12	1.23	39.40%
All 3	3.37	1.35	40.05%	3.34	1.12	33.48%
VPP-CP September 13, 2011 Event						
Portal Only	3.37	0.59	17.47%	3.52	0.65	18.45%
IHD, Portal	3.37	0.59	17.58%	3.12	0.34	10.85%

PCT, Portal	3.33	1.37	40.96%	3.28	1.18	36.05%
All 3	3.37	1.25	37.09%	3.32	1.31	39.40%
TOU-CP September 27, 2011 Event						
Portal Only	2.15	0.29	13.51%	2.19	0.31	14.37%
IHD, Portal	2.15	0.56	26.21%	2.16	0.24	11.13%
PCT, Portal	2.15	0.76	35.51%	2.34	0.95	40.45%
All 3	2.15	0.58	26.88%	2.47	0.86	34.72%
VPP-CP September 27, 2011 Event						
Portal Only	2.15	0.29	13.69%	2.47	0.53	21.64%
IHD, Portal	2.15	0.34	15.81%	2.24	0.38	17.17%
PCT, Portal	2.15	0.74	34.64%	2.48	1.02	41.24%
All 3	2.15	0.78	36.44%	2.34	0.91	38.94%

Table 4-17 Event Day Average Residential On-Peak Demand at Maximum Reduction

	Phase I Demand at Maximum Reduction			Phase II Demand at Maximum Reduction		
	Baseline	**Reduction**	**Percent**	**Baseline**	**Reduction**	**Percent**
TOU-CP July 08, 2011 Event						
Portal Only	4.12	0.88	21.49%	3.75	0.59	15.62%
IHD, Portal	3.94	1.16	29.53%	3.77	0.34	8.91%
PCT, Portal	3.52	1.81	51.49%	3.46	1.61	46.45%
All 3	3.64	1.61	44.13%	3.58	1.36	38.17%
VPP-CP July 08, 2011 Event						
Portal Only	3.94	0.87	22.15%	3.86	0.48	12.56%
IHD, Portal	3.94	0.93	23.67%	3.93	0.44	11.31%
PCT, Portal	3.52	1.69	48.06%	3.64	1.78	48.71%
All 3	3.94	1.84	46.72%	3.32	1.58	47.39%
TOU-CP July 15, 2011 Event						
Portal Only	4.69	0.77	16.45%	3.89	0.54	13.76%
IHD, Portal	4.23	1.14	27.04%	3.80	0.49	12.76%
PCT, Portal	3.79	1.86	49.02%	3.65	1.58	43.31%
All 3	4.23	1.86	44.06%	3.83	1.31	34.26%

VPP-CP July 15, 2011 Event						
Portal Only	4.23	1.00	23.55%	4.23	0.38	9.07%
IHD, Portal	4.23	0.91	21.43%	4.07	0.42	10.38%
PCT, Portal	4.12	1.59	38.65%	4.02	1.71	42.52%
All 3	3.90	1.78	45.65%	3.90	1.55	39.66%
TOU-CP August 08, 2011 Event						
Portal Only	4.55	0.83	18.28%	4.18	0.55	13.26%
IHD, Portal	4.72	0.86	18.31%	4.08	0.41	9.97%
PCT, Portal	4.43	1.63	36.79%	4.14	1.60	38.59%
All 3	4.55	1.78	39.06%	4.35	1.55	35.75%
VPP-CP August 08, 2011 Event						
Portal Only	4.55	0.71	15.72%	4.45	0.47	10.56%
IHD, Portal	4.55	0.85	18.67%	4.03	0.31	7.59%
PCT, Portal	4.43	0.92	20.79%	4.31	1.09	25.19%
All 3	4.55	1.33	29.20%	4.11	1.05	25.50%
TOU-CP August 24, 2011 Event						
Portal Only	4.55	0.77	16.98%	4.16	0.44	10.55%
IHD, Portal	4.55	1.08	23.66%	4.12	0.46	11.17%
PCT, Portal	4.51	1.86	41.39%	4.07	1.54	37.77%
All 3	4.55	1.91	41.92%	4.24	1.26	29.64%
VPP-CP August 24, 2011 Event						
Portal Only	4.63	0.69	14.84%	4.30	0.47	10.84%
IHD, Portal	4.55	0.92	20.19%	4.07	0.30	7.33%
PCT, Portal	4.51	1.81	40.20%	4.19	1.59	37.98%
All 3	4.55	1.79	39.44%	4.19	1.50	35.87%
TOU-CP September 01, 2011 Event						
Portal Only	3.88	0.67	17.34%	3.74	0.50	13.49%
IHD, Portal	4.19	0.92	22.01%	3.79	0.34	9.10%
PCT, Portal	3.83	1.96	51.22%	3.87	1.84	47.47%
All 3	3.88	1.81	46.51%	3.80	1.59	41.73%
VPP-CP September 01, 2011 Event						
Portal Only	3.88	0.89	22.95%	4.13	0.69	16.81%

IHD, Portal	3.88	0.79	20.34%	3.96	0.50	12.65%
PCT, Portal	3.83	1.79	46.90%	3.73	1.81	48.64%
All 3	3.88	1.84	47.48%	3.67	1.54	41.79%
TOU-CP September 13, 2011 Event						
Portal Only	3.51	0.71	20.31%	3.15	0.58	18.28%
IHD, Portal	3.82	0.94	24.50%	2.99	0.43	14.41%
PCT, Portal	3.14	1.55	49.33%	2.99	1.34	44.84%
All 3	3.15	1.43	45.18%	3.01	1.26	42.06%
VPP-CP September 13, 2011 Event						
Portal Only	3.51	0.72	20.50%	3.93	0.80	20.44%
IHD, Portal	3.51	0.66	18.87%	3.45	0.46	13.27%
PCT, Portal	3.00	1.49	49.68%	3.17	1.31	41.11%
All 3	2.99	1.40	46.96%	3.00	1.40	46.49%
TOU-CP September 27, 2011 Event						
Portal Only	2.28	0.33	14.41%	2.14	0.37	17.44%
IHD, Portal	2.28	0.65	28.39%	2.23	0.27	12.22%
PCT, Portal	2.03	0.79	39.15%	2.31	1.10	47.88%
All 3	2.02	0.69	34.04%	2.42	0.95	39.26%
VPP-CP September 27, 2011 Event						
Portal Only	2.28	0.34	14.89%	2.51	0.54	21.59%
IHD, Portal	2.02	0.38	18.65%	2.24	0.49	21.73%
PCT, Portal	2.03	0.86	42.68%	2.37	1.08	45.51%
All 3	2.28	0.78	34.43%	2.35	1.06	44.95%

Again, for all phases and groups, for the event days, the timing and duration of the event relative to the on-peak period, the price that was in place for the on-peak period before the event was called, and the temperature on the day of the event all have a dramatic impact on the savings during the event and for the remainder of the day. Most importantly for the maximum demand reduction is the timing of the start of the event and the price in place at that time. This will be explained more in the comments relating to the event day graphs below.

Table 4-18 Event Day Average Small Commercial On-Peak Demand

	Average On-Peak Demand			Demand at Maximum Reduction		
	Baseline	**Reduction**	**Percent**	**Baseline**	**Reduction**	**Percent**
TOU-CP July 08, 2011 Event						

Portal Only	5.95	-0.19	-3.20%	6.79	0.07	1.10%
IHD, Portal	7.23	0.76	10.53%	7.92	1.30	16.46%
PCT, Portal	7.36	0.84	11.46%	7.91	1.08	13.68%
All 3	7.23	0.45	6.21%	7.69	0.61	7.97%
VPP-CP July 08, 2011 Event						
Portal Only	5.66	0.13	2.25%	5.32	0.26	4.86%
IHD, Portal	6.75	0.47	6.93%	7.04	0.89	12.68%
PCT, Portal	5.11	1.21	23.71%	5.81	1.70	29.32%
All 3	7.71	0.22	2.85%	7.99	0.67	8.42%
TOU-CP July 15, 2011 Event						
Portal Only	5.82	-0.05	-0.86%	7.11	0.20	2.76%
IHD, Portal	6.95	0.71	10.23%	8.06	1.08	13.43%
PCT, Portal	7.01	0.84	11.98%	8.66	1.38	15.89%
All 3	6.90	0.70	10.14%	5.90	0.88	14.91%
VPP-CP July 15, 2011 Event						
Portal Only	5.63	0.08	1.40%	6.01	0.62	10.36%
IHD, Portal	6.75	0.30	4.40%	7.71	0.81	10.48%
PCT, Portal	5.24	1.30	24.86%	5.38	1.62	30.21%
All 3	7.59	0.28	3.70%	8.06	1.06	13.18%
TOU-CP August 08, 2011 Event						
Portal Only	6.88	0.86	12.53%	6.39	0.88	13.83%
IHD, Portal	8.33	1.36	16.38%	8.63	1.37	15.91%
PCT, Portal	8.88	2.25	25.31%	9.31	2.57	27.62%
All 3	8.32	0.48	5.75%	8.78	0.77	8.76%
VPP-CP August 08, 2011 Event						
Portal Only	6.76	0.73	10.79%	6.45	0.82	12.70%
IHD, Portal	7.61	0.24	3.14%	7.24	0.58	8.05%
PCT, Portal	6.26	1.04	16.61%	6.64	1.21	18.16%
All 3	8.72	1.13	12.92%	8.50	1.17	13.82%
TOU-CP August 24, 2011 Event						
Portal Only	6.89	0.30	4.42%	7.40	0.42	5.73%
IHD, Portal	8.34	1.37	16.40%	8.66	1.44	16.62%

PCT, Portal	8.90	2.14	24.03%	9.36	2.64	28.16%
All 3	8.33	1.59	19.10%	8.80	1.87	21.24%
VPP-CP August 24, 2011 Event						
Portal Only	6.77	0.56	8.27%	6.44	0.69	10.77%
IHD, Portal	7.62	0.24	3.15%	7.23	0.34	4.74%
PCT, Portal	6.27	1.87	29.87%	6.68	2.01	30.11%
All 3	8.72	2.10	24.03%	8.49	2.15	25.34%
TOU-CP September 01, 2011 Event						
Portal Only	6.16	0.38	6.10%	7.04	0.54	7.74%
IHD, Portal	7.57	1.38	18.23%	8.34	1.66	19.95%
PCT, Portal	7.63	1.44	18.89%	9.06	2.18	24.04%
All 3	7.45	0.69	9.32%	8.45	1.27	15.05%
VPP-CP September 01, 2011 Event						
Portal Only	5.97	0.49	8.22%	6.75	0.65	9.58%
IHD, Portal	7.01	0.17	2.43%	6.62	0.23	3.46%
PCT, Portal	5.56	0.74	13.22%	4.25	1.03	24.15%
All 3	7.98	1.03	12.94%	8.66	1.44	16.62%
TOU-CP September 13, 2011 Event						
Portal Only	6.54	0.88	13.43%	6.66	1.03	15.45%
IHD, Portal	7.65	0.48	6.25%	7.79	0.55	7.12%
PCT, Portal	8.29	2.42	29.18%	8.08	2.63	32.52%
All 3	7.80	0.24	3.14%	7.92	0.45	5.70%
VPP-CP September 13, 2011 Event						
Portal Only	6.11	0.12	2.04%	6.22	0.38	6.12%
IHD, Portal	7.18	-0.03	-0.37%	7.26	0.16	2.22%
PCT, Portal	5.68	1.35	23.84%	5.69	1.56	27.46%
All 3	8.10	1.36	16.78%	8.04	1.65	20.50%
TOU-CP September 27, 2011 Event						
Portal Only	4.78	0.87	18.29%	4.36	0.91	20.97%
IHD, Portal	6.23	1.47	23.54%	5.99	1.51	25.14%
PCT, Portal	6.50	1.52	23.40%	6.87	1.72	25.10%
All 3	6.22	1.03	16.50%	5.83	1.19	20.48%

VPP-CP September 27, 2011 Event						
Portal Only	4.67	0.66	14.19%	4.42	0.74	16.83%
IHD, Portal	5.51	0.78	14.17%	5.21	0.91	17.44%
PCT, Portal	3.88	1.02	26.39%	4.19	1.07	25.47%
All 3	6.62	2.37	35.83%	6.47	2.66	41.15%

Again, for all phases and groups, for the event days, the timing and duration of the event relative to the on-peak period, the price that was in place for the on-peak period before the event was called, and the temperature on the day of the event all have a dramatic impact on the savings during the event and for the remainder of the day. Most importantly for the maximum demand reduction is the timing of the start of the event and the price in place at that time. This will be explained more in the comments relating to the event day graphs below.

4.1.4 Event Day Impact Graphs

We now present the event day graphs, starting with the Phase I residential group. For each event day, we show the TOU-CP graph first, and then the VPP-CP graph. Across all the graphs, when the start of an event corresponds to an increase in price, there is a drop in load. If there is a price increase before or after the start of the event (from the beginning of the 0n-peak period), there is a secondary drop. The magnitude of the price increase generally corresponds to the reduction in load – if the price goes from a lower value to the critical price, there is more of a load drop. However, the temperature of the day also impacts the load available to be reduced – events called on mild days will not result in as much load reduction.

Calling events that start in the middle of the on-peak period on days that are not already at a critical price during the on-peak period most effectively "flatten out" the savings during the entire on-peak period. This situation will do the most effective job of maximizing the reduction at the usual time of the system peak, which is between 3:00 and 5:00 pm. This happened on the event days on 8/24, 9/1, and 9/27, though 9/27 was so mild that there was not much load available to be reduced. The timing of the 8/8 event corresponds to this situation, but the load reduction at the beginning of the event is somewhat less, since the price does not change. So any actions taken here are not a result of the automated response from the PCT.

One other general comment is that the savings seem to be sustained more for longer through the event than on non-event days with the same price. This may be due to the separate notification, with customers perhaps taking more manual actions in response to the event.

Figure 4-37 shows the load shapes for the TOU-CP rate on the July 8, 2011 event day. Both rate groups show a load drop at the beginning of the event and a smaller drop at the beginning of the on-peak period. The savings also seem to be sustained for longer through the event than on non-event days.

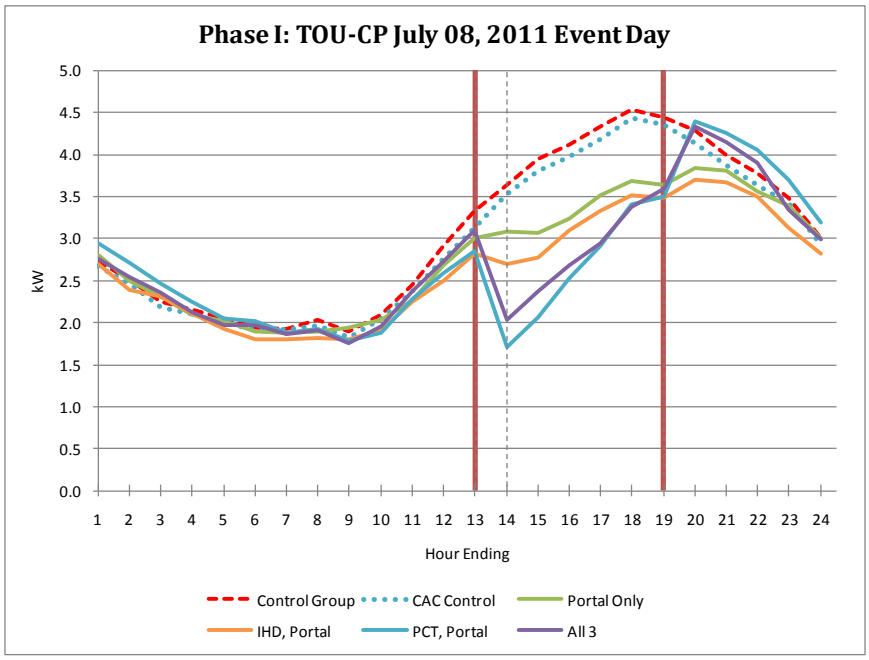

Figure 4-37 TOU-CP July 8, 2011 event day – Phase I Residential

Figure 4-38 shows the load shapes for the VPP-CP rate on the July 8, 2011 event day.

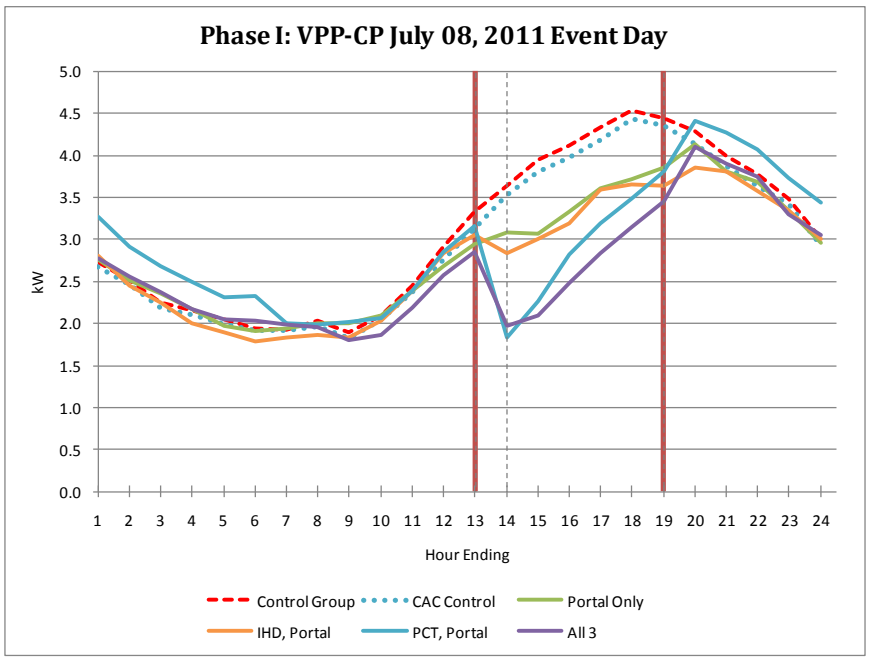

Figure 4-38 VPP-CP July 8, 2011 event day – Phase I Residential

Figure 4-39 shows the load shapes for the TOU-CP rate on the July 15, 2011 event day. With the event continuing after the end of the on-peak period, savings continue later, and the rebound period is delayed until after the end of the event.

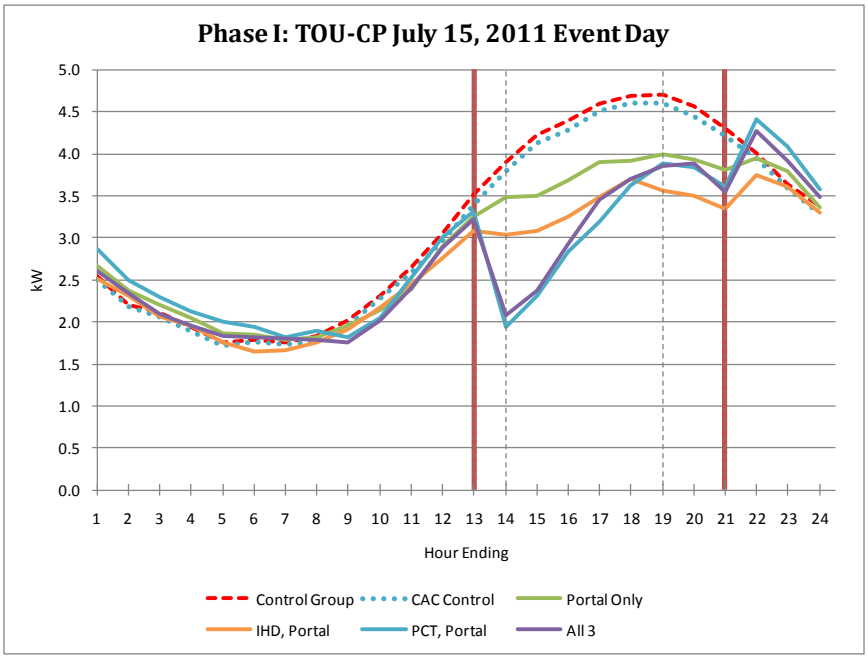

Figure 4-39 TOU-CP July 15, 2011 event day – Phase I Residential

Figure 4-40 shows the load shapes for the VPP-CP rate on the July 15, 2011 event day.

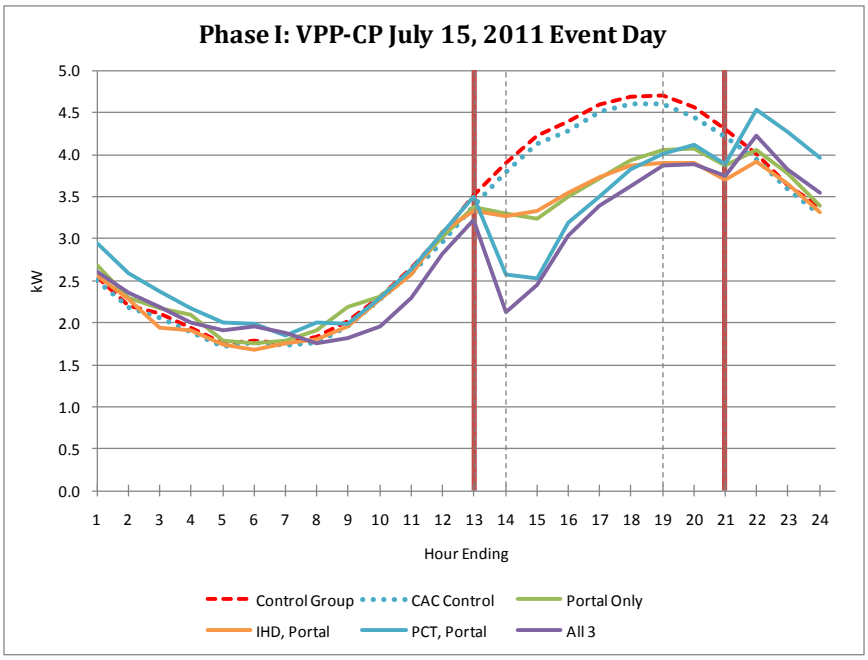

Figure 4-40 VPP-CP July 15, 2011 event day – Phase I Residential

Figure 4-41 shows the load shapes for the TOU-CP rate on the August 8, 2011 event day. For the TOU-CP customers, the event represents a change in price, and there is a corresponding additional load drop at the beginning of the event.

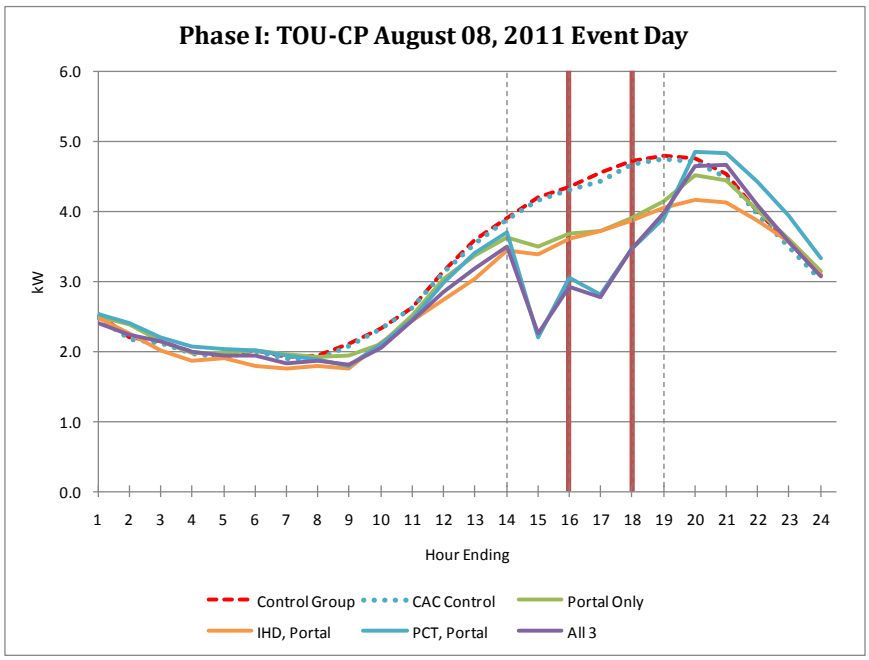

Figure 4-41 TOU-CP August 8, 2011 event day – Phase I Residential

Figure 4-42 shows the load shapes for the VPP-CP rate on the August 8, 2011 event day. This was already a Critical Price day before the start of the event, so the VPP-CP customers are already paying the highest price. As a result, there is no apparent load drop for the PCT and All 3 groups.

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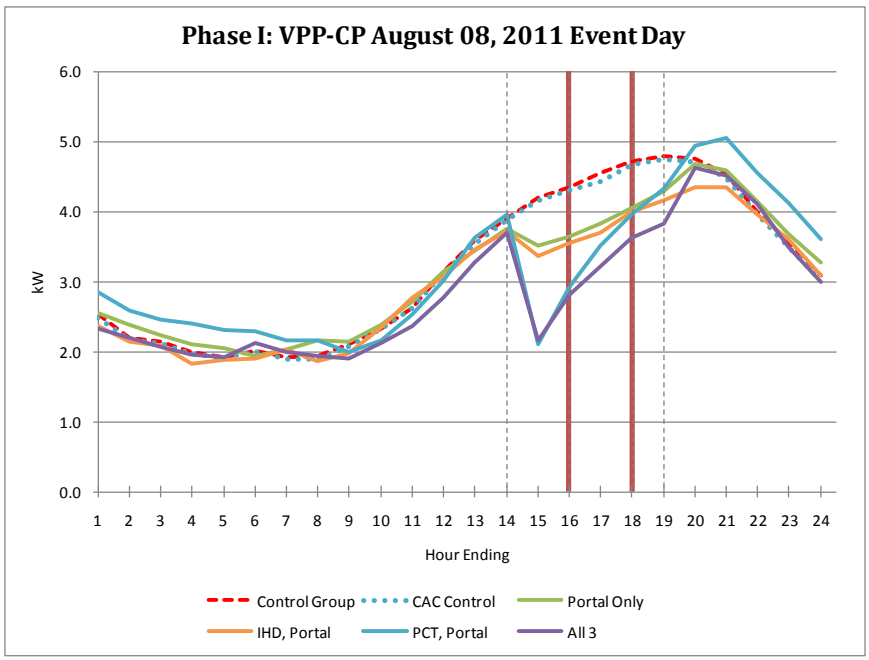

Figure 4-42 VPP-CP August 8, 2011 event day – Phase I Residential

Figure 4-43 shows the load shapes for the TOU-CP rate on the August 24, 2011 event day. For both the rate groups, the event is an increase in price, so there is a secondary reduction in load at the start of the event for the PCT and All 3 groups.

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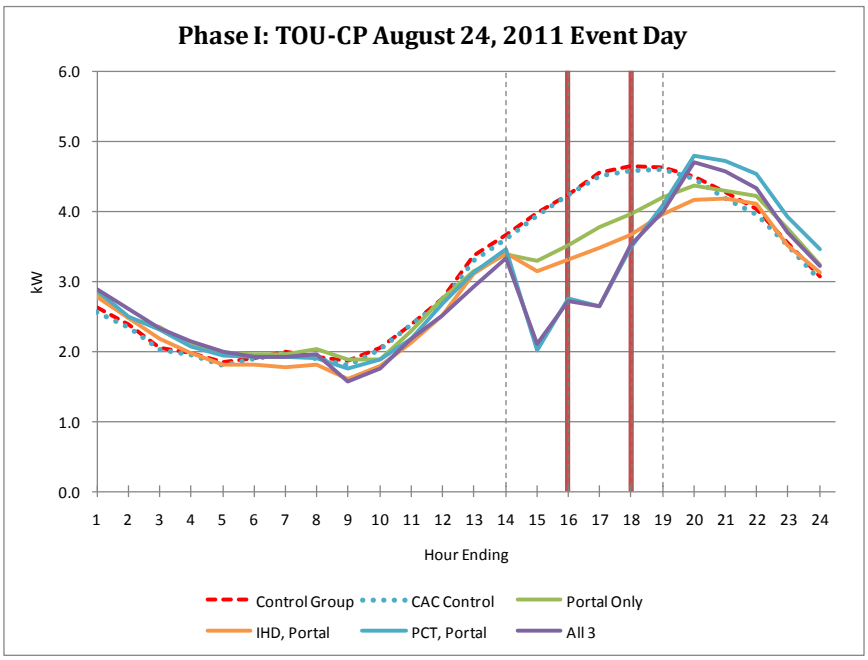

Figure 4-43 TOU-CP August 24, 2011 event day – Phase I Residential

Figure 4-44 shows the load shapes for the VPP-CP rate on the August 24, 2011 event day.

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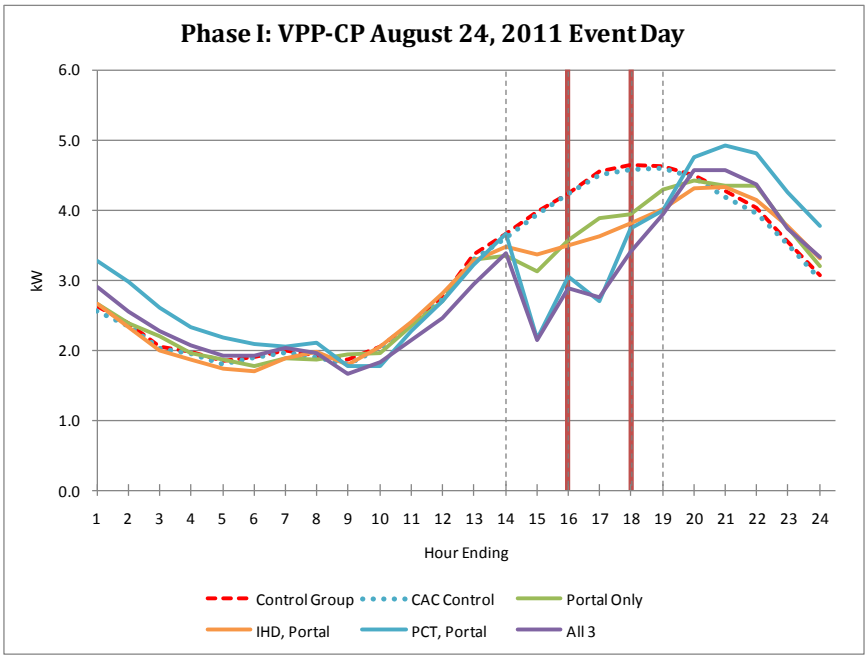

Figure 4-44 VPP-CP August 24, 2011 event day – Phase I Residential

Figure 4-45 shows the load shapes for the TOU-CP rate on the September 1, 2011 event day. For both rate groups, because of the timing of the event, there is an initial drop with the start of the on-peak period, and then another drop (load stays flat instead of increasing) an hour later when the event starts.

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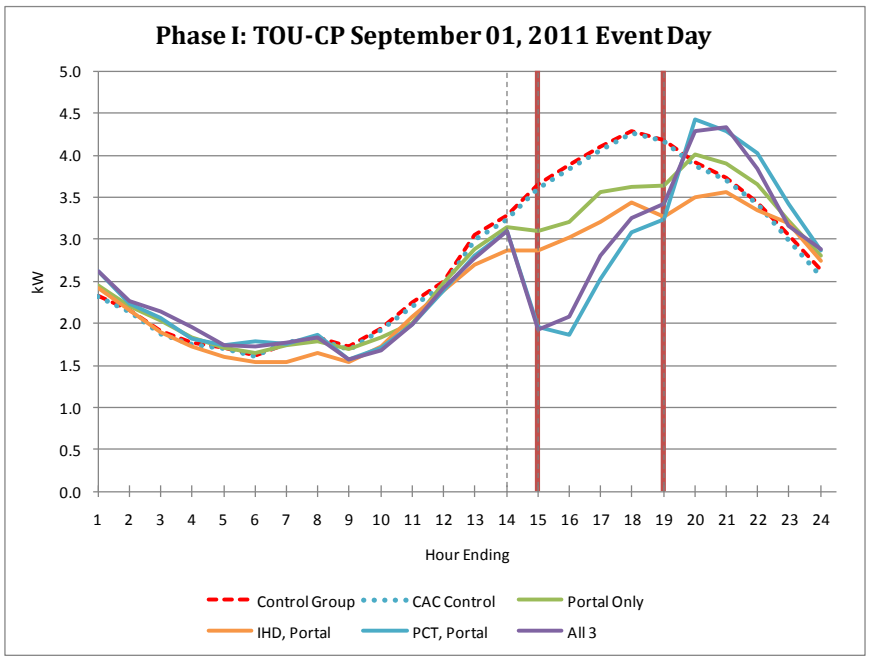

Figure 4-45 TOU-CP September 1, 2011 event day – Phase I Residential

Figure 4-46 shows the load shapes for the VPP-CP rate on the September 1, 2011 event day.

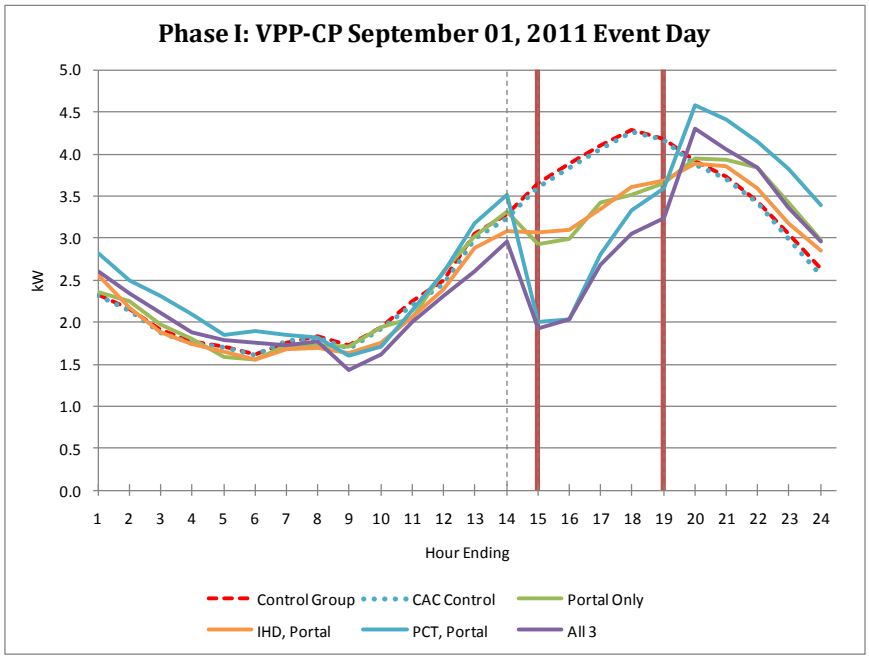

Figure 4-46 VPP-CP September 1, 2011 event day – Phase I Residential

Figure 4-47 shows the load shapes for the TOU-CP rate on the September 13, 2011 event day. Here, the start of the event is an hour earlier than the beginning of the on-peak period, and there appears to be less of an increase in the first hour of the on-peak period for both rate groups, perhaps because of other actions taken to reduce usage in general during the on-peak period.

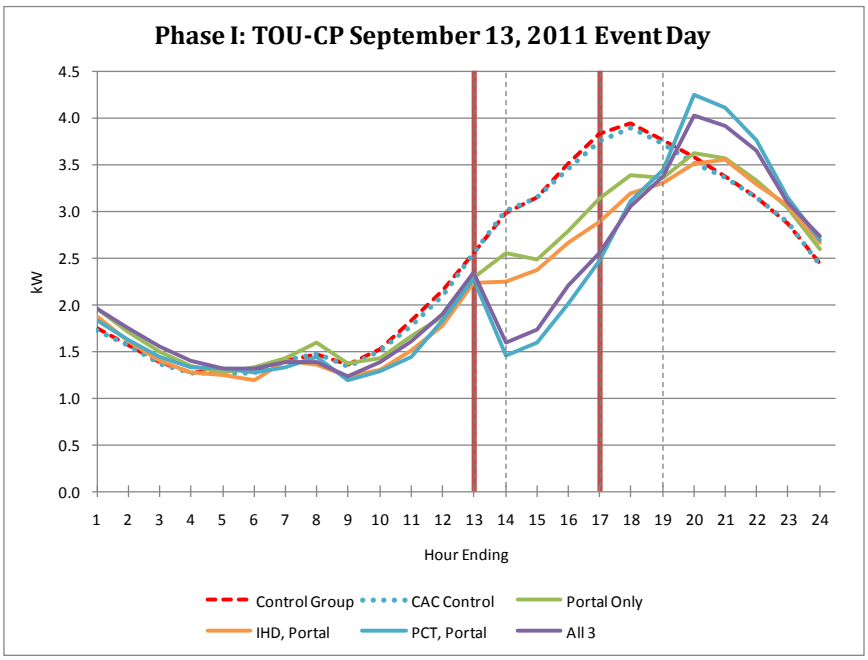

Figure 4-47 TOU-CP September 13, 2011 event day – Phase I Residential

Figure 4-48 shows the load shapes for the VPP-CP rate on the September 13, 2011 event day.

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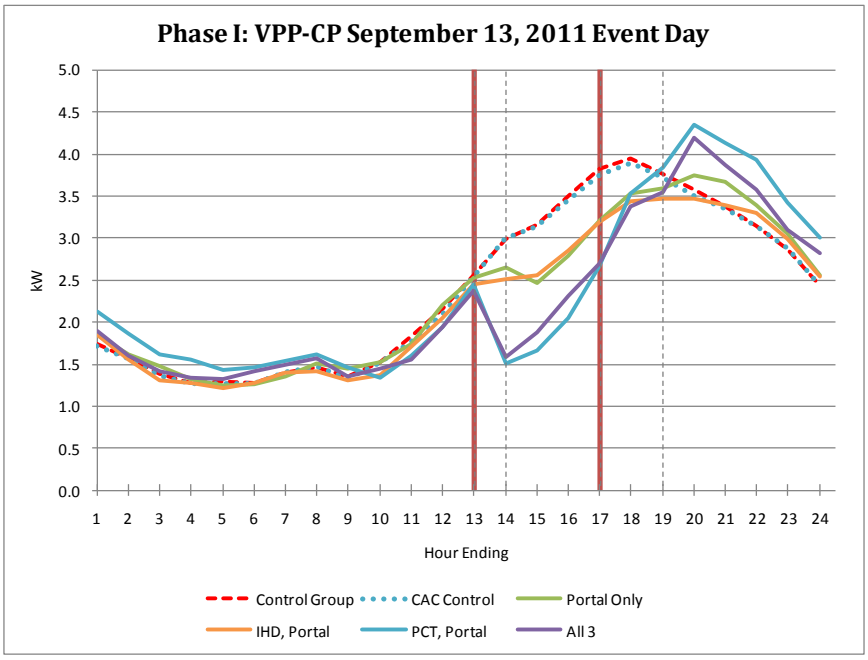

Figure 4-48 VPP-CP September 13, 2011 event day – Phase I Residential

Figure 4-49 shows the load shapes for the TOU-CP rate on the September 27, 2011 event day. This event is called in the middle the on-peak period, so there is a price increase at the beginning of the event. However, because it is a mild day (high temperature was only 86), there is less of a drop because there was not much load available.

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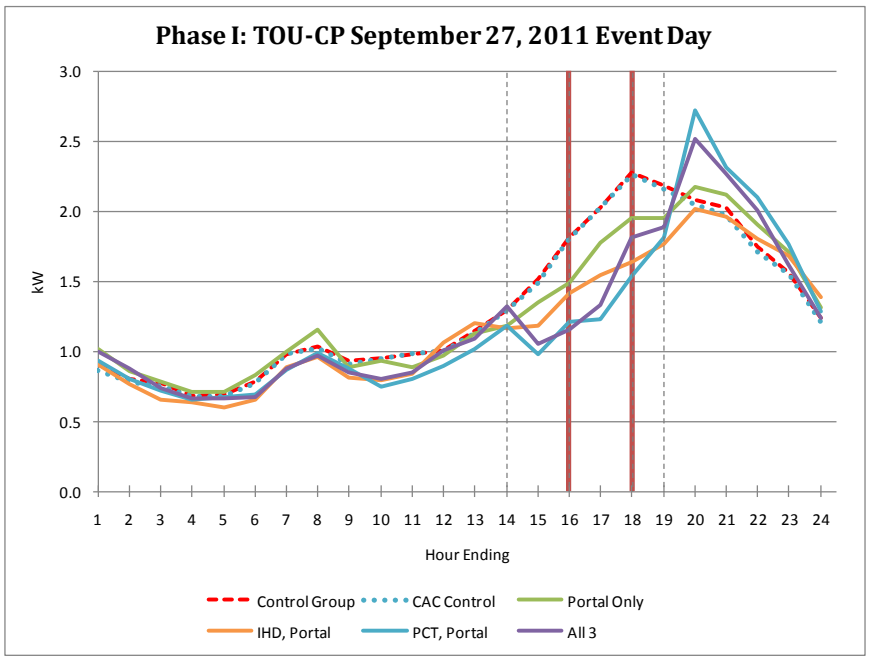

Figure 4-49 TOU-CP September 27, 2011 event day – Phase I Residential

Figure 4-50 shows the load shapes for the VPP-CP rate on the September 27, 2011 event day. This event is called in the middle the on-peak period when the price was low, so there is a sizable price increase at the beginning of the event. However, because it is a mild day (high temperature was only 86), there is less of a drop because there was not much load available. But this still shifts the maximum reduction to the time of the usual system peak.

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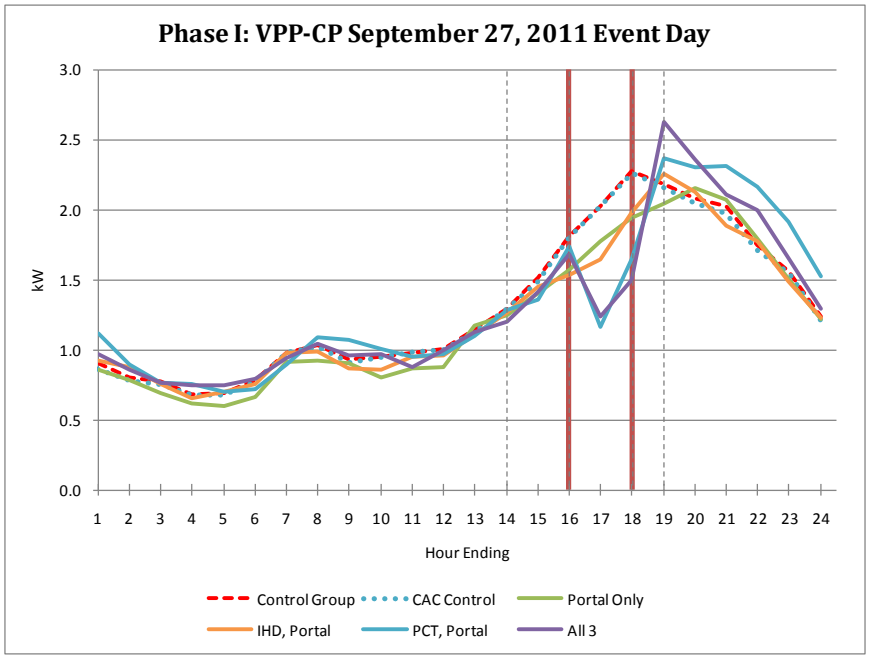

Figure 4-50 VPP-CP September 27, 2011 event day – Phase I Residential

We now present the graphs for the Phase II Residential group. The participant load shapes are similar to the phase I shapes, but the control groups vary somewhat because of the adjustments based on the pre-participation differences.

Figure 4-51 shows the load shapes for the TOU-CP rate on the July 8, 2011 event day. This is the first event day that the Phase II customers experienced, since they were not on the rate in

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2010. Both rate groups show a load drop at the beginning of the event and a smaller drop at the beginning of the on-peak period. The savings also seem to be sustained for longer through the event than on non-event days. The IHD and Portal groups don't seem to show as much reduction throughout the event as the Phase I customers in those groups did, which may indicate the effect of experience dealing with events.

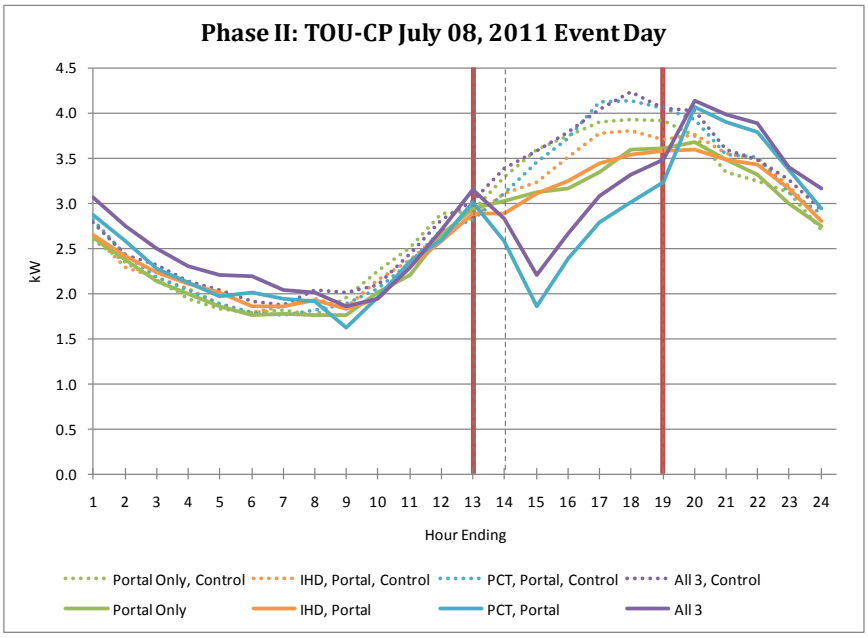

Figure 4-51 TOU-CP July 8, 2011 event day – Phase II Residential

Figure 4-52 shows the load shapes for the VPP-CP rate on the July 8, 2011 event day.

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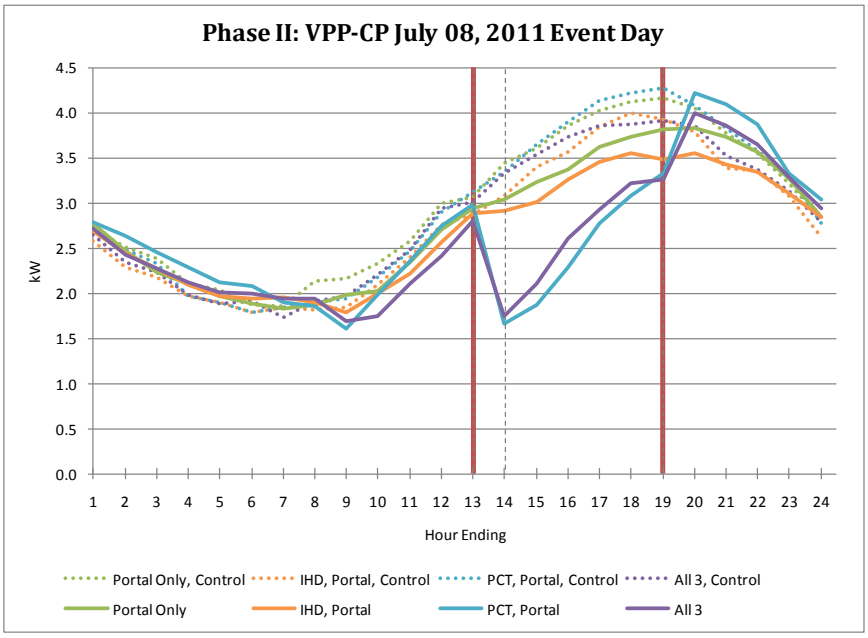

Figure 4-52 VPP-CP July 8, 2011 event day – Phase II Residential

Figure 4-53 shows the load shapes for the TOU-CP rate on the July 15, 2011 event day. Both rate groups show a load drop at the beginning of the event and a smaller drop at the beginning of the on-peak period. The savings also seem to be sustained for longer through the event than on non-event days.

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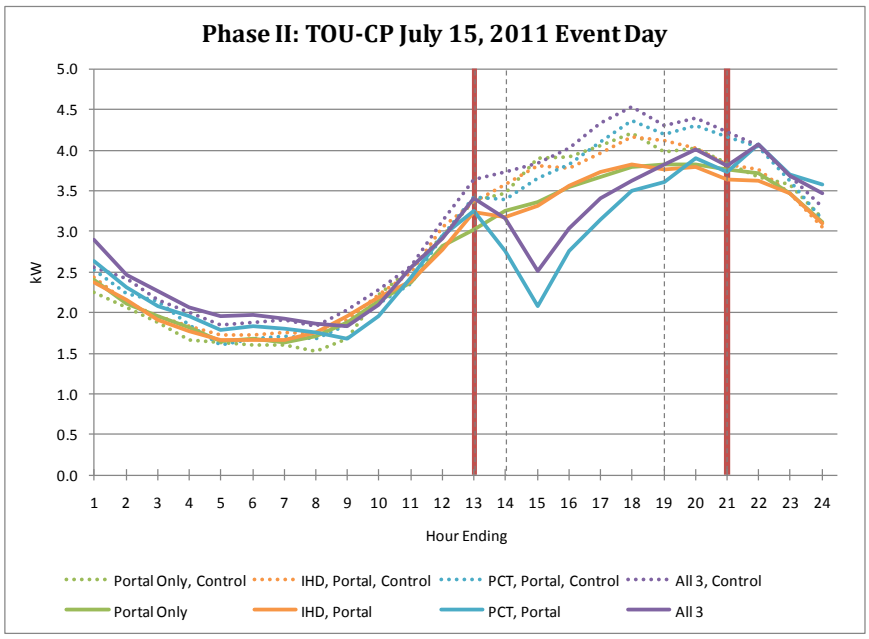

Figure 4-53 TOU-CP July 15, 2011 event day – Phase II Residential

Figure 4-54 shows the load shapes for the VPP-CP rate on the July 15, 2011 event day.

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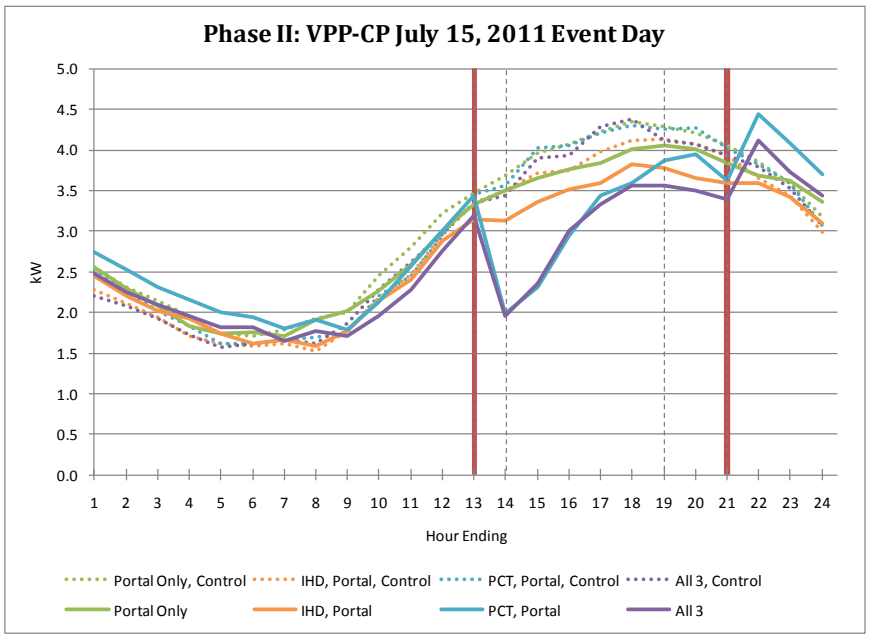

Figure 4-54 VPP-CP July 15, 2011 event day – Phase II Residential

Figure 4-55 shows the load shapes for the TOU-CP rate on the August 8, 2011 event day. . For the TOU-CP customers, the event represents a change in price, and there is a corresponding additional load drop at the beginning of the event.

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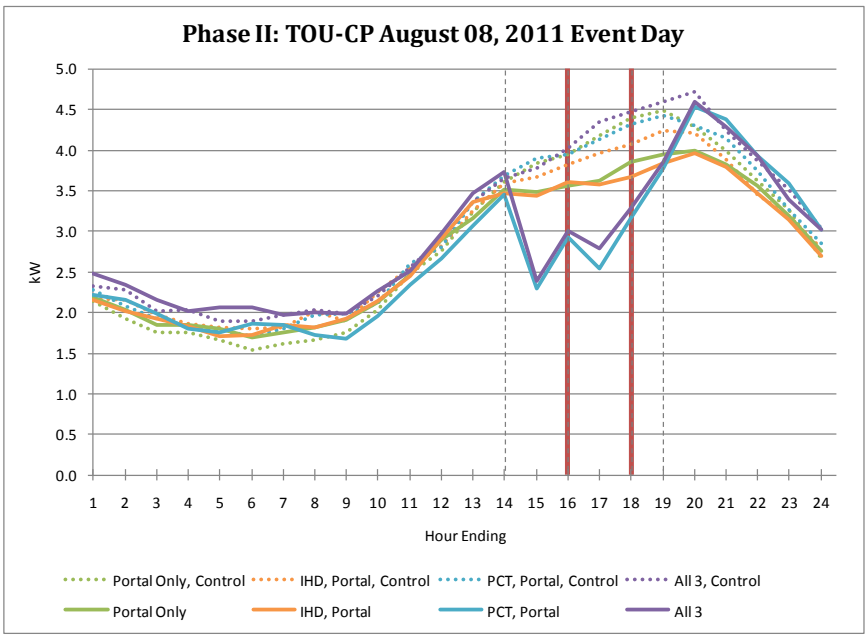

Figure 4-55 TOU-CP August 8, 2011 event day – Phase II Residential

Figure 4-56 shows the load shapes for the VPP-CP rate on the August 8, 2011 event day. This was already a Critical Price day before the start of the event, so the VPP-CP customers are already paying the highest price. As a result, there is no apparent load drop for the PCT and All 3 groups.

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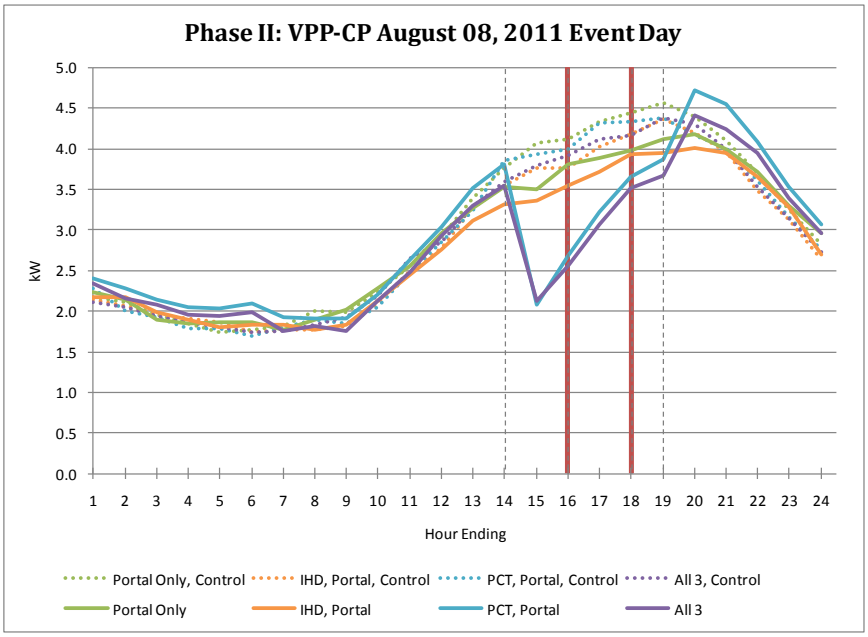

Figure 4-56 VPP-CP August 8, 2011 event day – Phase II Residential

Figure 4-57 shows the load shapes for the TOU-CP rate on the August 24, 2011 event day. For both the rate groups, the event is an increase in price, so there is a secondary reduction in load at the start of the event for the PCT and All 3 groups.

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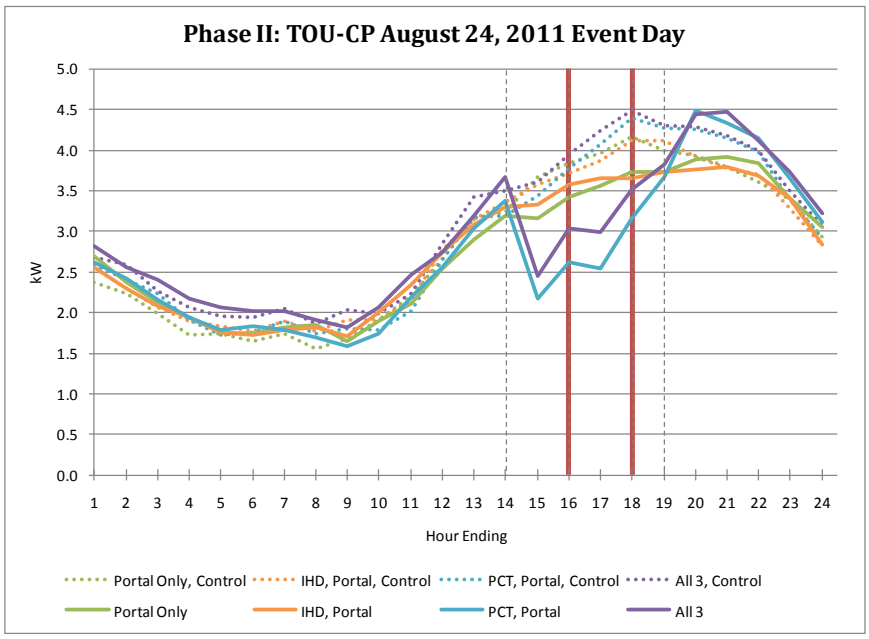

Figure 4-57 TOU-CP August 24, 2011 event day – Phase II Residential

Figure 4-58 shows the load shapes for the VPP-CP rate on the August 24, 2011 event day.

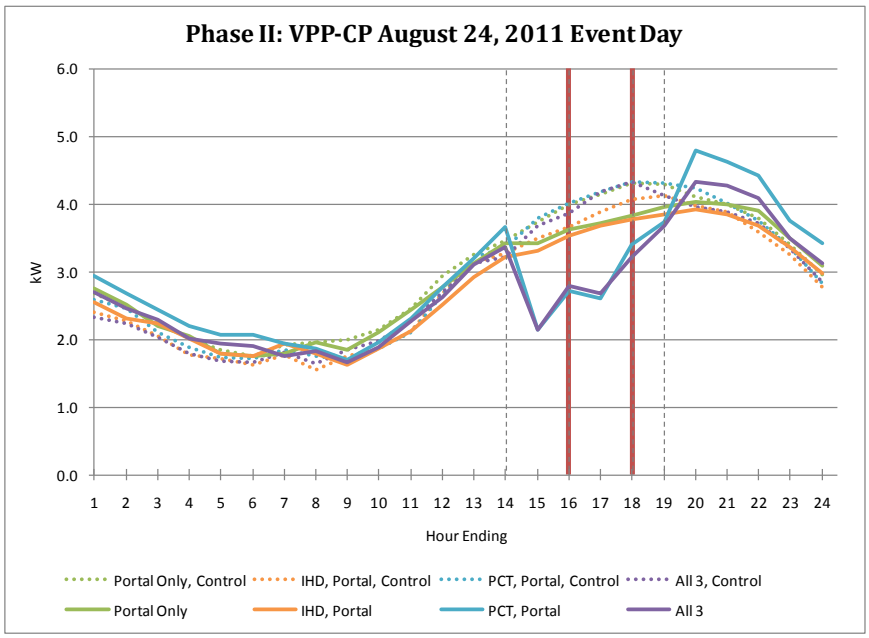

Figure 4-58 VPP-CP August 24, 2011 event day – Phase II Residential

Figure 4-59 shows the load shapes for the TOU-CP rate on the September 1, 2011 event day. For both rate groups, because of the timing of the event, there is an initial drop with the start of the on-peak period, and then another drop (load stays flat instead of increasing) an hour later when the event starts.

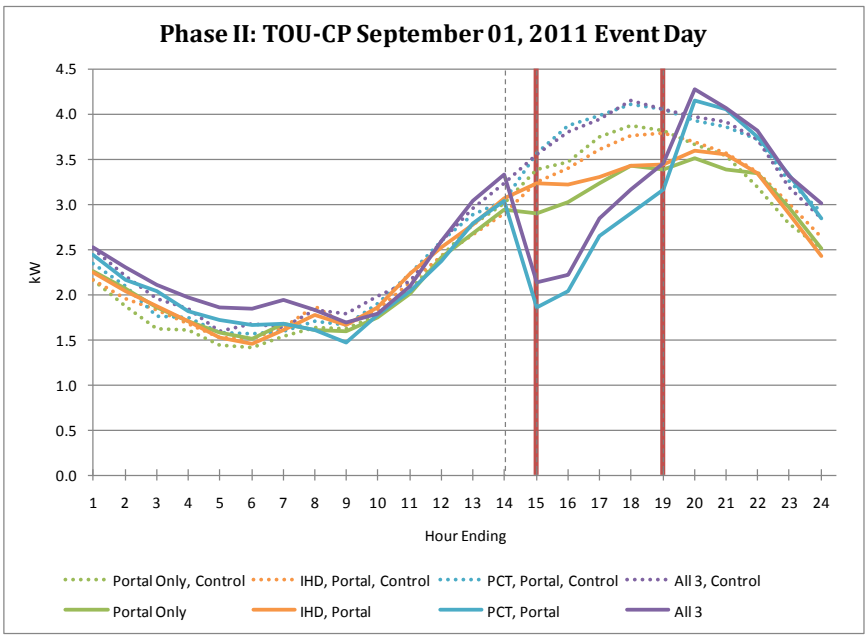

Figure 4-59 TOU-CP September 1, 2011 event day – Phase II Residential

Figure 4-60 shows the load shapes for the VPP-CP rate on the September 1, 2011 event day.

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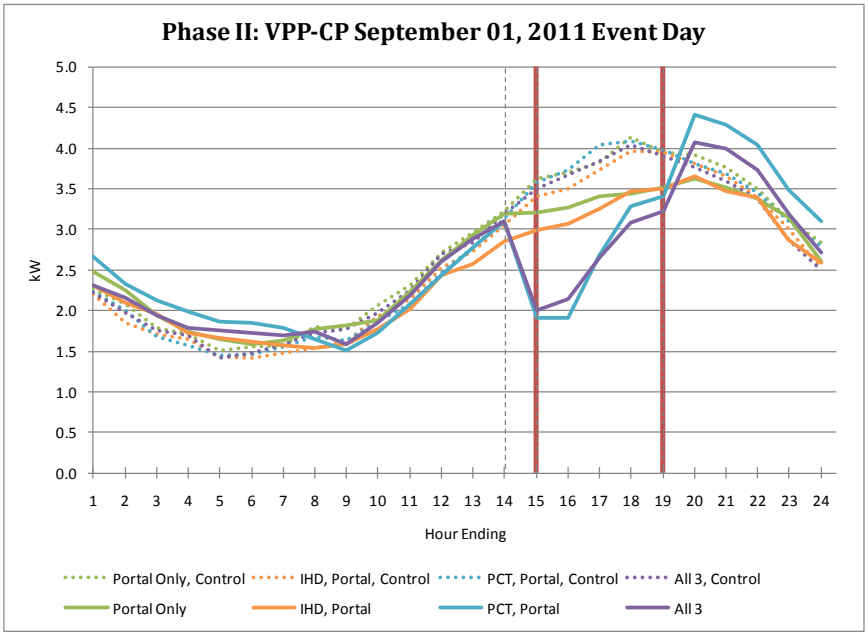

Figure 4-60 VPP-CP September 1, 2011 event day – Phase II Residential

Figure 4-61 shows the load shapes for the TOU-CP rate on the September 13, 2011 event day. Here, the start of the event is an hour earlier than the beginning of the on-peak period, and there appears to be less of an increase in the first hour of the on-peak period for both rate groups, perhaps because of other actions taken to reduce usage in general during the on-peak period.

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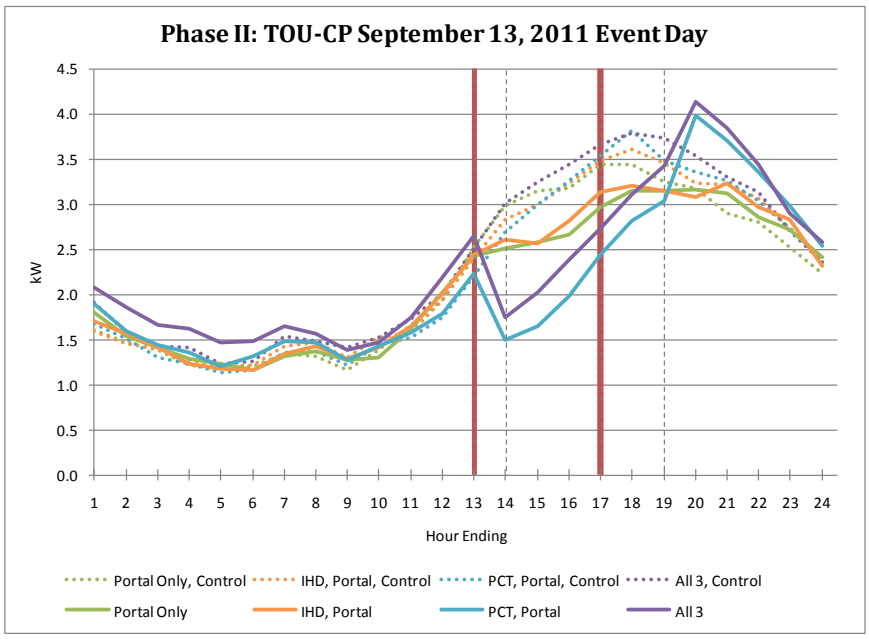

Figure 4-61 TOU-CP September 13, 2011 event day – Phase II Residential

Figure 4-62 shows the load shapes for the VPP-CP rate on the September 13, 2011 event day.

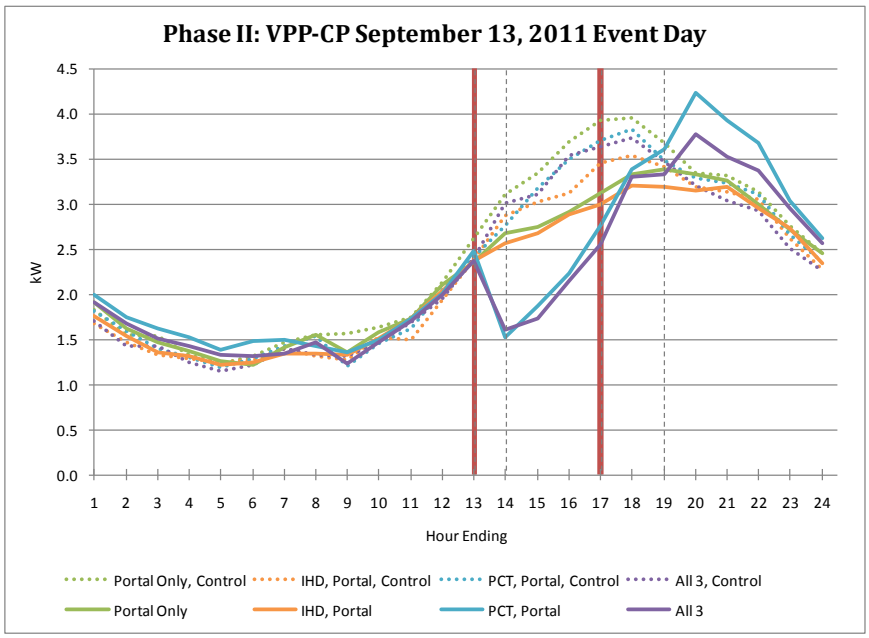

Figure 4-62 VPP-CP September 13, 2011 event day – Phase II Residential

Figure 4-63 shows the load shapes for the TOU-CP rate on the September 27, 2011 event day. This event is called in the middle the on-peak period, so there is a price increase at the beginning of the event. However, because it is a mild day (high temperature was only 86), there is less of a drop because there was not much load available.

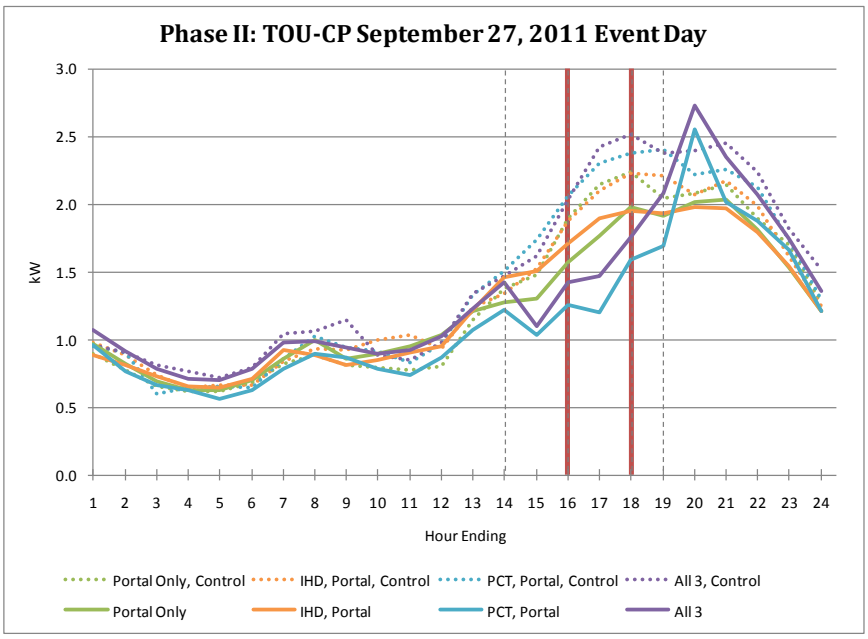

Figure 4-63 TOU-CP September 27, 2011 event day – Phase II Residential

Figure 4-64 shows the load shapes for the VPP-CP rate on the September 27, 2011 event day. This event is called in the middle the on-peak period when the price was low, so there is a sizable price increase at the beginning of the event. However, because it is a mild day (high temperature was only 86), there is less of a drop because there was not much load available. But this still shifts the maximum reduction to the time of the usual system peak.

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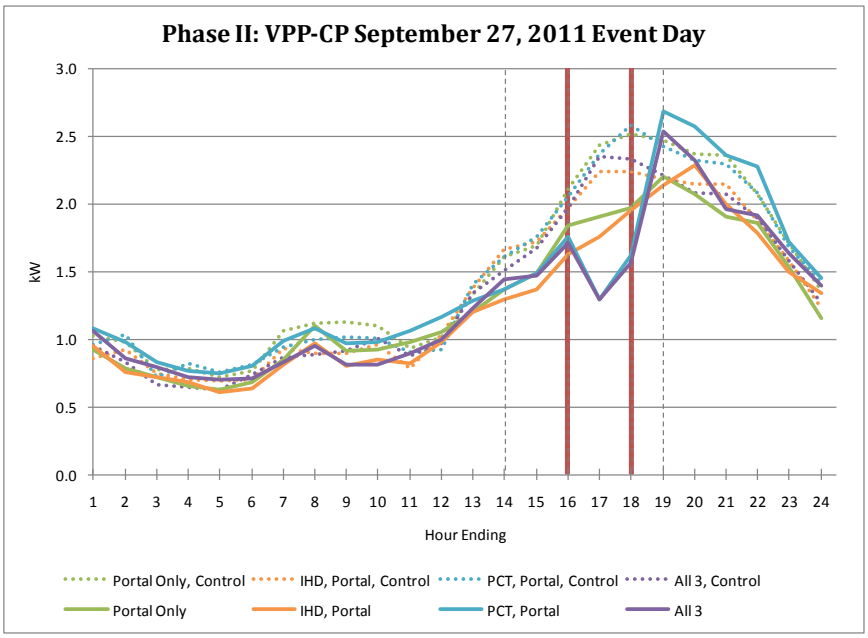

Figure 4-64 VPP-CP September 27, 2011 event day – Phase II Residential

We now present the graphs for the Phase II Small Commercial group. In general, there is much more variation in loads between small commercial customers. Because of this and because of the smaller sample sizes, the impacts across event days vary quite a bit. The general comments above in the Residential section about the timing and duration of events do apply in general here as well, though it is difficult to see things at the same level because of the variability.

Across all the event days, load reductions during events are generally higher than the reductions during non-event days. Because of the variability, these general comments characterize better than individual comments, so we do not include comments individual comments for these small commercial graphs.

Figure 4-65 shows the load shapes for the TOU-CP rate on the July 8, 2011 event day.

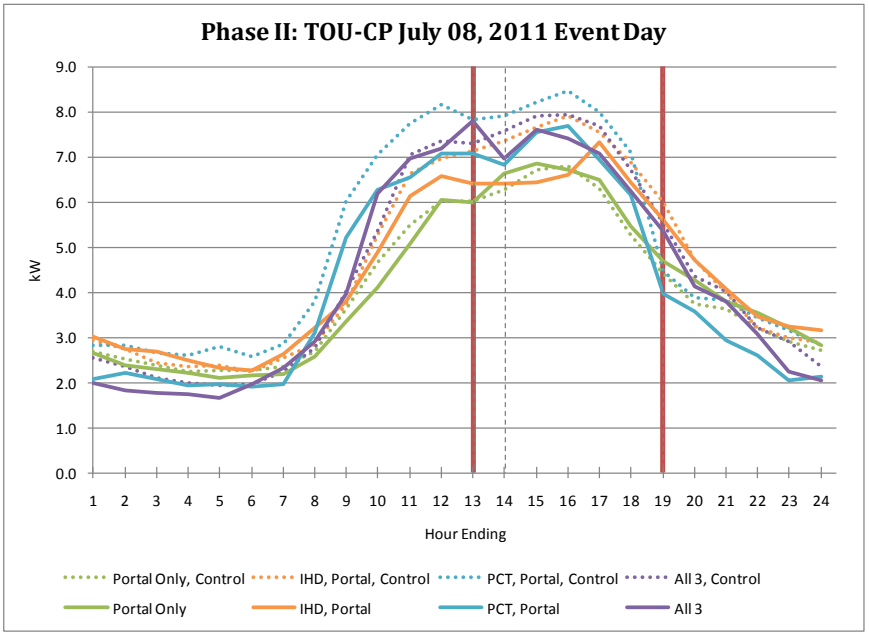

Figure 4-65 TOU-CP July 8, 2011 event day – Phase II Small Commercial

Figure 4-66 shows the load shapes for the VPP-CP rate on the July 8, 2011 event day.

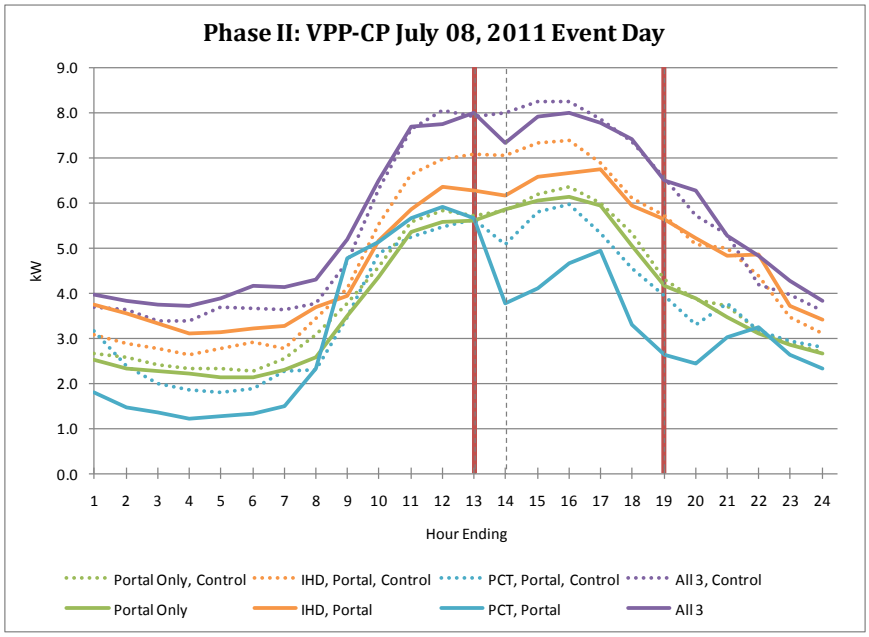

Figure 4-66 VPP-CP July 8, 2011 event day – Phase II Small Commercial

Figure 4-67 shows the load shapes for the TOU-CP rate on the July 15, 2011 event day.

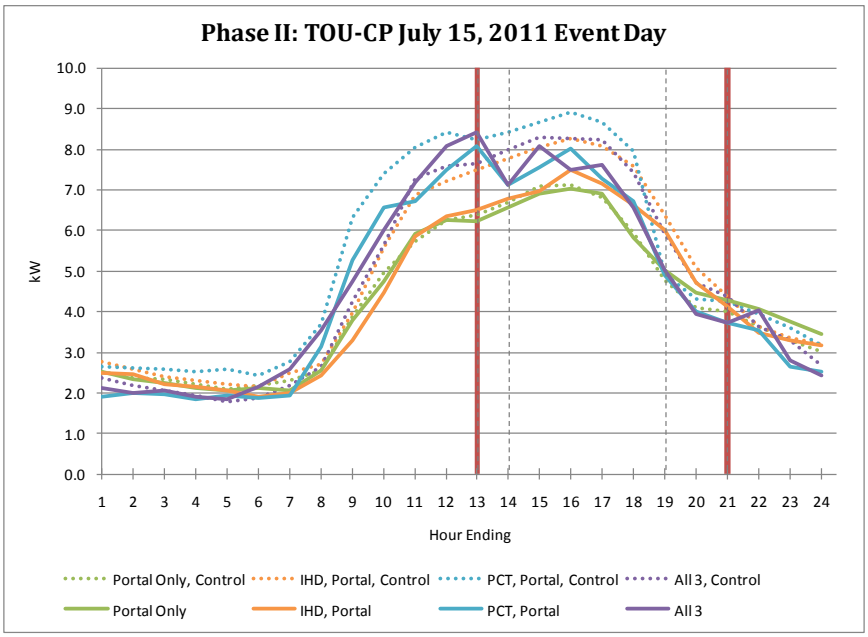

Figure 4-67 TOU-CP July 15, 2011 event day – Phase II Small Commercial

Figure 4-68 shows the load shapes for the VPP-CP rate on the July 15, 2011 event day.

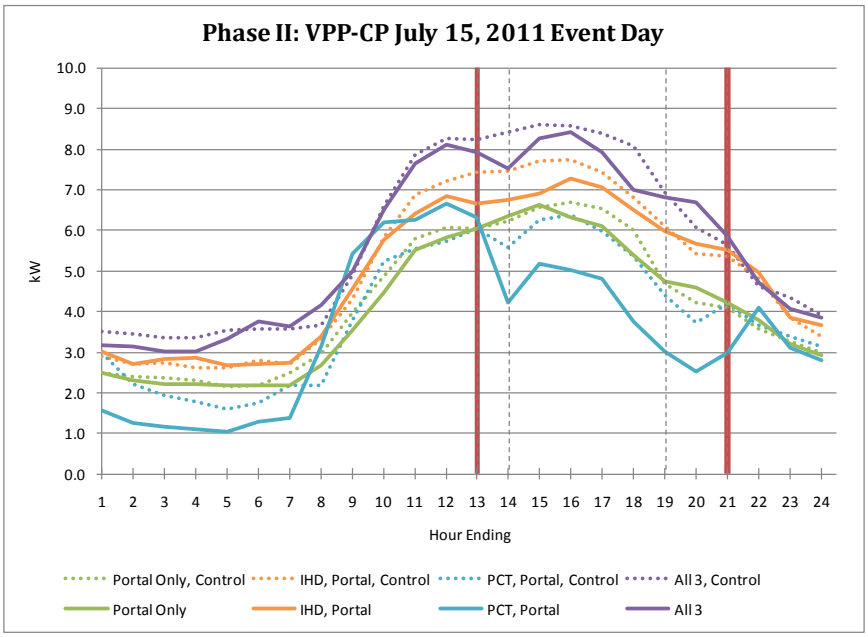

Figure 4-68 VPP-CP July 15, 2011 event day – Phase II Small Commercial

Figure 4-69 shows the load shapes for the TOU-CP rate on the August 8, 2011 event day.

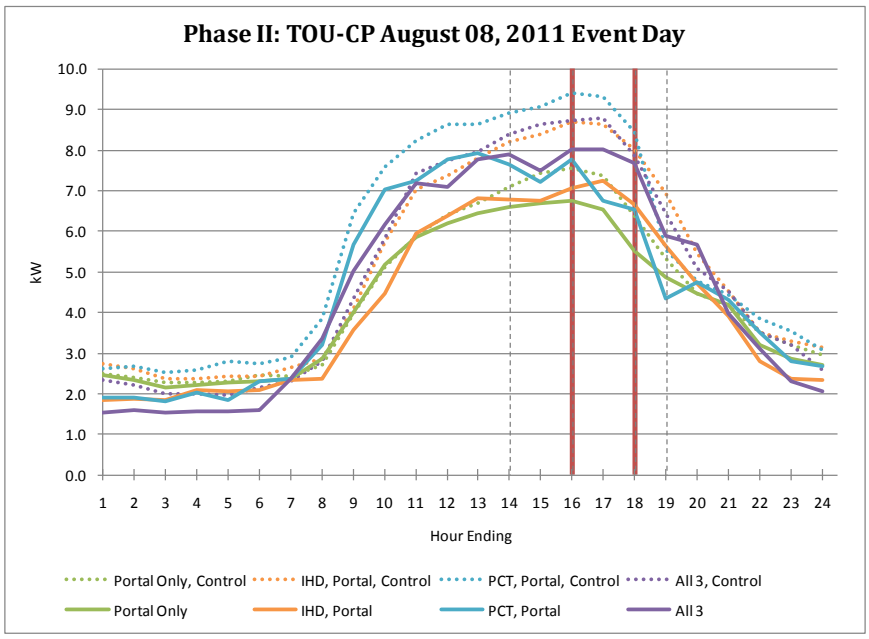

Figure 4-69 TOU-CP August 8, 2011 event day – Phase II Small Commercial

Figure 4-70 shows the load shapes for the VPP-CP rate on the August 8, 2011 event day.

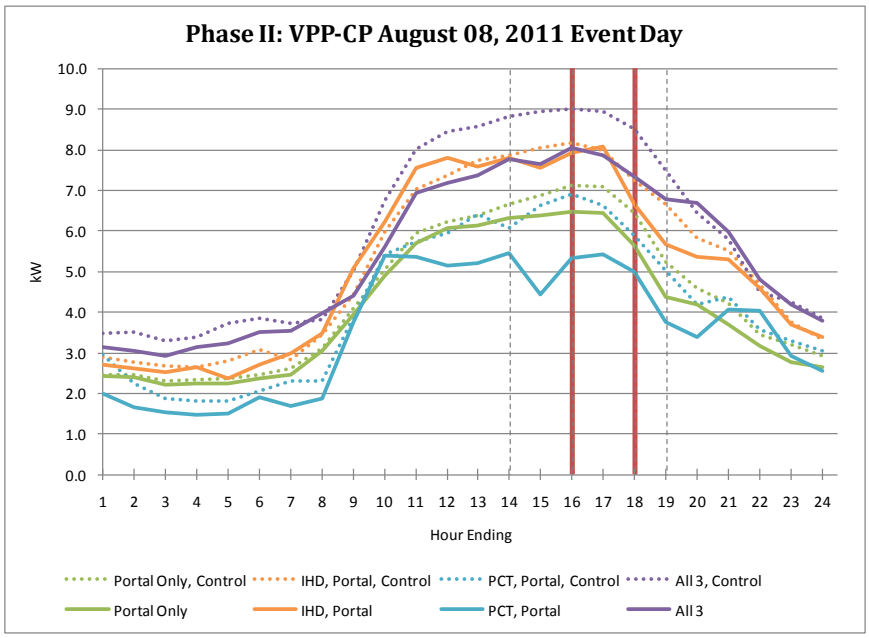

Figure 4-70 VPP-CP August 8, 2011 event day – Phase II Small Commercial

Figure 4-71 shows the load shapes for the TOU-CP rate on the August 24, 2011 event day.

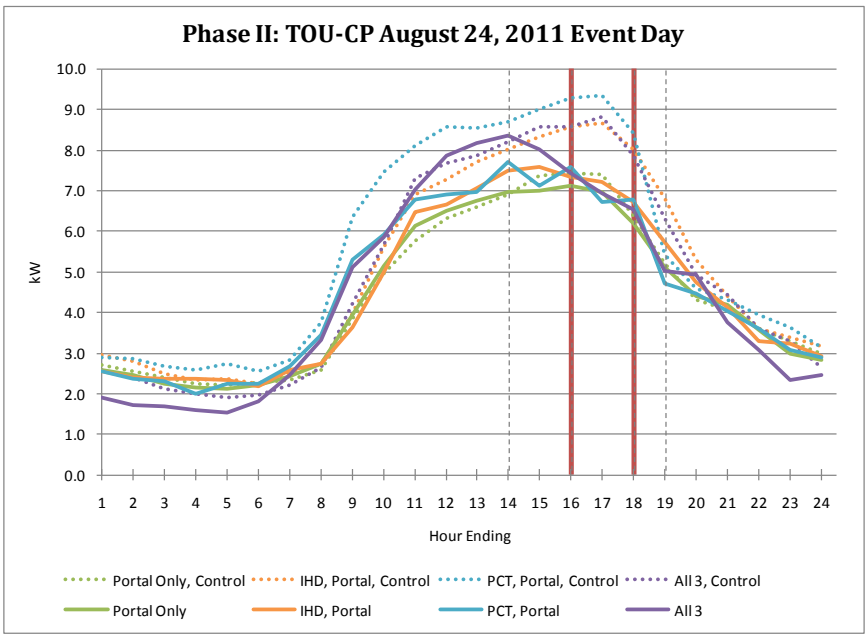

Figure 4-71 TOU-CP August 24, 2011 event day – Phase II Small Commercial

Figure 4-72 shows the load shapes for the VPP-CP rate on the August 24, 2011 event day.

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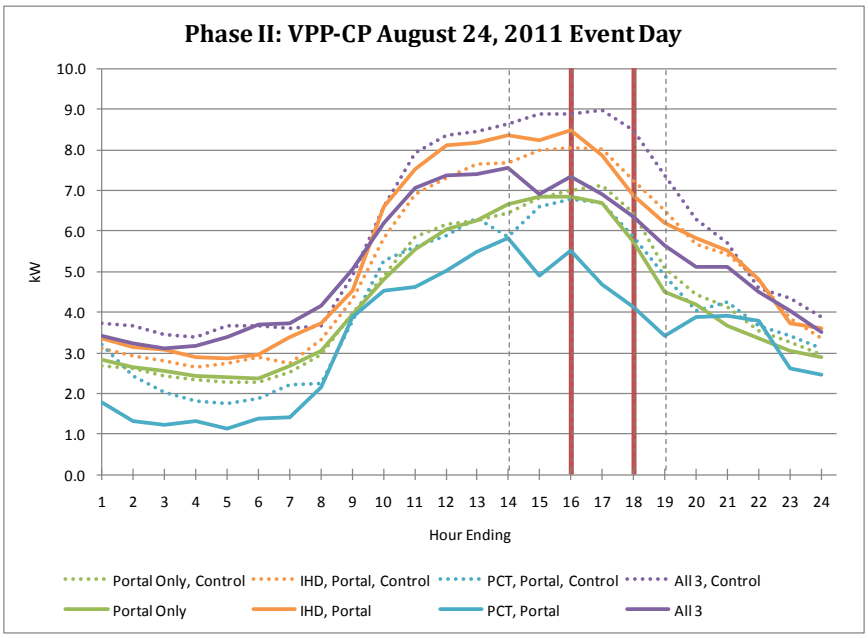

Figure 4-72 VPP-CP August 24, 2011 event day – Phase II Small Commercial

Figure 4-73 shows the load shapes for the TOU-CP rate on the September 1, 2011 event day.

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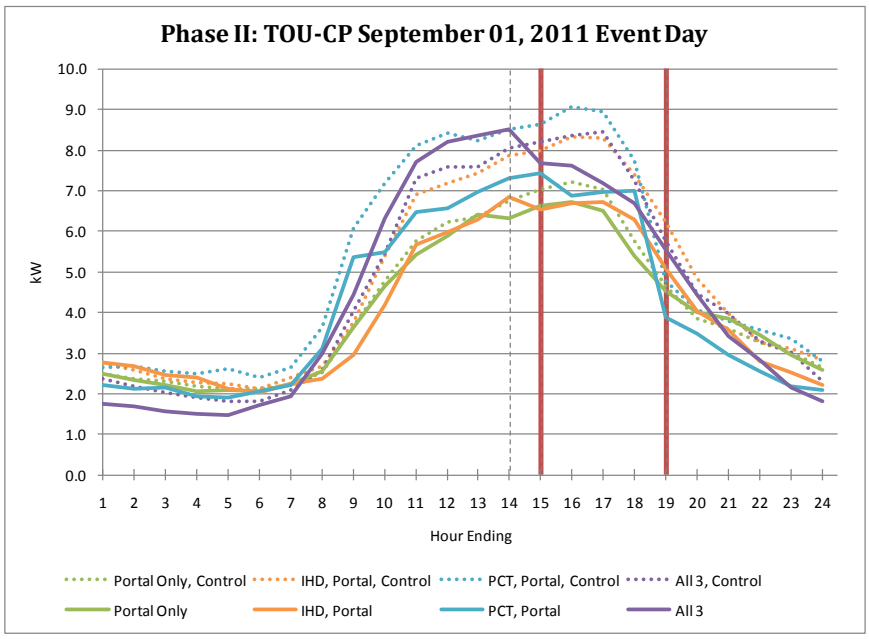

Figure 4-73 TOU-CP September 1, 2011 event day – Phase II Small Commercial

Figure 4-74 shows the load shapes for the VPP-CP rate on the September 1, 2011 event day.

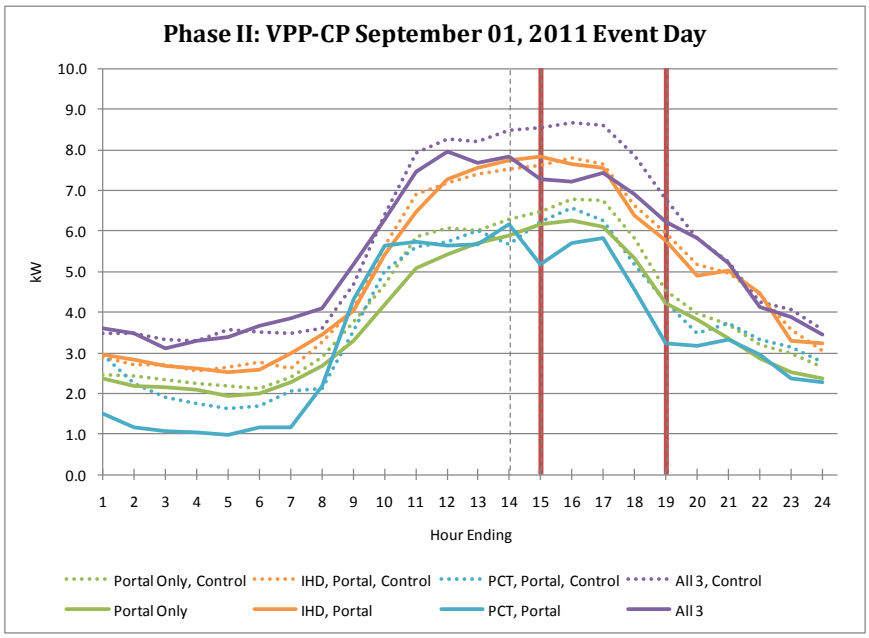

Figure 4-74 VPP-CP September 1, 2011 event day – Phase II Small Commercial

Figure 4-75 shows the load shapes for the TOU-CP rate on the September 13, 2011 event day.

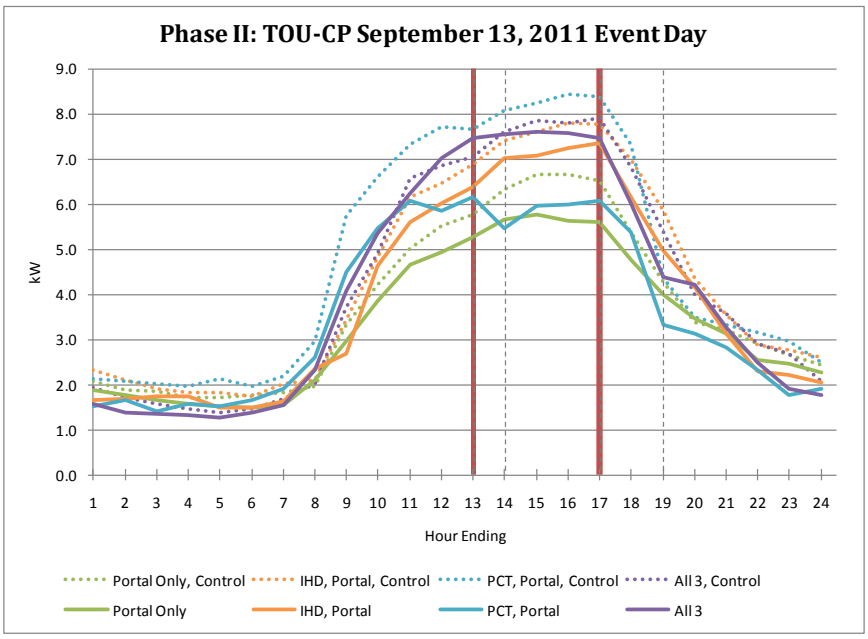

Figure 4-75 TOU-CP September 13, 2011 event day – Phase II Small Commercial

Figure 4-76 shows the load shapes for the VPP-CP rate on the September 13, 2011 event day.

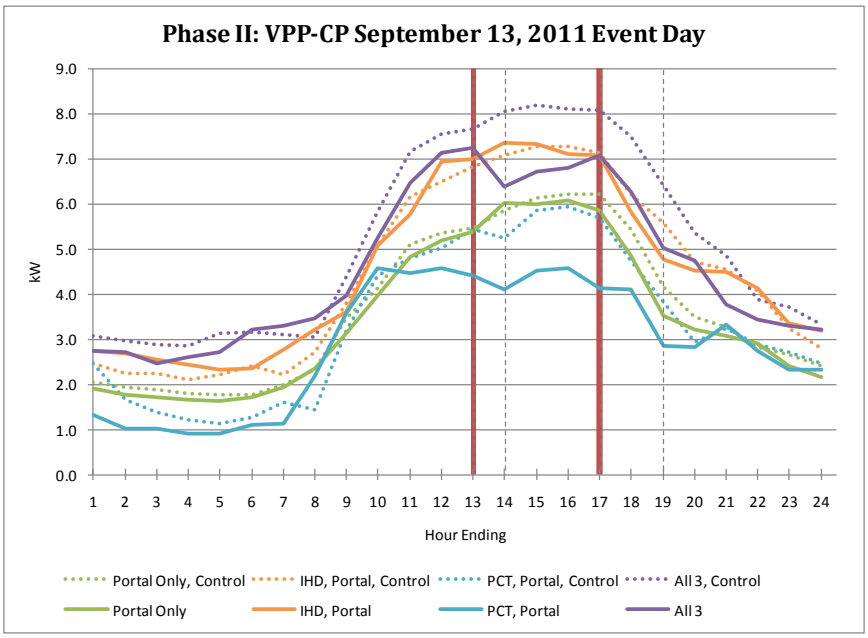

Figure 4-76 VPP-CP September 13, 2011 event day – Phase II Small Commercial

Figure 4-77 shows the load shapes for the TOU-CP rate on the September 27, 2011 event day.

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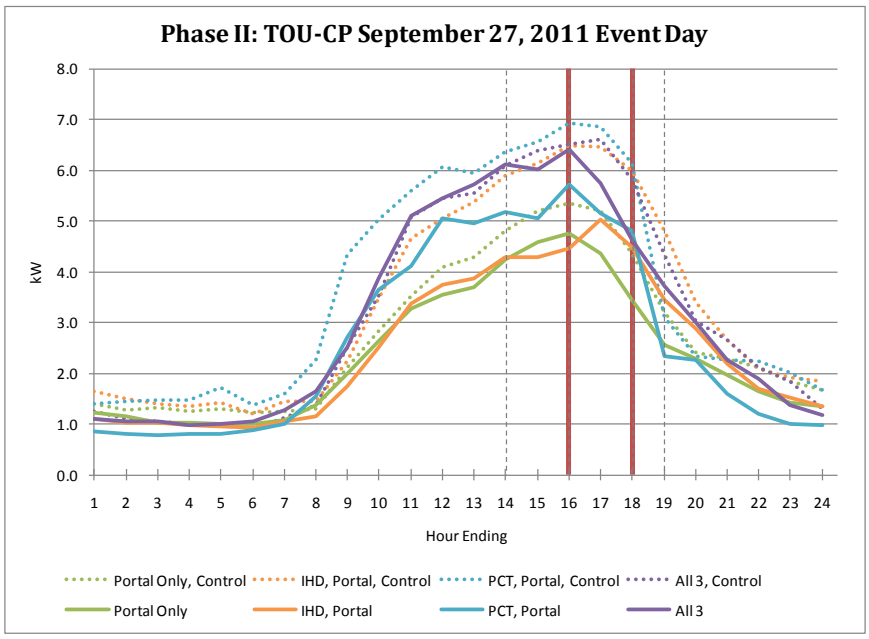

Figure 4-77 TOU-CP September 27, 2011 event day – Phase II Small Commercial

Figure 4-78 shows the load shapes for the VPP-CP rate on the September 27, 2011 event day.

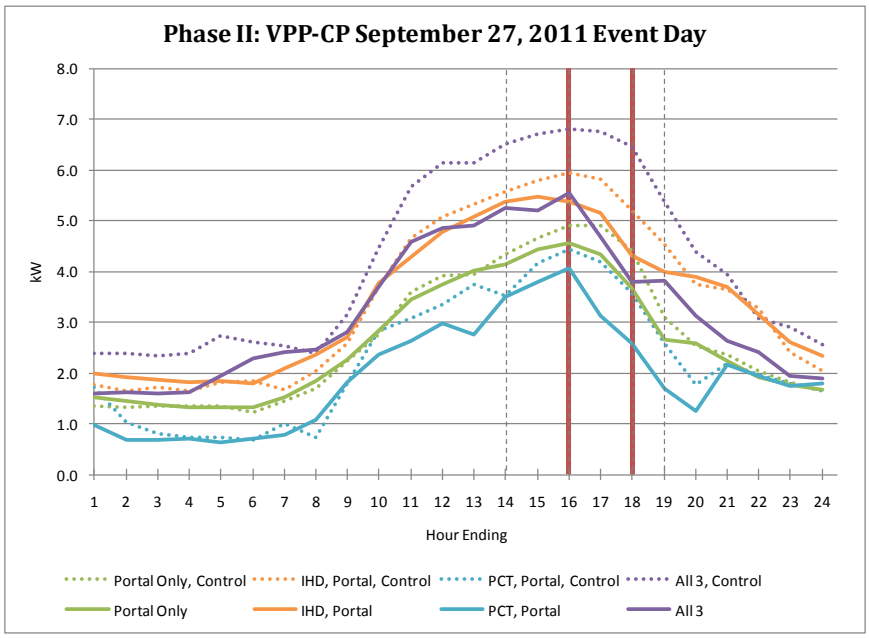

Figure 4-78 VPP-CP September 27, 2011 event day – Phase II Small Commercial

4.1.5 System Peak Day Projection

The most important day for load reduction for a demand response program is the day of the system peak. In this section, we consider the load reduction on the day of the system peak. The challenge here is that we only know the system peak after the fact, and the temperature, day, and time of the peak can differ from year to year. As shown in Section 1.5, during 2011 the system peak occurred on August 3, during the hour ending 4:00 pm, on a day with a high temperature of 108 and a low temperature of 82 for an average daily temperature 95. This was a typical system peak day, however the peak time more often falls at the hour ending 5pm.

The most effective technology for load reduction is clearly the PCT (both by itself and combined with the other technologies in the ALL 3 group). However, the drawback is that the load

reduction from a PCT is maximized during the first hour after a price increase. This presents a problem for a utility with a system load shape like OG&E's. The peak is broad, so in order to reduce the capacity requirement, the load must be reduced across several hours, not just a single hour. And the peak usually occurs during the hour ending 4:00 or 5:00, but the peak period starts at 2:00 pm. As a result, the maximum savings happens too early, and by the time of the system peak hour, the savings are less.

For the future, a TOU or VPP rate with two prices on weekdays, incorporating a "super-peak" period, perhaps from 4:00-6:00 pm, would provide the price signal needed to reduce the entire on-peak period but also reduce the period when the system peak is most likely to occur. This would fix the price structure to match the event that was called on August 24, 2011, shown in Figure 4-43, Figure 4-44, Figure 4-57, and Figure 4-58. This would provide the double spike in load savings, with the initial reduction at the beginning of the on-peak period, and a secondary drop at the usual time of the system peak. Figure 4-79 shows the estimated savings for August 24, with the expected savings for a non-event High price day and the incremental savings from the event, for the VPP-CP rate with a PCT.

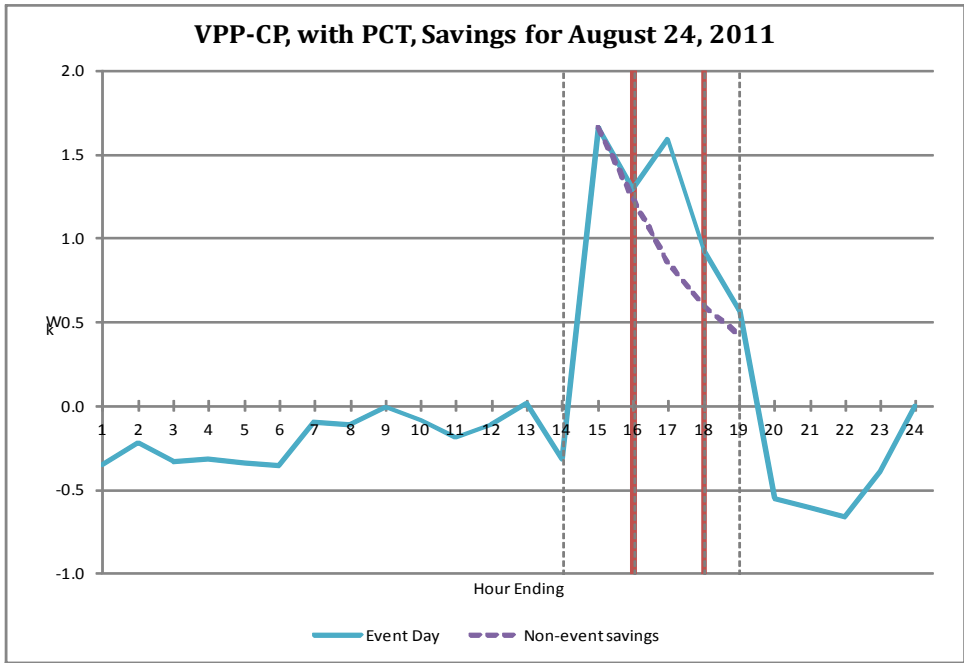

Figure 4-79 VPP-CP with PCT event day savings

Figure 4-80 shows the expected on-peak savings for the combination of VPP-CP and PCT for a system peak day with an average temperature of 95° and a High price using the regression model to estimate savings, and the August 24 event day to estimate the event day impact. For the key peak hours of 3:00 pm, 4:00 pm, and 5:00 pm, the load reduction is maximized, between 1.5 and 2 kW. The savings do drop off in the 6:00 pm hour, but they are not as low as they would be without the event.

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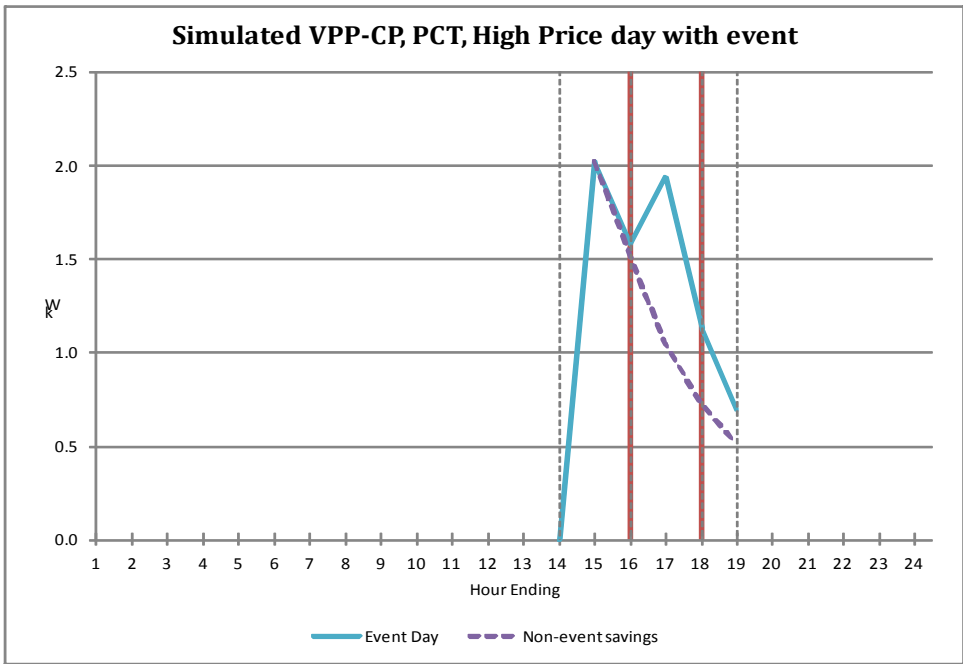

Figure 4-80 VPP-CP with PCT - Hypothetical System Peak Day at 95˚

The above estimate uses the August 24 event day to simulate what would happen with the addition of a "super-peak" period from 3-5 pm. In the long term, this would be a good approach, but would unfortunately require a rate change in a regulatory filing, which takes time. Given the current rates in place at OG&E, the best approach would be to emulate the August 24 event day on any day that is likely to end up as the system peak day. In other words, set the VPP price to high and then call a Critical Price Event from 4:00-6:00 pm. This would provide the best load reduction across the whole on-peak period, and deliver a true reduction in the system peak demand. This approach can be tested during the summer of 2012.

CHAPTER | 5

SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

The specific preliminary results of the Smart Study TOGETHER are listed below. Most of the conclusions for the residential customers from the Summer 2010 report still hold true.

Residential:

- There were not dramatic differences between the results for the Phase I and Phase II residential customers. There were some situations where the Phase I customers showed somewhat higher savings for some rate-technology groups, which could indicate that the Phase I customers have learned how to better respond to prices and events, but may also be random variation between customers
- In general, the automated response of the PCT and All 3 groups reduce load more than the information provided through the IHD and Web Portal. However, the IHD and Web Portal load reductions are more constant throughout the peak period, whereas the PCT and All 3 groups tend to have a load reduction spike at the beginning, and savings that decay later in the period. There was also usually a significant rebound effect after the event for the PCT and All 3 groups.
- There is very little change in weekend loads for either rate, either up in response to lower prices or down out of habit.
- It appears that some customers are programming their thermostats in conventional ways to reduce energy use while they are away from the home, which results in a small reduction in loads on low-priced days for VPP-CP customers.
- The TOU-CP shows significant load reductions for all technology groups on both non-event weekdays and event weekdays for the Phase I customers. For the Phase II customers, however, only the PCT and All Three groups showed statistically significant load reductions based on the direct load comparisons.
- The VPP-CP rate shows significant load reductions for all except the low price days for Phase I for all technologies, and for the same days for PCT and All Three for Phase II, based on the direct load comparisons. Based on the prices that were set during the study period, there was a positive relationship between price and load reduction.
- When events are called during the on-peak periods on any weekdays for the TOU-CP or on days that are not already critical price days for the VPP-CP, there is a secondary load drop at the start of the event.
- Because events were called on a variety of days, we now can better understand the interplay between events and the on-peak period, the price level for VPP-CP, the length of the event, and the timing of the start and end of the event.
- The PCT groups often show more savings that the All 3 group, but this is likely due to the fact that the PCT group included only those with central AC, and the All 3 group included customers both with and without central AC. In the regression model, which accounts for differences in central AC among participants, the PCT and All groups are very similar.
- In several cases, the All 3 group showed both overall load reductions throughout the day and further reductions in the peak period. This suggests that the information technologies (IHD and Web) are prompting behavioral changes in addition to the automated response of the PCT.

- Comparing the savings in 2011 for the Phase I customers, who are in their second year of participation, with the Phase II customers, who are in their first, there is some evidence that Phase I customers in the Web Portal, IHD, and All 3 groups are savings more than the Phase II customers. This could be an indication that those customers who have more experience with the rate are learning how to respond better, but that the learning is enhanced by the information provided by the web portal and IHD, since the PCT is not as conducive to learning and improving price responsiveness over time.

Small Commercial:

- The small commercial customers are much more variable in load shape, magnitude, and response to price than the residential customers, making the estimation and characterization of impacts more challenging. There are significant differences between the load shapes of small commercial customers in each of the rate/technology groups, so it is challenging to separate the effect of these differences from the effects of the rates and technologies.
- As with the residential, the automated response of the PCT and All 3 groups reduce load more than the information provided through the IHD and Web Portal. The IHD and Portal groups do not seem to be responding as much in general.
- The small commercial customers respond with a greater load reduction during critical price events than on non-event weekdays. This could be due to the notice process, and customers giving more weight to something that is an "event".

5.2 RECOMMENDATIONS

The most effective rate/technology combination going forward for residential customers is the VPP-CP with PCT. The VPP rate provided the highest load reduction on the hottest days, and also provides the full range of prices for OG&E to work with. On days when capacity is plentiful, there is no need for customers to reduce on-peak energy, so the low rate can be set. When capacity is short, a High or Critical price can be set, and the Load reductions will be greater. The VPP-CP allows OG&E to tailor the price to the capacity. Combining the PCT with the rate automates the load reduction, giving the customer the ability to choose between the relative importance of cost and comfort, and to vary that choice across the different prices.

With the current rates in place, in order to maximize the load reduction on the system peak day, or on any day when capacity is constrained, OG&E should set the VPP price as High, and then call a Critical Price event starting at 4:00. This will provide more continuous load reduction across the entire on-peak period, particularly at the time of the usual system peak.

In the long term, OG&E should investigate adding a "super-peak" period, probably from 4:00 pm to 6:00 pm, with a higher price than the on-peak period. This would allow the automated response of the PCTs to spread the savings more evenly over the entire on-peak period without having to call events as described above.

If the apparent learning effect for those customers with Web Portal, IHD, and All 3 is really happening, then efforts to engage those customers with PCTs in using the Web Portal could increase load response over time going forward, enhancing the effectiveness of the program.

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