

PECO Energy Company's Initial Dynamic Pricing and Customer Acceptance Plan

October 28, 2010

Table of Contents

| | |
|---|----|
| Executive Summary..... | 1 |
| 1 Overview of PECO Energy Company’s Initial Dynamic Pricing and Customer Acceptance Plan..... | 3 |
| 1.1 Plan Objectives..... | 3 |
| 1.2 Conceptual Approach to the Plan..... | 4 |
| 1.3 Expected Outcomes of the Plan..... | 7 |
| 1.4 Plan Organization..... | 8 |
| 2 Designing Dynamic Rates and Simulating Customer Impacts..... | 9 |
| 2.1 Evaluating Dynamic Pricing Options..... | 9 |
| 2.2 Designing the Dynamic Rates..... | 12 |
| 2.2.1 CPP Rate..... | 13 |
| 2.2.2 TOU Rate..... | 15 |
| 2.3 Understanding Customer Bill Impacts..... | 15 |
| 3 PECO’s Test and Learn Plan..... | 19 |
| 3.1 Plan Development..... | 19 |
| 3.1.1 Plan Development Process..... | 19 |
| 3.1.2 Meter Deployment Schedule..... | 20 |
| 3.1.3 Essential Elements of Research Design..... | 21 |
| 3.2 Treatment Options..... | 22 |
| 3.2.1 Tariffs..... | 23 |
| 3.2.2 Technology..... | 23 |
| 3.2.3 Customer Education..... | 23 |
| 3.2.4 Promotional Strategies..... | 23 |
| 3.3 Customer Acceptance Research Track..... | 24 |
| 3.3.1 Customer Preference Track..... | 26 |
| 3.3.2 Technology Research Track..... | 29 |
| 3.3.2.1 Notification..... | 30 |
| 3.3.2.2 Load Control Devices..... | 30 |
| 3.3.2.3 Information Feedback..... | 31 |
| 3.3.3 Promotional Strategies Research Track..... | 31 |
| 3.3.4 Customer Education Research Track..... | 35 |
| 3.3.5 Customer Acceptance Research Summary..... | 35 |

| | | |
|-------|--|----|
| 3.4 | Customer Communication Strategy..... | 37 |
| 4 | Measurement and Evaluation..... | 39 |
| 4.1 | Load Impact Evaluation..... | 39 |
| 4.1.1 | Residential Load Impact Evaluation..... | 41 |
| 4.1.2 | S/MC&I Load Impact Evaluation..... | 42 |
| 4.2 | Differential Enrollment Rates and Choice Analysis..... | 42 |
| 4.3 | Customer Surveys..... | 43 |
| 4.4 | Reporting..... | 43 |
| 5 | Budget and Cost Recovery Plan..... | 44 |

EXECUTIVE SUMMARY

This summary outlines PECO Energy Company's Initial Dynamic Pricing and Customer Acceptance Plan. The Plan is designed to fulfill PECO's obligations under Act 129 of 2008 (the "Act") with respect to dynamic pricing by offering to customers with smart meters the specific kinds of rates required by the Act. In particular, the Plan implements a research strategy designed to identify an effective combination of rates, technologies, customer education, and promotional strategies. While prior research shows that customers who are on dynamic rates change their energy usage behavior, studies have not focused on the best ways to get customers to enroll in these rate options.

PECO's research strategy, referred to as "test and learn," evaluates various packages of rates, technologies, promotional strategies, and customer education. These offers will go out beginning in the fall of 2012 to a target population of around 150,000 to 200,000 customers, timed to follow PECO's initial deployment of smart meters. Overall, PECO anticipates that around five percent of customers in the target population will enroll in a dynamic rate offer. Customer enrollment and load-response data will be collected and evaluated. As insights are gained from this analysis, effective packages will be retained and improved, while less effective packages will be eliminated. The packages will be structured so that a single element of interest (e.g., rate, technology, promotional material) can be evaluated.

Rates: PECO is proposing to offer two different rate options as part of the Plan: (i) Critical Peak Pricing ("CPP") and (ii) Time of Use ("TOU") pricing. The CPP rate features a discounted flat rate for all kilowatt hours ("kWh") consumed other than on those occasions when a "critical day" is called (critical days will be called 15 days per summer). On critical days, during a 4-hour peak period, customers who have selected the CPP rate will pay a premium for all kWh used. With the TOU rate, each weekday is divided into peak and off-peak periods and customers pay a discounted rate for off-peak usage and a higher rate for peak period usage relative to PECO's standard, non-time-differentiated rates. Residential customers who are not enrolled in PECO's Customer Assistance Program will be eligible for the CPP and TOU rates. Small and medium commercial and industrial customers will be eligible for the CPP rate only.

Technology: PECO will test several technologies to evaluate their impact on a customer's willingness to enroll in and respond to a dynamic rate. These technologies include automated response technologies such as Programmable Communicating Thermostats; information feedback technologies, such as In Home Displays ("IHDs") and web presentation of data; and notification technologies, such as text messaging, emails and smart-phone messages.

Promotion: A wide variety of promotional strategies will be tested, including combinations of messages, educational content, promotional channels, modes of communication,

number of contacts needed, timing of the offer, format of the presentation material, incentives, and targeting segments based on customer characteristics. PECO expects that the test and learn approach will allow it to quickly identify effective promotional combinations.

Education: PECO will evaluate the impact of several alternate customer education options that are designed to reinforce load reduction and load shifting behaviors. These can include reminders sent through the mail or email or IHD plus feedback messaging via the web.

The Company's measurement and evaluation plan describes how PECO will collect and evaluate data on its dynamic rate packages. Data analysis will include load impact evaluations and choice modeling based on evaluation of actual data and surveys to determine the level of customer understanding and customer experiences during critical events.

PECO's current budget estimate for the Plan, based upon its plan to target 150,000 to 200,000 customers, is \$11.6 million. The Plan will be eligible to receive funding from the matching grants awarded to PECO by the U.S. Department of Energy. Plan costs, net of the matching grants, will be recovered through the Company's Generation Supply Adjustment.

1 OVERVIEW OF PECO ENERGY COMPANY'S INITIAL DYNAMIC PRICING AND CUSTOMER ACCEPTANCE PLAN

This document comprises PECO Energy Company's ("PECO") Initial Dynamic Pricing and Customer Acceptance Plan ("Dynamic Pricing Plan" or "Plan") that is being submitted to the Pennsylvania Public Utility Commission ("PAPUC" or "Commission") in partial fulfillment of the requirements under Pennsylvania Act 129 of 2008 ("Act 129" or the "Act"). Act 129 directed Pennsylvania electric distribution companies ("EDCs") to file with the Commission, by August 14, 2009, a smart meter technology procurement and installation plan. The Act further defines minimum smart meter technology capabilities, including enabling time-of-use rates and real-time price programs, and provides for recovery of all prudent and reasonable costs. PECO's final Smart Meter Plan was approved by the Commission as set forth in the PAPUC's Order entered on May 6, 2010.¹

PECO's Smart Meter Plan details the Company's two-phase strategy for the deployment of smart meter technology throughout its service territory in accordance with the requirements of Act 129. The first phase comprises the selection, testing, and validation of the smart meter technology to be deployed, the deployment of the advanced metering infrastructure communication network, the initial deployment of up to 600,000 smart meters, and the development of a program to educate customers and implement initial dynamic pricing options. The second phase will complete the deployment of smart meters across PECO's service territory. The cost of deployment of smart meters is being funded in part through receipt of a \$200 million grant from the federal government as part of the Department of Energy's ("DOE") Smart Grid Investment Grant program.

In addition to the deployment of smart meters, the Act requires that specific kinds of rates be offered to customers that have been provided with smart meter technology. In particular, the Act requires EDCs to submit "one or more proposed time-of-use rates and real-time price plans" by January 1, 2010, or at the end of the applicable generation rate cap period, whichever is later.² This Plan describes the tariffs that PECO proposes to offer customers in response to Act 129, the strategy that PECO will employ to effectively promote these tariffs, and the process that will be used to continuously improve the tariff and service offerings and promotional strategies over time.

1.1 Plan Objectives

The Plan documented in this filing is designed to achieve the following objectives:

- Comply with Act 129 requirements;

¹ See Petition of PECO Energy Company for Approval of its Smart Meter Technology Procurement and Installation Plan, Docket No. M-2009-2123944.

² PECO's generation rate cap period ends on December 31, 2010.

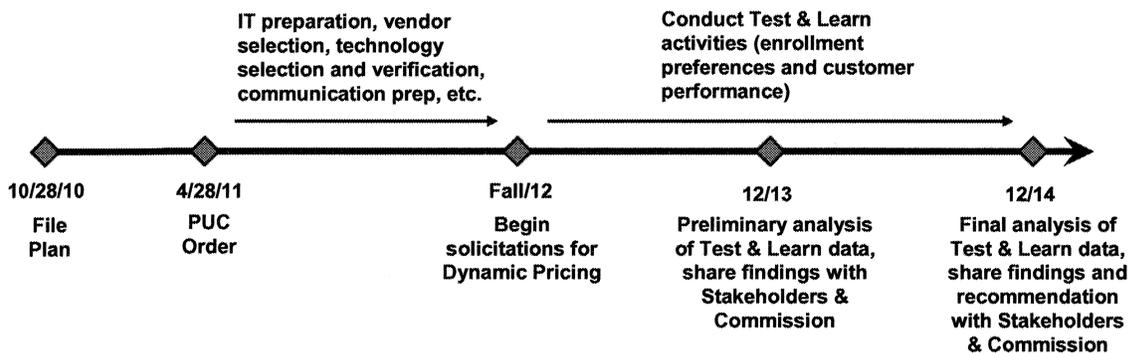
- Understand customer preferences for rate and technology options and identify a combination of rates and technologies that will help them better manage their energy costs;
- Understand how to educate and communicate with customers about new options; and
- Identify combinations of rates, technologies, education and marketing strategies that are effective.

1.2 Conceptual Approach to the Plan

The Plan presented here is conceptually different from the way in which many utilities have approached the implementation of dynamic pricing within the context of Advanced Metering Infrastructure (“AMI”). With some exceptions (particularly in California), most utilities in the United States are implementing multi-year, small-scale pilot programs designed primarily to understand if and to what degree customers will respond to dynamic pricing when decades of research clearly indicates that, on average, they will.

PECO’s Dynamic Pricing Plan is different from prior studies in several important ways. First, it focuses significant attention on understanding the drivers of customer acceptance of dynamic rates, rather than focusing exclusively on changes in usage for customers who are somehow coaxed onto such rates in a pilot setting. The Plan also differs from the typical practice of offering a single, predefined package of rates and technology based on a single marketing approach for a sustained time period. A key feature of this Plan is that it will simultaneously offer numerous tariff and technology options using a multitude of promotional strategies to determine what options customers prefer and how best to reach them, and will make changes in the offerings over time as insights are gained about what is and is not working. Finally, the scale of the proposed Plan is much larger than previous studies. Indeed, PECO believes the Plan is best described as a controlled launch of a full-scale portfolio of dynamic pricing and related service offerings.

The Plan has a time horizon that begins following deployment of smart meters (est. 2012). Details of this are presented later in the Plan; the major milestones envisioned are:



The Plan is based on a thorough understanding of what has and has not worked in the past, but also acknowledges that there is much to learn about what customers want and how best to present it to them. The Plan is structured around well-established principles of innovation management used in other industries. Product/service improvement, or innovation, happens by testing and learning—a systematic process of experimentation in which better products, services or promotional strategies are discovered by trying different options, quickly abandoning those that do not work, and improving those that do to make them work better.

Consistent with this philosophy of experimentation to drive learning and improvement, not every customer initially will receive the same offer on the same terms. Making different offers to randomly selected groups of customers is by far the best way to understand customer preferences and to determine which offerings are working and which are not. Surveys asking customers if they will choose specific options significantly overstate what they will actually do, especially when presented with a concept as new and unfamiliar as dynamic pricing. There is no good substitute for analysis of actual choice data from a representative sample of customers to determine what the broader population is likely to do if faced with similar offers.

The Plan also recognizes that there is a lot of research currently underway and in development, and new technologies are being introduced and refined. As such, it is important to maintain some flexibility concerning precisely what will be offered and tested when the initial offers are made in the fall of 2012. Much will be learned and new technologies may arise between now and when the initial offerings will need to be finalized. Accordingly, it is sensible and prudent to take advantage of those lessons learned, as well as new options rather than lock into a full list of specific offerings at this time. Also, flexibility is inherent in the basic "test and learn" strategy. For example, what should be offered (and not offered) in the second year of the roll out should be based on what was learned in the first year regarding customer preferences and the relative effectiveness of different promotional strategies and features.

As previously discussed, a key component of PECO's Dynamic Pricing Plan involves making actual offers to random samples of customers in a controlled manner that allows for a clear determination of which price/technology/education options are preferred by customers and which promotional strategies are most effective. This approach involves deploying a relatively large number of test cells in which customers will be offered a single rate/technology/education package based on a specific promotional approach. This systematic research strategy will be implemented through four different research tracks:

- The **customer preference track** will examine residential customer preferences for selected rate options. A comparison of the enrollment rates for each tariff based

on a common promotional strategy will provide an effective measure of the relative preferences of residential customers for the two primary rate options under consideration;

- The **technology track** will examine the impact of enabling technology on both customer acceptance and demand response for selected market segments. Potential technologies include, but may not be limited to, In Home Displays (“IHDs”), Programmable Communicating Thermostats (“PCTs”), and load control devices. These options will allow for an assessment of the differential impact of technology on both enrollment in, and response to, dynamic rates;
- The **promotional effectiveness track** will have various features of the promotional package across test cells while the rate and technology features will remain constant. Promotional strategies are comprised of a variety of features including, but not limited to, the message used to promote a tariff, communication channel, communication mode, the number of times each customer is contacted, timing, whether or not a sign-up incentive is offered, whether or not first-year bill protection is provided to overcome consumers’ risk aversion, and the targeting strategy used (e.g., to whom the offer is made). Various combinations of these promotional features will be offered to some customers and not others, and statistical models will be used to determine the relative effectiveness of each feature in determining customer enrollment; and
- The **customer education track** will test different types of enhanced information for selected customers who have signed up for a dynamic rate, such as reminders and suggestions for load response sent at various points during the spring/summer, to determine whether such information increases demand response.

The Plan will involve a large number of customers in the test cells that will receive different tariff/technology/education options based on a variety of promotional strategies. The precise number of customers to be included in the customer acceptance research component of the roll out will be determined at a later date and will evolve over time. For planning purposes, PECO is currently expecting to include somewhere between 150,000 and 200,000 customers in the research portion of the Plan, spread across several research phases starting 3 to 4 months after initial meter installation. Initial offers are expected to be made in early fall 2012 but this date could shift depending on the exact meter deployment schedule. Each test and learn sample will require around 5,000 customers, which represents the average size of the group that will receive offers. The expected number of customers who accept offers will be much less (estimated to be around 5% in most cases). This will allow PECO to test roughly 30 to 40 different options comprised of various combinations of rates, technology, education, and promotional features.

It is necessary to include a large number of customers in this Plan because PECO is attempting to implement a rigorous, scientifically sound exploration of the key drivers of customer acceptance of time-varying rates and related technologies based on actual

choice data – not pseudo choice data developed through surveys. This approach requires systematically comparing enrollment rates and/or load impacts across multiple options that vary along a single dimension. If multiple features vary across options, it is impossible to determine which of the feature differences cause the observed changes in enrollment or load impacts. Because there is a relatively large number of features that could drive enrollment and/or load impacts, this systematic methodology leads to a large number of test cells. Furthermore, because enrollment rates are expected to be relatively small (approximately 5%), at least initially before key insights gained from early tests are used to drive them higher, each option must be offered to a relatively large number of customers in order to obtain enrollment rates that are large enough to measure statistically significant load impacts and/or differences in enrollment rates across test cells.

1.3 Expected Outcomes of the Plan

The Plan is likely to produce much of the data and findings needed to develop a long term pricing strategy that will serve PECO and its customers for the foreseeable future. PECO expects to learn a great deal from this approach; the types of findings that are likely to be obtained include:

- Residential and small and medium commercial (“S/MC&I”) customer preferences for dynamic rates vs. default service;
- Residential customer preferences between dynamic pricing tariff options;
- Differential enrollment rates across multiple customer segments, including customers enrolled in the direct load control program, electric space heat customers, and customers with various characteristics (e.g., based on ex post analysis of enrollment by usage stratum, appliance holdings using survey data, income, etc.);
- The incremental effect of a sign-up incentive on enrollment;
- The effect of first year bill protection;
- The relative effectiveness of various messages concerning the benefits of time-varying pricing;
- The relative effectiveness of direct mail, telemarketing, and community-based marketing for residential customers;
- Differential enrollment rates between marketing in the early summer compared with marketing in the fall (prior studies have shown that seasonality is an important determinant of enrollment);
- For S/MC&I customers, the impact of combining PCTs with a dynamic rate, as well as the impact of a sign-up incentive;³

³ The number of options that can be tested among S/MC&I customers is much less than for residential customers because of the relatively small number of customers in the overall population who will receive smart meters in the Company’s initial deployment of 600,000 smart meters and the smaller enrollment rates that are typically found among S/MC&I customers relative to residential customers.

- The average load impacts associated with alternative rate options by customer segment, with and without selected enabling technologies; and
- Key insights (and predictive models) for targeting consumers with future tariff and technology promotions.

1.4 Plan Organization

The remainder of the Plan is organized as follows:

- Section 2 contains a detailed description of the proposed rates that will be offered to residential and S/MC&I customers and the reasons why those rates were selected over other rate options;
- Section 3 presents the details of the test and learn strategy that will be used to assess various options, to learn what options and promotional strategies are and are not successful, and to adapt to those findings across several dimensions, including rate preferences, promotional offers, customer education and enabling technology. This section also provides a high level summary of the communication plan that PECO will employ to prepare customers for the deployment of smart meters and to apprise them of the tariff and related opportunities that will be made available as a result of meter deployment;
- Section 4 describes the numerous measurement and evaluation processes that will be employed to learn what is working and what is not and to assess the impact of various options on energy usage patterns; and
- Section 5 summarizes PECO's budget and cost-recovery proposal.

2 DESIGNING DYNAMIC RATES AND SIMULATING CUSTOMER IMPACTS

At the core of the Plan are the retail rates that will be offered. These rates represent the new and innovative products that, ultimately, customers will decide to either accept or reject. As such, it is important that the rates be well designed and attractive to PECO's customers. There is a wide range of dynamic rate designs that could be offered by PECO, and each option offers a unique set of advantages and disadvantages. Some rate structures are very simple to understand, but do not provide significant opportunities for bill savings. Other designs tie very closely to hourly fluctuations in wholesale market prices, but are likely to be perceived as too risky for customers to enroll. However, carefully selected and well-designed rates can satisfy a broad range of objectives and provide customers with real incentives to participate and benefit. This chapter describes the methodology that was used to arrive at PECO's dynamic rate structure recommendations.

The chapter is organized into two sections. The first section describes the rate screening and selection process. The second section provides a detailed look at how customer bills will be affected when enrolling in the new rates. The bill impact analysis is provided both for the class average customer and across a representative sample of customers.

2.1 Evaluating Dynamic Pricing Options

There were several steps in selecting the recommended rate options. The first step was to identify the universe of possible rate options for consideration. Then, criteria were established for evaluating these options against the objectives of the Plan. Each rate option was subjectively screened against these criteria based on existing research and the industry experience of The Brattle Group. Based on this initial screening, prototypes of the more attractive rate options were developed and presented at a series of stakeholder meetings. Stakeholder feedback was incorporated into the analysis and the rate prototypes were refined to arrive at the final recommendations.

A broad range of rate options were initially considered in this analysis, ranging from a simple time-of-use (“TOU”) rate to a complex critical peak real time pricing (“CP-RTP”) rate. These are summarized in Table 2-1.⁴

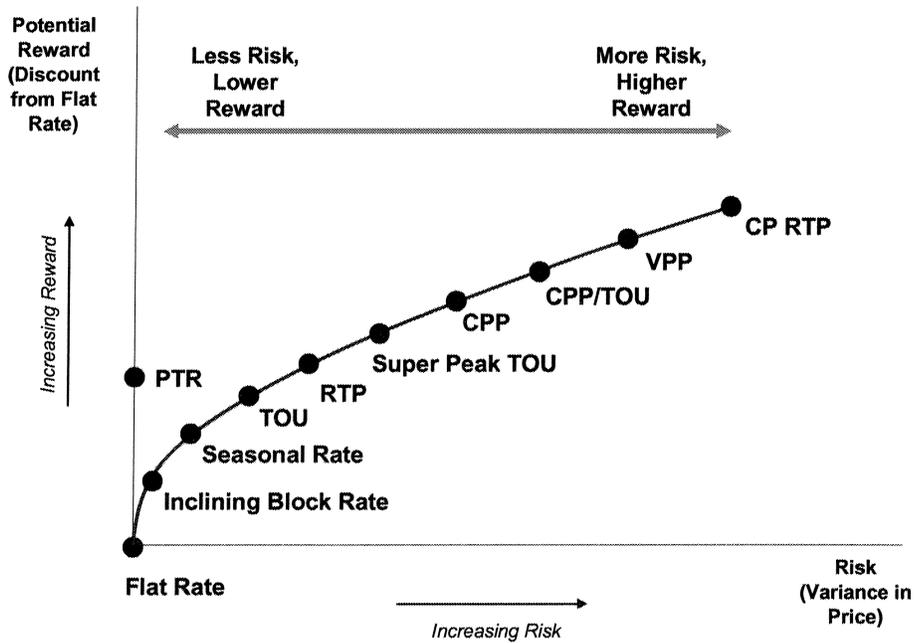
**Table 2-1:
Rate Options Initially Considered**

| Rate | Description |
|------------------------------------|---|
| Time-of-Use (TOU) | Charges a higher price during all weekday peak hours and a discounted price during off-peak and weekend hours |
| Super Peak TOU | Similar to the TOU except that the peak price is offered during a much smaller number of hours of the year, leading to a stronger price signal |
| Inclining Block Rate (IBR) | Customer usage is divided into tiers and usage is charged at higher rates in the higher tiers; meant to encourage conservation |
| Critical Peak Pricing (CPP) | Customers are charged a higher price during the peak period on a limited number of event days (often 15 or less); the rate is discounted during the remaining hours |
| Variable Peak Pricing (VPP) | Critical Peak Pricing rate with added variability |
| CPP-TOU Combination | A TOU rate in which a moderate peak price applies during most peak hours of the year, but a higher peak price applies on limited event days |
| Peak Time Rebate (PTR) | The existing flat rate combined with a rebate for each unit of reduced demand below a pre-determined baseline estimate during peak times on event days |
| Real Time Pricing (RTP) | A rate with hourly variation that follows Locational Marginal Pricing (LMPs), but with capacity costs allocated equally across all hours of the year |
| Critical Peak RTP (CP-RTP) | A rate with hourly variation based on LMPs and with a capacity cost adder focused only during event hours, creating a strong price signal at these times |

These rate structures vary across many distinguishing characteristics, such as the type of price signal they provide (higher peak price versus rebate payment for load curtailment), the granularity of the pricing periods (two periods, three periods, or hourly), and the frequency of the pricing periods (every weekday versus during a limited number of days in the summer). However, they all can be organized simply across the spectrum of risk and reward. Generally, those rates offering the most reward (in terms of bill savings potential) are also the most risky (in terms of exposing the customer to the volatility of the wholesale electricity markets). This is illustrated schematically in Figure 2-1.

⁴ For more detailed descriptions of each rate option, see Ahmad Faruqui and Ryan Hledik, “The Power of Dynamic Pricing,” *The Electricity Journal*, April 2009.

**Figure 2-1:
Risk-Reward Proposition for Innovative Pricing Structures⁵**



In order to evaluate the ability of each rate opportunity to meet PECO's Plan objectives, it was necessary to develop a list of rate evaluation criteria. Five key criteria were established to determine whether the rates were consistent with PECO's objectives and in the best interest of its customers. These five criteria are as follows:

- Simplicity and ease of understanding: Will customers be able to quickly understand the rate? Is it actionable?;
- Customer value proposition: Does the rate provide customers with a significant bill savings opportunity?;
- Retail-wholesale market connection: Does the rate tie the structure directly to the wholesale market; are rates developed consistently with how the Company is procuring power through its approved DSP?;
- Incentive to reduce peak demand: Is the rate expected to produce significant reductions in peak demand?; and
- Incentive for permanent load shifting: Will the rate encourage customers to permanently shift load from higher cost hours to lower cost hours?

A review of the evaluation against the goals suggested four rate designs that initially appeared to be the best candidates for meeting PECO's Plan objectives. These are CPP,

⁵The figure is presented purely for illustrative purposes – it is not intended to be a scaled illustration of potential risks and rewards.

CPP-TOU, PTR, and CP-RTP. The CPP rate would provide a strong demand response signal and create significant bill savings opportunities for customers. The CPP-TOU provides a similar demand response signal, and in addition includes a TOU component that provides an incentive for permanent load shifting and additional bill reduction opportunities. The CP RTP also provides similar opportunities for bill reduction, but with price uncertainty. Finally, the PTR appeared to be an attractive alternative in the sense that it cannot lead to bill increases relative to the existing rate.⁶ Further examination of these four rate options led to a preliminary conclusion that both CPP and CPP-TOU be included in the Plan as the top candidates for testing customer response and acceptance.

The recommended rate structures were then presented at a series of stakeholder meetings to solicit feedback on the rate designs, particularly with respect to the perceived attractiveness of the rates to customers. Some stakeholders felt that there were significant barriers to participation in rates that had a CPP component, which mostly related to customer price risk. These stakeholders considered the simplicity of the TOU rate to be a more attractive option. To recognize the concerns of the stakeholders and also design a program with a higher likelihood of customer acceptance and support, the CPP and TOU are proposed as the two residential rates for the program. This offering has the benefit of providing a load shifting incentive in the TOU rate and a demand response incentive in the CPP rate – the same two aspects that made the combined CPP-TOU rate an attractive option, but without the complexity and risk of that combined rate design. Including both a CPP and a TOU rate in the plan design allows for a beneficial comparison of which design is more attractive to customers. For S/MC&I customers, CPP will be the only rate offered initially. There are three primary reasons for this decision: First, with a CPP tariff, load impacts can be estimated without a control group of different customers while a TOU tariff would require a control group. Second, prior research suggests that the price responsiveness of S/MC&I customers is less than that of residential customers (on a percentage basis), so the impacts associated with a TOU rate would likely be small compared with those of a CPP rate (which provides a stronger peak price signal). Finally, PECO felt it was more important to test several different promotional strategies on this relatively small population than to test two rate options.

2.2 Designing the Dynamic Rates

Historical PECO system load and energy prices were used to determine the appropriate peak period and seasonal definition for the dynamic rates. The peak period was designed to balance the tradeoff between customer convenience (i.e., a shorter peak period) with the likelihood of the peak period to capture the highest price and load hours (i.e., a longer

⁶ Illustrations of the CP-RTP and PTR are provided in Appendix A (see Figures A-1, A-2 and A-3).

peak period). With these rate characteristics established, the several key principles in rate design were used to establish the prices.

Revenue neutrality: The CPP and TOU rates were designed to be revenue neutral. Revenue neutrality means that, on a customer class basis, in the absence of any change in customer behavior, PECO's revenues would be unaffected by the new rate (relative to revenues that would have been generated under the existing rate).

Cost-based prices: Each of the rates has been designed such that it is directly based on PECO's forward purchases of energy and capacity. The peak-to-off-peak price differential of the TOU rate is derived from PECO's forward market purchases. For both rate designs, the peak price also reflects the cost of generating capacity as reflected in the PJM capacity auction. The critical peak price of the CPP is higher than the peak price of the TOU since the capacity cost is allocated over 60 critical peak hours vs. 1044 peak hours in the TOU.

Seasonality: Each rate applies year-round, but the critical days can only occur during the summer season. The year-round design of the rates provide an added benefit to residential heating customers, who tend to have higher loads in winter months when they will experience the off-peak discount relative to the otherwise applicable rate.

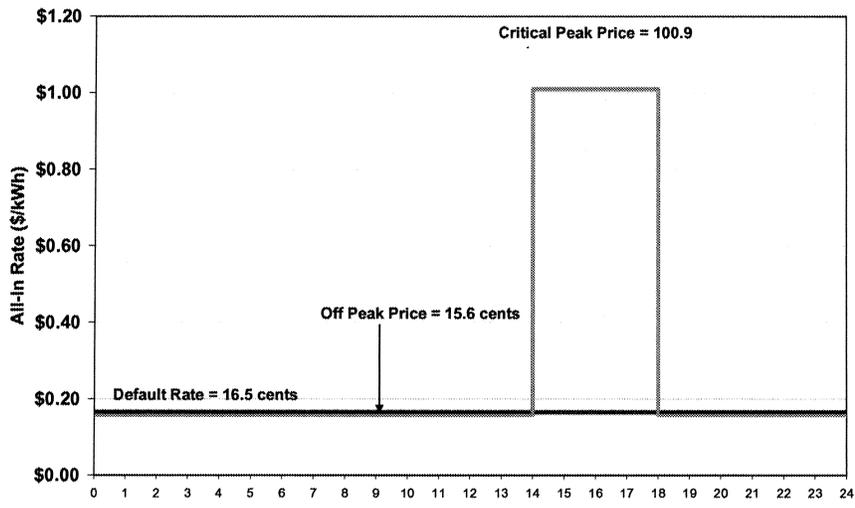
2.2.1 CPP Rate

The CPP rate features a higher-than-average critical peak price during the 4-hour peak period on event days (to be called 15 days per summer⁷) and a discounted off-peak rate for all other hours of the year. The critical peak rate is calculated by adding the energy portion of the existing generation charge to the cost of capacity (allocated evenly to the 60 critical peak hours). As shown in Figure 2-2, this results in a critical peak price of roughly \$1 per kWh for the residential class.⁸ The off-peak rate (which customers see in the remaining 8,700 hours of the year) is priced at just over a 5% discount from the default rate. As illustrated in Figure 2-3, during the non-summer months, the customers on this rate see only the off-peak discount. Note that these calculations are intended only to provide an illustrative picture of how the rates might look when deployed. While the methodological approach would remain unchanged in practice, the underlying costs are likely to change with the dynamics of the market (e.g. the critical peak price will be influenced by that year's RPM auction), and therefore the absolute prices will reflect the then current prices during the Plan's rollout.

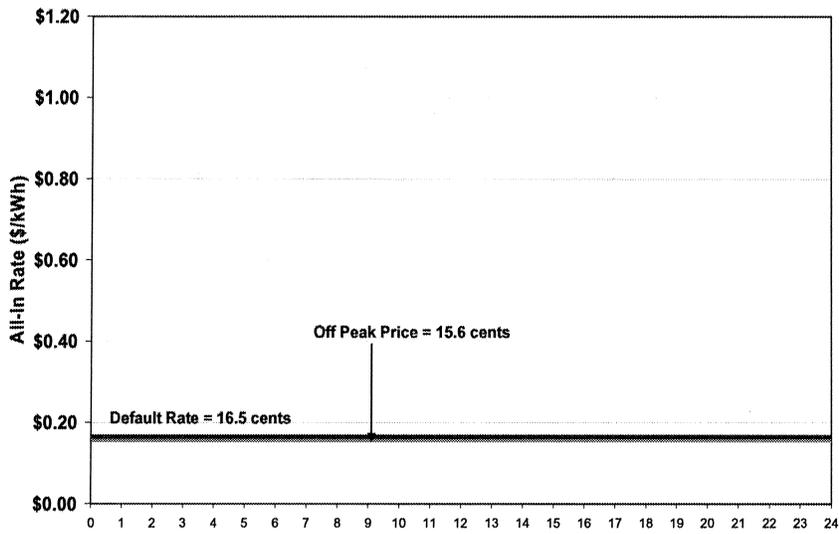
⁷ PECO will call event days utilizing a similar algorithm that will be used to call the 100 highest hours to comply with the load reduction requirements of Act 129.

⁸ The capacity adder is simply added to the energy portion of the existing generation charge. The non-generation adder is class specific, ranging from 2.3 cents for the S/MC&I customers to 6.5 cents for the residential class.

**Figure 2-2:
Illustrative CPP Rate for Residential Class – Summer**



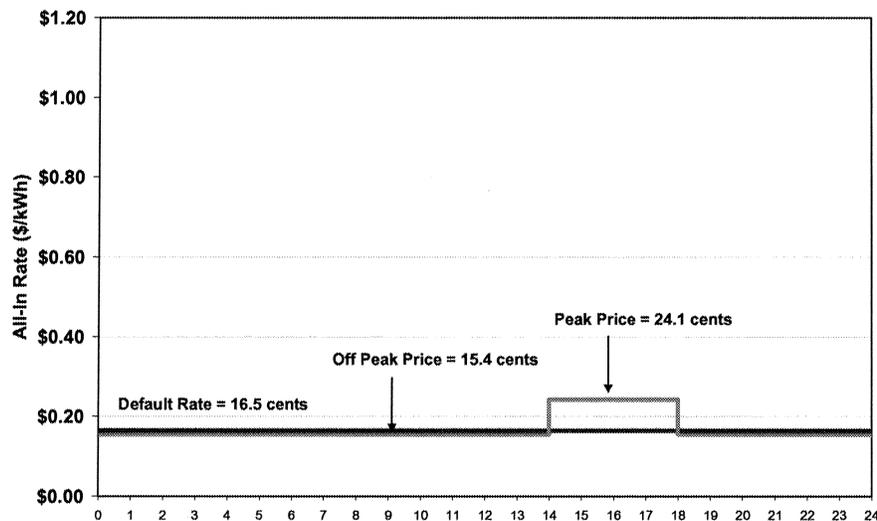
**Figure 2-3:
Illustrative CPP Rate for Residential Class – Non-Summer**



2.2.2 TOU Rate

The TOU rate, as illustrated in Figure 2-4, is composed of a moderate peak rate of approximately \$0.24.1/kWh during 1,044 hours of the year with an off-peak discount during the other hours of approximately 5% off of the default price. The peak price will apply during all non-holiday weekdays throughout the year, and the off-peak price will apply during all other hours.

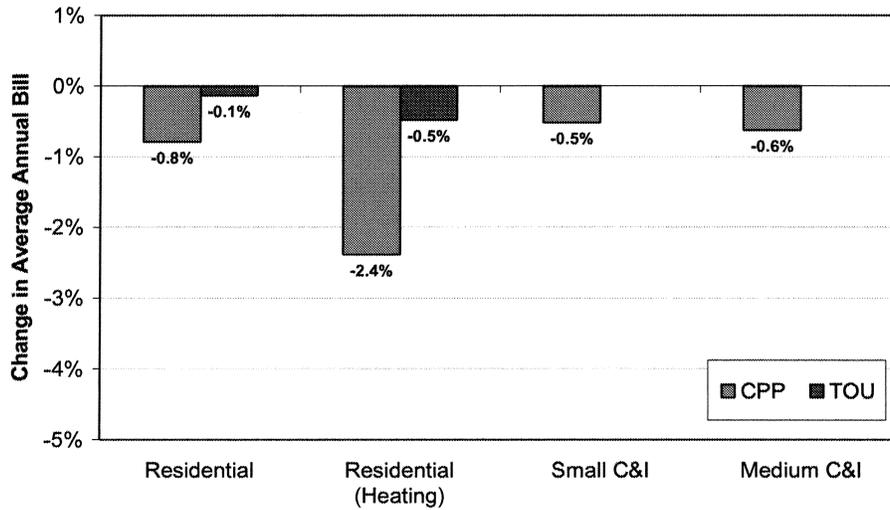
**Figure 2-4:
Illustrative TOU Rate for Residential Class – Year-Round**



2.3 Understanding Customer Bill Impacts

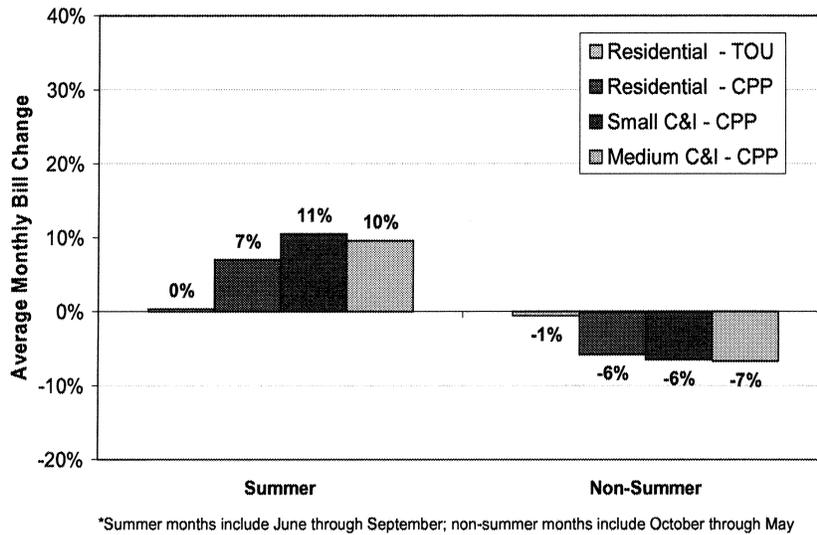
When faced with a CPP or TOU rate, it is expected that customers will shift or curtail load to save money on their bill. A calculation of the class average customer's bill before and after price response provides an estimate of savings customers can expect. For the residential class, the CPP and TOU rates are expected to lead to annual bill reductions of roughly 0.8% and 0.1%, respectively. Due to a usage pattern with higher consumption during the winter months and off-peak hours, residential heating customers are expected to see greater annual decreases. The estimated annual savings for each rate and class are shown in Figure 2-5.

**Figure 2-5:
Projected Change in Average Annual Bill**



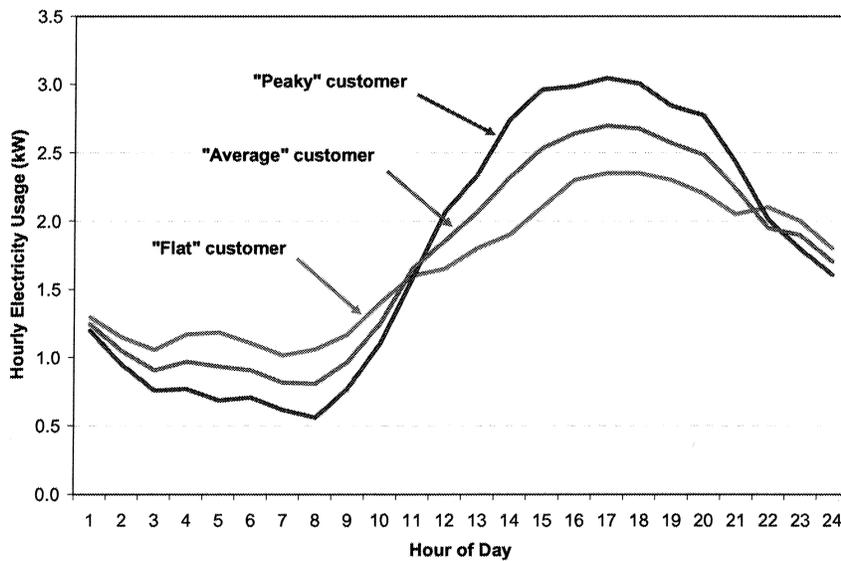
Because critical days occur in the summer, CPP bill impacts are not spread evenly throughout the year. Thus, the expected bill impact is an increase in the four summer months and a decrease in the eight non-summer months (averaging out to the annual bill reductions shown previously). Figure 2-6 shows that the average 4-month summer bill increase on the CPP rate should be around 7% for the residential class, balanced out by a bill decrease of 6% during the 8 non-summer months. For the S/MC&I customers, the summer bill increase could be as high as 11%, balanced out by bill decreases during the non-summer months. Due to the year-round nature of the TOU rate, the bill impacts are small for the average residential customer in both summer and non-summer seasons.

**Figure 2-6:
Average Seasonal Bill Impacts After Customer Response**



Analyzing expected bill impacts for the average customer only tells part of the story. Due to the revenue neutral design of the dynamic rates, the average customer is likely to experience modest bill changes. However, load profiles vary significantly across customers. Some customers tend to be “peaky,” with higher consumption during the peak hours of the day, while other customers tend to have flatter load shapes. These different types of load shapes are illustrated in Figure 2-7.

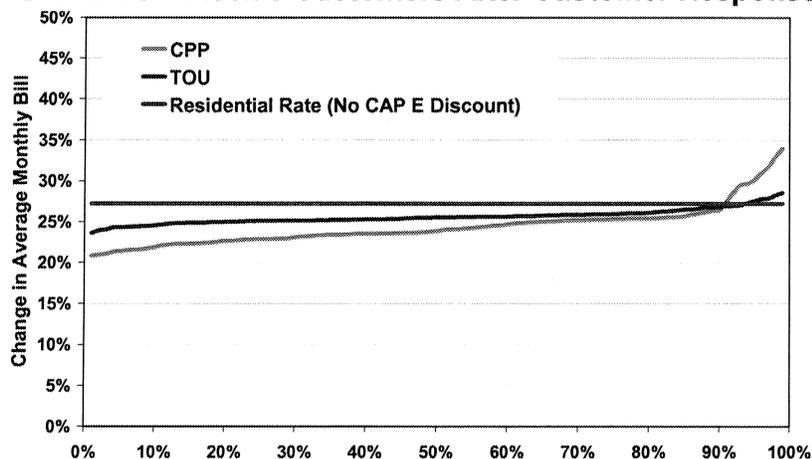
**Figure 2-7:
Average, Flat, and Peaky Load Profiles**



The bill impact of a dynamic rate is partly a function of the customer's load profile. Under dynamic pricing rates such as the CPP or TOU, customers with higher-than-average consumption in the critical peak and peak hours will tend to experience bill increases, while customers with flatter load shapes will tend to experience bill decreases. On an average annual basis, likely bill savings for residential customers is up to 4% and almost 30% of those customers on the CPP rate are expected to save greater than 2%. For S/MC&I customers, average annual bill savings could exceed 4% for some customers while about 20% of customers in this class will save 2% or more.⁹

Another important issue is the impact that the new residential rate offerings will have on low-income customers. Recent pilot studies have shown that low-income customers respond to dynamic rates, although typically less so than other residential customers. PECO has a very strong CAP program for the lowest income customers in its territory. Analysis shows that there are no customers currently on any of the CAP rates that would experience a bill savings if they were moved from the discounted CAP rate to an undiscounted dynamic price. The discounts provided to PECO CAP customers far exceed any potential savings that CAP customers could achieve under dynamic pricing rates. An example is shown in Figure 2-8 where CAP E customers (those who qualify for the smallest discount), would experience average bill increases of 24% and 26% with the CPP and TOU rates, respectively, even after shifting their load.¹⁰ In light of this analysis PECO has decided that CAP customers will not be eligible for the Plan's dynamic rates.

**Figure 2-8:
Distribution of Dynamic Bill Impacts:
CAP E Low Income Customers After Customer Response**



⁹ Appendix A, Table A-1 and Figure A-4 illustrate examples of customer actions taken in response to dynamic pricing.

¹⁰ These estimates assume that a CAP customer would be moved from the CAP rate to the regular residential rate and then the dynamic rate applied to their load.

3 PECO'S TEST AND LEARN PLAN

This section describes the approach that PECO will use to determine which rate options are preferred by various customer segments, what technology and educational offerings will complement the tariff offerings, and what promotional strategies will be effective in enrolling customers on these new rate options.

Section 3.1 briefly describes the process that was used to develop the Plan, a summary of the smart meter deployment schedule, and a high level description of key principles of experimental design that influenced the test and learn strategy. Section 3.2 provides a summary of the technology options that may complement dynamic pricing, the educational/communication schemes that might influence demand response in conjunction with dynamic rates, and the promotional strategies that could be employed to encourage customers to enroll in dynamic pricing. Section 3.3 summarizes the four research tracks that comprise the customer acceptance portion of the Plan and Section 3.4 briefly describes some key attributes of the communication plan that will support the promotion of dynamic rates.

3.1 Plan Development

This Plan was developed in consultation with Freeman, Sullivan & Co. ("FSC"), a leading research firm specializing in assisting utilities to better understand customer interest in, and response to, dynamic pricing and other demand response programs. FSC was engaged to work with PECO to develop a strategy for rolling out dynamic price structures and complementary options in a manner that will allow for systematic and continuous improvement in the options being offered and the manner in which they will be marketed.

3.1.1 Plan Development Process

The initial step in Plan development involved working with key internal and external stakeholders to understand the primary objectives of the Plan. PECO and FSC also agreed on a set of guiding principles that would be used in Plan development.

These include:

- The best way to learn about customer preferences is to make actual offers using different promotional strategies and see what customers choose. Surveys asking customers if they will choose specific options significantly overstate what they will actually do. There is no good substitute for using actual choice data.
- Product/service improvement, or innovation, happens by testing and learning—a systematic process of experimentation in which improvements to products, services or promotional strategies are discovered by trying different options,

quickly abandoning those that don't work well and improving those that work better.¹¹

- There is a lot of research currently underway and on the drawing boards, and new technologies are being developed and refined. As such, it is important to maintain flexibility in the Plan concerning precisely what will be tested when the initial offers are made in early fall 2012. In addition, given the test and learn philosophy of the Plan, subsequent offers should be based on previous offers.
- PECO does not want to reinvent the wheel. If there are things about promotional strategies or service offerings that can be learned from prior research, these should be used as a starting point for the test and learn strategy.
- PECO recognizes that dynamic rates will not provide financial benefits to every individual customer. Therefore, PECO will develop screening safeguards during the enrollment process such as scripted questions about the risks involved to caution certain customers from adopting a rate structure that could adversely impact their bills.

Plan development began with a two and a half day working meeting involving key PECO and FSC staff. PECO outlined the Company's objectives and, in particular, its focus on understanding customer education and acceptance of time-based pricing. FSC provided an overview of key findings from prior research related to dynamic pricing impacts and enrollment and also provided a brief tutorial on experimental design and product/service innovation. Having established a common understanding of PECO's interests and of the current state of knowledge provided by prior research, PECO and FSC began outlining a high level strategy at this initial meeting.

Following the meeting, FSC developed a detailed "straw man" approach and presented it to internal PECO stakeholders. Some modifications were made as a result of internal stakeholder feedback in preparation for the last two external stakeholder meetings, which were held on April 27th and August 12th, 2010. FSC refined the initial strategy and worked through numerous details based on data analysis, weekly conference calls, interactions with The Brattle Group and key PECO staff members, and ongoing monitoring of industry research and developments.

3.1.2 Meter Deployment Schedule

PECO's meter deployment schedule is a key driver of the timing of offers that will be made as part of the customer acceptance research. The smart meter deployment plan and schedule is currently under development and will likely evolve further prior to when the Dynamic Pricing Plan is launched in early fall 2012. The operating assumption underlying the Plan presented here is that there will be approximately 100,000 smart

¹¹ For a more detailed discussion of experimentation and innovation, see Michael Sullivan. *Using Experiments to Foster Innovation and Improve the Effectiveness of Energy Efficiency Programs*. California Institute for Energy and Environment and the California Public Utilities Commission's Energy Division. March 2009.

meters in place by fall 2012 and that the mix of customers who will have smart meters by this time will be reasonably representative of the broader population of customers who will ultimately receive smart meters. It is also assumed that the remainder of the 600,000 smart meters will be installed in a timely fashion to allow sample populations to be drawn for purposes of this Plan as presented below.

3.1.3 Essential Elements of Research Design¹²

In order to measure the effects of various features of the Plan (tariffs, promotional options, etc.), it will be necessary to determine the direct impact of these features on the outcomes of interest (enrollment and performance). To rigorously determine whether a particular feature causes a change in an outcome of interest, it is essential to control for other factors that might cause the observed effect. When research is designed so that causality can clearly be established, it is said to be an internally valid study.

The customer acceptance portion of the Plan is focused on enrollment. How does enrollment differ between CPP and TOU tariffs? How does enrollment for a CPP tariff change if PECO offers first year bill protection or a sign-up incentive compared with a situation in which these promotional strategies are not used? In order to determine causality between changes in offer features and enrollment, it is necessary to make offers to the same types of customers.¹³ This can be done by choosing random samples of customers to receive each offer. Random selection ensures that any observed difference in enrollment between two treatment groups is not due to some other factor—that is, it ensures the internal validity of the observed effect.

The other outcome of interest for this Plan is usage behavior. To determine whether a treatment has caused a change in usage behavior, it is necessary to estimate what usage would have been for customers who accept the treatment if the treatment was not in effect. There are two ways to do this: compare behavior of the same group of customers before and after exposure to the treatment; or compare the behavior of the treatment group to that of a similar group of customers who were not exposed to the treatment (i.e., a control group). The best approach varies with the type of treatment.

For options such as CPP rates, where there are days when the treatment is in effect and similar days when it is not, the before and after method is best. This approach is referred to as a “within-subjects, interrupted-time series design” and essentially uses participating

¹² For a more detailed discussion of research design issues and methods, see the report written by FSC Principals Dr. Sullivan and Dr. George: *Guidelines for Designing Effective Energy Information Feedback Pilots: Research Protocols*. EPRI, Palo Alto, CA: 2010. 1020855.

¹³ Obviously, this is not true when the “treatment” itself involves offering something to a different group of customers, as in the case of promotion to direct load control participants.

customers as their own control group. Electricity consumption during times when pricing events occur is compared with electricity consumption when pricing events are not in effect for the same customer to estimate the impacts of the price changes.¹⁴ This design has several important advantages over others that might be considered, including:

- Valid and reliable estimates of the impacts of pricing and technology on hourly customer electricity consumption can be observed without observing a control group and without reference to pre-treatment period measurements;
- Eliminating the need for control groups can significantly improve the internal validity of the study and reduce its cost; and
- It is possible to estimate the effects of the pricing design and technology combinations at the individual customer level. That is, it can be used to identify which customers are producing the largest load impacts – which can be very useful in future program targeting efforts.

The second approach for maintaining internal validity involves selecting a separate control group. This approach is needed when the treatment is in effect most or all of the time after a customer selects an option, such as for TOU rates and IHDs. To estimate impacts in these situations, customers will be asked to participate and then will be randomly assigned to treatment and control groups. This can be done by telling customers during the recruitment process that there are a limited number of treatments available and people will be provided with the treatment on a lottery process; and then enough people will be recruited to compile a control group from the volunteers.

3.2 Treatment Options

In the context of the Dynamic Pricing Plan, a treatment is defined as a combination of pricing, technology, customer education, promotional package and target market. For example, a CPP tariff offered to two groups of identical customers, but with one group receiving a sign-up incentive and the other group not, represents two different treatments. This subsection is intended to provide background discussion on the treatment options that were considered for inclusion in the Plan. Following this, Section 3.3 describes more specifically the treatments that will be tested, as known at this time, and the treatments that may be tested depending on technical and other dynamic pricing research developments between now and launch of the Plan in early fall 2012.¹⁵

¹⁴ Implicit in this statement is that there are a sufficient number of days when events are not called that are similar in terms of weather and other potential usage drivers, such as day of week effects, to establish a valid reference load or that the relationship between weather and usage can be accurately determined through regression analysis to accurately predict the reference load under event-like conditions. For an example of this method, see *2009 Load Impact Evaluation for Pacific Gas and Electric Company's Residential SmartRate—Peak Day Pricing and TOU Tariffs and SmartAC Program, Volume 1: Ex-post Load Impacts*. Freeman, Sullivan & Co., 2009.

¹⁵ See Appendix B for selected highlights from prior research.

3.2.1 Tariffs

As delineated in Section 2, PECO has elected to initially offer CPP and TOU tariffs to selected residential customers and a CPP tariff to S/MC&I customers. The residential tariffs will be offered to PECO's residential default service customers (Rate R and R-H). The dynamic tariffs will not be offered to CAP customers as described in section 2.2 above. With respect to S/MC&I customers, the CPP tariff will be offered to metered customers on general service, primary distribution, and high tension rates in procurement classes 2 and 3.¹⁶

3.2.2 Technology¹⁷

PECO plans to evaluate a variety of technologies within the Plan. Since the rate of advancement in this area is moving rapidly, it would not be prudent to decide exactly what will be offered in the Plan at this time. In general, the technology categories to be included are:

- Notification technology (e.g. pagers, text messages, email, phone);
- Load control technology (e.g. PCTs, load control switches); and
- Information feedback technology (e.g., IHDs, Web presentation of data and usage patterns).

3.2.3 Customer Education

Education in this Plan refers to enhanced information provided in conjunction with tariffs designed to help consumers make more informed energy-usage decisions. Feedback through an IHD is a form of consumer education, but for purposes of this Plan, that is classified as a technology treatment and not an education treatment. All customers in all treatments will receive a basic level of education that is appropriate for the chosen treatment. PECO envisions that one or two treatments would be chosen for a form of enhanced educational treatment. The educational package could take the form of providing consumers with examples of specific behaviors that other consumers have engaged in when facing dynamic rates or it might involve detailed load shape analysis designed, for example, to determine the weather-sensitive portion of load as input to provide guidance concerning air-conditioning use.

3.2.4 Promotional Strategies

The likely promotional options that PECO will test include:

- Promotional message (e.g., energy savings, reliability, control, etc.);

¹⁶ Procurement Class 2 represents small commercial/industrial customers with demands from 0 to 100kW. Procurement Class 3 represents medium commercial/industrial customers with demands >100kW up to 500kW.

¹⁷ See Appendix C for additional detailed explanations of technology.

- Educational content of material (e.g., how to explain time-based pricing);
- Mode (e.g., direct mail, telephone, in person, community organization, web portal, etc.);
- Number of contacts per person (e.g., how many times the same option is marketed to a specific customer);
- Timing (e.g., pre-summer, summer, post-summer, etc.);
- Format of promotional material (e.g., business letter, three-fold glossy brochure, etc.);
- Whether or not a sign-up incentive is offered;
- Whether or not first year bill protection is provided; and
- Targeting (the characteristics of customers who will receive an offer).

Recent research by FSC indicates that several of these factors can significantly influence enrollment rates.¹⁸ Appendix B contains a high-level summary of various tests of promotional options conducted by PG&E in conjunction with marketing that company's SmartRate tariff, a CPP tariff similar to what PECO plans to offer. Among the key findings were:

- A modest sign-up incentive of \$25 doubled enrollment rates using direct mail, but a sign-up incentive of \$50 had only a small incremental effect on enrollment rates compared with the smaller incentive;
- There is a strong seasonal effect on enrollment, with sign-up rates being nearly twice as high prior to the summer period than in late summer;
- Enrollment rates were nearly five times higher when SmartRate was offered to customers already enrolled in PG&E's direct load control program;
- Promoting the tariff using a business style letter and envelope was more effective than when a multi-color, glossy brochure was used; and
- Customers with central air conditioning, who provide much larger load reductions, are more difficult to enroll than customers without central air conditioning.

The research proposed in this Plan will test these and other enrollment options to determine what works best in PECO's service territory.

3.3 Customer Acceptance Research Track

This section summarizes the tests that will initially be conducted through the four research tracks that comprise the customer acceptance research portion of the Plan. As discussed in Section 1, the research will occur in several stages. This phased approach is essential to meeting the "test-learn-improve" objectives of the Plan—continuous improvement

¹⁸ Stephen S. George, Josh Bode, Mike Perry and Andrew Goett. *2009 Load Impact Evaluation for Pacific Gas and Electric Company's Residential SmartRate™—Peak Day Pricing and TOU Tariffs and SmartAC Program—Volume 2: Ex Ante Load Impacts*. Freeman, Sullivan & Co., 2009.

means building on what has been learned from prior “generations” of product or service offerings.

The customer acceptance portion of the Plan is comprised of three stages. Stages 1 and 2, which will be implemented beginning in the fall of 2012 through late spring/early summer 2013, are largely exploratory. During these stages, numerous offers comprised of specific rate, technology, and marketing/promotional features, will be made to randomly selected groups of customers to determine relative enrollment rates across these options. Stage 3 will involve additional offers being made in the fall of 2013 and spring of 2014. These offers will be comprised of the most promising rate, technology, marketing and education combinations based on the findings about customer acceptance obtained from the first two stages of research. Load impacts will be estimated from all three stages of research based on usage data for all enrolled customers through the end of summer 2014.

The exact number and specific elements of each test cell over the two-year research period encompassed in the Plan is not currently known, nor should it be. Identifying at this time exactly what will be tested in later stages of the research would require ignoring what might be learned in earlier stages that could, and most likely will, influence the focus of the later test cells. The total number of customers that will receive offers across all test cells is large, but uncertain at this time. Sample sizes are a function of several factors, including expected enrollment rates and the magnitude of the impact that must be estimated. For example, detecting a 1 percentage point difference in enrollment based on an expected take rate of 10% would require sample sizes of roughly 10,000. On the other hand, detecting a 2 percentage point difference if the expected take rate is 5% would only require offering the option to a sample of roughly 1,200 customers. To estimate load impacts, participant samples in the 300 or 400 range would be ideal (which, with a 5% take rate would require offering the option to 6,000 to 8,000 customers).

Given all of the relevant research currently underway or being planned in the industry, useful insights may become available prior to project launch that can be used to optimize sample sizes. For planning purposes, a sample size of 5,000 customers has been used for most test cells. This is large enough to detect differential enrollment rates of a magnitude of interest and also to determine load impacts based on within-subjects, interrupted time series designs (such as those that will be used for load impact estimation for CPP rates). The number of customers recruited for the TOU and IHD test cells may need to be larger because of the need to separate customers who accept the offer into treatment and control groups in order to develop unbiased estimates of load impacts for these treatment options.

Although the locations that smart meters will be deployed are yet to be determined, if the roughly 600,000 accounts that receive smart meters during the initial deployment are reasonably representative of the overall PECO population, PECO would expect to have a distribution of customers across various segments of interest similar to that shown in Table 3-1.

**Table 3-1:
Number of Accounts Available for Inclusion in
Research Track by Customer Segment**

| Customer Segment | Fall 2012 | Initial Deployment |
|--|------------------|---------------------------|
| Rate R | 62,500 | 375,000 |
| Rate R-H | 9,000 | 54,000 |
| Rate R + Enrolled in Load Control Program | 5,500 | 33,000 |
| CAP | 13,000 | 78,000 |
| S/MC&I¹⁹ | 10,000 | 60,000 |
| Approximate # of Installed Meters | 100,000 | 600,000 |

PECO notes that not all customers who have meters in the fall of 2012 will be included in the test cells. This is due primarily to concerns about the impact of season on customer acceptance. As discussed in Appendix B, prior research indicates that the timing of promotional campaigns can significantly impact acceptance rates for dynamic tariffs. However, this prior research did not test late-fall campaigns. In addition, most programs that offer load control are marketed in spring, not fall. As such, PECO proposes to test some options in the fall and others in the spring, with some duplication of specific offers to determine how seasonality affects customer acceptance.

Sections 3.3.1 through 3.3.4 summarize the four research tracks that comprise the Customer Acceptance Plan.

3.3.1 Customer Preference Track

The customer preference track is primarily designed to determine customer preferences among the two rate options for residential customers, CPP and TOU, and among various

¹⁹ The estimates for S/MC&I customers overstate the number available for inclusion in the research tracks, but by how much is unknown. These estimates represent the number that will have smart meters. Some of these accounts will be served by competitive electricity suppliers and, therefore, will not be eligible for a CPP tariff. It is difficult to know what percent of these accounts will not be eligible. For planning purposes, we have assumed that 15% of S/MC&I customers will not be eligible for inclusion in test cells.

rate/technology combinations. Selected customer segments will be offered one or more rate/technology options and acceptance rates will be compared to determine which options are preferred for each segment. In addition, within each segment, analysis will be done to see whether other customer characteristics (e.g., usage, air conditioning ownership, business type) are correlated with acceptance rates. Such information could prove quite useful in targeting customers for future marketing campaigns.

A key complication in assessing customer preferences for rate/technology options is controlling for other potential determinants of enrollment such as seasonality and the presence or absence of sign-up incentives. Since prior research indicates that modest sign-up incentives materially increase acceptance rates, PECO has included the incentive in all of the customer preference options in order to determine the incremental effect of the technology on tariff acceptance rates.²⁰

The other factor that affects the initial research strategy is seasonality. While there will be a sufficient number of customers with smart meters in the fall of 2012 to test the CPP/IHD and CPP/PCT cells, PECO believes that both the IHD and PCT will provide greater value for managing energy use in the summer than in the winter. As such, PECO believes it is logical to market these combinations in the spring rather than the fall.

Table 3-2 summarizes the treatment/customer-segment combinations that initially will be tested.

²⁰ An alternative approach would be to exclude the sign-up incentive from all offers. However, this could make it more difficult to sign up a sufficient number of customers in the relatively short marketing window available in fall 2012. As indicated in Section 3.3.3, the impact of the sign-up incentive will be assessed as part of the marketing effectiveness research track.

**Table 3-2:
Customer Preference Track Offers and Timing**

| Target Population | Tariff/Technology/Offer | Fall 2012 | Spring 2013 |
|--|------------------------------------|------------------|--------------------|
| Rate R | CPP with sign-up incentive | X | X |
| | TOU with sign-up incentive | X | X |
| | CPP with incentive and IHD | | X |
| | CPP with incentive and PCT | | X |
| Rate R-H | CPP with sign-up incentive | X | X |
| | CPP with incentive and PCT | | X |
| Rate R + Enrolled in Load Control Program | CPP with sign-up incentive | | X |
| S/MC&I | CPP with incentive and PCT | X | X |
| | CPP with incentive and without PCT | | X |

When comparing enrollment rates for offers that do and do not include PCTs, it will be important to screen for central air conditioning ownership, as only customers with central air conditioning are eligible for PCTs whereas all customers can accept an offer for either the tariff alone or in conjunction with an IHD. This may require enrolling more customers than would otherwise be needed in the CPP test cell, so that statistically meaningful comparisons can be made for households with and without central air conditioning.

In summary, the Rate R test cells will allow PECO to gain insights concerning the following important policy questions:

- Which tariff, CPP or TOU, is more popular overall among Rate R customers?
- How do acceptance rates for each tariff differ across customers with various characteristics (e.g., usage strata, likelihood of owning an air conditioner, etc.)?
- For each tariff, are customer acceptance rates higher or lower if the tariffs are marketed in the fall or in the spring?²¹

²¹ This issue concerns the timing of the marketing campaign and is part of the “touch and timing” research plan discussed below. It is included here because the test cells must be included in the customer acceptance research track as well.

- Are acceptance rates higher or lower for a tariff offered alone, or in conjunction with a PCT (controlling for air conditioning ownership) or an IHD?
- Is the answer different for Rate R customers with different characteristics?

A sample of Rate R customers who had previously enrolled in PECO's direct load control program will also be offered the CPP tariff in the spring of 2013. This is a self-selected group of customers, all of whom have central air conditioning. As discussed in Appendix B, prior research conducted by FSC found that customers that already have enabling technology sign up at much higher rates than other customers. Enrollment rates for this group of customers will be compared with the enrollment rate for Rate R customers with central air conditioning, with and without a PCT included in the offer. This CPP tariff will be offered to load control customers in the spring of 2013 to allow for a valid comparison to be made with the CPP/PCT offer that is not influenced by potential seasonal effects.

Rate R-H customers will be offered the CPP rate (along with a sign-up incentive) in both the fall and the spring. Bill analysis conducted by The Brattle Group indicated that more Rate R-H customers are likely to have preferable bill impacts from the CPP tariff than from the TOU tariff. As such, only the CPP tariff will be offered to this customer segment. Differential enrollment rates for the CPP tariff for Rate R and Rate R-H customers will be compared in both the fall and spring to determine whether customers with electric space heating are more or less attracted to time-varying rates than customers without electric space heating. A group of Rate R-H customers will also be offered PCTs to test the impact of PCTs on enrollment and energy use for this customer segment.

As previously discussed, S/MC&I customers will only be offered a single rate option, CPP. The standard promotional track for S/MC&I customers will involve telemarketing, a sign-up incentive and an offer of a PCT. These features should help maximize participation in the fall of 2012, when the number of S/MC&I customers with smart meters will be relatively small. The same offer will be extended in the spring of 2013, along with an offer made to another test cell that does not include the PCT. This will allow for a comparison of customer preferences for the enabling technology and differential acceptance rates for the tariff with and without the PCT.

3.3.2 Technology Research Track

PECO will evaluate three categories of technology that can aid demand response or otherwise influence energy use: notification technology, control devices and information feedback devices.

3.3.2.1 Notification

PECO is planning to offer multiple notification options to each customer that accepts a dynamic rate offer but is not planning to examine the relative effectiveness of each individual method (e.g., telephone, email, text messaging, etc.), since there is no need to choose among these relatively low cost options—multiple options will always be provided and customers can self select the options that work best for them. As part of the load impact analysis for the CPP rate, PECO will assess whether participants who provide multiple notification options produce greater load impacts than those who only provide a single option, as was the case for PG&E's SmartRate tariff discussed in Section 3.2.2 and Appendix B. At this point in time, PECO is not planning to test dedicated notification devices such as the Energy Orb, given that there are many less expensive ways of notifying customers through pre-existing channels. Notification through multi-use devices, such as PCTs and IHDs, will likely be included for test cells where these technologies are present.²²

3.3.2.2 Load Control Devices

As described above in the customer preference track discussion, PECO will offer a sample of customers who are enrolled in the Company's direct load control program an opportunity to sign up for a dynamic rate. This will allow PECO to determine both the effect of prior enrollment in load control on customer acceptance of dynamic rates and also the incremental effect of dynamic rates combined with load control. PECO also will offer a PCT to Rate R customers that are not already enrolled in the load control program. This will allow for a determination of the impact on enrollment in a CPP tariff of including an enabling technology as part of the offer. Comparing load impacts between CPP customers with and without a PCT also will allow for a determination of the incremental effect of the technology on demand response.

Prior research suggests that PCTs may play an even more important role in aiding price-driven demand response among small commercial customers than they do among residential customers. As such, PECO plans to test the impact of PCTs on S/MC&I enrollment and demand response. Indeed, given the relatively small population of S/MC&I customers that will have smart meters in the fall of 2012, PCTs will be an integral part of the initial dynamic rate offer in the hope of maximizing participation among this initial population. In spring 2013, when the available population of S/MC&I customers is larger, PCTs will be removed from the dynamic rate offer for a test sample of S/MC&I customers in order to assess the impact the technology offer has on enrollment and demand response and also to determine whether PCTs are cost effective.

²² It is important to note that all customers regardless of class or income will have their usage data history available for viewing via a web portal. The data will be displayed on a next-day basis after the information has been verified by PECO.

3.3.2.3 Information Feedback

Information feedback provided through IHDs will be examined for four different customer segments—Rate R customers, CPP customers, TOU customers and CAP customers. As discussed in Section 2, CAP customers will not be offered dynamic rates so it will not be possible to assess the incremental effect of feedback on demand response among this population. The impact of feedback on overall energy use will be determined for CAP customers and also for Rate R customers. The incremental impact of feedback on demand response will be determined from the test cells that accept both the CPP rate and the IHD and the TOU rate and IHD.

Table 3-3 summarizes the current strategy for understanding the impact of technology on enrollment, demand response and energy use.

**Table 3-3:
Summary of Technology Research Track Offers and Timing**

| Technology | Residential Customers | | | | S/MC&I Customers |
|---------------------|-----------------------|--|-------------|-----------|--------------------------|
| | Rate R | CPP | TOU | CAP | |
| Notification | n/a | All | n/a | n/a | All |
| PCT | n/a | Spring 2013 | n/a | n/a | Fall 2012 Spring 2013 |
| No PCT | n/a | n/a | n/a | n/a | Spring 2013 |
| Load Control | n/a | Spring 2013 (Achieved through offers to DLC program participants) | n/a | n/a | n/a |
| IHD | Fall 2012 | Spring 2013 | Spring 2013 | Fall 2012 | n/a |

3.3.3 Promotional Strategies Research Track

The promotional strategies track will have the greatest number of test and learn cells, as there is a wide variety of promotional options to be explored. Understanding how best to attract customers to sign up for time varying rates is one of the most important and least studied areas of research in the industry. Fortunately, it is also something that can be assessed rather quickly as it is possible to promote the tariffs of interest using a variety of different strategies simultaneously and it only takes a few weeks or, at most, a couple of months to determine which promotional packages are working better than others.

As discussed above, promotional strategies are comprised of a variety of features, including the message used to promote the tariff, the educational content of the offer, mode, the number of times each customer is contacted, timing, whether or not a sign-up incentive is offered, whether or not first year bill protection is used to overcome consumers' risk aversion, and the targeting strategy used (e.g., to whom the offer is made). Given all of the above options, there are many dozens of permutations and combinations that could be tested. The full set of options that will be tested will depend, in part, on results from early test cells and what is learned from industry research and technology development between the Plan filing date and the project launch roughly two years later. Below is an outline of an initial strategy that may evolve between now and fall 2012 and that will likely be modified as early findings suggest new options to test in subsequent offerings.

The effectiveness of each promotional strategy for offers made to most residential customers will be determined relative to a standard promotional package that prior research done by FSC suggests is reasonably effective.²³ The standard promotional strategy for residential customers will involve a core message based on bill savings, direct mail communication, a modest sign-up incentive of \$25, first year bill protection and a format consisting of a business letter with a return post card. Insights concerning promotional strategies will be gained in part by targeting specific groups (e.g., customers previously enrolled in the direct load control program and customers on the R-H tariff as indicated under the customer preference track discussion) and in part by analysis of differential enrollment rates for customers with specific characteristics among the randomly selected groups comprising each test cell.

The promotional feature that will be examined for residential customers in Stage 1 concerns the sign-up incentive. Two randomly selected groups will be offered the CPP rate, one with a modest sign-up incentive and the other without it. All other features of the marketing package will be the same, so that the differential enrollment rates between these two groups will provide a precise measure of the effect of the sign-up incentive on enrollment. Depending on the outcome of this analysis, all offers in Stages 2 and 3 will likely include or exclude the sign-up incentive.

Table 3-4 contains a straw man proposal for a minimum number of Stage 1 and Stage 2 test cells for residential customers. These test cells will be implemented based on just the CPP tariff offered to Rate R residential customers. PECO does not believe it is necessary

²³ See Section 3.2.4, Appendix B, and Stephen S. George, Josh Bode, Mike Perry and Andrew Goett. *2009 Load Impact Evaluation for Pacific Gas and Electric Company's Residential SmartRate™—Peak Day Pricing and TOU Tariffs and SmartAC Program—Volume 2: Ex Ante Load Impacts*. Freeman, Sullivan & Co., 2009.

to test each promotional option with each tariff, since there is little reason to believe that the relative effectiveness of various promotional features will differ across the two tariff options. In other words, PECO believes that it is appropriate to predict what the enrollment rate would be for the TOU tariff without an incentive by multiplying the TOU enrollment rate with an incentive by the ratio of enrollment for CPP without an incentive to enrollment for CPP with an incentive.

**Table 3-4:
Minimum CPP Tariff Offers Made to Residential Customers
for Promotional Strategies Research Track in Stages 1 and 2**

| Sample | Standard Promotional Package | Standard Package w/o Sign-up Incentive | Standard Package w/o First Year Bill Protection | Standard Package with Different Message | Standard Package Promoted via Telephone | Standard Package Promoted Through Community Organizational |
|--------|------------------------------|--|---|---|---|--|
| 1 | Fall 2012 | | | | | |
| 2 | Spring 2013 | | | | | |
| 3 | | Fall 2012 | | | | |
| 4 | | Spring 2013 | | | | |
| 5 | | | Spring 2013 | | | |
| 6 | | | | Spring 2013 | | |
| 7 | | | | | Spring 2013 | |
| 8 | | | | | | Spring 2013 |

The first four samples shown in Table 3-4 are designed to test for the impact of a modest sign-up incentive on enrollment while controlling for seasonal effects. The other test cells will allow for an analysis of the impact on enrollment of eliminating first year bill protection, an alternative message, telephone promotion and community based promotion. It is not possible to test alternative communication channels, such as print (e.g., newspapers, magazines, etc.), radio and television, in this context as the key to testing all other strategies is controlling who receives each offer. General advertising of specific offers is

not possible. PECO will likely explore other forms of directed promotion besides direct mail, such as email and web portal pop-up messages.²⁴

Numerous other promotional options could be tested in Stage 2. Options of potential interest include testing an alternative format (e.g., a glossy brochure), an alternative sign-up incentive (e.g., \$50), additional messages, door-to-door marketing, more than one community-based campaign, etc. The decision concerning whether to expand the number of promotional strategies to be tested and which ones to examine will be made in late 2012 or early 2013.

Two important elements of the promotional mix that will also be tested for residential customers in Stage 2 are the impact of multiple “touches” to the same customer and the impact of timing. A strategy for sorting out the individual effects of these two important promotional strategies is complicated by seasonal effects. For example, If customers are contacted the first time in spring, and those who do not respond are contacted again in the summer and again in the fall for those who do not respond to the second touch, it is impossible to sort out the effect of seasonality from the effect of multiple customer contacts or touches. A strategy for sorting out the individual effects of seasonality and the number of promotional touches is shown in Table 3-5.

**Table 3-5:
Preliminary Strategy for Determining the Impact of Multiple “Touches” and
Timing on Enrollment for Residential CPP Customers**

| Sample | 2012 | | 2013 | | | |
|--------|----------------------------|-------------------------------------|------------------------------|-------------------------------------|-------------------------------------|-------------|
| | 1 st Fall Offer | 6 Weeks After 1 st Offer | 1 st Spring Offer | 6 Weeks After 1 st Offer | 6 Weeks After 2 nd Offer | Late Summer |
| 1 | Touch 1 | Touch 2 | | | | |
| 2 | | Touch 1 | | | | |
| 3 | | | Touch 1 | Touch 2 | Touch 3 | |
| 4 | | | | Touch 1 | Touch 2 | |
| 5 | | | | | Touch 1 | |
| 6 | | | | | | Touch 1 |

The standard offer strategy for S/MC&I customers will differ from that of residential customers because direct mail solicitation is largely ineffective with business customers.

²⁴ If implemented, web portal promotion would have to involve pop ups to randomly selected customers rather than provide a link that anyone who accesses the PECO web portal would be able to see.

Given this, the plan is to use telephone solicitation as part of the standard promotional package. In addition, initially, the standard package will also include the offer of a PCT and a sign-up incentive. As discussed in Section 3.3.1, offers with and without the PCT will be examined as part of the Customer Preference research track. The impact of the sign-up incentive will be examined by removing it from the promotional offer for a test cell in spring or early summer 2013. It is difficult to determine at this time how many promotional tests will be sensible or possible for S/MC&I customers for several reasons. First, there is even less research to guide decision making for S/MC&I customers than there is for residential customers and, if enrollment rates are very low, the number of test cells will be severely limited. Furthermore, the number of S/MC&I customers that will be eligible for offers is unknown, since the number of S/MC&I accounts that will be served by competitive electricity suppliers two years from now, and therefore will be ineligible, is highly uncertain. A decision concerning the specific number and type of promotional strategies to test for S/MC&I customers will be made in late fall 2012 or early 2013.

3.3.4 Customer Education Research Track

Another area of investigation will be whether enhanced education leads to greater load impacts for residential CPP rate customers. Most customers do not have a good idea of what activities use the most energy in general, or during peak periods, or what types of behavior changes might have the greatest impact on energy usage and bills. While all customers who go on a CPP tariff will receive some education to help them better manage their loads, PECO plans to test one or more enhanced information treatments to determine whether they increase demand response. What form these treatments will take will be determined at a later date, but possibilities include reminders and tips on what to do when a critical peak event is called. Such information can be delivered through various means, such as phone messaging, written materials, emails, IHDs, etc.

Unlike factors that affect enrollment, which can be assessed shortly after a promotional campaign has been launched, determining the effect of enhanced information on load reduction and energy use requires a comparison between treatment and control customers for 6 to 12 months after the treatment is in effect for CPP customers. Starting prior to the summer of 2013, a group of customers that have signed up for the CPP tariff through the various promotional strategies tested prior to that time will be selected for at least one enhanced education treatment. Energy use and demand response for this group will be compared to that of other customers to determine whether the enhanced education cases provide additional behavioral change in energy use levels or patterns.

3.3.5 Customer Acceptance Research Summary

Table 3-6 summarizes the various treatments that will be tested as part of the residential customer acceptance research tracks through the first year of the Plan, and the timing of

those treatment offers. Table 3-7 summarizes the currently planned offers to S/MC&I customers. Based on insights gained from these tests in the first year, brand new features—or new combinations of the most effective features from those that had been tested—may be offered to new, randomly selected customer groups in the fall of 2013 and the spring of 2014. The number of new test cells, and the number of new customers that will be offered rates and technology in this third research phase, will be determined in late summer or early fall 2013.

**Table 3-6:
Summary of Initial Treatments for Residential Customers**

| Target Population | Tariff/Technology/Offer | Fall 2012 | Spring 2013 |
|--|---|---|--|
| Rate R | CPP with sign-up incentive | X | X |
| | TOU with sign-up incentive | X | X |
| | CPP with incentive and IHD | | X |
| | TOU with incentive and IHD | | X |
| | CPP with incentive and PCT | | X |
| | CPP with no incentive | X | X |
| | CPP with incentive but without first year bill protection | | X |
| | CPP with incentive and alternative message | | X |
| | CPP with incentive, 1 st touch | X (6 weeks after 1 st fall offer) | X(6 weeks after 1 st spring offer) X(6 weeks after 2 nd spring offer) X(Late summer) |
| | CPP with incentive, 2 nd touch | X (6 weeks after 1 st fall offer) | X(6 weeks after 1 st spring offer) X(6 weeks after 2 nd spring offer) |
| | CPP with incentive, 3 rd touch | | X(6 weeks after 2 nd spring offer) |
| | IHD | X | |
| <u>Other possibilities TBD later:</u> Email or social media marketing | | X | |

| Target Population | Tariff/Technology/Offer | Fall 2012 | Spring 2013 |
|--|--|-----------|-------------|
| | Web portal pop-ups Door-to-door Higher sign-up incentive Alternative messages Alternative community-based campaign | | |
| | Enhanced education for CPP (Offered to subset of those who enroll in CPP through various promotional options above) | | X |
| Rate R-H | CPP with sign-up incentive | X | X |
| | CPP with incentive and PCT | | X |
| Rate R + Enrolled in Load Control Program | CPP with sign-up incentive | | X |
| CAP | IHD | X | X |

**Table 3-7:
Summary of Initial Treatments for Small/Medium Commercial Customers**

| Target Population | Tariff/Technology/Offer | Fall 2012 | Spring 2013 |
|-------------------|-------------------------------|-----------|-------------|
| S/MC&I | CPP with incentive and PCT | X | X |
| | CPP with incentive but no PCT | | X |
| | CPP with PCT but no incentive | | X |

3.4 Customer Communication Strategy

PECO's communication strategy will be developed in detail at a later date, but it will adhere to the following guidelines:

- It will address both smart meter technology deployment and the specific offers of rates and technologies that will be made as part of the Dynamic Pricing Plan, as well as all of the variations in promotional strategies that will be tested. Given the large number and variation in offer packages, there will need to be a large number of different communication materials developed to support the Plan.
- The communication strategy must allow for very precise targeting of specific offers to specific customers. It will be vitally important to put systems in place to ensure that it is possible to track how each participant heard about the option that they enroll in, while also using broad-based tactics for general education.
- The dynamic tariffs and other offers made as part of the Plan will be made in a way that is consistent with other associated messages and formats that PECO is

using at the time. This is important as customers do not distinguish well between similar messages or programs such as energy efficiency, demand response, or direct load control. Separate branding would likely to be more costly and confusing than enlightening.

4 MEASUREMENT AND EVALUATION

This section describes the measurement and evaluation (“M&E”) activities that PECO will use to estimate the load impacts that result from the various rate/technology/education options that will be offered in the customer acceptance tracks, to assess the relative effectiveness of various promotional strategies, and to determine the cost-effectiveness associated with each of the key options. M&E activities are vital to meeting one of the primary objectives of the Plan—to test a number of options, learn what is working and what is not, and improve the Company’s rate and service offerings over time.

The M&E plan is comprised of the following primary work streams:

- Load impact evaluations for each rate/technology option;
- Assessment of the enrollment rates associated with each treatment and choice modeling that will allow for estimation of the likelihood that a customer will enroll on a rate as a function of rate characteristics, customer characteristics and promotional features;
- Surveys to determine customer understanding of and satisfaction with rates and technologies, the actions customers take in response to such rates and how selected customers use the technologies provided to them (e.g., IHDs);
- Post event surveys to assess whether customers are experiencing any discomfort or other inconveniences when critical peak pricing events are called;
- Analysis to determine effective combinations of rates, technology, promotional features and education; and
- Reporting activities that include holding periodic stakeholder meetings and preparing an interim and final report to discuss Plan findings and recommendations for next steps.

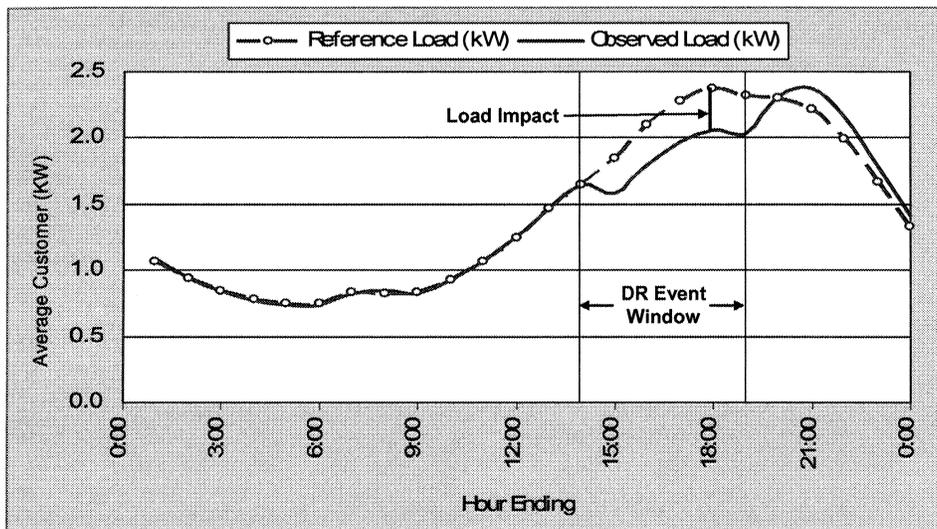
A summary of how the M&E activities might be conducted is provided below. This is useful to ensure that the research design and budgets are suitable. However, PECO intends to contract out the M&E work and to allow bidders to propose alternative methods to those described below.

4.1 Load Impact Evaluation

Load impacts associated with demand response (“DR”) resources such as dynamic rates are defined as the difference between a customer’s actual (observed) electricity demand, and the amount of electricity the customer would have demanded in the absence of the price or DR program incentive. The latter cannot be observed and must be estimated. This estimate is referred to as the reference load or counterfactual. Figure 4-1 illustrates

the load impacts associated with an event-based DR resource, such as a critical peak price.²⁵

**Figure 4-1:
Load Impacts for Demand Response Resources**



As illustrated in Figure 4-1, load impacts for dynamic pricing can occur not just during the event window (i.e., the peak period on critical days), but also during the hours leading up to or following an event window.²⁶ For example, with critical peak pricing, a residential participant with air conditioning might pre-cool their house before an event window begins, thus increasing load for an hour or two before the event starts relative to normal usage on a non-event day. Similarly, for direct load control, load following the end of an event window is often higher than it otherwise would have been, as air conditioners cycle more frequently once cycling control ceases in order to return a house to its normal temperature setting. Because of this load shifting possibility, load impact estimates should include the change in usage during both peak and off-peak periods. Indeed, recently published protocols that specify the requirements associated with load impact estimation in Ontario, Canada and California, require that load impacts be estimated for all 24 hours of a day for selected day types (e.g., critical peak days, normal weekdays for TOU rates, etc.).²⁷

²⁵ Event-based DR resources are triggered by the occurrence of pre-defined “event” conditions, such as system emergencies or supply resource constraints. Event-based resources are distinguished from “continuous” DR resources, such as TOU rates or permanent load shifting programs, that effectively reduce peak demand all (or most) of the time.

²⁶ See 3.3.2.1 for a description of how customers are notified of events.

²⁷ Stephen S. George and Josh Bode. *Protocols for Estimating Load Impacts Associated with Demand Response Resources in Ontario*. Prepared for the Ontario Power Authority by Freeman, Sullivan & Co., December 31, 2009. Also see *Load Impact Estimation for Demand Response: Protocols and Regulatory Guidance*. California Public Utilities Commission. March 2008.

The load impacts associated with many demand response resources such as dynamic pricing and load control vary significantly across events, due to variation in exogenous factors such as weather and normal patterns of commerce. PECO will define a minimum set of ex ante conditions that the models used to develop ex post estimates should support.

As discussed in Section 3.1.3, in order to estimate load impacts, PECO will use participants as their own controls (e.g., within-subjects, interrupted-time-series design) for the CPP tariff. For the TOU and IHD treatments, the planned approach is to recruit customers into each treatment and then randomly assign customers to treatment and control groups.

4.1.1 Residential Load Impact Evaluation

The evaluation plan will estimate load impacts for twelve rate/technology/education/target population combinations, as summarized below:

- A. A CPP tariff offered to Rate R customers with standard education package;
- B. A CPP tariff offered to Rate R customers along with an enhanced education package;
- C. A CPP tariff offered to Rate R customers who had previously enrolled in PECO's direct load control program;
- D. A CPP tariff offered to Rate R customers along with a PCT for customers that have central air conditioning;
- E. A CPP rate offered to Rate R-H (electric space heat) customers;
- F. A CPP rate offered to Rate R-H customers along with a PCT;
- G. A TOU rate offered to Rate R customers;
- H. A TOU rate offered to Rate R customers with an PCT;
- I. An IHD offered to CAP customers (with no time-varying tariff);
- J. An IHD offered to Rate R customers (with no time-varying tariff);
- K. An IHD offered to CPP customers; and
- L. An IHD offered to TOU customers.

Treatments A through F do not require an external control group in order to develop highly accurate, unbiased load impact estimates. Because of the repeated measures, interrupted time-series nature of the treatment, participants can act as their own control. For treatments G through L, treatments are in effect on all or most days, so the impact analysis must be based on comparisons between the treatment and the external control group and alternative estimation methods such as panel regressions. Special care must be taken to obtain a control group that is not biased by selection or other factors that may call into question the internal validity of the impact estimates. Appendix D contains a

summary of the evaluation approach that will be taken for each of the options outlined above.

4.1.2 S/MC&I Load Impact Evaluation

The load impact evaluation for S/MC&I customers will be simpler than for residential customers because fewer treatments are being tested, primarily due to the small number of customers in the available smart meter population and the relatively low expected enrollment rates. Since only the CPP rate will be offered to S/MC&I customers, no external control groups are needed for impact estimation.

4.2 Differential Enrollment Rates and Choice Analysis

A key objective of the Plan is to understand how customer enrollment differs across combinations of rates and technologies offered to selected market segments using different promotional strategies. A simple comparison of enrollment rates for CPP and TOU tariffs offered to two randomly selected groups of Rate R customers is an appropriate measure of customer preferences for the two rates.²⁸ In making this comparison, because the two offers were made to randomly selected groups and there were no differences in the promotional strategies employed in each case, the only plausible explanation for any observed difference is different preferences for each tariff. Similar calculations can be done to compare the relative effectiveness of all of the different promotional strategies that will be tested (e.g., first year bill protection, sign-up incentive, different promotional messages, etc.).

The simple calculation and comparison of acceptance and/or enrollment rates will be quite useful for assessing customer preferences for selected rate options, determining if certain targeted groups (e.g., load control participants, electric space heat customers) have significantly different take rates, and for identifying which promotional strategies are clear winners and losers. However, an even more enlightening and useful type of analysis involves using multivariate statistical regression to estimate a model of the probability that a customer will accept an offer as a function of both the offer features (e.g., rate type, promotional features) and customer characteristics (e.g., air conditioning ownership, income, etc.).²⁹ Such models can be used to project future enrollment and, very importantly, to determine how enrollment might vary based on differences in customer characteristics, which is quite useful for developing targeting strategies for future promotional campaigns.

²⁸ A determination can be made concerning whether any observed differences are statistically significant using standard calculations for the difference between two mean values.

²⁹ For an example of this type of analysis related to dynamic rates for residential customers, see Stephen S. George, Josh Bode, Mike Perry and Andrew Goett. *2009 Load Impact Evaluation for Pacific Gas and Electric Company's Residential SmartRate™—Peak Day Pricing and TOU Tariffs and SmartAC Program—Volume 2: Ex Ante Load Impacts*. Freeman, Sullivan & Co., 2009.

PECO will use both comparative statistics and choice modeling to analyze enrollment rates and determine the key drivers of customer acceptance.

4.3 Customer Surveys

PECO will employ surveys to assess satisfaction with each rate, technology and educational option to which customers are exposed, determine actions taken by customers in response to the pricing and information provided, monitor customer perceptions of comfort and/or inconvenience associated with critical peak events, and determine how customers use particular technologies (e.g., are they using IHDs to monitor usage toward goals, or in some other manner?). PECO will also use surveys to assess the effectiveness of our marketing/educational efforts by assessing whether customers actually understand the concepts of time varying pricing and load response.

The survey methods PECO will choose will be consistent with best practices for the sort of information being sought. PECO's current assumption is that surveys will be used sparingly on subsets of customers to minimize the risk of influencing the behavior that the surveys are designed to measure. Some additional discussion of survey methods and issues is contained in Appendix E.

4.4 Reporting

PECO proposes to keep stakeholders and the Commission informed of its progress through periodic meetings and annual reporting. PECO will continue the stakeholder update and feedback sessions on a mutually beneficial and agreed upon schedule to report progress, share information from the test-and-learn process and provide any important customer feedback. PECO also will prepare two reports for the Commission. The first will be an interim report at the end of 2013 that will present results for customer acceptance and demand response based on the offerings made in Stages 1 and 2. The report will also indicate how insights gained from the analysis will be applied in the 2014 test-and-learn enrollment and customer performance efforts. The second, and final report, will summarize all key findings on customer acceptance and demand response from the entire project, along with additional areas for further study, if any. The final report will provide insight concerning why certain offerings were more effective than others. Finally, the report will present PECO's recommended combinations of rates, technologies, promotional strategies and customer education efforts to be offered to remaining customers who will receive smart meters.

5 BUDGET AND COST RECOVERY PLAN

In PECO's Smart Meter Plan the initial budget for customer acceptance programs was estimated to be \$13 million. PECO's current estimate based upon its revised plan to target 150,000 to 200,000 customers is \$11.6 million. Table 5-1 provides an overview of the proposed budget for dynamic pricing programs for 2010 through 2014.

The budget is comprised of the following major categories:

- Plan Preparation and Filing – costs include consultant support for plan preparation, testimony and ongoing regulatory support;
- Plan Development and Design – costs include consultants/contractors to help refine the plan following approval and provide expertise developing Request for Proposals for sourcing equipment and plan implementation;
- Plan Execution – costs include turnkey plan including technology (IHDs, PCTs, etc.), incentives and other marketing promotions, call center for enrollment and maintenance, and development of web applications supporting programs;
- Communications – costs include direct mail, outbound telemarketing and collateral materials;
- Measurement and Evaluation – costs include evaluating the effectiveness of programs including load impact analysis, enrollment analysis, customer surveys and preparing reports; and
- PECO Oversight – costs include the incremental labor or contractor support to provide overall project management.

For the current year (2010), the Company expects to spend approximately \$511,000 comprised of actual costs through August of \$311,000 and projected costs of \$200,000 for the remainder of the year. Dynamic pricing costs will be eligible for the DOE stimulus grant, further reducing costs to ratepayers by approximately 48%, as shown in Table 5-1. The effect of the stimulus grant is to reduce the 2010 costs to be recovered from customers from \$511,000 to approximately \$266,000 and the overall program costs to be recovered from customers from \$11.6 million to \$6.0 million. The dynamic pricing budget is preliminary and will be further refined after the programs are approved and designed and when a schedule for meter deployment is further developed.

PECO will recover the costs of the proposed Dynamic pricing programs through its Generation Supply Adjustment (GSA) Mechanism. The dynamic pricing program costs, net of the stimulus grant, will be included as administrative costs in the appropriate GSA cost recovery mechanism for Procurement Class 1, 2 and 3. Procurement Class 4 (customers with registered demands >500kW), will not be assigned any costs; customers in this class are not eligible to participate in dynamic pricing programs. Common costs will be allocated to the appropriate GSA mechanism based on the proportion of the associated procurement class and projected GSA sales to the total projected GSA sales

for Procurement Class 1, 2 and 3. To the extent that certain costs are readily identifiable to a particular class, those costs will be directly assigned.

**Table 5-1:
Overview of the Proposed Budget for 2010 through 2013**

| Category | 2010 | | | 2011 | | | 2012 | | | 2013 | | | Total | | |
|--------------------------------------|---------------|-------------|---------------|-----------------|-------------|-----------------|-----------------|-------------|-----------------|-----------------|-------------|-----------------|-----------------|-------------|-----------------|
| | O&M | Capital | Total | O&M | Capital | Total | O&M | Capital | Total | O&M | Capital | Total | O&M | Capital | Total |
| Plan Preparation & Filing | \$ 511 | \$ - | \$ 511 | \$ 14 | \$ - | \$ 14 | \$ - | \$ - | \$ - | \$ - | \$ - | \$ - | \$ 525 | \$ - | \$ 525 |
| Plan Development & Design | - | - | - | 570 | - | 570 | 190 | - | 190 | - | - | - | 760 | - | 760 |
| Plan Execution | - | - | - | 880 | - | 880 | 2,639 | - | 2,639 | 2,346 | - | 2,346 | 5,865 | - | 5,865 |
| Communications | - | - | - | 392 | - | 392 | 1,175 | - | 1,175 | 1,044 | - | 1,044 | 2,610 | - | 2,610 |
| Measurement & Evaluation | - | - | - | 38 | - | 38 | 188 | - | 188 | 525 | - | 525 | 750 | - | 750 |
| PECO Oversight (PM) | - | - | - | 357 | - | 357 | 347 | - | 347 | 347 | - | 347 | 1,050 | - | 1,050 |
| Total Program Costs | \$ 511 | \$ - | \$ 511 | \$ 2,250 | \$ - | \$ 2,250 | \$ 4,538 | \$ - | \$ 4,538 | \$ 4,262 | \$ - | \$ 4,262 | \$11,560 | \$ - | \$11,560 |
| Estimated Stimulus Grant Funding * | \$ (245) | \$ - | \$ (245) | \$ (1,080) | \$ - | \$ (1,080) | \$ (2,178) | \$ - | \$ (2,178) | \$ (2,046) | \$ - | \$ (2,046) | \$ (5,549) | \$ - | \$ (5,549) |
| Total, Net PECO Program Costs | \$ 266 | \$ - | \$ 266 | \$ 1,170 | \$ - | \$ 1,170 | \$ 2,360 | \$ - | \$ 2,360 | \$ 2,216 | \$ - | \$ 2,216 | \$ 6,011 | \$ - | \$ 6,011 |

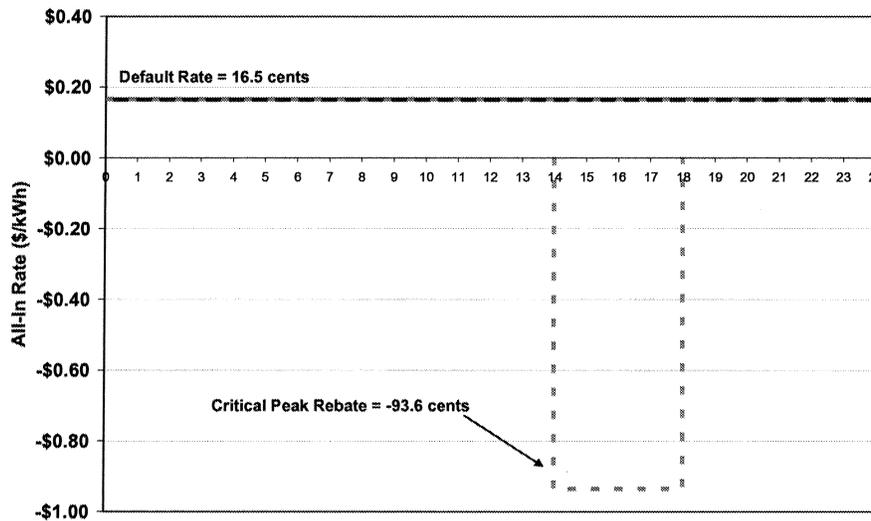
* Note: Reflects DOE Stimulus Grant funding assumed at approximately 48% of total.

APPENDIX A SUPPLEMENTAL INFORMATION ON TARIFF SELECTION

This appendix contains supplemental information to support the rate selection and customer impact analysis.

Figure A-1 is an illustration of the PTR Rate for the residential class during the summer months, when there is a rebate during critical hours. Figure A-2 shows the PTR rate in the winter, during which it is no different than the existing rate.

**Figure A-1:
PTR Rate During Summer Months**



**Figure A-2:
PTR Rate During Winter Months**

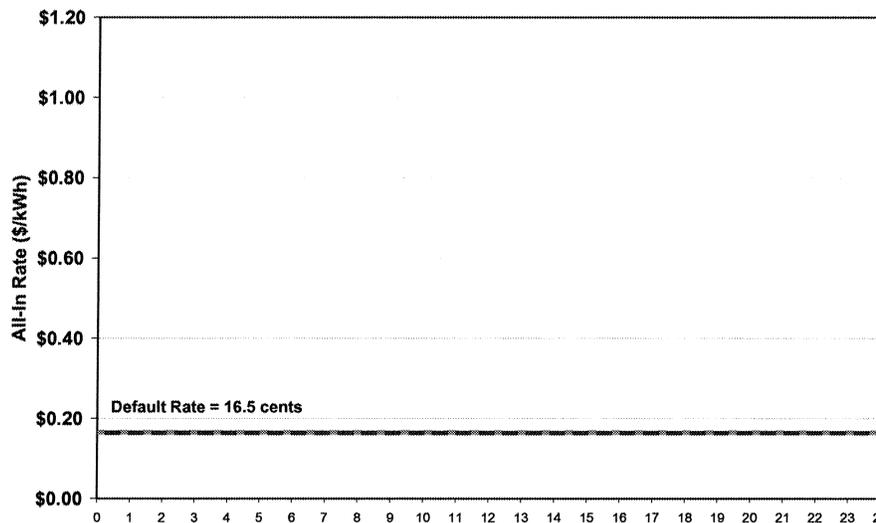


Figure A-3 is an illustration of the RTP rate on a typical critical day during the summer.

**Figure A-3:
RTP Rate During Summer Event Day**

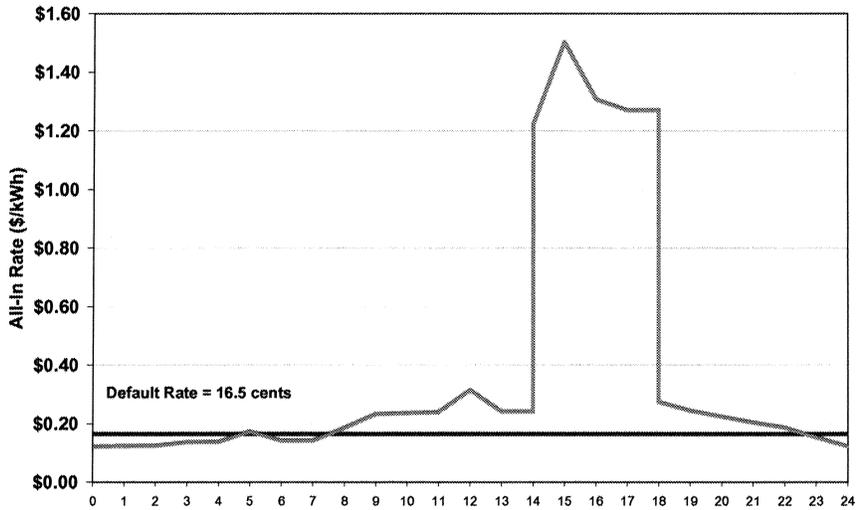


Table A-1 lists the actions that residential and business customers have taken in response to the peak rates during the California Statewide Pricing Pilot.

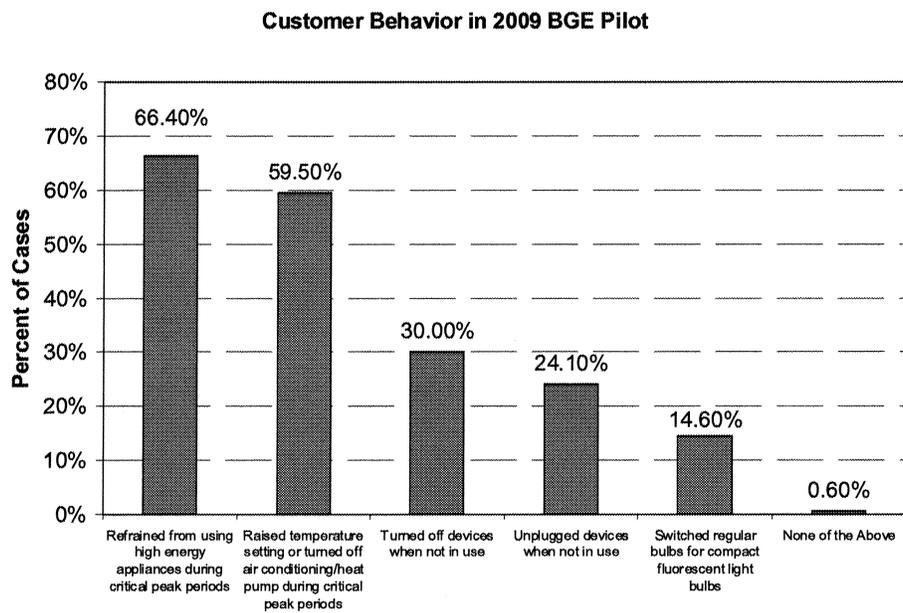
**Table A-1:
Actions Taken in Response to Peak Rates in California Statewide Pricing Pilot**

| Residential | Business |
|--------------------------------------|---|
| Shift laundry | Turn lights/equip off when not needed |
| Use appliances less | Turn AC off more |
| Turn off lights | Raise thermostat setting on AC |
| Turn AC off/use less | Replace lights/fixtures with more efficient |
| Shift dishwasher use | Install programmable thermostat |
| Reduce laundry water temperature | Change hours of operation |
| Shift pool/spa pump/filter use | Remove lights/reduced wattage |
| Improvements to home EE | Install lights/equipment timers |
| Turn up AC temperature | Make improvements to facility EE |
| Turn off appliances | Shift employee work schedule |
| Turn off tv/computer | Change hours of operation |
| Do not use stove/oven | Replace old equipment |
| Leave house | |
| Shift cooking time | |
| Reduce fan usage | |
| Line dry clothes | |
| Use "Heat off" setting on dishwasher | |

Source: Compiled from several reports on end-of-pilot surveys conducted during the California Statewide Pricing Pilot.

Figure A-4 displays the percent of customers that took a particular action in response to dynamic rates during the 2009 Baltimore Gas & Electric pilot.

**Figure A-4:
Customer Behavior in 2009 BGE Pilot³⁰**



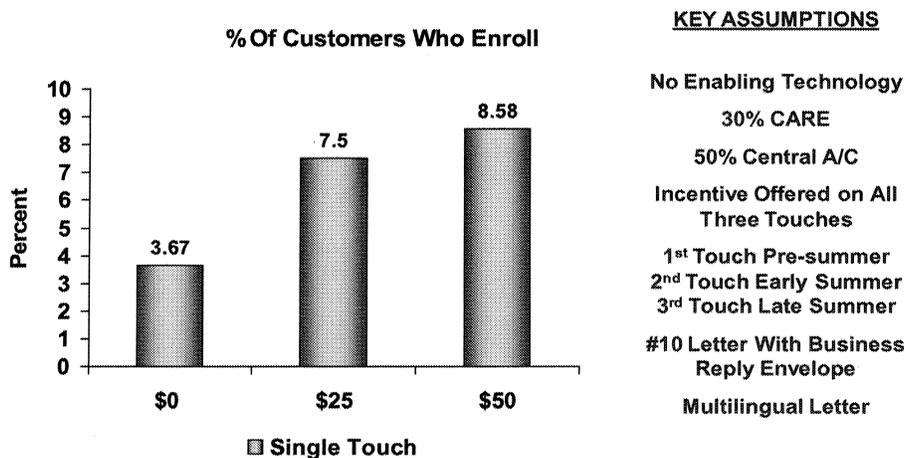
³⁰ Source: 2009 Smart Energy Pricing (SEP) Post Pilot Program Residential, Customer Experience Comparison Report. Maryland Marketing Source

APPENDIX B SUPPLEMENTAL INFORMATION ON THE RELATIVE EFFECTIVENESS OF ALTERNATIVE PROMOTIONAL FEATURES

This appendix summarizes analyses performed by FSC for PG&E based on marketing of the Company's SmartRate tariff. SmartRate is a CPP tariff similar to what PECO is planning to offer. PG&E tested different promotional strategies and FSC combined data from these choice experiments with information on customer characteristics to estimate a choice model similar to what is mentioned in Section 4.2 of this Plan. Some highlights of this work are contained below. The detailed documentation can be found in: Stephen S. George, Josh Bode, Mike Perry and Andrew Goett. *2009 Load Impact Evaluation for Pacific Gas and Electric Company's Residential SmartRate™—Peak Day Pricing and TOU Tariffs and SmartAC Program—Volume 2: Ex Ante Load Impacts*, Freeman, Sullivan & Co., 2009.

One key finding from the SmartRate analysis concerns the impact of sign-up incentives on enrollment. Figure B-1 illustrates how a modest sign-up incentive of \$25 doubled enrollment rates compared with no incentive but increasing the incentive to \$50 had only a modest incremental effect.³¹ Direct mail solicitation was used to market SmartRate.

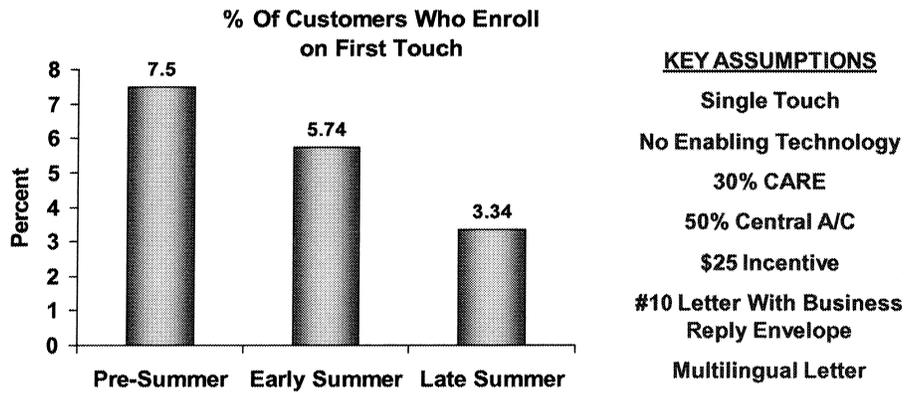
**Figure B-1:
The Impact of a Sign-up Incentive on CPP Enrollment
PG&E SmartRate Tariff**



³¹ When considering the information provided in Figure B-1 and the other figures in this Appendix, it is important to note the key assumptions listed alongside the figures. If some of these assumptions change, the enrollment rates and the difference in enrollment across the various treatments depicted in each figure could change. For example, if the saturation of air conditioning were lower than the 50% assumed here, the enrollment rates would be higher and vice versa. Note that in this and other figures, CARE stands for California Alternate Rates for Energy. It is a program through which low income consumers receive lower electricity rates. It is similar to PECO's CAP tariff.

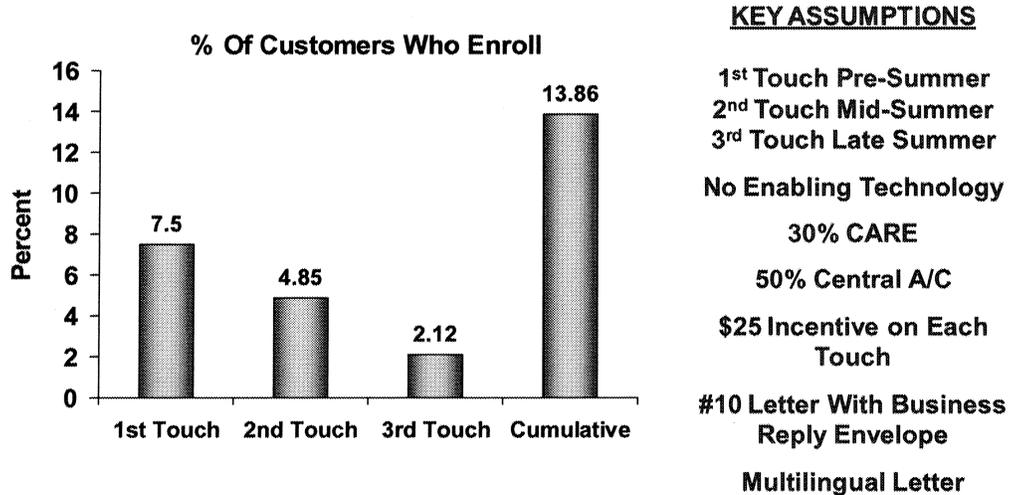
Another interesting finding from the analysis of PG&E's SmartRate is the impact of seasonality. Figure B-2 shows the average enrollment rate for offers that are made in pre-summer, early summer and late summer. Enrollment when the rate was marketed prior to the summer was more than twice as large as when the rate was marketed in late summer.

**Figure B-2:
Impact of Timing of Promotional Campaign on CPP Enrollment
PG&E SmartRate Tariff**



The incremental effect of multiple solicitations for the PG&E CPP rate is shown in Figure B-3. As is typical with direct mail solicitation, the enrollment rate with second and third mailings to the same customer is about half the rate of the prior mailing.

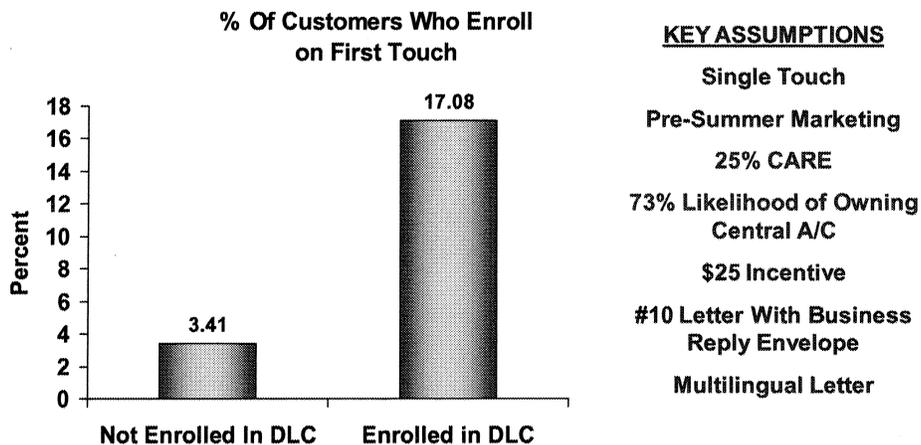
**Figure B-3:
Impact of Multiple Direct Mail Solicitations (“touches”) on CPP Enrollment
PG&E SmartRate Tariff**



One of the more significant findings from analysis of PG&E’s SmartRate marketing campaigns was the dramatic difference in enrollment rates when SmartRate was offered to customers that had previously enrolled in PG&E’s direct load control program, known as SmartAC. Customers who agree to participate in the SmartAC program are paid a one-time incentive of \$25 for allowing PG&E to cycle their air conditioner under relatively rare emergency conditions. There is no additional annual payment associated with participation. PG&E currently has about 135,000 control devices installed through this program, mostly on residential air conditioners. Customer surveys indicate that the motivation for signing up has more to do with “helping to keep the lights on” and avoiding the need for new power plants than for any monetary benefit associated with the modest incentive payment. For customers who have already enrolled in SmartAC, SmartRate gives them an opportunity to reduce their energy bill and to use the control device to aid in that process. As seen in Figure B-4, this monetary motivation, and the convenience of the enabling technology in helping to automate demand response, dramatically increased the SmartRate enrollment rate compared with customers that were not enrolled in SmartAC.³²

³² It should be noted that a key assumption underlying these results differs from that in the other figures in this section. SmartAC participants all have central air conditioning, so it is not appropriate to compare the enrollment rate for households in the SmartAC program with the enrollment rate for the general population, since not everyone in the general population has central air conditioning and, as indicated later in this section, the presence of central air conditioning has a significant and negative impact on enrollment rates for CPP tariffs. In the PG&E analysis, information on air conditioning ownership was not available, but a “propensity of ownership” variable was created for all customers. In Figure B-4, the average propensity score for SmartAC households was 73%, which is much higher than the 50% average underlying the enrollment estimates in the other figures. That is why

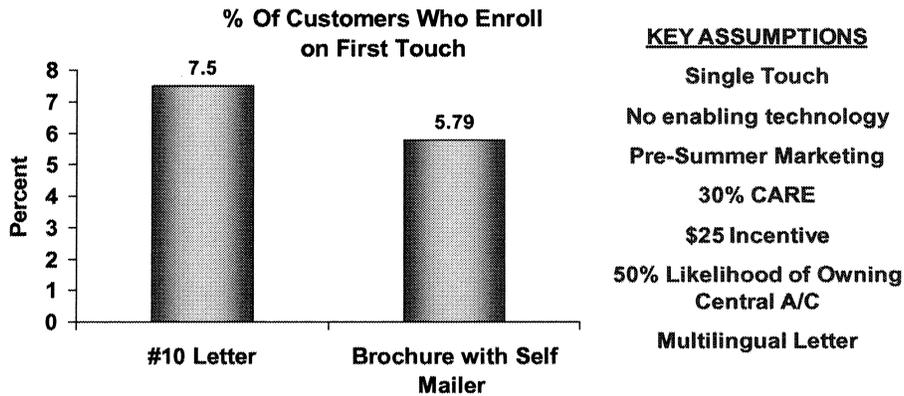
**Figure B-4:
Impact of Enabling Technology on CPP Enrollment
PG&E SmartRate Tariff**



Figures B-5 and B-6 show the rather modest impact on enrollment of different messages or different formats for the promotional material that is provided. Figure B-5 shows that a promotional campaign based on a standard letter with a business reply envelope is more effective than one that is based on a three-fold, glossy brochure, although the difference is modest. Figure B-6 shows the even smaller difference in enrollment between a strategy based on a single message about bill savings and messages that emphasize both the environment and bill savings or “saving money for your family.”

the enrollment rate of 3.4% for households that were not in the SmartAC program is less than the 7.5% rate shown in Figure B-1 for customers with 50% air conditioning saturation and a \$25 sign-up incentive.

**Figure B-5:
Impact of Promotional Material Format on CPP Enrollment PG&E SmartRate Tariff**



**Figure B-6:
Impact of Promotional Message on CPP Enrollment
PG&E SmartRate Tariff**

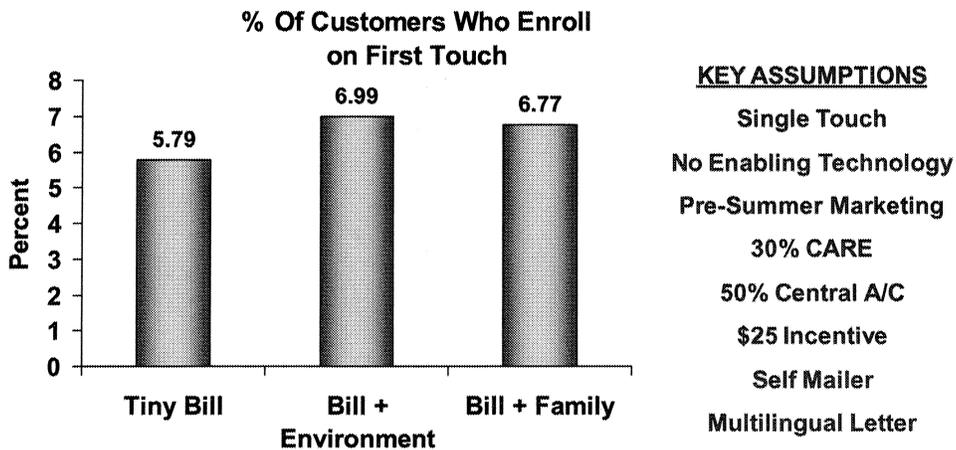


Figure B-7 shows the significant, and negative, impact that central air conditioning ownership has on enrollment in dynamic pricing programs. Not surprisingly, customers that have central air conditioning are less interested in paying higher prices at times when they are most likely to be using their air conditioner. These customers also are more likely to be structural losers than structural winners if they go on a CPP or TOU tariff, since a higher than average percent of their overall electricity use will occur during the peak period when prices are high. On the other hand, a wide variety of research indicates that customers with central air conditioning are more likely to respond and provide greater load relief during high priced periods than customers without air conditioning. That is, the customers that are most difficult to enroll in a dynamic pricing plan are the same

customers that will provide the greatest demand response. As indicated in Figure B-7, households with a greater than 75% likelihood of owning central air conditioning have more than a 50% lower probability of enrolling in a CPP rate than do households with less than a 25% likelihood of owning a central air conditioner. This enrollment differential could be even greater in PECO's service territory given the even higher value that customers place on air conditioning in more humid climates like Philadelphia than they do in drier climates like California.

**Figure B-7:
Impact of the Likelihood of Central Air Conditioning Ownership on Enrollment in CPP PG&E SmartRate Critical Peak Pricing Tariff**

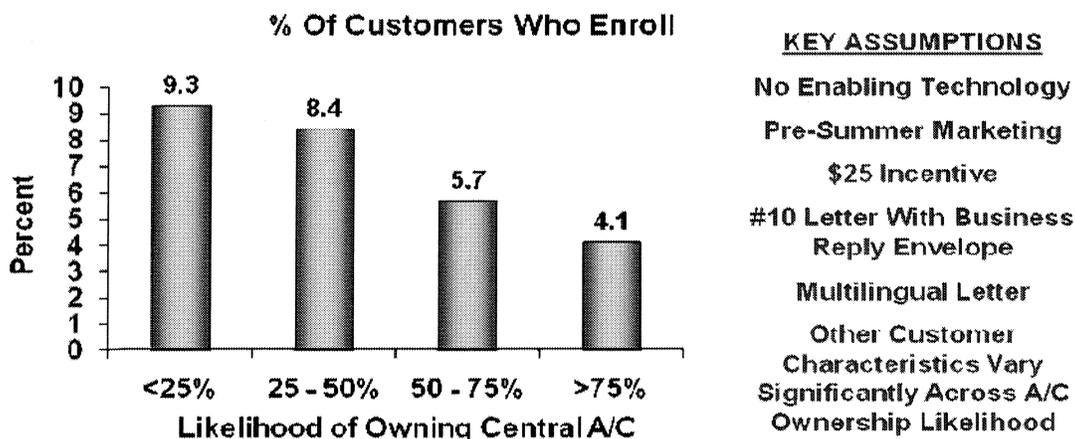
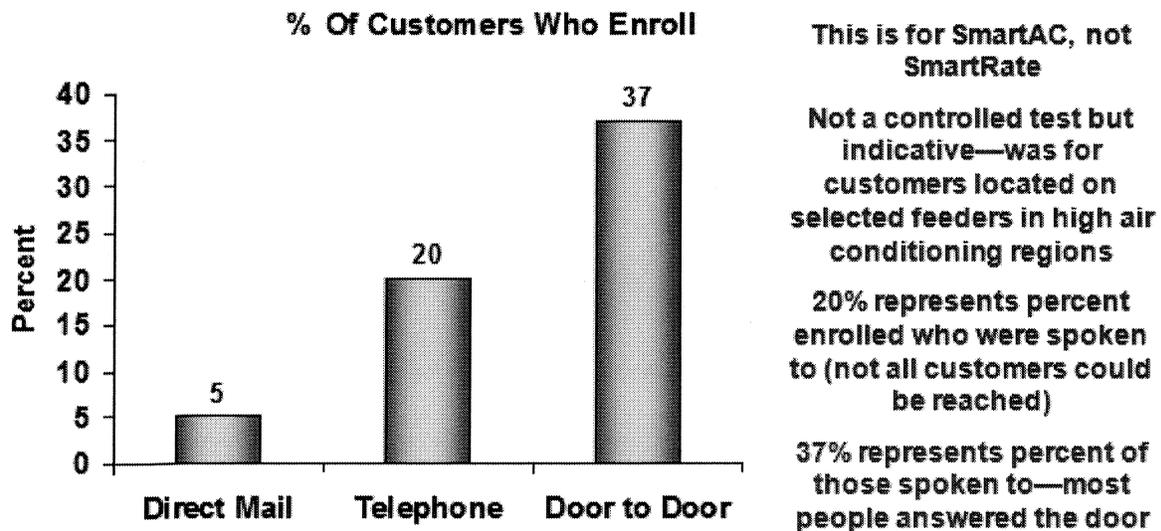


Figure B-8 shows the potential impact of different marketing modes on enrollment. The results depicted there are not for a dynamic rate program but, rather, are for PG&E's SmartAC program. Nevertheless, it is reasonable to think that similar differences across modes might exist when marketing dynamic rates, as the primary difference between direct mail and the other two modes is the ability to interact with customers in real time, answering questions they might have and minimizing additional transaction costs associated with enrollment when solicited through direct mail (e.g., mailing in a response card, picking up the phone and calling, etc.). The results shown in the figure were not based on a scientific comparison of marketing modes (as will be done in the promotional strategies track that PECO will implement). Rather, they were based on a project in which it was essential to recruit more customers in specific locations in a short period of time than was possible through direct mail. Importantly, the customers who were contacted via telephone and in person already had been contacted through direct mail and had not signed up to participate. A side-by-side test of marketing modes among customers that never had been contacted previously could produce even bigger differences.

Of course, a significant downside to telephone and door-to-door solicitation with residential customers is that it is either impossible (in the case of telephone recruitment) or very expensive (in the case of door-to-door solicitation) to contact a random sample of customers. With telephone solicitation, a large portion of households have caller ID and refuse to pick up calls from 800 numbers or numbers from unknown callers, and this reluctance is not random. With door-to-door solicitation, recruitment is much more cost effective if solicitors can go to every household in a neighborhood than if they must go to randomly selected households that will be much further apart, even with the most efficient route. These shortcomings are not of much concern if the only goal is maximizing enrollment. However, when a project requires that solicitation be random and representative of the broader population for most test cells, as is the case here, these alternative modes are not appropriate.

Figure B-8
Impact of Marketing Mode on Enrollment in a Direct Load Control Program
PG&E SmartAC Program



APPENDIX C SUPPLEMENTAL INFORMATION ON TECHNOLOGY OPTIONS

This appendix provides additional background on technologies. Utilities and regulators often are interested in the effects of three main types of technology that may increase demand response impacts or reduce overall energy use: notification technology, load control technology, and information feedback technology.

Notification technologies allow a utility to inform customers when dynamic prices are in effect. Notification methods include:

- General communication channels such as email, phone calls, and text messages;
- Dual-purpose technologies such as programmable communicating thermostats (PCTs) and in-home information display devices (IHDs), which can provide notification in addition to their main functionality (e.g., load control, information feedback); and
- Although not recommended for PECO's Plan specialized devices such as an Energy Orb (e.g., a device that can be placed in homes or businesses that glow a different color depending on the current price of electricity) that have notification as their sole function.³³

Recent work by FSC illustrates the value of ensuring that customers are aware of dynamic pricing events by using multiple notification methods. Results from a recent load impact evaluation of PG&E's SmartRate tariff found that consumers with four different notification options produced average load impacts that were almost four times greater than consumers that were reached through a single-notification channel.³⁴

A second category of technologies that can be used to enhance price-driven demand response are devices used to control end-use equipment such as central air conditioners ("CAC"). The most widely used control options are PCTs and load control switches for CAC's. PCTs adjust the thermostat setting a few degrees when a signal is received and control switches prevent the air conditioning compressor from operating a certain percentage of each hour based on a predetermined cycling strategy. When used in conjunction with dynamic pricing, the temperature adjustment or cycling operation automates demand response associated with air conditioning during the peak period on critical peak days.

³³ PECO does not believe that single function devices will be the preferred mode of notification after the rollout of a smart grid capable of communicating via existing multi-function devices; this discussion is provided as background.

³⁴ See Stephen George, Josh Bode, Mike Perry and Zach Mayer. *2009 Load Impact Evaluation for Pacific Gas and Electric Company's Residential SmartRate—Peak Day Pricing and TOU Tariffs and SmartAC Program, Volume 1: Ex-post Load Impact*. Freeman, Sullivan & Co. 2009.

A variety of pricing pilots³⁵ have shown that air conditioning control technologies increase the demand response associated with dynamic pricing by 50% to 100%, although quite often reported differences are misleading as households with control devices all have air conditioners whereas some households without control devices don't have air conditioners.³⁶ Although technology can be used to control end uses other than air conditioners (e.g., water heating, pool pumps, etc.), the greatest demand response potential in PECO's service territory is associated with central air conditioning. The saturation of central air conditioning in the PECO service territory is approximately 60%.

Turning to SMC customers, a key finding from California's Statewide Pricing Pilot³⁷ ("SPP") was that small non-residential customers did not provide any load reduction in response to dynamic tariffs in the absence of enabling technology. This study also found that the incremental effect of enabling technology on medium business customer's load impacts was significant. Another useful insight from the California SPP was that, even when offered for free, many SMC customers did not accept a PCT. In fact, for customers with peak demands below 20 kW, only one third took a free PCT. For medium customers, roughly 60% agreed to have a PCT installed for free.

The third primary technology option that may be useful for reducing energy use either as a complement to dynamic pricing or as a standalone treatment involves devices that provide frequent or near real-time information feedback to consumers. A wide variety of research going back several decades suggests that the provision of information on energy use and costs more frequently than the standard monthly bill can improve energy usage decisions and lead to reductions in energy use.³⁸ One theory of why such changes might be observed is that more frequent feedback helps consumers see the relationship between their usage decisions and the cost of those decisions. With real time feedback devices in a home, for example, consumers can see what happens to the rate of expenditure on energy when their air conditioner turns on during a hot day, or when they turn on their electric drier. Another theory is that consumers can use such devices to understand the relative contribution of various end uses to their overall energy bill. Research indicates

³⁵ For a summary of the results from many past pricing pilots, see Ahmad Faruqi and Sanem Sergici. *The Power of Experimentation: New Evidence on Residential Demand Response*, The Brattle Group, 2008.

³⁶ Since studies show that households with air conditioners tend to provide greater demand response than those without air conditioners, some of the reported differences might result from this apples-to-oranges comparison.

³⁷ Stephen S. George, Ahmad Faruqi and John Winfield. *California's Statewide Pricing Pilot: Commercial & Industrial Analysis Update*. CRA International. June 28, 2006.

³⁸ Darby S (2006) *The Effectiveness of Feedback on Energy Consumption. A Review for DEFRA of the Literature on Metering, Billing and Direct Displays*. Environmental Change Institute, University of Oxford

<http://www.defra.gov.uk/environment/climatechange/uk/energy/research/pdf/energyconsump-feedback.pdf>
and <http://www.defra.gov.uk/environment/climatechange/uk/energy/research/pdf/energyconsump-feedbackappendix.pdf>

that customers often have misperceptions concerning which end uses use the most electricity in their homes and businesses, and make adjustments to energy use based on these misperceptions that don't lead to significant reductions in energy use. Information feedback devices can also be used by consumers to set energy budgets or goals and manage their energy use toward those goals. Behavioral research shows that information feedback combined with goal setting is often more effective in changing consumer behavior than feedback alone.

Near real-time information feedback on energy use and costs can be provided through dedicated IHDs that communicate directly with advanced meters, or through other methods that communicate with multi-use devices that consumers already own, such as personal computers and smart phones. Access to day-late usage data can be provided to consumers with personal computers through web portals, and other types of information feedback, such as bill alerts, can be delivered through a variety of existing or new channels (e.g., phone, emails, text messages, messaging to IHDs, etc.).

While there is a growing number of studies underway focused on understanding the impact of information feedback on overall energy use, relatively few have examined the impact of information feedback on demand response.³⁹

³⁹ Faruqui, Ahmad, Sanem Sergici, and Ahmed Sharif (2010), "The Impact of Informational Feedback on Energy Consumption - A Survey of The Experimental Evidence," *Energy* 35 (2010), 1598-1608

APPENDIX D SUPPLEMENTAL INFORMATION ON IMPACT EVALUATION METHODS

This appendix elaborates on the discussion of evaluation methods contained in Section 4. Table D-1 summarizes the evaluation approach and type of output that is desired from a planning perspective and that can be generated from the analysis methods outlined in the table. Because participants can be used as their own controls for the CPP rate options, load impacts can be estimated for each participant based on time series regressions using individual customer data. This approach makes it possible to look at the distribution of impacts across customers and to tie these impacts to customer characteristics,⁴⁰ notification options, and other variables of interest such as recruitment methods.⁴¹

**Table D-1:
Load Impact Evaluation Methods and Output for Residential Treatments**

| Treatment | Approach | Output | Timing |
|---|--|--|---------|
| A: CPP for Rate R (standard education package) | 1. Participants used as own control | 1. Average Impact per hour under various weather conditions | Q4 2013 |
| | 2. Estimate individual customer regressions of hourly usage as a function of weather, time-of-use variables and event variable | 2. Distribution of impacts (% of customers providing impacts of various amounts) | Q4 2014 |
| | | 3. How average impacts vary by customer characteristics to be used for future targeting | |
| | | 4. How average impacts vary based on customers who enroll in response to various recruitment methods | |
| | | 5. How average impacts vary with number of notification options used | |

⁴⁰ For an example of the recommended approach and the type of output that can be produced from individual customer regressions, see Stephen George, Josh Bode, Mike Perry and Zach Mayer. *2009 Load Impact Evaluation for Pacific Gas and Electric Company's Residential SmartRate™—Peak Day Pricing and TOU Tariffs and SmartAC Program—Volume 1: Ex Post Load Impacts*. Freeman, Sullivan & Co., 2009.

⁴¹ It is possible that customers recruited based on different promotional strategies might differ in ways that influence their load impacts. If time or money were no object and the study population was very large, one could argue that the best approach to testing whether promotional methods attract customers that respond differently to the price signal would be to select a separate control group for each promotional treatment. However, this would require dozens of control groups and simply is not feasible. Testing for these effects based on data from a single comparison group and data pooled across all different promotional samples for the CPP rate, for example, runs the risk of some selection bias but the ideal approach is not practical given the large number of promotional treatments that are included in the Plan.

| Treatment | Approach | Output | Timing |
|---|--|---|--------------------|
| B: CPP for Rate R (enhanced education package) | 1. Random sample of CPP group will be selected and provided with enhanced education package. Analysis approach will be same as A for examining individual impacts of CPP with enhanced information. In addition, panel regression will be estimated using pooled data with customers from standard education package to assess whether enhanced education increases average demand response | 1. Same as A1 through A5 for group with enhanced education plus estimate of incremental effect of enhanced education for average customer | Q4 2013 Q4 2014 |
| C: CPP for Rate R + Direct Load Control⁴² | 1. Air conditioner will be cycled in such a manner so that DLC will always operate when CPP events are in effect but there will also be hours when DLC will operate on days when CPP events are not in effect. This will allow for estimation of the joint impact of CPP and DLC during CPP event hours, and the operation of DLC without prices in effect during similar hours 2. Can use same analysis approach as in A to determine individual and average impact for combined CPP and load control for sample of customers who self selected into both programs | 1. Same as A1 through A3 for DLC population 2. For hours where DLC events are in effect, this analysis will produce an estimate of the average incremental effect of CPP over and above average impact of DLC 3. For hours where DLC events are not in effect, but DLC is used to automate CPP response, this analysis approach will produce estimates of the average incremental effect of DLC over and above CPP, but only for this self-selected population of participants in the DLC program 4. This design DOES NOT allow for estimation of the incremental effect of DLC for customers who volunteered for the CPP tariff | Q4 2013 |

⁴² For treatment C, it is possible to estimate the impact of DLC for hours in which DLC is called and CPP is not, and to estimate the joint impact of DLC and CPP for hours in which they are both called. Given that this treatment is being offered only to the DLC population and that customers who choose the CPP rate will have their air conditioners cycled during CPP events, there will not be any hours in which the CPP rate is called and air conditioners are not cycled. During the study period, the program will be operated for customers that accept the CPP offer so as to generate data for a number of hours that have both DLC and CPP in effect and others that have just DLC in effect. In this manner, it will be possible to estimate the incremental effect of CPP over and above the effect of load control. On the other hand, with this design, it will not be possible to estimate the incremental effect provided by the load control technology over and above what the same customers would have provided based on price signals alone. This effect can be estimated from the analysis described in row D of Table 4-1, comparing impacts for customers who sign up for the CPP rate with a PCT. As indicated in the table, this comparison can be made with a group of CPP only customers who have air conditioners or, to ensure that there are no selection affects associated with customers that accept PCTs in addition to the rate, with a control group that is assigned from the volunteers for the CPP/PCT treatment. The second approach is technically superior to the first, but more costly.

| Treatment | Approach | Output | Timing |
|------------------------------------|---|---|-------------------------------|
| D. CPP + PCT for Rate R | <ol style="list-style-type: none"> Participants used as own control Same regression approach as in A To estimate incremental effect of the PCT compared with customers that are on the CPP tariff without a PCT, one could compare the data from this group with that from a subset of the CPP-only participants who have air conditioners and use panel regression to determine incremental effect of enabling technology over and above what customers with central air conditioning will provide without the enabling technology. This approach has the potential to introduce selection effects, as customers that accept both the CPP and PCT may differ from customers that accept the CPP tariff when only that option is offered. To eliminate this potential effect, the CPP/PCT group could be over recruited and split into treatment and control groups. Once done, the analysis approach would be the same as above | <ol style="list-style-type: none"> Same outputs as for A, plus an estimate of the average incremental effect of the technology on demand reduction compared with households that have central air conditioning and no technology | <p>Q4 2013</p> <p>Q4 2014</p> |
| E. CPP for Rate R-H | Same as A | Same as A | <p>Q4 2013</p> <p>Q4 2014</p> |
| F. CPP + PCT for R-H | Same as D | Same as D | <p>Q4 2013</p> <p>Q4 2014</p> |
| G. TOU for Rate R customers | <ol style="list-style-type: none"> Estimate average load impact by hour of day and/or for each rate period (peak and off-peak) for the average customer using panel regressions with pooled data from treatment and control groups | <ol style="list-style-type: none"> Average impact per hour or by rate period under various weather conditions | <p>Q4 2013</p> <p>Q4 2014</p> |
| H. TOU + PCT for TOU | Same as G | Same as G | <p>Q4 2013</p> <p>Q4 2014</p> |
| I. IHD for CAP | <ol style="list-style-type: none"> Focus is on energy use, not demand response, so can use pretreatment period data on monthly kWh usage in analysis. Analysis will be based on panel regression using data from treatment and control customers | <ol style="list-style-type: none"> Change in monthly energy use for average CAP customer with IHD | <p>Q4 2013</p> <p>Q4 2014</p> |
| J. IHD for Rate R | Same as I | Same as I | <p>Q4 2013</p> <p>Q4 2014</p> |
| K. IHD for CPP | <ol style="list-style-type: none"> Same as I for estimating impact of IHD on annual energy use and incremental effect of IHD on average CPP impact Can use same approach as in A to examine impact of CPP tariff on CPP days compared with non-CPP days for the treatment group | <ol style="list-style-type: none"> Same as I Incremental impact of IHD on average CPP demand response for the average customer Same as A1 through A3 for incremental impact of CPP relative to non-CPP days | <p>Q4 2013</p> <p>Q4 2014</p> |

| Treatment | Approach | Output | Timing |
|----------------|-----------|-----------|--------------------|
| L. IHD for TOU | Same as I | Same as I | Q4 2013 Q4 2014 |

APPENDIX E SUPPLEMENTAL INFORMATION ON SURVEYS

Surveys can be used to obtain basic information about customer characteristics for use in choice modeling or for determining differences in load impacts tied to customer characteristics. However, there are significant shortcomings with trying to collect and use such data, including non-response bias, loss of sample due to non-response, inability to extrapolate to specific customers for targeting purposes (because information doesn't exist for the target population), and others. While survey information is often essential to evaluation, understanding the limitations of survey data is also important.

Surveys can be used to measure behavior change resulting from exposure to time-varying pricing and information feedback. The simplest, but least accurate, approach to survey design for this purpose is a single treatment period or post-treatment survey that asks customers to report changes they have made in their behavior in the recent past. The accuracy of information obtained in this manner is low for two reasons. First, respondents may be unable to accurately recall changes they made that occurred more than a few days prior to the survey interview and may not be aware of changes that were made by other parties in the household. Second, respondents may overstate the changes they have made if they believe such changes are socially desirable or if they think that is the answer the surveyor would like to hear.

A more accurate and reliable approach to determining behavioral change through consumer surveys is to conduct two surveys of both treatment and control customers, one before and the other after the treatment goes into effect. These surveys would be designed to measure behavior in the recent past, say within the last week or month, and would focus on easily answered questions about household energy use behaviors. Examples of such questions are, "What is the set point on your thermostat right now?"; "About how many of the rooms in your home that are not currently occupied by people have the lights on right now?"; "Are there any entertainment centers running in rooms in your home right now that are not occupied by anyone?" Of course, it is also possible to pose questions about electricity consumption behavior that refer to prior time periods and also to ask questions about the occupant's perceptions and opinions about energy use in such surveys.

Surveying only treatment group customers can determine whether changes occurred between the pretreatment and treatment periods for that group, but not whether the changes were caused by the treatment. Other factors could lead to such changes (e.g., headlines about climate change, general information campaigns about the importance of conserving energy, the purchase of a programmable thermostat by a consumer who did not previously have one, changes in economic conditions, etc.). In order to establish

causality, it is necessary to obtain the same information on treatment and control customers.

In addition, surveys can be used to determine the extent to which respondents understand the nuances of the tariffs they have selected, or whether they have increased their knowledge regarding energy matters (from the information feedback provided by an IHD, for example). Questions could be asked about the start and stop times for peak periods, and approximately what the price ratios are between peak and off-peak periods. Such information could be used in regression analysis to see if the depth of understanding of key features of the tariff correlates with demand response (e.g., whether customers with a high degree of understanding produce larger load impacts than those that have less understanding of these key features).

When developing a survey strategy for assessing changes in behavior, it is very important to keep in mind that surveys can generate artificial effects if used frequently and indiscriminately. Frequent surveys about the treatment that is of interest can cause people to take actions that they wouldn't otherwise take in the absence of the surveys. Surveys can also generate misleading information in that respondents have a tendency to tell you what they think you want to hear, which often overstates actions that are actually taken.